Social anxiety biases the evaluation of facial displays: Evidence from single face and multi-facial stimuli

Céline Douilliez

Univ Lille Nord de France, Lille, France and UDL3, PSITEC, Villeneuve d'Ascq, France

Vincent Yzerbyt

Université catholique de Louvain, Louvain-la-Neuve, Belgium

Eva Gilboa-Schechtman

Bar-Ilian University, Israël

Pierre Philippot

Université catholique de Louvain, Louvain-la-Neuve, Belgium

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Correspondence regarding this paper should be addressed to Céline Douilliez, Univ Lille-Nord de Franc-UDL3, UFR de Psychologie, Laboratoire PSITEC, Domaine universitaire Pont du Bois, BP 60149 - 59 650 Villeneuve d'Ascq, France. Email : celine.douilliez@univ-lille3.fr

Abstract

The current study examined the contribution of social anxiety to evaluative judgments of emotional facial stimuli, while controlling for participant and stimulus genders. Participants (n=63) completed two tasks: a single face evaluation task in which they had to evaluate angry *vs*. neutral faces and a facial crowd evaluation task in which they had to evaluate displays with a varying number of neutral and angry faces. In each task, participants had to evaluate the stimuli with respect to (a) the degree of disapproval, and (b) the emotional cost. Consistent with earlier studies, results showed that the evaluation of single faces was modulated by social anxiety for emotional cost, but not for disapproval ratings. In contrast, facial crowd evaluation was modulated by social anxiety on both ratings.

Key words: social anxiety; emotional facial expression; interpretation bias; evaluation bias

Social anxiety biases the evaluation of facial displays: Evidence from single and multiple facial stimuli and from different evaluation dimensions

The fear of being evaluated negatively by others is at the heart of social anxiety (SA). According to cognitive models, SA is maintained by the tendency of socially anxious individuals (SAs) to evaluate social information more negatively than non-socially anxious individuals (nSA) do (e.g., Rapee & Heimberg, 1997). A broad range of studies on evaluation biases focused on verbally transmitted social information (e.g., Gilboa-Schechtman, Franklin, & Foa, 2000). However, social situations entail the presence of audience members who are more likely to express their evaluation non-verbally than verbally, for instance, through emotional facial expressions (EFE). Accordingly, researchers explored evaluation biases in the processing of EFE.

A first line of research examining EFE decoding suggest that SAs are as accurate as nSA in identifying facially expressed emotions (e.g., Philippot & Douilliez, 2005; Schofield, Coles, & Gibb, 2007), but that they might differ in their sensitivity to angry signals in animated displays (Joormann & Gotlib, 2006; Montagne, Schutters, Westenberg, & van Honk, 2006). However, results are divergent regarding the direction of this bias: Joorman and Gotlib (2006) found that SAs are more sensitive to angry cues whereas Montagne et al. (2006) observed that SAs were less sensitive in recognising anger and disgust than controls.

A second line of research has focused on the emotional implications of EFE. For many evaluation dimensions, SAs do not demonstrate an evaluation bias for EFE (e.g., valence: Mohlman, et al. 2007; pleasantness: Heuer, Rinck, & Becker, 2007; perceived threat: Douilliez & Philippot, 2003). Only two studies evaluated a potential bias in evaluating the emotional cost for interacting with the individual displaying an EFE: Schofield et al. (2007) found that SAs over-estimated the emotional cost for interacting with an individual expressing disgust, while Campbell et al. (2009) failed to evidence such a bias for angry and

disgust faces[1]. These results suggest that, while SAs are not biased in their evaluation of valence or of threat attributed to unambiguous EFE, they may be more extreme in their evaluation of the emotional cost for interacting with people expressing rejection.

The above-mentioned studies focused on the evaluation of single faces. However, in real-life people often interact with multiple individuals simultaneously and such situations are the most feared by SAs (Latane, 1981). Investigating reactions of SAs to audiences, Veljaca and Rapee (1998) showed that SAs detect negative feedback, delivered by audience members while they give a speech, more accurately than nSA, and use a more liberal criterion for interpreting an event as negative. Gilboa-Schechtman, Presburger, Marom, and Hermesh (2005) observed that SAs evaluate facial crowds with a minority of disapproving faces more negatively than nSA. However, Lange, Keijsers, Becker, and Rinck (2008) failed to show a bias in the evaluation of friendliness of angry-neutral and happy-angry crowds in SAs women. These divergent results do not allow drawing firm conclusions on the evaluation bias of facial crowd in social anxiety.

The goal of the present study is to investigate the evaluation of (a) neutral vs. angry single faces and (b) facial crowds varying in the number of neutral and angry faces. We assessed two core evaluation dimensions for SA: disapproval/threat/unfriendliness[2] on the one hand, and the emotional cost for interacting, on the other. For the former dimension, several adjectives were selected to capture more broadly the negative evaluation that typically signals SA. The latter dimension—emotional cost for interacting—has only been examined for single faces in previous studies (Campbell et al., 2009; Schofield et al., 2007). It is considered as a proxy of the difficulty to approach others, i.e., the conscious self-evaluation of the approach tendency.

Based on previous research, we did not expect an effect of SA on the disapproval ratings for single faces. However, extending Schofield et al.'s (2007) observation for

disgusted faces, we hypothesised an effect of SA on emotional cost ratings. In contrast, we expected effects of SA for both ratings of facial crowds. Our rationale was that, when confronted with a crowd of EFE varying in expressed threat, SAs selectively detect threatening EFE, disregarding neutral ones, thereby displaying an anger superiority effect.

Finally, studies on evaluation of single faces generally used male and female faces. Unfortunately, none of the available studies in SAs systematically examined the effect of gender stimuli. Participants' gender is likely to be crucial: Rotter and Rotter (1988) reported an interaction between participant and stimulus genders in decoding EFE in a normal sample. Further, SAs frequently report difficulties interacting with opposite gender partners. Schofield et al. (2007) showed an effect of participant gender on evaluation but did not examine the interaction between stimulus and participant genders. To overcome these limitations, we took both factors into account.

To sum up, this study examined how SA influences evaluative judgments of emotional facial stimuli. Participants were presented with either single facial expression or multiple facial expressions (crowd) and had to (a) rate them in terms of disapproval, and (b) evaluate the emotional cost for interacting.

Method

Participants

Participants were 63 undergraduates (45 women; mean age: 20.49, *sd*=2.04) who received a lottery ticket for their participation. SA was assessed with the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987; *M*=47.02, *sd*=19.57). Participants also completed the Beck Depression Inventory (BDI-II, Beck, Steer, & Brown, 1994; *M*=10.03, *sd*=8.66).

Material

Seventy-two pairs of single face pictures (one showing a neutral expression and the other an angry expression) of 72 individuals (half were women) were used. Seventy pairs

were obtained from the Karolinska Directed Emotional Faces (Lundqvist, Flykt, & Öhman, 1998) and two pairs were obtained from the Japanese and Caucasian Facial Expressions of Emotion Faces (Matsumoto & Ekman, 1993-2004). Pictures were resized to 5.01x5.01 cm, in an 8-bit greyscale. Each of the 144 faces was displayed once in the single face evaluation task (SFET).

For the facial crowd evaluation task (FCET), 72 matrices of 9 (3x3) facial expressions were constructed. Matrices varied as a function of the ratio of angry vs. neutral faces (this factor is called "threat intensity" hereafter) and as a function of the expresser's gender —each matrix contained only same gender expressers. There were 9 levels of intensity from 0 (crowd comprising no angry face and 9 neutral faces) to 8 (crowd comprising 8 angry faces and one neutral face). Four sets were constructed for each gender-intensity combination. Stimulus size was 15.03x15.03cm.

Procedure

Participants completed the FCET and SFET in E-Prime 1.1 (Schneider, Eschman, & Zuccolotto, 2002). The order of the tasks was counterbalanced across participants. In both tasks, each trial started with a fixation cross displayed during a random duration varying from 1200 to 1700 ms. Next, the stimulus (single face vs. facial crowd) was displayed during 300 ms. Following stimulus offset, the disapproval scale appeared in the centre of the screen until a response was provided, followed by the emotional cost scale.

SFET. Participants were asked to evaluate how disapproving/approving the face was (disapproval rating) using a scale from -3 (*completely disapproving, unfriendly, threatening*) to +3 (*completely approving, friendly, reassuring*). Finally, they were asked to evaluate how difficult it would be to interact with this individual (emotional cost rating) using a scale from -3 (*very difficult*) to +3 (*very easy*). There were 3 practice trials and 144 experimental trials.

FCET. Similar to the SFET, participants were requested to provide disapproval and emotional cost ratings. There were 3 practice and 72 experimental trials.

Afterwards, participants completed the questionnaires, and were debriefed.

Statistical analyses

Similarly to recent studies (e.g., Schofield et al., 2007), we used hierarchical linear modelling (HLM). HLM allows accounting for intra- and inter-individual variances simultaneously and is thus particularly suited for this study design. Participants constituted level-1 units with within-subject factors (stimulus gender and valence for SFET; stimulus gender and linear and quadratic trends in threat intensity for FCET) as predictors, and participants' characteristics (gender, SA) were level-2 units (for description of HLM, see Raudenbusk, & Bryk, 2002). We usedHLM 6 (Raudenbusk, Bryk, Cheong, Congdon, & duToit, 2004).

We analyzed the data separately for the FCET and SFET, and examined dependent measure separately to determine whether stimulus gender, threat intensity, SA, and participant gender predicted the intensity of disapproval[3] of face/crowd and the emotional cost for interacting with the individual/crowd.

Results

Disapproval ratings

In the SFET (Table 1), results showed an interaction between SA, participant gender, and face valence, $t(59)=-2.12$, $p<.05$. Following this interaction, we ran separate analyses for men and women. The effect involving SA was not significant for female or male participants. This pattern of results does not plead for a significant moderation by social anxiety of disapproval ratings for single faces.

In the FCET (Table 2), as expected, disapproval ratings increased as a function of SA, $t(59)= 4.38$, $p<.001$. The linear effect of threat intensity, $t(59)= 9.31$, $p<.001$, indicating an

increase of disapproval as threat intensity increased, was moderated by SA, $t(59)= 2.76$, $p<.01$, in that the linear impact of threat intensity was more marked at higher SA levels. This interaction was qualified by a three-way interaction with participant gender, $t(59)=-2.00$, $p= .05$. For females, disapproval ratings increased as a function of SA, $t(43)= 3.63$, $p<.001$, without any interaction with intensity. For males, we found an effect of SA, $t(16)= 5.81$, $p<.001$, qualified by an interaction with linear threat intensity, $t(16)= 4.03$, $p= .001$, and quadratic threat intensity, $t(16)= 2.43$, $p<.05$. Thus, in female participants, SA increased disapproval judgment in crowds irrespective of their intensity, wheras for males, the impact of SA is greater for more intensely angry crowds.

There was also an interaction between SA and crowd gender, $t(59)= 2.26$, $p<.05$. This interaction was qualified by a three-way interaction between social anxiety, participant gender and crowd gender, $t(59)=-2.67$, $p<.05$. For male participants, the correlation between SA and disapproval ratings of female faces was significant, $r=.68$, $p<.005$, indicating that increased SA was associated with a greater tendency to evaluate female crowds as disapproving, whereas the correlation between SA and disapproval ratings of male faces was not significant, $r=.18$, $p=.47$. For female participants, the correlation between SA and disapproval ratings of male crowds was significant, $r=.33$, $p<.05$, indicating that, in female participants, greater SA was associated with a greater tendency to evaluate male crowds as disapproving, whereas the correlation between social anxiety and disapproval ratings of female crowds was not significant, $r=.28$, $p=.07$. In sum, this interaction indicates that the more participants were socially anxious, the more they judged a facial crowd of the *opposite* gender as being disapproving.

Emotional cost ratings

Consistent with our hypothesis, we found that in SFET (see Table 1), the SA was positively associated with greater emotional cost of an anticipated social interaction $t(59)=$

3.97, $p<.001$. Interestingly, this effect was not moderated by the emotionality of the face, suggesting that, in the single face condition, SA enhances emotional cost for angry as well as neutral facial expressions.

These findings were replicated in the FCET. Emotional cost for interacting increased as a function of SA, $t(59)= 5.44$, $p<.001$. However, the linear effect of intensity, $t(59)= 8.22$, $p<.001$, showing that the emotional cost increased as a function of the threat intensity of the crowd, was moderated by social anxiety, $t(59)= 2.51$, $p<.05$: The positive linear impact of threat intensity was more marked at higher levels of social anxiety. There was a three-way interaction between SA, participant gender, and quadratic threat intensity, $t(59)=-2.82$, $p<.01$. For female participants, the emotional cost increased as a function of SA, $t(43)= 3.63$, $p= .001$. Turning to male participants, we found an effect of SA, $t(16)= 4.38$, $p<.001$, qualified by an interaction with quadratic threat intensity, $t(16)= 5.63$, $p<.001$, confirming the fact that the quadratic impact of threat intensity tended to be more marked at higher levels of SA. In other words, as was the case for disapproval judgment, social anxiety increased the cost for interacting among female participants. In contrast, among male participants, this effect was moderated by the anger intensity of the crowd: The effect increased as a function of crowd intensity, and this increase was more marked at higher level of intensity.

There was also an interaction between SA and crowd gender, $t(59)=2.49$, $p<.05$. This interaction was moderated by a marginal three-way interaction between social anxiety, participant gender and crowd gender, $t(59)=-1.96$, $p=.05$. For male participants, the correlation between SA and crowd of female faces was significant, $r=.69$, $p< .005$, indicating that the more male participants were socially anxious, the more they evaluated female crowds as disapproving, whereas the correlation between SA and emotional cost ratings of male faces tend to be significant, $r=.44$, $p=.06$. For female participants, the correlations between SA and emotion cost ratings of both male and female crowds were significant, respectively, $r=.52$,

$p<.001$, and $r=.46$, $p<.002$, indicating that the more female participants were socially anxious, the more they evaluated crowds as disapproving, irrespective of crowd gender. Examination of the correlation pattern suggests that SA was related to emotional cost ratings with facial crowd although the magnitude of the correlation varies as a function of participant and crowd genders.

Discussion

Disapproval ratings

In line with previous work (e.g., Douilliez & Philippot, 2003; Heuer et al., 2007), the present findings suggest that SA does not impact the explicit evaluation of disapproval of single angry and neutral faces. This was not the case for stimuli involving multiple emotional expressions. SA became more sensitive as the number of angry faces in the crowd increased. As mentioned in the introduction, two other studies also investigated the evaluation of facial crowds in social anxiety. Lange et al. (2008) found an impact of social anxiety in terms of action tendencies (see discussion below) but not in ratings of friendliness. This latter scale, however, is less ecologically valid than disapproval ratings, as socially anxious individuals are especially afraid of *negative* social judgment. In contrast, Gilboa-Schechtman et al. (2005) observed differences between social phobic individuals and controls when evaluating disapproval in facial crowds. The effect reported by Gilboa-Schechtman et al. (2005) is slightly different from the one observed in the present study in that their social anxiety effect appeared only for moderately disapproving crowds. Several methodological differences offer a potential explanation for this difference. In Gilboa-Schechtman et al (2005)'s study, crowds comprised angry, neutral as well as happy expressions, less angry expressions were used, and time of exposure was longer (2500ms). Moreover, participants were depressed and/or socially anxious patients. Taken together, the present results suggest that SA influences the evaluation of facial crowds in terms of disapproval.

The present data support the notion that SA differentially affects the processing of emotional faces depending on whether the emotional expression is to be found in a single display or in a crowd. When confronted with simple unambiguous emotional expressions, socially anxious individuals provide evaluations of disapproval that are similar to control participants. In contrast, crowds are frequently complex stimuli, containing conflicting information. When confronted with such information, socially anxious individuals might more rapidly detect (Gilboa-Schechtman et al., 1999) and give more weight to disapproval cues that are relevant for their concerns. These results support the notion that "the presence of angry faces in neutral crowd appears to trigger an increase in the threat evaluation in SAs" (Lange et al., 2008, p. 941). However, single faces could also be ambiguous. A recent study by Gilboa-Schechtman, Foa, Vaknin, Marom, and Hermesh (2008) showed that biases in the decoding of a single face emerge under condition of ambiguity which was created by morphing. Future studies may further explore this role of ambiguity in the evaluation of disapproval and emotional cost for interacting with single faces.

An alternative explanation for the difference between the evaluation of single faces versus facial crowds is that socially anxious individuals may be more reactive when confronted with several individuals as opposed to one. A crowd would thus elevate their state anxiety more than a single individual, resulting in an evaluation bias for the former but not the latter. It is interesting to note that the only study to evidence a decoding bias for single static faces in social anxiety had induced a state of social anxiety prior to the task (Mohlman et al., 2007).

Emotional cost ratings

Schoefield et al.(2007) showed that SA overestimate the emotional cost for interacting with an individual facially expressing disgust even though they were not biased in their decoding of the same expressions. The present study replicates and extends this finding in

several ways. Whereas no effect was observed for disapproval ratings, SA increased the perceived emotional cost for interacting with single faces, whether expressing neutral state or anger. This discrepancy between rating dimensions could be explained by the fact that the difficulty to interact with other is closer to the action tendency that is affected by SA (see Heuer et al., 2007). It is interesting to note that neither our study nor Heuer et al.'s study found a moderating effect of face valence. In other words, it appears that socially anxious individuals believe that interacting with another person is emotionally taxing, regardless the emotional state of the expected interlocutor.

A similar effect of SA was observed: The perceived emotional cost of interacting increased as a function of SA. However, in contrast to the single face condition, the impact of the number of angry faces in the crowd on the emotional cost for interacting increased with SA. Lange et al. (2008), in their Approach Avoidance Task, also observed that the avoidance of neutral-angry crowds tended to increase with the number of angry faces in SAs but not in nSA.

A note on participant and stimulus gender

This study considered participant and stimulus genders, and revealed that their interaction was qualified by SA for both evaluation dimensions in a facial crowd. As expected, the more participants were socially anxious, the more they judged a facial crowd of the opposite gender as disapproving. However, the pattern of results was less clear for the emotional cost ratings. SA seems to be related to a higher emotional cost for interacting with crowds regardless of gender of crowds and participants.

Participant gender seems to moderate the relationship between SA and intensity of facial crowds. Indeed, female participants were not affected by the crowd's intensity: The more socially anxious they were, the more they judged crowds as disapproving and as costly. In contrast, for male participants, both the linear and quadratic impacts of crowd intensity

were more pronounced at higher levels of SA for the disapproval ratings. For emotional cost ratings, the quadratic impact of threat intensity was more marked at higher levels of social anxiety.

However, the results must be cautiously interpreted with some cautious given the our sample size of our sample.

Limitations and Future Directions

First, the present study views social anxiety as a continuum (e.g., Rapee & Heimberg, 1997) and therefore focused on the whole range of social anxiety. Our findings have to be replicated in clinical populations. Second, the current study only explored neutral and angry expressions. Our results need to be generalised to other negative (e.g., contempt, disgust) as well as positive (e.g., joy, see Campbell et al., 2009) expressions that may be relevant for the understanding of disapproval and emotional cost ratings in social anxiety. Finally, the present design cannot exclude the possibility that an elevation of anxiety due to the confrontation of a facial crowd explains the difference in disapproval evaluation between single face and facial crowd. In future research, anxiety could be manipulated or at least measured before and after each task in order to control its effect on judgment.

In conclusion, the present findings add to previous studies that indicate that SA does not bias the interpretation of simple and non-conflicting stimuli such as single faces. They are also congruent with previous data showing that SA increases the cost for interacting with others presented as facial stimuli. This latter bias may index a core maintaining factor of SA that appears to mediate successful treatment changes (Hofmann, 2007). In sharp contrast, when people are confronted with conflicting information, as is often the case in facial crowds, SA increases the sensitivity to threat intensity in disapproval as well as in emotional cost judgements.

The discrepancy between single and multiple facial displays may be explained by several, not necessarily incompatible, explanations. First, the greater ease of detecting angry faces in social anxiety (Gilboa-Schechtman et al, 1999). This attentional bias may lead to assign this information more weight in their judgment. Second, it may be that the intensity of a single face may not be sufficient to activate a disapproval evaluation whereas facial crowds may be (a "dose effect"). At the same time, however, single angry faces are more threatening than single neutral faces and can thus be considered a greater “dose” than the latter. The fact that our data revealed no clear difference between single anger and neutral faces clearly questions this alternative explanation.

Obviously, further research is needed using eye movement recording during the evaluation task in order to better understand how selection and interpretation processes relate to each other when people process facial crowds. This kind of research allows for an examination of the extent to which attentional indexes (e.g., first fixation, number of angry faces fixed, and fixation duration on angry faces) can predict facial crowd evaluation.

Finally, the current study underlines the importance of integrating both participant and stimuli genders in research designs. Some discrepancies between studies may be explained by the gender composition of sample and materials (e.g., Lange et al., 2008, used only female participants). It should be noted that SA men displayed a negative interpretation towards complex stimuli that was more sensitive to threat intensity than in women.

Concluding comments

Consistent with earlier studies, we found that the disapproval evaluation of a crowd of angry and neutral faces, but not of a single angry or neutral face, was modulated by social anxiety. Furthermore, our findings suggest that SA over-evaluate the cost for interacting with a single individual or with a group of individuals. Combined, these data offer strong support

for Hofmann's comprehensive model of social anxiety (2007) that underlines the core role of biased estimated social cost in the maintenance of social anxiety.

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Footnotes

[1] It should be note that the operationalisation of “cost for interacting” is slightly different in those two studies. In Schofield et al. (2007), participants had to evaluate “what it would be like to interact with” on a scale from very bad to very good for me. Campbell et al. (2009) asked their participants to evaluate how likely they are “to approach and engage the presented person in a social interaction”.

[2] This dimension is called « disapproval rating» in the remainder of the text.

[3] In order to facilitate the interpretation of results for the evaluation of disapproval and the emotional cost for interacting, theses scales were reversed: the higher the score, the higher the disapproval or the emotional cost for interacting.

Table 1.

Summary of SFTE results for disapproval and emotional cost ratings

	Dependent variable	
Predictor	*Disapproval ratings*	*Emotional cost ratings*
	Coefficient (SE)	Coefficient (SE)
Level 1		
Intercept	0.566 (0.047)***	0.544 (0.059)***
Participant Gender	-0.063 (0.045)	-0.034 (0.064)
Social Anxiety	0.004 (0.002)	0.011 (0.003)***
Social Anxiety x Participant Gender	-0.000 (0.002)	0.002 (0.003)
Level 2		
Face Gender		
Intercept	-0.116 (0.014)***	-0.128 (0.015)***
Participant Gender	-0.051 (0.015)***	-0.046 (0.016)*
Social Anxiety	0.001 (0.001)	0.001 (0.001)
Social Anxiety x Participant Gender	-0.001 (0.001)	-0.000 (0.001)
Face Valence		
Intercept	1.012 (0.050)***	0.948 (0.055)***
Participant Gender	0.084 (0.048)	0.074 (0.056)
Social Anxiety	0.002 (0.003)	0.002 (0.003)
Social Anxiety x Participant Gender	-0.006 (0.003)*	-0.005 (0.003)

*Note.** $p < .05$; ** $p < .01$; ***. $p < .001$

Table 2.

Summary of FCET results for disapproval and emotional cost ratings

	Dependent variable	
Predictor	*Disapproval ratings*	*Emotional cost ratings*
	Coefficient (SE)	Coefficient (SE)
Level 1		
Intercept	0.242 (0.061)***	0. 230 (0.060)***
Participant Gender	-0.173 (0.057)**	-0.066 (0.057)
Social Anxiety	0.010 (0.002)***	0.015 (0.003)***
Social Anxiety x Participant Gender	0.000 (0.002)	0.002 (0.003)
Level 2		
Crowd Gender		
Intercept	-0.115 (0.026)***	-0.104 (0.023)***
Participant Gender	-0.097 (0.025)**	-0.075 (0.022)**
Social Anxiety	0.003 (0.001)*	0.001 (0.002)*
Social Anxiety x Participant Gender	-0.004 (0.001)*	-0.001 (0.002) †
Crowd Intensity$_{linear}$		
Intercept	0.114 (0.012)***	0.110 (0.013)***
Participant Gender	-0.016 (0.013)	-0.011 (0.014)
Social Anxiety	0.001 (0.000)**	0.001 (0.000)*
Social Anxiety x Participant Gender	-0.001 (0.000)	-0.001 (0.000)
Crowd Intensity$_{quadratic}$		
Intercept	0.006 (0.001)***	0.006 (0.001)***
Participant Gender	-0.001 (0.001)	-0.001 (0.001)
Social Anxiety	0.000 (0.000)	0.000 (0.000)
Social Anxiety x Participant Gender	-0.000 (0.000) †	-0.000 (0.000)**

Note. * $p < .05$; ** $p < .01$; *** $p < .001$