



Empathy for positive and negative emotions in social anxiety disorder



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ABSTRACT

Social anxiety disorder (SAD) is associated with elevated negative and diminished positive affective experience. However, little is known about the way in which individuals with SAD *perceive* and *respond emotionally* to the naturally-unfolding negative and positive emotions of others, that is, cognitive empathy and affective empathy, respectively. In the present study, participants with generalized SAD ($n = 32$) and demographically-matched healthy controls (HCs; $n = 32$) completed a behavioral empathy task. Cognitive empathy was indexed by the correlation between targets' and participants' continuous ratings of targets' emotions, whereas affective empathy was indexed by the correlation between targets' and participants' continuous self-ratings of emotion. Individuals with SAD differed from HCs only in positive affective empathy: they were less able to vicariously share others' positive emotions. Mediation analyses revealed that poor emotional clarity and negative interpersonal perceptions among those with SAD might account for this finding. Future research using experimental methodology is needed to examine whether this finding represents an inability or unwillingness to share positive affect.

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1. Introduction

Social anxiety disorder (SAD) is characterized by a consistent and disproportionate fear of social situations resulting in avoidance of, or intense discomfort in, such situations (American Psychiatric Association, 2013). A large literature has now documented elevated levels of negative affect in SAD (Farmer & Kashdan, 2014; Hofmann, 2007; Watson, Clark, & Carey, 1988), and a growing literature indicates that the atypical emotional functioning associated with SAD also includes low levels of positive affect (Brown, Chorpita, & Barlow, 1998; Hughes et al., 2006; Kashdan, 2007; Watson et al., 1988). However, in contrast to our understanding of the emotional *experience* of individuals with SAD, we know far less about how individuals with SAD *perceive* and *respond emotionally* to the negative and positive emotions of others, a form of social cognition known as empathy.

This gap in our knowledge about SAD is unfortunate because the way a person perceives and responds emotionally to others exerts a powerful influence on his or her social functioning (Eisenberg &

Miller, 1987; Zaki & Ochsner, 2012) and we know that SAD is characterized by marked social impairment. People suffering from SAD have fewer friends, have fewer romantic and sexual relationships, and are less likely to marry than people in the general population and even individuals with other anxiety disorders (for review, see Alden & Taylor, 2004). Given these interpersonal difficulties, it is reasonable to consider that individuals with SAD may experience dysregulated empathic functioning. Indeed, difficulties with empathy might be a transdiagnostic mechanism explaining, at least in part, social impairment in a number of mental health conditions.

1.1. Empathy

Most theories suggest that empathy consists of both cognitive and affective components (e.g., Davis, 1994; Wispe, 1986; Zaki & Ochsner, 2011). Cognitive empathy, otherwise known as mentalizing, refers to the accurate perception of the emotional state of another, whereas affective empathy, otherwise known as experience sharing, refers to the vicarious affective responding with the same emotion to the emotional state of another (Gladstein, 1983; Zaki & Ochsner, 2012). There are a number of other concepts associated with empathy that will not be considered in the current

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study. These include motor empathy (mimicry) and emotional contagion, which often precede empathy, and sympathy, compassion, and prosocial concern/behavior, which may follow empathy (for reviews, see Singer & Lamm, 2009; Zaki & Ochsner, 2012).

As with emotion experience, empathy can be differentiated according to valence. Negative empathy, or the understanding and/or sharing of others' negative emotional states, can be contrasted with the less-studied positive empathy, or the understanding and/or sharing of others' positive emotions (see Morelli, Lieberman, & Zaki, 2015). Akin to the constructs of negative and positive affect, negative and positive empathy are moderately positively correlated (Morelli, Lee, Arnn, & Zaki, 2015; Sallquist et al., 2009), but are also differentiable. In couples, for example, receipt of positive empathy was more strongly associated with relationship well-being than was receipt of negative empathy (Gable, Gonzaga, & Strachman, 2006).

1.2. Cognitive and affective empathy in SAD

To date, one study has explicitly examined the association between social anxiety and cognitive empathy and further inferences about cognitive empathy in SAD can be drawn from related lines of research. In a recent study, an unselected sample of undergraduate students was asked to make post hoc ratings of the negative affect of videotaped targets describing instances of social exclusion and inclusion (Auyeung & Alden, 2016). Greater social anxiety was associated with enhanced cognitive empathy when participants were faced with a social threat, but there was no association between social anxiety and cognitive empathy when participants were not facing social threat, nor was there an association between social anxiety and cognitive empathy for targets' descriptions of social inclusion. Also highly relevant is one study that examined theory of mind, that is, the ability to make accurate inferences about others' mental states, which some consider to be equivalent to cognitive empathy (Blair, 2005). When asked to identify emotions using only eyes as stimuli, participants with SAD were more likely than controls to miscategorize negative emotions (e.g., sad, angry; Hezel & McNally, 2014). However, they did not differ in accuracy for categorizing positive or neutral emotions or in identifying the valence of the emotion being portrayed (i.e., negative, neutral, positive). On a second task, which involved answering multiple-choice questions referring to the causes and nature of emotions experienced by characters in a short film, participants with SAD endorsed more incorrect choices than healthy control participants. The responses selected by participants with SAD indicated that they tended to over-theorize about the causes of others' emotions, that is, they included inferences beyond those justifiable by the content presented.

Also related to cognitive empathy is research on interpersonal emotion knowledge, defined as the ability to identify others' emotions as well as to understand their causes and consequences (Eisenberg, Hofer, & Vaughan, 2007). In a recent meta-analysis, social anxiety was inversely correlated to interpersonal emotion knowledge, although the overall effect size was small ($r = -0.18$) and the direction of relationship between social anxiety and emotion knowledge was inconsistent across studies (O'Toole, Hougaard, & Mennin, 2013). Notably, task complexity moderated findings. A stronger relationship between social anxiety and reduced interpersonal emotion knowledge was observed for tasks involving complex emotional situations relative to basic, discrete emotions.

Even less is known about affective empathy than cognitive empathy in SAD. In an unselected sample of college students, the self-reported tendency to experience feelings of sympathy and concern for others exhibited a small positive correlation with social

anxiety (females $r = 0.12$, males $r = 0.14$; Davis, 1983). Similarly, the self-reported tendency to experience feelings of sympathy and concern for others exhibited a non-significant, small positive correlation with heterosocial anxiety (a specific type of social anxiety) in heterosexual undergraduate participants in a romantic relationship ($r = 0.13$; Davis & Oathout, 1992). In a more recent study, also in an unselected sample, Samson, Lackner, Weiss, and Papousek (2012) found that social anxiety was inversely associated with perceived funniness of cartoons that required theory of mind inferences, but not for cartoons that did not require theory of mind inferences. The authors suggested that this may indicate either a lack of positive affect sharing (indicating low positive affective empathy) or increased empathy for the actor in the cartoons which resulted in increased negative affect (indicating elevated negative affective empathy) and reduced humor. Alternatively, the results could be explained by disruptions in cognitive empathy.

These findings on the relationship between social anxiety and empathy hint that individuals with SAD may be more adept than low-anxious individuals at mentalizing about others' negative emotional states as pertain to experiences of social exclusion (Auyeung & Alden, 2016); however, there is also evidence that social anxiety may be associated with difficulties mentalizing about others' emotional states, particularly when discerning complex rather than simple emotions (O'Toole et al., 2013). Our inferences are also limited in that the majority of these studies has used static, staged stimuli (e.g., pictures of facial expressions) and all have used discrete response options (e.g., multiple choice). With respect to affective empathy, it appears that positive affective empathy may be impaired and negative affective empathy facilitated in SAD. However, these hypotheses are based on only three studies which were conducted in non-clinical samples and are limited by the same factors as mentioned for cognitive empathy, namely, static stimuli and discrete response options. What is needed is a direct examination of cognitive and affective empathy in individuals with SAD in the context of others' naturally-unfolding emotions.

1.3. The present study

The primary aim of the present study was to compare cognitive empathy and affective empathy in individuals with SAD to that of matched, non-anxious, healthy control participants (HCs). We assessed empathy with an adapted version of the empathic accuracy task (Zaki, Bolger, & Ochsner, 2008), in which participants watch brief film clips of various individuals (i.e., targets) discussing negative and positive emotional situations. During each film clip, participants are instructed to continuously rate changes in emotion valence of either the target's emotion or his/her own emotion. Cognitive empathy is inferred from the degree of congruence between the target's and participant's rating of the target's emotion (Zaki et al., 2008). Using a similar approach, we sought to provide the first behavioral index of affective empathy by examining the degree of congruence between the target's self-rating of emotion and the participant's self-rating of emotion. Based on prior literature, we expected that relative to HCs, cognitive empathy in individuals with SAD would be no different, but negative affective empathy would be more congruent and positive affective empathy would be less congruent.

We also sought to explore *why* differences in empathy might arise. There are a number of potential mechanisms that may explain group differences in empathy. Given that data for the current study were collected as part of a larger study on treatment mechanisms of cognitive behavioral group therapy compared to mindfulness-based stress reduction (Goldin et al., 2016), we selected three theoretically-derived candidate variables from this database to explore as mechanisms of the relationship between

SAD and empathy. The first, emotion experience, is suggested by the fact that self-reported empathy covaries positively with daily levels of positive and negative affect (Nezlek, Feist, Wilson, & Plesko, 2001). A second potential variable is emotion knowledge, such as the ability to identify one's own emotions (Jonason & Krause, 2013). Social anxiety is inversely associated with emotion knowledge, specifically, the tendency to attend to one's own emotions and the ability to describe one's own emotions (e.g., Davila & Beck, 2002; Turk, Heimberg, Luterek, Mennin, & Fresco, 2005). Therefore, any impairments in empathy in SAD could be explained by these factors. A third variable implicated in empathy is interpersonal perception. Positive perceptions of a target, such as greater perceived similarity to or likeability of the target, may motivate one to try to understand the target's perspective and may increase the importance one attaches to the target's perspective. Although interpersonal perceptions in non-self-relevant contexts is understudied in SAD (for review, see Alden & Taylor, 2004), there is some evidence that social anxiety is associated with negative perceptions of others (Jones & Briggs, 1984; Leary, Kowalski, & Campbell, 1988). Thus, this may also account for any observed SAD-related differences in empathy.

2. Method

2.1. Participants

Participants were 32 individuals with generalized SAD and 32 HCs matched on gender, education level, and ± 3 years of age.¹ Participants with SAD were part of a randomized controlled trial (RCT) comparing cognitive behavioral therapy, mindfulness-based stress reduction (MBSR), and a waitlist control condition (Goldin et al., 2016). The final RCT sample included 108 participants who met diagnostic criteria for a principal diagnosis of generalized SAD according to the Anxiety Disorders Interview Schedule for DSM-IV, Lifetime version (ADIS-IV-L; Di Nardo, Brown, & Barlow, 1994). SAD participants were selected for the current analyses based on match with one of the HCs.

The inclusion/exclusion criteria for HCs were the same as for SAD patients (see below), except they were required to not have any current or past psychiatric disorders according to interview with the ADIS-IV-L. Of the 37 HCs recruited, 3 did not have usable data for the empathy task, either due to participant or computer error. Two of the HC participants did not have an SAD participant match within five years of their age and therefore were not included in the current study, thus resulting in the final sample of 32 individuals in each group. Participants with SAD were provided treatment free of charge and HC participants were provided modest financial compensation for their participation. All participants provided informed consent in accordance with the Institutional Review Board at Stanford University.

All participants were required to be 21–55 years of age, speak fluent English, be right-handed, have full color vision, pass a magnetic resonance imaging (MRI) safety screen, and be free of current pharmacotherapy or psychotherapy, history of medical disorders, head trauma, neurological disorders, and significant learning disorders. Participants with SAD were also excluded for having previously completed six or more sessions of CBT or having taken an MBSR course, participated in a formal meditation retreat,

or having engaged in regular meditation practice. They were additionally excluded for comorbid psychiatric disorders other than secondary diagnoses of generalized anxiety disorder, specific phobia, obsessive-compulsive disorder, panic disorder, major depressive disorder, and dysthymia.

Table 1 provides demographic information for the two samples. Participants with SAD did not differ from control participants in age, gender, education level, or ethnicity. As expected, they reported significantly greater levels of social anxiety.

2.2. Interview and self-report measures

The *Anxiety Disorders Interview Schedule for DSM-IV, Lifetime version* (ADIS-IV-L; Di Nardo et al., 1994) is a semi-structured interview for the diagnosis of anxiety disorders and related conditions (Brown, Di Nardo, Lehman, & Campbell, 2001). In a sample of patients with a range of anxiety disorders, it showed excellent reliability for a principal diagnosis of SAD ($\kappa = 0.77$, Brown et al., 2001). In the current study, the ADIS-IV-L was administered by interviewers who were trained according to standards set forth by Brown et al. (2001). To assess inter-rater reliability, we had Ph.D. clinical psychologists and doctoral students review 20% of the interviews. There was 100% agreement with the original principal diagnosis of SAD ($\kappa = 1.0$).

The *Liebowitz Social Anxiety Scale - Self-Report version* (LSAS-SR; Fresco et al., 2001; Liebowitz, 1987; Rytwinski et al., 2009) assesses fear and avoidance of a range of social interaction and performance situations. Participants rate their level of fear and frequency of avoidance for each of 24 situations during the past week on two 4-point scales that range from 0 (*none/never*) to 3 (*severe/usually*). Sample situations include 'going to a party,' speaking up in a meeting,' and 'resisting a high pressure sales person.' The total score is the sum of the 24 fear ratings and 24 avoidance ratings. The LSAS-SR has shown excellent internal consistency ($\alpha = 0.95$) and good convergent and discriminant validity with other self-report measures (e.g., Fresco et al., 2001). Reliability in the present sample was also good (HC $\alpha = 0.87$, SAD $\alpha = 0.92$).

The *Positive and Negative Affect Schedule* (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item questionnaire that includes two 10-item scales comprised of words that describe feelings or emotions rated on a scale from 1 (*very slightly or not at all*) to 5 (*extremely*). Participants were asked to complete these ratings based on the "extent you have felt this way in the PAST WEEK." One scale measures positive affect (PA; sample items: 'enthusiastic,' 'interested,' and 'proud'), whereas the other measures negative affect (NA; sample items: 'guilty,' 'irritable,' and 'afraid'). The measure has demonstrated good convergent and external validity in a sample of undergraduates (r 's = 0.76 - 0.92; Watson et al., 1988), and good internal consistency in a sample of 18–29 year olds (α 's = 0.75 and 0.86 for PA and NA, respectively; Mackinnon et al., 1999). In the current sample, it also demonstrated good internal consistency (PA scale: HC $\alpha = 0.89$, SAD $\alpha = 0.89$; NA scale: HC $\alpha = 0.82$, SAD $\alpha = 0.90$).

One's own emotion knowledge, specifically the inclination to attend to one's emotions (attention to emotions) and the ability to identify one's own emotions (clarity of emotions), was assessed with a 23-item scale derived by Palmieri, Boden, and Berenbaum (2009) using multidimensional scaling and confirmatory factor analysis on items from the *Toronto Alexithymia Scale-20* (TAS; Bagby, Parker, & Taylor, 1994) and the *Trait Meta-Mood Scale* (TMMS; Salovey, Mayer, Goldman, Turvey, & Palfai, 1995). The 10-item attention to emotions subscale includes 2 of the 7 TAS-Externally Oriented Thinking items (e3, e7) and 8 of the 13 TMMS-Attention to Emotions items (a2, a5, a6, a7, a8, a11, a12, a13). The 13-item clarity of emotions subscale includes 5 of the 7 TAS-

¹ Efforts were also made to match participants on ethnicity, although several participants reported ethnicity as "more than one" or "other" and so were matched only on the other three demographic variables. One matched pair differed by one "level" in education, although the number of years of education endorsed by these participants differed by only one year.

Table 1
Demographic information by group.

| | SAD (n = 32) | HC (n = 32) | Test statistic |
|--------------------------------|--------------|-------------|-----------------------|
| # Males | 18 (56.3%) | 18 (56.3%) | $\chi^2(1) = 0.00$ |
| Age, M (SD) | 31.9 (7.9) | 31.7 (8.0) | $t(62) = 0.07$ |
| Education Level | | | $\chi^2(3) = 0.15$ |
| Completed high school | 1 | 1 | |
| Some college | 4 | 5 | |
| Completed college | 13 | 12 | |
| Advanced degree | 14 | 14 | |
| Race/ethnicity | | | $\chi^2(2) = 1.67$ |
| Caucasian | 14 (43.8%) | 17 (53.1%) | |
| Asian | 10 (31.2%) | 11 (34.4%) | |
| Latino | 0 | 0 | |
| African American | 0 | 0 | |
| American Indian/Alaskan native | 0 | 0 | |
| More than one race | 3 (9.4%) | 3 (9.4%) | |
| Other | 5 (15.6%) | 1 (3.1%) | |
| Marital status | | | $\chi^2(1) = 0.59$ |
| Single, never married | 18 (56.3%) | 18 (56.3%) | |
| Married | 9 (28.1%) | 9 (28.1%) | |
| Divorced, separated, widowed | 0 (0.0%) | 3 (9.4%) | |
| Living with partner | 5 (15.6%) | 2 (6.2%) | |
| LSAS-SR, M (SD) | 88.2 (18.2) | 14.4 (8.9) | $t(62) = 20.62^{***}$ |

Note. SAD = social anxiety disorder; HC = healthy control; LSAS-SR = Liebowitz Social Anxiety Scale – self-report version. The test for ethnicity compares Caucasian versus Asian versus all others. The test for marital status compares single/divorced/separated/widowed versus married/living with partner. *** $p < 0.001$.

Identification of Feelings items (i1, i3, i5, i6, i7) and 8 of the 11 TMMS-Clarity of Emotions items (c1, c3, c4, c7, c8, c9, c10, c11) (Palmieri et al., 2009). Participants rated their agreement with each item on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were keyed such that higher scores indicated higher levels of attention to and higher clarity of emotions. Example items include “I pay a lot of attention to how I feel” (attention to emotions subscale) and “I am often confused about what emotion I am feeling” (reverse-keyed; clarity of emotions subscale). Each subscale has demonstrated good internal consistency (attention subscale $\alpha = 0.87$; clarity subscale $\alpha = 0.89$) and good convergent validity (Palmieri et al., 2009). In the current sample, internal consistency ranged from adequate to excellent (attention subscale: HC $\alpha = 0.86$, SAD $\alpha = 0.79$; clarity subscale: HC $\alpha = 0.86$, SAD $\alpha = 0.94$).

2.3. Empathy task

Participants completed a modified version of the empathic accuracy task (Zaki et al., 2008). In the development of the empathic accuracy task, Zaki et al. (2008) first videotaped 14 target participants discussing the four most positive and four most negative personal events they were comfortable describing. These target participants then watched the videotaped clips of themselves and provided a continuous rating of the level of positive or negative affect they had felt at each moment while talking using a 9-point Likert scale (1 = *very negative*, 9 = *very positive*). Of the clips that target participants approved for use and which showed sufficient variability in self-ratings ($n = 88$), 40 were chosen for use in the task (21 negative, 19 positive). In the subsequent empathic accuracy protocol, perceiver participants watched the clips and provided continuous ratings of how they believed the target was feeling, using the same scale target participants had used (Zaki et al., 2008). Empathic accuracy, i.e., cognitive empathic accuracy, was then inferred from the degree of congruence between targets' and perceivers' continuous ratings of the targets' affect. See Fig. 1 for a schematic of the empathic accuracy task procedure.

Results from the empathic accuracy task suggest that perceivers are moderately accurate at assessing targets' continuous affect (time-course r between targets' and perceivers' ratings = 0.47, Zaki

et al., 2008; $r = 0.46$, Zaki, Weber, Bolger, & Ochsner, 2009). Moreover, accuracy did not differ depending on the valence of the event targets described, nor did accuracy differ by perceivers' gender (Zaki et al., 2008). Evidence of construct validity of the empathic accuracy task has also been provided in several studies. Empathic accuracy scores were moderately positively correlated with perceivers' self-reported trait empathy in one study ($\rho = 0.40$; Ripoll et al., 2013), but not in a second ($r = 0.04$; Zaki et al., 2008). In the latter study, however, evidence of construct validity was provided by findings that perceivers' self-reported trait empathy interacted with targets' self-reported emotion expressivity to predict empathic accuracy (Zaki et al., 2008). Individuals with schizotypal personality disorder, characterized by impaired social cognition, have also exhibited poorer negative empathy on the empathic accuracy task than HC participants (Ripoll et al., 2013). Finally, empathic accuracy scores were predicted by activity in brain regions implicated in cognitive and affective empathy (Zaki et al., 2009).

For the current study, ten clips were selected from the larger stimulus set of Zaki et al. (2008) based on the goals of balancing the number of male versus female targets and the number conveying a positive versus negative emotion. To minimize participant burden, given that these data were collected as part of the baseline assessment of a randomized controlled trial, only brief clips were selected (i.e., <180 s; $M = 125$ s).

Participants in the current study were instructed that they were going to watch a series of film clips in which people discussed emotional events in their lives. Participants performed one of two tasks during each clip. For “Other” trials, participants were instructed to rate how the target was feeling during the clip, while talking, as opposed to during any other time (i.e., identical instructions as during the original Zaki et al., 2008 study on empathic accuracy). For “Self” trials, participants were instructed to rate his/her own emotion while watching the clip. For both types of trials, participants were instructed to focus not just on the overall emotion, but on the “moment-to-moment changes” in the emotional state of the target/self.

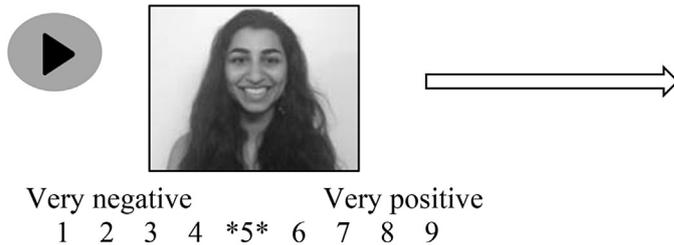
The focus of ratings for each clip was indicated just prior to each clip with the presentation of either the word “Other” or “Self” in the center of the screen for three seconds. Participants were instructed

Procedure

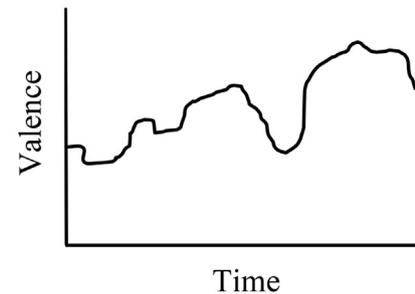
1. Target videotaped while discussing event



2. Target rates own continuous emotion



Example Time-courses



3. Participant rates target's or own continuous emotion

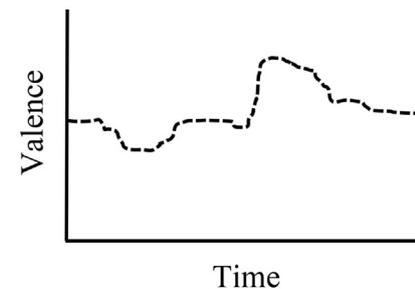
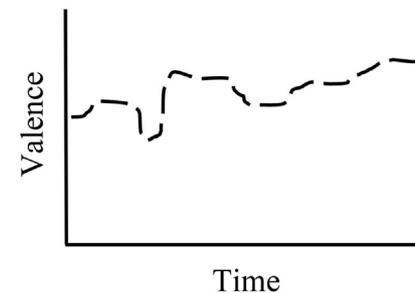
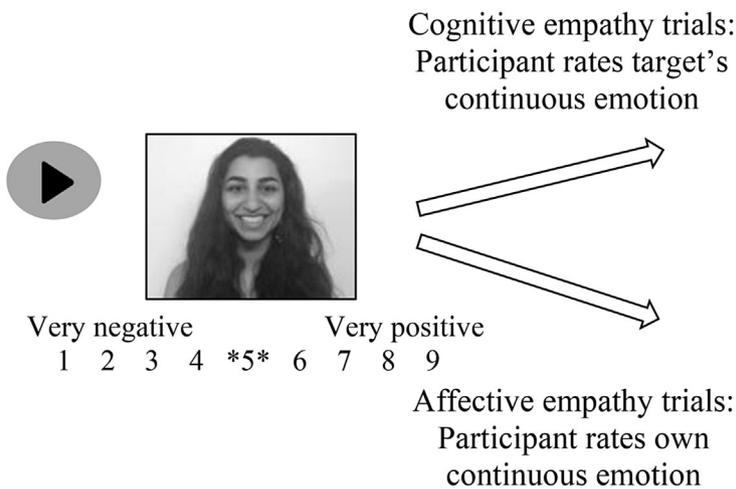


Fig. 1. Schematic of the empathy task procedure and sample time-courses for target and participant ratings. Primary outcomes consisted of the time-series correlation between ratings produced by targets with those produced by participants (for target = cognitive empathy, for self = affective empathy).

to use the left and right arrow keys on the keyboard to continuously rate emotion on a 9-point Likert scale (1 = *very negative*, 9 = *very positive*) while watching each clip. The rating scale was displayed at the bottom of the computer screen for the duration of each clip. At the beginning of each clip, the number 5 on the scale was highlighted by two asterisks, indicating neutral (neither negative nor positive). With each press of an arrow key to indicate a rightward (more positive/less negative) or leftward (more negative/less positive) shift in emotion, the highlighted number shifted in correspondence. Participants could make an unlimited number of shifts during each clip and this number was recorded.

After each film clip, participants were asked to respond to a

series of items. The first seven items were included to orient participants' attention to relevant aspects of the task at hand, including the extent to which targets had felt specific emotions ("Overall, how angry/amused/sad/frightened/contented did this person seem while they were talking?"), global affective response to the film clip ("Overall, how did you feel while watching this video?"), and participants' perceived accuracy in rating the target's emotions ("Overall, how accurate did you think you were about this person's emotions?").

The remaining three items following each clip assessed interpersonal perceptions of the targets. These ratings were examined as a potential mechanism of group differences in empathy.

Participants rated their perceived similarity to the target (“How similar do you feel you are to this person?”), degree of liking of the target (“Overall, how likeable did you find this person”), and perceived importance of the target’s narrative (“How important do you think what this person talked about was?”). All post-clip items were rated from 1 (*Not at all*) to 9 (*Extremely*) except for the global affective response item, which was rated from 1 (*Very negative*) to 9 (*Very positive*). The three interpersonal perception item ratings were averaged to yield a composite score for each participant for each condition (positive cognitive empathy trials: HC $\alpha = 0.88$, SAD $\alpha = 0.77$; negative cognitive empathy trials: HC $\alpha = 0.64$, $\alpha = 0.68$; positive affective empathy trials: HC $\alpha = 0.73$, SAD $\alpha = 0.67$; negative affective empathy trials: HC $\alpha = 0.76$, SAD $\alpha = 0.51$).

All participants saw the same ten clips, presented in the same pseudo-random order. The first clip, a positively-valenced “Other” clip, was completed for practice while the experimenter stayed in the room. The experimenter left the room for the remaining nine experimental clips, which comprised 4 “Other” clips (3 negative, 1 positive) and 5 “Self” clips (2 negative, 3 positive).

2.4. Procedure

Participants were recruited through referrals, community flyers, and web listings. After passing an initial online screener (including the LSAS-SR), telephone interview, and diagnostic interview, participants were invited to enroll in the study. Participants completed baseline assessments that included online questionnaires (including the PANAS and emotional awareness measure), an MRI session, and a behavioral session involving computer tasks. The empathy task was completed as part of the behavioral session. All assessments were completed prior to randomization to treatment for SAD participants.

2.5. Data reduction and analysis

Data reduction and time-series correlations for the empathy task data were performed using Matlab 7.1 (Mathworks, 2005). Ratings for each video were averaged across two-second intervals and each two-second mean served as one point in the subsequent time-series analyses. Ratings were z-scored and then a time-course correlation was calculated between participants’ ratings and those of the target, yielding an empathy coefficient. These coefficients were then *R*-to-*z* transformed (Fisher, 1921) and then averaged across videos of the same trial type and valence. This procedure has been used to calculate empathic accuracy (i.e., cognitive empathy) scores from this task in previous studies (e.g., Lee, Zaki, Harvey, Ochsner, & Green, 2011; Zaki et al., 2008). To examine whether current comorbid depression had an effect on empathy, we repeated primary analyses examining group differences in cognitive and affective empathy after removing the subset of SAD participants with current comorbid depression (10% of the SAD sample; $n = 2$ with current dysthymia, $n = 1$ with current major depressive disorder and dysthymia) and their HC matches.

Mediation analyses were conducted using Hayes’ PROCESS macro (Hayes, 2013) for SPSS, which uses ordinary least squares (OLS) regression. We tested whether diagnostic group (*X*) differences in empathy (*Y*) were mediated by the following variables (*M*) in separate models: (i) negative and positive affect, (ii) one’s own emotion knowledge, (i.e., attention to and clarity of one’s own emotions), and (iii) interpersonal perceptions. The PROCESS macro provides an index of the indirect effect of *X* on *Y* through *M*, computed as the product of the regression coefficient for path *a*, the effect of *X* on *M*, with the regression coefficient for path *b*, the effect of *M* on *Y* when *X* is taken into account (Preacher & Hayes, 2008). Bias-corrected, bootstrapped (10,000 iterations) confidence

intervals (CIs) of the indirect effect were used for significance testing. If the 95% CI does not include zero, the indirect effect is considered significant at the $p < 0.05$ level. The strength of the indirect effect was indexed by (1) the proportion of the indirect effect accounted for by *M* relative to the total effect of *X* on *Y* (see Alwin & Hauser, 1975), and (2) Preacher and Kelley’s (2011) kappa-squared (κ^2) effect size, which reflects the proportion of the maximum possible indirect effect, with 0.01, 0.09, and 0.25 representing small, medium, and large effects. Because data in the current study are cross-sectional, we are precluded from making any inferences about causality. As such, these analyses should be considered exploratory and hypothesis-generating for future studies using longitudinal or experimental designs.

3. Results

3.1. Empathy task: preliminary analyses

To check whether “positive” clips were rated as more positive than “negative” clips, we conducted 2 group (SAD, HC) \times 2 valence (positive, negative) repeated measures analyses of variance (ANOVAs) on mean affect ratings of each clip (i.e., collapsing across the time-series), separately for cognitive empathy and affective empathy trials. As expected, positive clips were rated as more positive than negative clips for both cognitive empathy trials, $F(1, 62) = 361.70$, $p < 0.001$, $\eta_p^2 = 0.85$, and affective empathy trials, $F(1, 62) = 327.18$, $p < 0.001$, $\eta_p^2 = 0.84$. Neither of these main effects of valence were significantly moderated by group [cognitive empathy trials interaction: $F(1, 62) = 3.29$, $p = 0.08$, $\eta_p^2 = 0.05$; affective empathy trials interaction: $F(1, 62) = 3.15$, $p = 0.08$, $\eta_p^2 = 0.05$], although both were trend-level, indicating that individuals with SAD tended to exhibit more negative mean affect ratings than HCs during negative cognitive empathy trials, $F(1, 62) = 3.47$, $p = 0.07$, $\eta_p^2 = 0.05$, and during positive affective empathy trials, $F(1, 62) = 7.02$, $p = 0.01$, $\eta_p^2 = 0.10$.

Over the course of each film clip, each change in rating was counted as a single shift [*M*(SD) number of shifts for positive cognitive empathy trials: HC = 6.78(0.90), SAD = 8.94(1.14); negative cognitive empathy trials: HC = 9.40(0.86), SAD = 11.77(1.26); positive affective empathy trials: HC = 8.44(0.82), SAD = 8.57(0.84); negative affective empathy trials: HC = 7.67(0.66), SAD = 8.23(0.88)]. To examine whether the groups differed in the number of ratings made per clip, we conducted 2 group (SAD, HC) by 2 valence (positive, negative) ANOVAs on the number of shifts, separately for cognitive and affective empathy trials. There were no significant main effects of group for either the cognitive empathy trials, $F(1, 62) = 2.78$, $p = 0.10$, $\eta_p^2 = 0.04$, or affective empathy trials, $F(1, 62) = 0.11$, $p = 0.74$, $\eta_p^2 < 0.01$, nor were either of the interactions significant [cognitive empathy trials interaction: $F(1, 62) = 0.03$, $p = 0.89$, $\eta_p^2 < 0.01$; affective empathy trials interaction: $F(1, 62) = 0.21$, $p = 0.65$, $\eta_p^2 < 0.01$]. This indicates that the groups did not differ in responsiveness to the task instruction to make continuous ratings.

3.2. Empathy task: primary analyses

3.2.1. Cognitive empathy

Cognitive empathy was indexed by the *Z*-transformed time-course correlation between targets’ and participants’ ratings of the targets’ emotions (i.e., empathic accuracy scores). A 2 group \times 2 valence repeated measures ANOVA on empathic accuracy scores revealed no significant main effect of valence, $F(1, 62) = 0.24$, $p = 0.63$, $\eta_p^2 < 0.01$, no significant main effect of group, $F(1, 62) = 0.16$, $p = 0.69$, $\eta_p^2 < 0.01$, and no significant interaction of group by valence, $F(1, 62) = 0.31$, $p = 0.58$, $\eta_p^2 < 0.01$. Therefore,

compared to HCs, individuals with SAD did not exhibit any difficulties continuously tracking either the negative or positive emotions of targets. Exclusion of SAD participants with current comorbid depression and their HC matches did not change results [main effect valence: $F(1, 56) = 0.39, p = 0.54, \eta_p^2 < 0.01$; main effect group: $F(1, 56) = 0.04, p = 0.84, \eta_p^2 < 0.001$; interaction effect: $F(1, 56) = 0.18, p = 0.68, \eta_p^2 < 0.01$].

3.2.2. Affective empathy

Affective empathy was indexed by the Z-transformed time-course correlation between targets' and participants' self-ratings of emotion (i.e., empathic congruence scores). A 2 group \times 2 valence repeated measures ANOVA on empathic congruence scores revealed significant main effects of valence, $F(1, 62) = 6.43, p = 0.01, \eta_p^2 = 0.09$, and group, $F(1, 62) = 4.50, p = 0.04, \eta_p^2 = 0.07$, which were moderated by a significant interaction of group by valence, $F(1, 62) = 4.83, p = 0.03, \eta_p^2 = 0.07$. Follow-up univariate ANOVAs of group within each valence revealed that for positively-valenced clips, individuals with SAD exhibited significantly lower empathic congruence than HCs, $F(1, 62) = 7.44, p < 0.01, \eta_p^2 = 0.11$. In contrast, for negatively-valenced clips, the groups did not differ in their empathic congruence, $F(1, 62) = 0.05, p = 0.82, \eta_p^2 < 0.01$. See Fig. 2. These findings indicate that individuals with SAD exhibited difficulties with affective empathy for positive emotions of targets but not for negative emotions of targets.

Exclusion of SAD participants with current comorbid depression and their HC matches yielded similar results. There was a significant main effect of valence, $F(1, 56) = 4.62, p = 0.04, \eta_p^2 = 0.08$, a main effect group that approached statistical significance, $F(1, 56) = 3.54, p = 0.07, \eta_p^2 = 0.06$, and an interaction effect that also approached statistical significance, $F(1, 56) = 2.96, p = 0.09, \eta_p^2 < 0.05$. Follow-up tests of the interaction effect revealed an identical pattern of results: for positively-valenced clips, individuals with SAD exhibited significantly lower empathic congruence than HCs, $F(1, 56) = 5.23, p = 0.03, \eta_p^2 = 0.09$, whereas for negatively-valenced clips, the groups did not differ in their empathic congruence, $F(1, 62) = 0.14, p = 0.71, \eta_p^2 < 0.01$.

3.3. Secondary analyses: mediation of group differences in positive affective empathy

Results of the mediation models are presented in Table 2. As expected, SAD participants endorsed greater negative affect, lower

positive affect, and lower clarity of emotions than HCs (see Table 2, path a). SAD participants did not, however, differ from HCs in their attention to emotions. The interpersonal perceptions of the SAD group during positive affective empathy trials was marginally more negative than those of the HC group, $p = 0.09$.

Neither the indirect effect of negative affect nor the indirect effect of positive affect was significant. When accounting for the effect of positive affect on positive affective empathy, the effect of group (c') remained significant. When accounting for the effect of negative affect, however, the effect of group on positive affective empathy was no longer significant, suggesting that group differences in negative affect partially accounted for group differences in positive affective empathy.

The indirect effect of attention to emotions was not significant, whereas the indirect effect of clarity of emotions was significant. The indirect effect of interpersonal perceptions was also significant. Effect sizes for the two significant indirect effects (clarity of emotions and interpersonal perceptions) were in the medium-to-large range. Therefore, the tendency of the SAD group to experience poorer clarity of emotions and to perceive targets (who were expressing positive emotions) more negatively than HCs may account their relatively poorer affective empathy for positive emotions.

4. Discussion

Interpersonal difficulties lie at the heart of SAD, making the understanding of social cognitive mechanisms underlying SAD a critical area of research. As such, our primary aim was to assess cognitive and affective empathy in individuals with SAD compared to demographically-matched HCs. Consistent with our hypothesis, individuals with SAD did not differ from HCs in their ability to accurately perceive (i.e., continuously track) either the negative or positive emotions of others, indicating intact cognitive empathy. Inconsistent with our hypothesis of facilitated negative affective empathy in SAD, individuals with SAD also did not differ from HCs in their vicarious sharing of negative emotions. In contrast and consistent with our hypothesis, individuals with SAD exhibited impaired sharing of positive emotions - the degree of congruence between participants' and targets' self-ratings of emotion during positive emotion displays was significantly lower for individuals with SAD than for HCs.

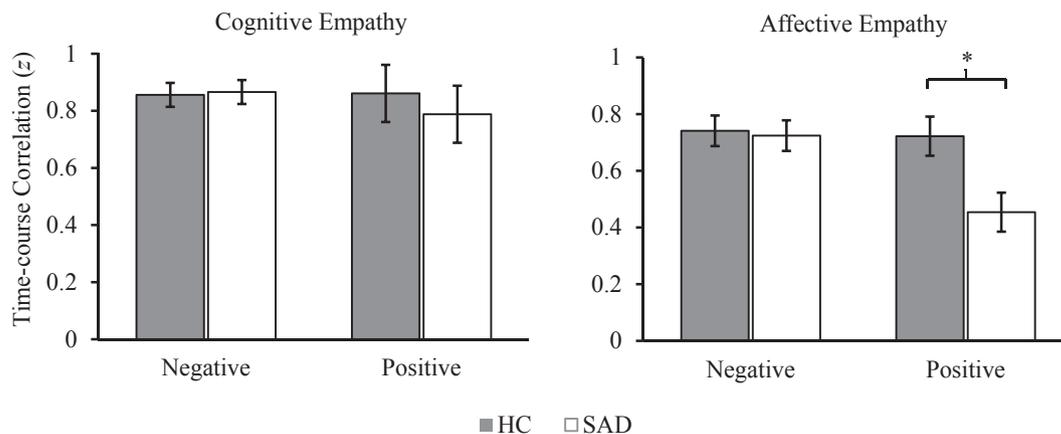


Fig. 2. Mean Fisher-transformed time-course correlations for cognitive empathy trials (i.e., correlation between targets' and participants' ratings of targets' affect) and affective empathy trials (i.e., correlation between targets' and participants' self-ratings of affect) during targets' negative and positive emotion displays in healthy control (HC) and social anxiety disorder (SAD) groups. Error bars represent standard errors. * $p < 0.01$.

Table 2
Mediation of the effect of diagnostic group on positive affective empathy.

| Mediator | <i>a</i> | <i>b</i> | <i>c'</i> | IE | SE | [95% CI] | ES | κ^2 |
|---------------------------|-----------|----------|-----------|--------|------|-----------------|-------|------------|
| Negative affect | 11.41*** | −0.004 | −0.23 | −0.04 | 0.09 | [−0.23, 0.13] | 0.16 | 0.04 |
| Positive affect | −7.22*** | −0.01 | −0.31** | 0.05 | 0.05 | [−0.07, 0.16] | −0.17 | 0.05 |
| Clarity of emotions | −10.53*** | 0.02** | −0.08 | −0.16* | 0.06 | [−0.31, −0.06] | 0.66 | 0.18 |
| Attention to emotions | 0.87 | −0.004 | −0.24* | −0.004 | 0.01 | [−0.06, 0.01] | 0.01 | 0.005 |
| Interpersonal perceptions | −0.51 | 0.16** | −0.17 | −0.08* | 0.05 | [−0.20, −0.002] | 0.32 | 0.11 |

Note. Diagnostic group (*X*) is coded dichotomously (HC = 0, SAD = 1). Positive affective empathy (*Y*) is the z-transformed correlation between targets' and participants' self-ratings of affect. *a*, *b*, *c'* = unstandardized regression coefficients for paths from *X* to *M*, *M* to *Y*, and *X* to *Y* controlling for *M*, respectively; IE = indirect effect (*a'b*) of group on positive affective empathy through mediator; SE = bootstrap standard error; CI = bias corrected bootstrap confidence intervals; ES = effect size ratio of the indirect effect to the total effect ($P_M = ab/(ab + c')$). **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

4.1. Cognitive empathy

To date, no study has explicitly examined cognitive empathy in SAD and studies in unselected samples and of related constructs have yielded inconsistent evidence. In the one study that explicitly examined cognitive empathy, social anxiety in participants facing social threat was positively associated with empathic accuracy for negative emotions expressed by targets talking about experiences of social exclusion (Auyeung & Alden, 2016). In contrast, results of a study of theory of mind in SAD suggest impairments in the ability to accurately categorize others' negative emotions (Hezel & McNally, 2014). Finally, studies on interpersonal emotion knowledge suggest that social anxiety-related difficulties mentalizing about others' emotions may be limited to complex emotional displays (for review, see O'Toole et al., 2013).

There are several methodological differences between our study and previous studies that may help to explain the conflicting results, particularly for negative emotions. Compared to the study on cognitive empathy by Auyeung and Alden (2016), we did not include a social threat condition, nor were our targets' autobiographical events specific to instances of social exclusion or inclusion. Our participants were also asked to provide continuous ratings of emotion valence, as opposed to post hoc ratings of five types of negative emotion. As such, further research will be needed to address the possibility that individuals with SAD may exhibit enhanced ability to track the valence of others' emotions under some conditions, namely, when they believe they are being watched and are hearing about negative experiences they have likely encountered themselves.

Another distinction between our study and several previous studies that may explain our null result is that we asked participants to provide ratings of the valence of emotion being displayed by targets, but not of the category of emotion being displayed. In their study of theory of mind, for example, Hezel and McNally (2014) found that individuals with SAD were impaired relative to HCs in their ability to identify the category, but not valence, of emotion. Future studies will be needed to examine whether individuals with SAD can accurately track the category of targets' naturally-unfolding emotions.

A third distinction between our study and previous studies on constructs related to cognitive empathy is that our participants were asked to provide ratings in a continuous, on-line fashion. Given that errors in theory of mind (collected in an off-line fashion) appear to be due to over-theorizing about the states of minds of others (Hezel & McNally, 2014), perhaps our requirement of making continuous ratings did not allow the time for over-thinking to occur. Although speculative, it may be that individuals with SAD are able to accurately identify the emotions and states of minds of others if required to do so in a time-limited manner, whereas more time may allow for the biases of elaborative processing (e.g., anticipatory processing; Hinrichsen & Clark, 2003) to take hold. This argument is consistent with evidence from the social cognitive

processing literature in which individuals with SAD tend to construe ambiguous social stimuli in a negative manner (e.g., Amir, Foa, & Coles, 1998; Stopa & Clark, 2000; Yoon & Zinbarg, 2007), except when asked to make these inferences in an on-line manner. In the latter case, they exhibit a lack of positive interpretation bias characteristic of non-anxious individuals, suggesting they are, in fact, more accurate in appraising the emotional valence of ambiguous social situations (Hirsch & Mathews, 2000; Philippot & Douilliez, 2005). This prediction may seem incongruent with the findings of Auyeung and Alden (2016) who used off-line ratings and found social anxiety to be associated with greater accuracy, but the greater accuracy was only for negative affect expressed while talking about socially painful experiences. In this case, greater time allowing for more elaborative processing may have allowed the "negatively biased" processing of the socially anxious individuals to overcome the *empathy gap* (i.e., the tendency for people to underestimate the physical pain of others; Kappesser, Williams, & Prkachin, 2006).

4.2. Affective empathy

We had hypothesized that SAD would be associated with enhanced negative affective empathy and impaired positive affective empathy based on results of three previous studies in unselected samples (Davis & Oathout, 1992; Davis, 1983; Samson et al., 2012). However, only our hypothesis regarding impaired positive affective empathy was supported, as individuals with SAD did not differ from HCs in their vicarious sharing of negative emotions.

These results carry several implications. First, the lack of group difference in negative affective empathy suggests that the previous findings of elevated negative affective empathy in social anxiety in unselected samples do not extend to those with a diagnosis of SAD, and/or that self-reported affective empathy does not map onto behavioral indicators of affective empathy. Given that this was the first study to modify the empathic accuracy task to provide a behavioral index of affective empathy, further research on the correspondence between these methods is required. Indeed, Zaki et al. (2008) found self-reported trait affective empathy to be related to behavioral cognitive empathy only when targets were high in emotion expressivity.

Our finding of reduced positive affective empathy in SAD is consistent with a growing literature documenting dysregulation of positive emotions in SAD. Individuals with elevated social anxiety preferentially attend away from positive relative to neutral social information (Taylor, Bomyea, & Amir, 2010), fear positive evaluation (Weeks, Heimberg, Rodebaugh, & Norton, 2008), exhibit less savoring of positive emotions (Eisner, Johnson, & Carver, 2009), and report greater expressive suppression of positive emotions (Farmer & Kashdan, 2012; Turk et al., 2005). Although we did not examine these constructs as mechanisms of the deficit in positive affective empathy among those with SAD, they may very well underlie affective empathy in SAD. For example, individuals with SAD may

suppress expression of positive emotions to a greater extent than non-anxious individuals to mitigate the likelihood of becoming the focus of others' attention. Importantly, in individuals high in social anxiety, greater suppression of positive emotions is associated with fewer positive social experiences and lower positive affect the following day (Farmer & Kashdan, 2012). Therefore, the habitual use of positive emotion suppression could have extended to the current context, even though participants were not at risk of becoming the center of attention, resulting in lower levels of positive emotion experience while viewing targets express positive emotions.

The current study also points to one way in which positive affect dysregulation in SAD may extend to interpersonal contexts. If individuals with SAD do not vicariously share in the positive emotions of interaction partners, this may be conveyed as disinterest or worse (e.g., jealousy), and may have a significant detrimental effect on the quality of the interaction and on the interaction partner's perception of the individual with SAD. Indeed, there is evidence that social anxiety is associated with the provision of less supportive responses to good news shared by a romantic partner (Kashdan, Ferrissizidis, Farmer, Adams, & McKnight, 2013). In turn, these failures to provide capitalization support have adverse consequences on the relationship, such as greater likelihood of relationship termination and greater declines in relationship quality over time (Kashdan et al., 2013). Future research is needed to explore the extent to which failures to exhibit positive empathic behaviors is driven by impaired experience of positive empathy.

4.3. Mechanisms of positive affective empathy

We selected three sets of variables to examine as mechanisms of the relationship between diagnostic group and empathy: (i) negative and positive affect, (ii) one's own emotion knowledge, (i.e., attention to and clarity of one's own emotions), and (iii) interpersonal perceptions. Of these putative mechanisms, only clarity of emotions and interpersonal perceptions exhibited significant indirect effects on positive affective empathy.

Inconsistent with hypothesis, we observed only weak evidence for the role of negative affect in positive affective empathy and no evidence for a role of positive affect in positive affective empathy. Although results of one previous study suggested that daily negative and positive affect covary positively with daily empathy, the measure of empathy in that study collapsed across negative and positive empathy domains and did not differentiate between cognitive and affective empathy (Nezlek et al., 2001). Therefore, the current results indicate that the role of trait affect in empathy may vary across different types of empathy.

We find the non-significant indirect effect of positive affect on positive affective empathy to be particularly surprising and worthy of further investigation. It may be that impaired positive affect sharing is driven by *state* positive affect rather than positive affect experienced over the previous week, as was assessed in the current study. Alternatively, *trait* positive affect may underlie positive affective empathy only in the context of particular affective states (e.g., amusement). Either way, a better understanding of the relationship between positive affect and positive affective empathy may help to explain why engaging in kind acts increases positive affect in highly socially anxious individuals (Alden & Trew, 2013). It may be that helping others increases positive affect by increasing opportunities to experience positive affective empathy. This would be consistent with the findings of a recent study which found that helping others, especially when also providing emotional support such as empathy, was associated with higher levels of happiness in helpers (Morelli et al., 2015).

When we included clarity of emotions as a mechanism of

diagnostic group on positive affective empathy, the indirect effect was significant and the direct effect of diagnostic group was no longer significant. Therefore, poorer clarity of emotions among individuals with SAD may account for their relative difficulty vicariously sharing others' positive emotions. This finding is in line with results of two previous studies of self-reported empathy, which found a positive relationship between clarity of emotions and *negative* affective empathy (Grynberg, Luminet, Corneille, Grezes & Berthoz, 2010; Guttman & Laporte, 2002). However, to our knowledge, this is the first study to examine the association between clarity of emotions and *positive* affective empathy.

Negative interpersonal perceptions (i.e., a composite variable comprised of perceived similarity to and likeability of the target, and perceived importance of the target's message) also accounted for the group difference in positive affective empathy. Although limited, there is some evidence that in non-self-relevant contexts, socially anxious individuals are more critical of others than are non-anxious individuals (e.g., Leary et al., 1988). In the current study, individuals with SAD exhibited marginally more negative interpersonal perceptions of targets expressing positive emotions than did HCs, a difference which accounted for the group difference in the sharing of targets' positive emotions. Therefore, the current finding is consistent with existing empirical support for the positive connection between empathy and greater perceived similarity to and likeability of targets, as well as perceptions of greater importance of targets' message (e.g., Krebs, 1975).

One potential explanation for the role of interpersonal perceptions in positive affective empathy is that participants with SAD were *actually* less similar to targets than were control participants. For example, individuals who reported having been raped endorsed more empathy towards a purported rape victim than did controls who denied having been raped (Barnett, Tetreault, & Masbad, 1987). The question of whether the greater empathy was due to perceived versus actual similarity was not addressed, however, nor could we address it in the current study, as we did not assess the frequency with which participants engaged in the situations targets described (e.g., being bullied, winning a scholarship). There is reason to believe that individuals with SAD experience positive affect-enhancing situations less frequently than HCs. Indeed, two of the three situations described in the positive affective empathy condition were those of successful relationship milestones (i.e., going on a vacation with a partner, getting engaged) and the incidence of romantic relationships is known to be lower for socially anxious individuals compared to non-anxious individuals (for review see Alden & Taylor, 2004). Nevertheless, the results of at least one study suggest that having similar experiences as targets may not affect objective empathic accuracy, such as our own time-course correlation, as much as it affects perceived empathy (Hodges, Kiel, Kramer, Veach, & Villaneuva, 2010). Future studies are therefore needed to test whether the significant indirect effect of negative interpersonal perceptions is motivated primarily by *actual* differences in life experiences.

4.4. Limitations and future directions

Our study had several notable strengths. First, the film clips were comprised of non-scripted discussions of real emotional situations by non-actors, thus more-closely approximating the format of disclosure that occurs in typical interpersonal interactions compared to previous studies. Relatedly, the task required dynamic judgments of complex emotion stimuli rather than simple recognition of discrete emotions, a distinction which is relevant in the assessment of interpersonal emotion knowledge in SAD (O'Toole et al., 2013). An additional strength is that our empathy task took into account the subjective ratings of targets, as compared to

previous studies in SAD, which compared participants' summary judgments of emotions to pre-defined "correct" responses. Furthermore, the time-course correlation provided a novel way to examine on-line empathy over time. Finally, stimuli were not self-relevant; this is important because elevated self-referential processing could limit understanding and vicarious sharing of others' emotions.

However, several limitations also bear noting, and these offer potential lines of further investigation. First, our matched samples are relatively small and participants with SAD were required to meet stringent recruitment criteria, thus limiting generalizability to all individuals with SAD. In particular, the rate of current comorbid depression in our sample (i.e., 10%) is relatively low for individuals with SAD, and therefore, generalization of our results should be made with caution. With regard to the empathy task, one potential limitation is that the rating of emotion *during* viewing could interfere with attention to the video clips. With regard to task stimuli, targets described varied experiences classified into two valences, but which could be comprised of a variety of different individual emotions (e.g., frustration, sadness). Furthermore, the film clips were relatively brief, with one to three total clips of each valence by trial type (cognitive empathy, affective empathy) pairing. This choice allowed us to (a) have clear and consistent stimuli across participants, and (b) limit fatigue effects. However, given that social anxiety may differentially affect different emotions within each valence (e.g., anger, sadness; Joormann & Gotlib, 2006), one important direction for future research will be to examine affective empathy and cognitive empathy related to diverse negative and positive emotions. Finally, the ratio of negative to positive clips differed across cognitive versus affective empathy trials. For cognitive empathy, three clips were negative and one positive, whereas for affective empathy, two clips were negative and three positive. There was also one positive cognitive empathy trial for practice that was not analyzed. This imbalance could have influenced results. We believe the most likely consequence would be in increasing relative Type II error for the trials that were less well represented (i.e., positive cognitive empathy and negative affective empathy trials) compared to their counterpart.

Additional research is also necessary to clarify the relationship between SAD and empathic abilities. Given that our observed group difference in positive affective empathy was a relatively small, although significant, effect, it remains unclear the extent to which positive affective empathy deficits in SAD contribute to the clinical presentation of SAD. Similarly, prospective studies are necessary to investigate whether impairments in positive affect sharing contribute to the etiology or maintenance of SAD or are a secondary effect of elevated social anxiety, a distinction that may have important implications for treatment. Related to this point, our mediation analyses should be considered hypothesis-generating for future longitudinal and experimental studies given that they were conducted on cross-sectional data. Finally, future research should examine the specificity of the current findings to SAD by including a comparison diagnostic group (e.g., individuals with a principal diagnosis of depression).

5. Conclusion

In sum, we observed deficits in the vicarious sharing of positive emotions in SAD and this deficit appears to be related to both poorer clarity of one's own emotional experience and more negative interpersonal perceptions of targets. Results of the current study also suggest that people with SAD have no difficulty perceiving the valence of emotions of targets, although previous research suggests they may have difficulty with more complex mentalizing abilities, such as understanding the motivations and

intentions of others (Hezel & McNally, 2014). Future research is required to confirm and extend the current findings but they offer promising avenues for understanding the social cognitive processes of individuals with SAD.

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