



Social Evaluation in Emerging Adults: Associations with Interpretation Bias and Perceived Social Support

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Abstract

Social anxiety symptoms are one of the most common mental health concerns across the lifespan (Bandelow and Michaelis in *Dialogues Clin Neurosci* 17(3):327–335, 2015. <https://doi.org/10.31887/DCNS.2015.17.3/bbandelow>) and are especially relevant during emerging adulthood, when social feedback occurs daily (Auxier and Anderson in *Social media use in 2021, 2021*. <https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/>) as emerging adults navigate new social environments. Two cognitive processes have been identified as relevant to social anxiety: high threat interpretation bias (i.e., the tendency to appraise threat from ambiguity; Rozenman et al. in *Behav Ther* 45(5):594–605, 2014. <https://doi.org/10.1016/j.beth.2014.03.009>; *J Anxiety Disord* 45:34–42, 2017. <https://doi.org/10.1016/j.janxdis.2016.11.004>) is associated with high social anxiety, whereas high perceived social support is associated with low social anxiety. In this study, emerging adults ($N = 303$) completed an online adaptation of the Chatroom task (Guyer et al. in *Arch Gen Psychiatry* 65(11):1303–1312, 2008. <https://doi.org/10.1001/archpsyc.65.11.1303>), an experimental paradigm designed to simulate social acceptance and rejection, as well as a performance-based measure of interpretation bias (Word Sentence Association Paradigm; Beard and Amir in *Behav Res Ther* 46(10):1135–1141, 2008. <https://doi.org/10.1016/j.brat.2008.05.012>), and a self-report measure of perceived social support (Multidimensional Scale of Perceived Social Support; Zimet et al. in *J Pers Assess* 52(1), 30–41, 1988. https://doi.org/10.1207/s15327752jpa5201_2). Social anxiety symptoms did not increase as a function of acceptance or rejection during the Chatroom task. However, there were significant interactions between each cognitive predictor and social anxiety change: emerging adults with low interpretation bias towards threat and emerging adults with high perceived social support both experienced decreases in social anxiety from pre- to post-Chatroom task, regardless of whether they were accepted or rejected during the Chatroom task. If replicated, low interpretation bias and high perceived social support may serve as promotive factors in social interactions for emerging adults.

Keywords Social anxiety · Interpretation bias · Perceived social support · Chatroom task · Emerging adulthood · Social evaluation

Social anxiety (SA) is one of the most common mental health concerns across the lifespan. While concerns about social evaluation naturally increase over the lifespan [1], these concerns constitute a disorder for 13% of individuals at some point in their lives [2]. At both diagnostic and elevated symptom levels,¹ SA can cause impairment in educational, occupational, and social domains [3]. Compared to those without SA, individuals with SA tend to have fewer friends and romantic partners, and consider their relationships to

be lower quality [4]. Understanding the social mechanisms underlying SA can help to inform intervention and prevention efforts, as well as to identify factors that may protect against SA risk.

Emerging adulthood, the period of life from the late teens through the twenties [5], represents a crucial window for understanding the experience of SA. As adolescents transition to early adulthood, they become increasingly independent, relying less on parental support and more on the support of peers and romantic partners [6]. This developmental stage brings new challenges and opportunities, such as navigating

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¹ The present study examines SA *symptoms*, rather than *diagnoses*. All mentions of SA henceforth refer to symptoms unless otherwise specified.

new social environments and establishing new social identities [5]. The stress of these transitions may trigger or exacerbate mental health problems [7], including SA [8].

Emerging adults receive social feedback daily [9], and arguably constantly [10], as they navigate new social environments, including virtual ones. Eighty-four percent of emerging adults use social media sites [9]. While individuals interact virtually starting as early as middle childhood, emerging adulthood represents a particularly important window for studying social media usage. New-found decreases in parental supervision over their online activities, coupled with increases in autonomy over their time [11], distinguishes this developmental stage from others. Online, emerging adults may receive explicitly positive (e.g., receiving “likes” on pictures) and negative (e.g., being “unfriended”) social feedback, which may be perceived as acceptance and rejection, respectively.

Regardless of whether feedback is explicitly positive or negative, individuals with SA respond differently from their non-anxious counterparts: they are more likely to (1) “catastrophize” mildly negative feedback [12] and (2) discount positive feedback, interpreting it negatively [13]. This negative and threat-focused cognition, even in response to explicitly positive feedback, has been proposed as a process underlying SA [14]. But what are the cognitive mechanisms that drive this social misperception? In this study, we propose that two forms of social perception—threat interpretation bias and perceptions of social support—may be relevant to how individuals experience social acceptance and rejection, and that these two processes may drive SA.

One process underlying SA that may be relevant to social feedback is interpretation bias (IB), or the tendency to appraise threat from ambiguity [15, 16]. As social demands increase over the course of development, IB may drive avoidance of social interactions and increase SA. This, in turn, can perpetuate a worsening cycle of IB, social withdrawal/avoidance, and SA over time [17]. IB has been identified as a cross-sectional correlate and causal predictor of anxiety, including in elevated symptom [18] and unselected community [19] samples. Critically, the content of IB is specific to anxiety symptom domain [12, 20]. For example, individuals with SA are particularly attuned to interpret threat from ambiguous *social* situations, but not necessarily from other anxiety domains. As such, this study will focus on *social* IB, and henceforth any mention of IB refers to social IB specifically.

To date, IB has been primarily examined in the context of *social ambiguity*, whereby individuals are asked to attribute meaning to social information that is not explicitly positive or negative and instead leaves room for interpretation by the individual. However, as SA is associated with misperceptions of explicitly objective positive (e.g., social acceptance) and negative (e.g., social rejection) information [12, 13], IB

may also be relevant to social information that is unambiguous. Said differently, objective rejection may lead to higher threat IB about ambiguous social situations.

A second and separately examined process in SA is perceived social support (PSS), or the “perception that one is cared for and esteemed” [21]. Low PSS confers risk for the development of mental health problems [22], while high PSS protects against them [23]. PSS is associated with SA specifically: low levels of PSS are linked to high levels of SA, and vice versa [24, 25]. PSS is particularly important to understand during emerging adulthood, when primary sources of support shift from parents to peers and romantic partners [6]. Furthermore, PSS is important to understand in the context of online social evaluation, since emerging adults rely on online social networks for support [26].

IB and PSS represent two processes that may influence SA. Both may be considered *cognitive* processes, given that each relies on individual perceptions of one’s environment. While IB has been explored as a cognitive bias for decades [27], PSS has not yet been linked to models of cognitive processing. Yet evidence suggests that PSS may be a cognitive process: low PSS is associated with negative interpretations of supportive behaviors [28] and negative attributions may decrease the positive effects of PSS on mental health symptoms [29]. For example, a socially anxious individual might react to a social invitation by thinking, “They don’t actually like me, they just invited me to be polite.” Currently, it is unclear whether IB and PSS each contribute to the experience of SA.

The Current Study

The present study aimed to conduct a cross-sectional investigation of SA, IB, and PSS in emerging adults. First, we aimed to examine associations between SA, IB, and PSS *prior to social evaluation* (Aim 1), hypothesizing that IB and PSS would be negatively correlated: low levels of PSS would be correlated with high levels of IB, and vice versa. We also explored whether each construct contributed unique variance in statistically predicting SA. Second, no prior work has examined whether the experience of acceptance or rejection moderates the relationship between IB or PSS with SA change. To this end, we examined whether SA changed as a function of acceptance or rejection (Aim 2), hypothesizing that SA would increase from pre- to post-*rejection*, as compared to *acceptance* during social evaluation. We also explored whether IB and PSS might moderate the relationship between acceptance/rejection and SA change.

Table 1 Demographics for full sample and by condition

	Total sample (<i>N</i> = 303)	Accepted (<i>n</i> = 152)	Rejected (<i>n</i> = 151)
Age (<i>M</i> , <i>SD</i>)	19.39 (1.44)	19.38 (1.36)	19.40 (1.52)
Gender (<i>n</i> , %)			
Cisgender woman	225 (74.24%)	108 (71.05%)	117 (77.48%)
Cisgender man	65 (21.45%)	35 (23.03%)	30 (19.87%)
Transgender woman	4 (0.01%)	3 (1.97%)	1 (0.66%)
Genderfluid	4 (0.01%)	3 (1.97%)	1 (0.66%)
I prefer not to disclose	5 (0.02%)	3 (1.97%)	2 (1.32%)
Ethnicity (<i>n</i> , %)			
Not Hispanic/Latinx	265 (87.46%)	131 (86.18%)	134 (88.74%)
Hispanic/Latinx	33 (10.89%)	18 (11.84%)	15 (9.93%)
I prefer not to disclose	5 (0.02%)	3 (1.97%)	2 (1.32%)
Race (<i>n</i> , %)			
White	246 (81.19%)	124 (81.58%)	122 (80.79%)
American Indian/Alaska Native	4 (0.01%)	3 (1.97%)	1 (0.66%)
East Asian	12 (0.04%)	4 (2.63%)	8 (5.30%)
South Asian	6 (0.02%)	4 (2.63%)	2 (1.32%)
Native Hawaiian or other Pacific Islander	1 (0.00%)	1 (0.66%)	0 (0.00%)
Black or African American	10 (0.03%)	5 (3.29%)	5 (3.31%)
More than one race	13 (0.04%)	4 (2.63%)	9 (5.96%)
I prefer not to disclose	6 (0.02%)	5 (3.29%)	1 (0.66%)
Other	5 (0.02%)	2 (1.32%)	3 (1.99%)
SCAARED (<i>M</i> , <i>SD</i>)			
Total score	37.46 (16.19)	36.51 (17.77)	38.40 (14.41)
SA subscale score	6.56 (3.47)	6.50 (3.60)	6.63 (3.34)
MSPSS (<i>M</i> , <i>SD</i>)	5.57 (0.99)	5.56 (0.96)	5.57 (1.02)
WSAP (<i>M</i> , <i>SD</i>)	0.46 (0.18)	0.48 (0.20)	0.45 (0.17)

SCAARED Screen for Adult Anxiety Related Disorders, MSPSS Multidimensional Scale of Perceived Social Support, WSAP Word Sentence Association Paradigm

Method

Participants

Participants included 303 emerging adults at the University of Denver who were at least 18 years of age at the time of participation and who completed all study procedures. Demographic information for the full sample is presented in Table 1.

Due to the preliminary nature of this work, we did not conduct a priori power analyses; to our knowledge, no previous studies provide effect sizes for associations between PSS and performance-based IB. In regards to Aim 1, prior studies examining associations between the WSAP and the SCAARED [30–32] in college students found moderate, positive, and significant correlations (range: lowest $r = 0.26$, $p = 0.03$; highest $r = 0.62$, $p < 0.001$) in sample sizes ranging from 40 to 130. To our knowledge, no prior studies with the Chatroom task have examined associations between anxiety change (either total anxiety or SA) in the context of

acceptance/rejection (Aim 2). A target sample size of 200 was determined based on these data and length of time for recruitment (6 months based on the allocation of the Department of Psychology subject pool extra credit slots).

We conducted post-hoc sensitivity analyses with G*Power 3.1 using our final sample size ($N = 303$). Assuming 0.80 power and $\alpha = 0.05$ for Aim 2b, our highest-order interaction test (Analysis of Covariance three-way interaction with condition [accept, reject] x WSAP [or MSPSS] x time [SA pre-Chatroom, SA post-Chatroom]), we determined that we would be able to detect an effect size of $f = 0.20$ (a small-to-medium effect).

Procedure

This study was approved by the University of Denver's Institutional Review Board prior to initiation of any study procedures. Participants were recruited through the Department of Psychology subject pool, flyers posted around campus in non-Psychology buildings and university common areas, and

online through student-focused organizations and introductory courses across disciplines. Interested participants were directed to a Qualtrics link where they reviewed and signed an informed consent document, and subsequently uploaded a headshot under the guise that it would be used for study participation in a national online study of emerging adult social interaction.

Once the receipt of their headshot was confirmed, participants were emailed a personalized link to access the study via Inquisit's Millisecond web-based software (Inquisit [33]). Participants were informed that when they clicked the link, they would be prompted to download Millisecond to "connect to the nationwide network of college students participating in this study"; in reality, it simply enabled the experiment to run on participants' computers.

Once the experiment began, participants provided demographic information and completed questionnaires assessing anxiety symptoms (including SA), PSS, and state affect "right now" (see Materials and Tasks section). Participants completed the performance-based IB task and the first phase of the social interaction task. After repeating the state affect questionnaire, they completed the second phase of the social interaction task, a third assessment of state affect, and anxiety (including SA) "right now." Finally, deception was assessed via an online funnel method [34] and participants were debriefed. (For study flow, see Supplementary Material Figure S1.)

Materials and Tasks

Participants were asked to report their age, gender, race, ethnicity, and year in school.

The Screen for Adult Anxiety Related Disorders (SCAARED, [35]) is a 44-item self-report measure of anxiety symptoms with four subscales (i.e., SA, somatic/panic/agoraphobia, generalized anxiety, separation anxiety). Theoretically, the SCAARED measures clinical anxiety symptoms consistent with those in the Diagnostic and Statistic Manual of Mental Disorders (DSM), and, as such, may be considered trait-like symptoms (rather than state anxiety symptoms). Measures of trait anxiety (e.g., [36]) and clinical anxiety symptoms (e.g., [37]) have shown to be sensitive to changes in anxiety when administered pre-/post-same-day experimental manipulations. Moreover, this measure was selected for its strong psychometrics in regard to identifying clinical anxiety symptoms in both community and diagnosed samples [35]. The first time the SCAARED was administered near the start of study procedures, participants were instructed to respond based on their anxiety symptoms over the last three months. The second time it was administered following the social evaluation task, participants were instructed to respond based on their anxiety "right now." The SA subscale was used for analyses of primary aims,

though we also examined total anxiety scores, described in the Supplementary Material. In this sample, Cronbach's alpha for the SA subscale pre-Chatroom was 0.84 and for the SCAARED total score pre-Chatroom was 0.94.

The Multidimensional Scale of Perceived Social Support (MSPSS, [38]) is a 12-item self-report measure of PSS that queries perceptions of how much an individual feels they can count on friends, family, and significant others. The scale has good to excellent internal consistency and convergent and discriminant validity [39], and has been validated for use with emerging adults [40]. In this sample, Cronbach's alpha for the MSPSS was 0.90.

The Word Sentence Association Paradigm (WSAP) is a performance-based measure of IB. Though it was initially developed for adults [41], the task has been adapted, and psychometric properties established, for use across development [15, 16], including in emerging adulthood [30].

Each trial begins with the presentation of a fixation cross in the center of the screen for 500 ms, immediately followed by either a threat word (e.g., ugly) or a neutral word (e.g., pretty) in the center of the screen for 500 ms. An ambiguous sentence (e.g., "Your friend comments on your new haircut") then appears in the center of the screen until the participant presses a spacebar to indicate that they have finished reading the sentence. The computer then prompts, "Was the word related to the sentence?" and the participant indicates with a button press (yes/no) whether they believe the word and sentence were related. A response was considered a "threat interpretation" if participants indicated that, "yes," a threatening word was related to an ambiguous sentence. Participants are instructed to respond as quickly and as accurately as possible, unaware that word stimuli have threat or neutral valence and that sentences were ambiguous. A total of 100 trials reflecting social IB were administered, with each sentence presented twice: once following a threat word and once following a neutral word, for a total of 50 threat trials and 50 neutral trials presented in random order.

Data were screened and cleaned per convention. First, data from included trials were determined based on reaction times (within 50–3500 ms range; [16, 41]). On average, participants had 98% usable data (range 76–100%). As in other studies using the WSAP [15, 16, 30, 41], the percent of threat interpretations endorsed was calculated out of all possible threat interpretations from that participant's useable data (i.e., trials when threat words appeared with ambiguous sentences with responses within 50–3500 ms response range).

The International Positive and Negative Affect Scale—Short-Form (I-PANAS-SF, [42]) is a 10-item self-report measure of affect with two subscales (i.e., positive affect [PA], negative affect [NA]) whereby participants rate on a 5-point Likert scale how much they feel each emotion "right now." The I-PANAS-SF was administered three times:

before starting Phase 1 of the social evaluation task, after Phase 1 (following selection of prospective chat partners), and after Phase 2 (following receipt of feedback [i.e., acceptance or rejection]). We utilized the NA subscale to explore differences between Chatroom task conditions (acceptance, rejection) in post-hoc analyses (see Supplementary Material Fig. S3).

The Chatroom task [43] is a performance-based task designed to simulate social acceptance and rejection. As the task has previously been used in the laboratory, we consulted with task developer Dr. Amanda Guyer (personal communication, March 11, 2021) to ensure that the current study procedures retained the core elements of the task for online administration. As in prior Chatroom studies (e.g., [43, 44]), in the first phase of the task (i.e., Phase 1), participants were told that they were participating in a nationwide study of (non-romantic) social media interaction amongst college students, that they would create a profile that would be viewed by other participants, and that they would view others' profiles. Participants were further told that they would be matched to interact with someone at a different university based on their interests. Participants then sequentially viewed 60 age-matched headshots of these supposed other participants and indicated whether they were interested in interacting with each of them.

In the second phase of the task (i.e., Phase 2), participants did not know that they were randomly assigned to either an acceptance or a rejection condition. In both conditions, participants viewed each of the 60 headshots they previously rated and, during each headshot view, were reminded whether had indicated that they did or did not want to chat with that participant [45]. They were then informed about whether each other participant (i.e., the headshot they viewed) wanted to interact with them. In the acceptance condition, 40 of the 60 headshots said "interested" and 20 said "not interested." In the rejection condition, 40 of said "not interested" and 20 said "interested." This proportion of feedback was selected in accordance with previous iterations of the task (e.g., [46–49]) and was intended to obscure the contingency of the feedback in order to maintain participant deception. For a visual depiction of this portion of the task, see [50].

Preliminary Data Analyses

Prior to conducting analyses for primary aims, preliminary analyses were conducted. First, demographic variables and anxiety symptoms (total and SA) for the two Chatroom randomized groups (acceptance, rejection) were examined; there were no significant group differences. Data were also examined with regards to participant deception status. Per prior work [51, 52], participants were categorized as "deceived" versus "not deceived" based on their responses to the funnel

debriefing. We decided a priori that if there were no group differences (deceived, not deceived) on demographic or pre-Chatroom clinical variables (i.e., anxiety, PSS, and IB), we would retain non-deceived participants, as in other studies [51, 52], there were not group differences and all participants were retained in analyses. Finally, pre-Chatroom SCAARED total score (minus SA items) was explored to control for non-SA anxiety; this was not a significant covariate in any analysis and therefore was excluded from results presented herein.

Analyses for Aims 1 and 2 were selected a priori. However, given some results, post-hoc analyses were also conducted (see Results below and Supplementary Material A). For Aim 1, bivariate correlations were conducted to test potential associations between IB, PSS, and SA, and a linear regression was used to test whether IB and PSS each *uniquely* predicted variance in SA. For Aim 2, repeated measures Analysis of Variance (ANOVA) analyses were conducted to test whether the experience of acceptance or rejection during the Chatroom task resulted in changes in SA from pre- to post-Chatroom, as well as to test if the experience of acceptance or rejection during social evaluation moderated the relationship between the cognitive process (IB, PSS) and change in SA. We made a priori decisions to use an adjusted Bonferroni correction for each analysis in Aim 2. We also decided that, for parsimony, if the three-way interaction between group (acceptance, rejection) x cognitive process (IB, PSS) x time (pre-, post-Chatroom) was not significant, it would be removed from the model and ANOVA re-run with both two-way interactions (cognitive predictor x time, condition x time). It was decided a priori that, for any significant two-way or higher interactions, the cognitive predictor (IB, PSS) would be median split and t-tests re-run for ease of interpretation.

Results

Bivariate correlations testing the association between IB, PSS, and SA were all significant and in the expected directions (see Table 2). A linear regression testing whether IB and PSS each uniquely statistically predicted variance in pre-Chatroom SA revealed that the full model explained a significant proportion of variance in SA ($R^2 = 0.15$, $F(2, 300) = 26.19$, $p < 0.001$). However, while IB significantly predicted SA ($\beta = 0.36$, $t(302) = 6.72$, $p < 0.001$), PSS did not ($\beta = -0.08$, $t(302) = -1.39$, $p = 0.17$) when in the model with IB.

A repeated measures ANOVA testing whether the experience of acceptance or rejection during social evaluation influences SA revealed no group x time (i.e., pre- and post-SA) interaction ($F(1, 301) = 0.18$, $p = 0.68$), although there was a main effect of time ($F(1, 301) = 6.22$, $p = 0.01$). On

Table 2 Bivariate correlations

	1	2	3
1. WSAP	–		
2. MSPSS total score	– .19**	–	
3. SCAARED SA subscale score	.38**	– .14**	–

WSAP=Word Sentence Association Paradigm, MSPSS multidimensional scale of perceived social support, SCAARED screen for adult anxiety related disorders

** $p < .01$

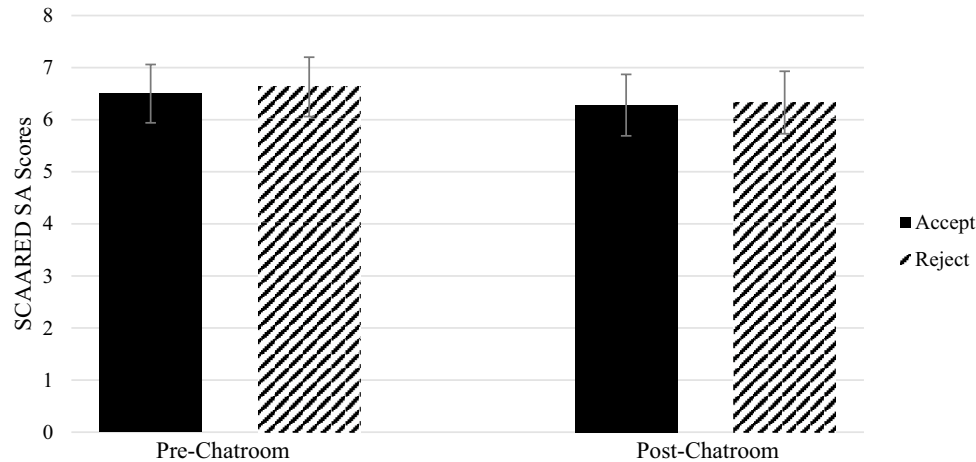


Fig. 1 Social anxiety symptoms over time by chatroom task condition. *Note.* SCAARED=Screen for Adult Anxiety Related Disorders. SA=Social Anxiety. Figure depicts non-significant condition (acceptance, rejection) x time (SA pre-Chatroom, SA post-Chat-

A repeated measures ANOVA testing whether the experience of acceptance or rejection during social evaluation moderated the relationship between PSS and change in SA did not find a three-way interaction ($F(1, 299)=0.66$, $p=0.42$). The model was re-run without the three-way interaction to interpret two-way interactions. There was not a significant condition x time interaction ($F(1, 300)=0.17$, $p=0.68$) but there was a significant SA (pre-Chatroom, post-Chatroom) x PSS interaction ($F(1, 300)=5.05$, $p=0.03$). Splitting PSS at the sample median score (5.67) revealed that participants with high PSS evidenced a significant decrease

average, SA scores decreased from 6.57 points ($SE=0.20$) pre-Chatroom task to 6.30 points ($SE=0.21$) post-Chatroom task (see Fig. 1). Given the non-significant interaction, follow-up tests were not conducted.

A repeated measures ANOVA testing whether the experience of acceptance or rejection during social evaluation moderated the relationship between IB and change in SA did not find a significant three-way interaction ($F(1, 299)=0.07$, $p=0.79$). The model was re-run without the three-way interaction to interpret two-way interactions. There was not a significant condition x time interaction ($F(1, 300)=0.04$, $p=0.85$), but there was a significant time x IB interaction ($F(1, 300)=7.00$, $p=0.01$). Splitting IB at the sample median score (44% of threat interpretations endorsed) revealed that participants with low IB evidenced a significant decrease in SA scores (pre-Chatroom SA $M=5.28$, $SE=0.26$; post-Chatroom SA $M=4.72$, $SE=0.27$; $t(149)=3.96$, $p<0.001$), but at high IB there was no significant change in SA scores (pre-Chatroom SA $M=7.82$, $SE=0.26$; post-Chatroom SA $M=7.86$, $SE=0.27$; $t(152)=-0.26$, $p=0.79$). See Fig. 2.

room) interaction. There was a main effect of time ($F(1, 301)=6.22$, $p=.01$). On average, SA scores decreased from 6.57 ($SE=0.20$) pre-Chatroom task to 6.30 ($SE=0.21$) post-Chatroom task. Error bars reflect standard error of the mean SA at each timepoint

in SA scores (pre-Chatroom SA $M=6.20$, $SE=0.26$; post-Chatroom SA $M=5.79$, $SE=0.28$; $t(172)=2.89$, $p<0.01$), but at low PSS there was no significant change in SA scores (pre-Chatroom SA $M=7.05$, $SE=0.30$; post-Chatroom SA $M=6.99$, $SE=0.32$; $t(129)=0.36$, $p=0.72$). See Fig. 3.

We were surprised by the lack of significant main and interaction effects for Chatroom task condition across Aim 2 analyses, as it was hypothesized that social rejection would result in increased SA symptoms pre-to-post-task. We had previously decided a priori to retain all participants; however, the lack of significant findings led us to reconsider. We therefore compared groups on deception status to make sure that none of the current results differed based on group (deceived versus not deceived); they did not. As such, post-hoc analyses were conducted in attempt to determine whether the insignificant condition x time interaction occurred in isolation, or whether this also occurred for anxiety symptom total scores on the SCARED and for the I-PANAS-SF NA subscale. Results were consistent with original models such that Chatroom

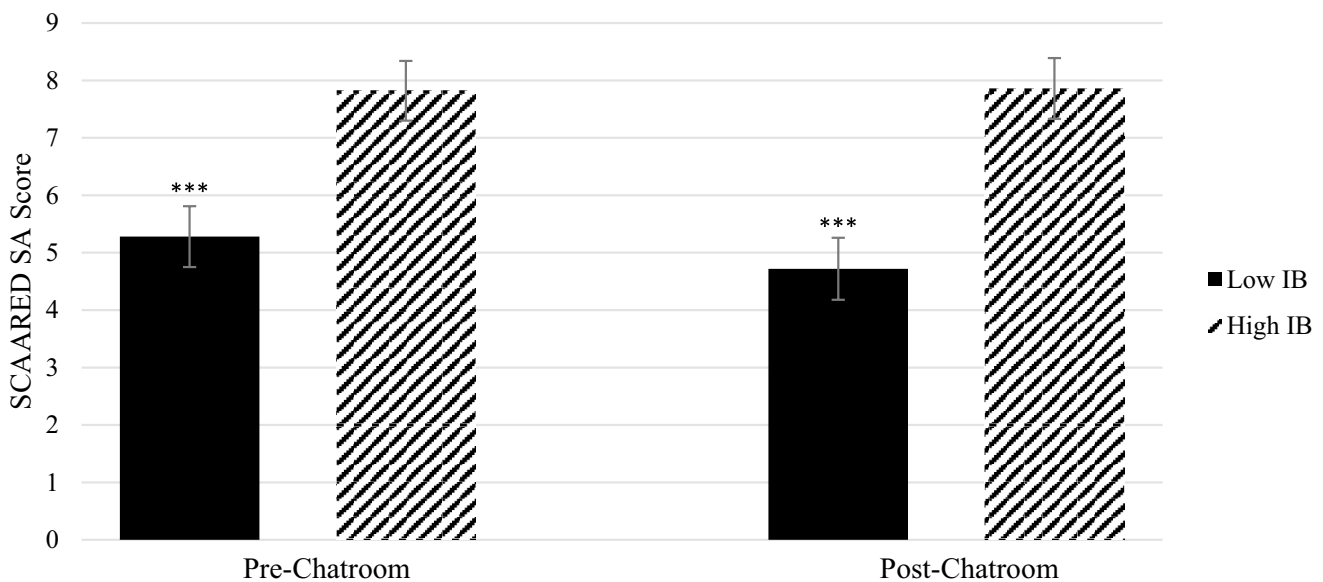


Fig. 2 Social anxiety symptoms over time by high/low interpretation bias. *Note.* SCAARED=Screen for Adult Anxiety Related Disorders. SA=Social Anxiety. IB=Interpretation Bias. *** $p < .001$. Figure depicts significant IB x time (SA pre-Chatroom, SA post-Chatroom) interaction such that participants with low IB evidenced a significant decrease in SA scores (pre-Chatroom SA $M = 5.28$, $SE = .26$;

post-Chatroom SA $M = 4.72$, $SE = .27$; $t(149) = 3.96$, $p < .001$). At high IB, there was no significant change in SA scores (pre-Chatroom SA $M = 7.82$, $SE = .26$; post-Chatroom SA $M = 7.86$, $SE = .27$; $t(152) = -0.26$, $p = .79$). Error bars reflect standard error of the mean SA at each timepoint

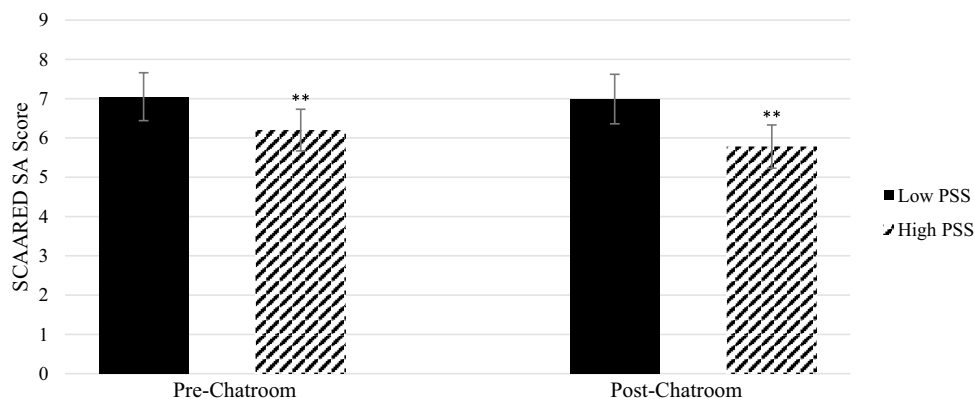


Fig. 3 Social anxiety symptoms over time by high/low perceived social support. *Note.* SCAARED=Screen for Adult Anxiety Related Disorders. SA=Social Anxiety. PSS=Perceived Social Support. ** $p < .01$. Figure depicts significant PSS x time (SA pre-Chatroom, SA post-Chatroom) interaction such that participants with high PSS evidenced a significant decrease in SA scores (pre-Chatroom

SA $M = 6.20$, $SE = .26$; post-Chatroom SA $M = 5.79$, $SE = .28$; $t(172) = 2.89$, $p < .01$). At low PSS, there was no significant change in SA scores (pre-Chatroom SA $M = 7.05$, $SE = .30$; post-Chatroom SA $M = 6.99$, $SE = .32$; $t(129) = 0.36$, $p = .72$). Error bars reflect standard error of the mean SA at each timepoint

task condition did not seem to influence total anxiety or negative affect (see Supplementary Material A and Figures S2 and S3).

Discussion

This study aimed to examine relationships between social anxiety symptoms (SA), social interpretation bias (IB), and perceived social support (PSS) in general and in the context of objective social evaluation in emerging adults. As hypothesized, IB and PSS were correlated with each

other and with SA. However, when these two cognitive variables were examined in relation to SA in the context of the other, only IB (not PSS) significantly predicted variance in SA. One interpretation of this finding is that PSS may reflect a cognitive process driven by underlying and uncontrolled cognitive biases, such as real-time IB measured with a performance-based task. In other words, it is possible that IB about social ambiguity may impact PSS downstream. Prior research suggests that emerging adults with IB may catastrophize negative social interactions or discount supportive ones [12]. In this context, the current finding links a self-report measure of PSS to real-time, online IB measured with a performance-based task. Perhaps a behavioral (rather than self-report) measure of PSS would contribute additional variance in predicting SA alongside IB. Nonetheless, the current associations between IB and PSS suggest that future studies of SA and social interaction that study either cognitive variable might also include the other.

Contrary to hypotheses, SA scores did not increase as a function of the Chatroom task, and, actually, SA scores evidenced a slight (and statistically significant) decrease from pre- to post-Chatroom, irrespective of condition. These results are unexpected, given that previous versions of the task have found neural [45, 53, 54], pupillary [55], behavioral [56], and self-reported [44, 51] group differences by condition. However, two other studies using the Chatroom task that have asked participants to complete state affect ratings (similar to the I-PANAS-SF but consisting of a single item [i.e., “How do you feel?”]) also did not find group differences [19, 57]. Several explanations are possible.

First, it is possible that the anticipation of social feedback, rather than the receipt of social feedback, corresponds more strongly to SA. Indeed, SA is associated with fear of both negative and positive evaluation [58]. Immediately before Phase 2 of the Chatroom task, participants may have felt anxious about both rejection (i.e., that prospective chat partners didn’t want to interact with them) and acceptance (i.e., maintaining chat partners’ positive impressions once they interacted). Participants may have subsequently felt less anxious, regardless of whether their feedback was positive or negative.

Second, the current iteration of the Chatroom task is the first (to our knowledge) to examine an entirely virtual adaptation of the task. Previous experiments were conducted in the laboratory, where participants interact with research personnel. Though research personnel are not explicitly evaluating participants during this task, their presence may trigger fears of negative evaluation [59]. By contrast, participants in this study presumably completed the task in a space that was familiar, and where indications of social support may be more salient. These differences may have buffered against SA and should be considered in future iterations of this

work. A measure of social belongingness may have helped to evaluate this possibility.

Third, it is possible that variables associated with anxiety, but not anxiety itself (which is considered a stable trait, particularly when measured with a symptom questionnaire [60]), may be more malleable in the context of social evaluation. For example, other versions of the Chatroom task have found condition to matter when investigating interest in the prospective peer [57] and expectations for being liked [44]. Condition may have emerged as a significant predictor and/or moderator if these variables reflecting emotions and perception, rather than SA, had been included as the outcome.

Fourth, although the study was described as a study non-romantic social interaction, participants may have viewed the task as akin to a dating app. The ubiquity of online dating culture may have immunized college-aged participants against the sting of rejection, particularly by “students at a different university” they have never met and with whom they will not interact in the future.

Finally, it is possible that the comparison of *trait* anxiety prior to the Chatroom task, versus *state* anxiety following the Chatroom task, may have obscured our ability to detect changes in self-reported anxiety. In other words, the SCAARED may not be sensitive to changes in state anxiety within single-session manipulations.

Of note, participants reported the full range of SA symptoms (i.e., SA subscale scores ranged from 0 to 14 out of a possible 14 points). A score of 7 or higher on this subscale is taken to indicate the potential presence of Social Anxiety Disorder; 48.84% of our sample ($n = 148$) met this clinical cut-off. Thus, we do not attribute the lack of hypothesized findings to a restricted range or severity of SA in our sample.

In any case, this finding should be interpreted with caution, given that the statistically significant decrease in SA scores may not necessarily be clinically meaningful: the SA subscale of the SCAARED ranges from 0 to 14 points with a score of 7 indicating clinically significant SA symptoms [35], and the mean decrease in SA from pre- to post-Chatroom was from 6.57 to 6.30 points, a less than half-point decrease.

Regardless of condition, IB and PSS both predicted SA change, and there was a significant interaction between each cognitive predictor and SA change. Those with low IB experienced decreases in SA from pre- to post-Chatroom, irrespective of whether they were accepted or rejected, while those with high IB experienced no change in SA. These findings are consistent with prior work that suggests that individuals with anxiety experience high levels of IB [16]. It may be possible that low levels of IB serve as a promotive factor in social interactions, regardless of what objectively occurs during the interaction (e.g., acceptance or rejection). Similarly, those with high levels of PSS experienced reductions in SA from pre- to post-Chatroom, again irrespective of

condition, whereas those with low levels of PSS experienced no change in SA scores. PSS has been found to serve as a promotive factor or buffer against mental health problems [23]. As with our IB finding, this finding may suggest that high PSS serves as a promotive factor in social interactions. While the anxiety literature tends to examine IB, and often PSS, from a deficit perspective (i.e., more IB and low PSS are “bad”), our findings may provide support for these two variables from a buffer perspective. Bolstering of *perceived* social support to buffer against SA has not been pursued and thus represents an exciting avenue for future research. We are enthused by these findings, given that IB has been primarily examined in the context of social ambiguity; this work provides preliminary support that both IB and PSS are relevant to unambiguous social information.

The current study has several strengths. The methods were developed based on a strong theoretical framework and extant empirical data. Using a well-validated social evaluation paradigm [43], we examined two constructs (IB, PSS) implicated in SA [24, 61], yet have not been previously studied together. Measuring IB via a validated performance-based measure increased confidence that we are measuring the cognitive bias under study. Although PSS was measured with a self-report, the MSPSS has strong psychometric properties [39] and has been used in studies of anxiety in emerging adults [40].

The current study is not without limitations. As previously mentioned, the measurement of both trait and state anxiety may have limited our abilities to draw conclusions about how social acceptance and rejection affect self-reported anxiety. Furthermore, SA was assessed via self-report, rather than clinical assessments, which limits our conclusions to symptoms, rather than diagnoses. We view this work as an initial proof of concept study that may lead to work with diagnosed individuals. Additional limitations of the present study are that participants were recruited from a predominantly White private university; this homogeneity limits the generalizability of our findings. Given the relatively small number of participants who identified as non-binary genders and minority racial/ethnic identities (see Table 1), we did not conduct moderation analyses by these variables, although they may be relevant to social interaction.

Nonetheless, this work extends our understanding of the cognitive processes associated with SA. While IB and PSS have each been previously linked to SA, the current study confirms that these constructs are associated with each other. Of note, the current findings also provide preliminary support that low IB for threat and high PSS may buffer against the persistence of SA in the face of social feedback; we look forward to replication of these findings in future samples. Given that emerging adults receive social feedback constantly via social media platforms, understanding both

the promotive and risk factors that reduce SA during these interactions may inform intervention and prevention efforts during this critical developmental transition. Specifically, bolstering PSS—in addition to pre-existing interventions that modify IB—may protect against the development and/or maintenance of SA.

Summary

Social anxiety symptoms are one of the most common mental health concerns across the lifespan [2]. Emerging adulthood represents a crucial window for understanding the experience of social anxiety, as emerging adults receive social feedback daily [9]. Two cognitive processes have been identified as relevant to social anxiety: interpretation bias, or the tendency to appraise threat from ambiguity [15, 16], and perceived social support, or the “perception that one is cared for and esteemed” [21]. High threat interpretation bias is associated with high social anxiety, whereas high perceived social support is associated with low social anxiety. In this study, emerging adults ($N = 303$) completed an online adaptation of the Chatroom task [43], an experimental paradigm designed to simulate social acceptance and rejection, as well as a performance-based measure of interpretation bias (Word Sentence Association Paradigm [41]), a self-report measure of perceived social support (Multidimensional Scale of Perceived Social Support [38]), and a self-report measure of anxiety symptoms (Screen for Adult Anxiety Related Disorders [35]). Interpretation bias and perceived social support were correlated with each other and with social anxiety. Social anxiety symptoms did not increase as a function of acceptance or rejection during the Chatroom task. However, there were significant interactions between each cognitive predictor and social anxiety change: emerging adults with low interpretation bias towards threat and emerging adults with high perceived social support both experienced decreases in social anxiety from pre- to post-Chatroom task, regardless of whether they were accepted or rejected during the task. If replicated, low interpretation bias and high perceived social support may serve as promotive factors in social interactions for emerging adults.

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Declarations

Competing interest Emily Jones has no competing interests to disclose. Michelle Rozenman has received funding from the American Psychological Foundation, National Institute of Mental Health, and the University of Denver in the last three years and receives royalties from Oxford University Press for books unrelated to the current project.

Ethical Approval This study was approved by the University of Denver Institutional Review Board.

Consent to Participate Informed consent was obtained from all participants.

Consent to Publish Consent to publish was obtained from all participants.

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