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The influence of social anxiety on interpersonal information processing in a military-life environment

A cross-sectional study

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Abstract

Although social anxiety as a ubiquitous emotion impacting people's social behaviors has aroused much researchers' interest in exploring its cognitive behavioral model, no previous study has focused on soldiers with different social anxiety within the context of the specific military environment.

To explore the associations between social anxiety and interpersonal information processing concerted on interpretation and judgment, the study may provide an intervention point for soldiers to ameliorate social anxiety and accommodate to the military-life environment.

A self-reported questionnaire and 2 behavioral tasks were conducted in the cross-section study to explore the associations.

Seventy-four soldiers were randomly recruited from a naval base. The Interpersonal Anxiety Scale was used to assess social anxiety of soldiers. Two behavioral tasks were designed to test the characteristics of interpersonal information processing, one for interpretation bias and the other for judgment bias.

This cross-sectional study showed social anxiety had a significant negative correlation with interpretation bias and abidance (as judgment bias), signaling that soldiers with higher levels of social anxiety had a stronger tendency to negative interpretation bias and showed lower abidance. The mediating effect analysis showed the interpretation bias could indirectly affect the soldier's abidance through social anxiety. Notably, none of the interaction effects of social anxiety and social information types were statistically significant; therefore, the level of social anxiety predetermined the abidance of soldiers.

Soldiers' social anxiety has an influence on processing military-life interpersonal information, and it plays a certain intermediary role in the associations between low abidance and negative interpretation bias. The stronger negative interpretation bias than positive bias of soldiers, the higher social anxiety they could show with the less possibility to abide, which might result in behaviors against the military collective requirements. Social anxiety has the primary effect on the abidance of soldiers; hence, in the future, the interpretation bias modification could be a plausible cognitive-behavior therapy to help soldiers ameliorate social anxiety, thus contributing to enhancing their sense of belonging to the troops and accommodation to military life.

Abbreviations: AST = ambiguous scenarios test, ERPs = event-related potentials, fMRI = functional magnetic resonance imaging, HSA = high social anxiety, IAS = The Interaction Anxiousness Scale, LSA = low social anxiety, PTSD = post-traumatic stress disorder.

Keywords: compliance, interpersonal information processing, interpretation bias, military life, social anxiety, soldiers

Editor: Massimo Tusconi.

Yin Qianlan and Dong Wei contributed equally to this work.

The datasets analyzed and materials used in this study are available from the corresponding author on reasonable request.

This study was approved by the ethics committees of the NAVY Military University. A complete survey description was first presented to the participants. Informed written consent, together with oral approvals, was obtained before the testing session according to the Declaration of Helsinki.

The authors declare that they have no competing interests.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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How to cite this article: Yin Q, Dong W, Chen A, Song X, Hou T, Cai W, Deng G. The influence of social anxiety on interpersonal information processing in a military-life environment: a cross-sectional study. Medicine 2020;99:47(e23340).

Received: 3 January 2020 / Received in final form: 20 August 2020 / Accepted: 17 October 2020

http://dx.doi.org/10.1097/MD.0000000000023340

1. Introduction

Social anxiety features in the fear and avoidance to negative interpersonal information, which also could be a mechanism to protect people away from the danger and being isolated from the point of evolution.[1] However, due to processing either the emotional social information in a negative or threatening manner,[2] people with social anxiety suffer from increased disability, decreased quality of life, and poor role functioning.[3,4] Investigation into social anxiety disorder in representative civilian has showed that social anxiety disorder has a high lifetime prevalence of approximately 5% to 12%.[5–7] Notably, the impacts of social anxiety disorders could be exacerbated in military personnel who are more likely to expose to stresses such as adapting a unique community life, the exposure, discipline, and strains associated with ranks and combat situations.[8] Especially in China, a large proportion of recruits would be more vulnerable to the stress, as the discipline is very strict. Most of them are from rural areas and enlisted at a relatively young age, which indicates that young soldiers are not sophisticated enough in socializing. Meanwhile, the collectivism praised highly in Chinese military cultural also has deeply influenced the socialization of soldiers.[9] Estimated by Wang et al in 2013, 21.2% of military officers and soldiers suffered from at least one social fear, for example, fear for the scrutiny of others, embarrassment or humiliation.[9] In the army, both of the panic attacks and depression are the most common psychiatric conditions associated with social anxiety.[9] Hence, more attention should be paid to social anxiety among military personnel by psychologists and psychiatrists and relative interventions should be prompt.

Psychologically, the development and maintenance of social anxiety are closely related to the information processing biases emphasize by cognitive models.[10,11] Interpretation bias refers to the recursively assignation of threating meanings to ambiguous stimuli that could have various possible interpretations.[12] As has been proved, negative interpretation bias is an important character of people with general anxiety disorder, and it could mediate the relationship between social anxiety and the social anxiety symptoms pertaining to specific social situations.[4,13] In real life, a lot of ambiguous scenarios present in the intercourse, also in the military, and negative interpretation in these situations can lead to serious consequences. However, no prior study has focused on the soldiers' social anxiety in the military-life environment. Hence, this study is first to focus on the relation between interpretation bias and social anxiety in soldiers and hypothesized that negative interpretation bias could be a significant character of interpersonal information processing in soldiers with high level of social anxiety.

Off-line measures are used to assess interpretation bias retrospectively by recalling or questioning the subjects. In an off-line measure with ambiguous scenarios as the context, participants are allowed unlimited time to judge the positive or negative emotional explanation of the scenarios, which are actually emotionally ambiguous or neutral.[14,15] For example, if you are going to a movie with a friend and the friend refuses you, it may be explained by that he or she does not like me or may not be feeling well and does not plan to go. Anxious individuals were more likely to agree with the first explanation, which was listed as a negative interpretation of the scenario. The specific ambiguous scenarios help to discover the characters of interpretation bias in specific environment. Methodically in the experiment, participants were required to complete several open-ended ambiguous scenarios by deciding how much they believed in the positive and negative ending of each sentence, and their positive interpretation bias and negative interpretation bias would be measured separately and be independent components of interpretation bias.[15] Specially, given the convenient for clinic implication, the ratio of 2 components could be plausible to indicate the interpretation bias.[16] Differently, in this study, we aimed to focus on the relation between interpretation bias and social anxiety of soldiers; therefore, the contents of open-ended ambiguous scenarios were adapted and based on the military intercourse. Twenty scenarios were designed according to the real life in military, which have been proven valid and effective in our previous study.[17] Moreover, the self-involvement in the socially interactive scenarios is associated with the triggering of interpretation bias.[14,15] Following the same pattern, we divided the military-life ambiguous social scenarios into self-related (like the communication between "The commander" and "I") and nonself-related (like events happen in "the commander" and "another soldier") categories to ensure the validity and specify the influence of social anxiety. Preliminarily, we hypothesized social anxiety of military personnel could impact interpretation bias for both self-related and nonself-related military ambiguous scenarios.[19–25] Submissiveness toward the high social rank, such as the conformity, could be a unique interpersonal information judgement bias affected by social anxiety in the processing interpersonal information.[18] Conformity refers to the phenomena that people keep their opinions or behaviors in accordance with the majority.[19] It includes 2 categories: the irrational conformity (herd behavior) and the rational conformity (abidance, compliance, and obedience).[20] The emergence of judgement bias like the rational conformity—abidance—depends on the ambiguous condition or problems faced by the followers.[21] Under the conditions of uncertainty or psychological ambiguity, the cues for others and others' behaviors are the important guidance for the followers. However, no previous study has showed the relation between interpretation bias and judgement bias in ambiguous social situations; meanwhile, a paucity of studies has put the conceptual exploration into real-life condition. Some famous studies, such as Milgram's electric-hit experiments and Zimbardo's prison-mimic experiments, reflected the conformity to authority but received a lot of the critics.[22,23] The core of these experiments could be forming a mimic hierarchy relationship. However, the military environment is virtually characterized by the strictly hierarchy management and provides a real-life condition for social rank, which is a rigid and observable in the military personnel based on their years of military-life experiences and being disciplined. In this case, submissiveness of soldiers could highly close to conformity, differential to the rational one—abidance. Therefore, the backdrop of military environment could facilitate studying the influence of social anxiety on soldiers' abidance and provide some vital evidence for the interpretation bias and judgement bias.[26,28,29] In this novel study, a computer paradigm was designed with the natural social rank in military personnel. This experiment required the participant to judge their tendency of abidance to the disputed concepts or opinions expressed by the superior or authentic people and the counterparts or inferiors respectively, and recorded participants' immediate responses. By this method, the abidance of soldiers was measured by their endorsement rate of the concept expressed by the people with high social rank.

As mentioned above, we hypothesized that in soldiers, interpretation bias would be related to social anxiety, while social anxiety could have a special relation to judgement bias such as abidance. However, whether interpretation bias could have relation to judgement bias, in which social anxiety could play a significant role, is a novel question. Hence, we further hypothesized that soldiers' social anxiety could mediate the relationship between interpretation bias and abidance. The purpose of our study is to find the potential intervention method to decrease the negative consequences of soldiers' social anxiety and the plausible methods to help soldiers better accommodated to the military environment.

2. Methods

2.1. Participants

All participants were recruited from a certain group army and a certain coastal defense brigade in China. Seventy-four soldiers were invited and consented to participate the experiments. Seventy-three followed the requirements of the experiments and submitted valid questionnaires, while 1 failed to complete the experiments and was excluded. All the soldiers were of Han nationality and were aged between 19 and 40 years (Mean = 23.53, SD = 3.70), male and right-handed, and had no history of color blindness, neurological problems, psychotherapy, or other physical and mental problems. They all reported to be enlisted in the army at least 1 year. Participants completed all procedures composed of a questionnaire and 2 behavioral tasks, and they were rewarded with a toy used for relieving anxiety.

2.2. Measures

2.2.1. The Interaction Anxiousness Scale (IAS). The Interaction Anxiousness Scale (IAS) is a self-report measure of dispositional social anxiety developed by Leary.[24] The IAS demonstrates high test-retest and internal reliability. Correlations with measures relevant to social and general anxiety document its convergent and discriminant validity, and it correlates well with measures of anxiety and interpersonal concern in actual interactions. The IAS consists of 15 items rated on a 5-point Likert-style scale with options ranging from 1 = not at all characteristic of me to 5 = extremely characteristic of me. Items 2, 3, 6, 10, and 15 are reversely scored. It spans a broad range of anxiety-evoking situations, including interactions with strangers, parties, dealings with authority figures, cross-sexed encounters, casual conversations, job interviews, telephone conversations, and other general, unspecified interactions. Every item has a correlation of at least 0.45 with the total of all items, with a Cronbach alpha of 0.87. It has an 8-week test-retest reliability of 0.80 and also a correlation coefficient of 0.80.[25]

2.2.2. Ambiguous Scenarios Test (AST). Twenty-four ambiguous scenarios based on military environment were selected from the collected open questionnaires of 216 soldiers. These questionnaires were rated emotional valence of the adapted military scenarios on an 11-point Likert-style scale. The ambiguous scenarios met the criterion that the score of emotion valence ranged from 3.050–4.900 with standard division between 0.447 and 1.930. For example, the emotion valence of "the company commander asked me to come to his office" was 4.90 ± 0.447 and "the company commander and the instructor often disagreed with each other" was 3.05 ± 1.791. These scenarios were defined as ambiguous military scenarios. From the questionnaires, 81 scenarios were collected, and then we selected 12 self-related scenarios and 12 nonself-related scenarios into the experiment design. The scenarios were circulated to 8 military psychological experts and 20 military personnel, most of whom had military life experience, on an 11-point scale with "-5" representing the strongest negativity and "5" representing the strongest positivity. The average score of positive interpretations for all selected scenarios was 3.586 ± 0.512 and that for negative interpretations was -3.433 ± 0.698. There is a significant difference between the 2 explanations ($t = 34.843$, $P < .001$), indicating a good degree of differentiation between the 2 explanations, which can be adopted in the next experiment (according to the recommend criterion reported by Zhu).[26] The scenarios were presented in the form of open-ended sentences with 9 to 20 Chinese characters, which could be easily read within 2500 ms. Finally, the interpretation bias was measured by the ratio of participants' endorsement rate for positive interpretation and negative interpretation agreement in each scenario. The higher mean score of interpretation bias for all the 24 scenarios meant the positive bias would be stronger than the negative bias.

The paradigm was written by e-prime software, and the entire process is shown in Figure 1. First, each trail consisted of a white fixation cross against a black background for 500 ms. Then, an ambiguous military situation, selected from the designed materials randomly, followed and was presented for 2500 ms. Later, the first interpretation showed up, participants were asked to choose their endorsement rate to the interpretation after fully thinking. Next, the second explanation replaced the first one and participants were also required to score the endorsement rate. Participants had to rate on a 1 to 5 scale (with 1 meaning the least agreeable and 5 representing the most agreeable). The participant

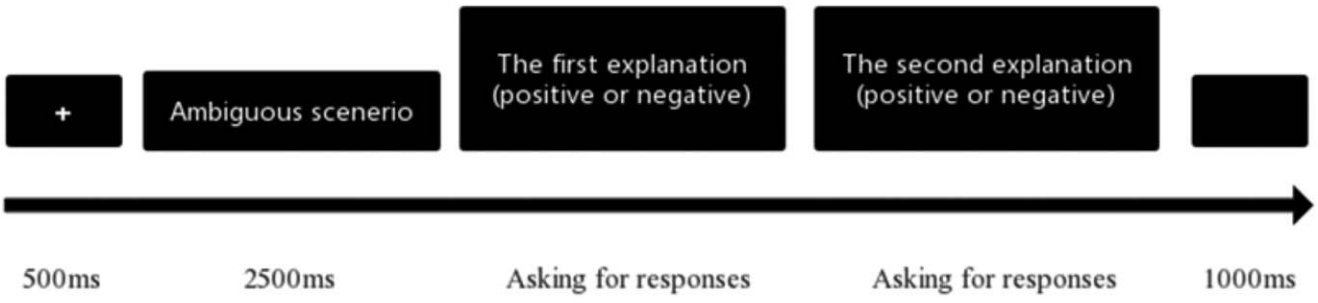


Figure 1. The procedure of paradigm for AST.

should respond to the answers using the number keys of the keyboard. There was no time limit on the rating process. To avoid thinking stereotype, the first and second presentation of positive interpretation or negative interpretation was counterbalanced. After the 2 responses for the rating were collected, then a new trial was initiated 1000 ms after target offset. Participants' ratings were recorded as independent variables.

2.2.3. Paradigm for abidance. The main content of the experiment is social information judgment task shown in Figure 2. First, a fixation cross was centered on the screen for 500 ms, then followed by the stimulates of persist presentation until participates made responses. A new trial was initiated after participants keying their choice. The stimuli was a piece of opinion for inconclusive and disputed knowledge presented by the authentic tone like "the expert said..." and the non-authentic one like "someone said..." in form of sentences, while the stimulates of opinions about military living and training skills expressed by the superiors and comrades were respectively presented as for judgement bias to military-life disputes. Then, the participants were required to judge the degree of trust on a 4-point scale (1 = completely no trust; 2 = slightly trust; 3 = half trust; 4 = completely trust). The participant should respond to the answers using the number keys of the keyboard. The task included 48 trails with 2 types of tones for each opinion or knowledge randomly presented and counterbalanced. Half of the trails' presentations were based on the ordinary life like "the dietitian says coffee is benefit for weight losing" and "a friend says coffee helps weight losing." Twenty-four were based on military life, for example, "the command says there will be an emergent calling today" and "a soldier says there will be an emergent calling today." Each participant was required to complete 48 trials that lasted approximately 5 minutes. In the end, the total score of participants' choosing rate for authoritative expression was compared to that of non-authoritative expression, and then the ratio indicated the participants' tendency of abidance. The greater the ratio was, the higher abidance presented.

2.3. Procedure

A computer program was utilized to present the questionnaire and collect the answers of the participants. The questions would be answered at 2 minutes at most and completed before the rest 2 computer tasks. This procedure of 2 computer tasks was processed by E-prime 2.0 (Psychology Software Tools Inc., Pittsburgh, PA). The entire tasks were presented on a 19-inch display (PC, refresh rate D 70-Hz) with 1440 × 900 resolution with a white background, black instruction, and reminder. All the font of Chinese characters sized in 24 using Microsoft blackbody. AST was before the paradigm for abidance. At the end of the experiment, the computer would reflect the total scores of the IAS and some psychological implications for the results. The experiment was conducted in the military meeting room where the surrounding had the least distraction and was well-lighted. Each time 1 soldier was invited to begin his tasks after understanding the instruction of our assistant and finished tasks alone. The study protocol was approved by the local institutional review board at the authors affiliated institution and the military authorities. All the participants were provided with written informed consent.

2.4. Statistical analyses

The experimental data were imported into SPSS21.0 software for analysis. Correlations were calculated among anxiety, interpretation bias, and abidance scores. Regressions assessed the liner effects of anxiety on interpretation bias and abidance; furthermore, the mediation analysis was performed based on the result of the regression utilizing AMOs, which examined a variable's mediating effect while controlling the effects of other factors in the model. In our model, we adopted Sobel test to check the mediating effect considering the sample size was small and the overall mediating effect could be small.[27] Our procedure was a variation on the Sobel test that accounts for the non-normal distribution of the AB path through the construction of asymmetric confidence intervals.[28] In this way, the mediating effect could be detected on the condition that either A or B path has an insignificant regression coefficient. According to the scores of IAS, we selected the participants who obtained a social anxiety score at the top as the high social anxiety (HSA) group, and who at the bottom as the low social anxiety (LSA) group to further explore the role of social anxiety on interpretation bias and abidance (Mackinnon, Lockwood, Hoffman, West, & Virgil, 2002). Analysis of variance of repeated measurements was adopted in 2 tasks. In the AST, the social anxiety was defined as between-subject factors and the self-involvement type for the military ambiguous scenarios was as within-subject factors, which was a 2 x 2 experiment design. Meanwhile, in the second task, there were 2 within-subject factors, the types of the scenarios (nonmilitary and military environment) and the form of expression (nonauthentic and authentic), which was a 2 x 2 x 2 mixed experimental design. Two-sided tests were used and a P value $< .05$ was considered statistically significant.

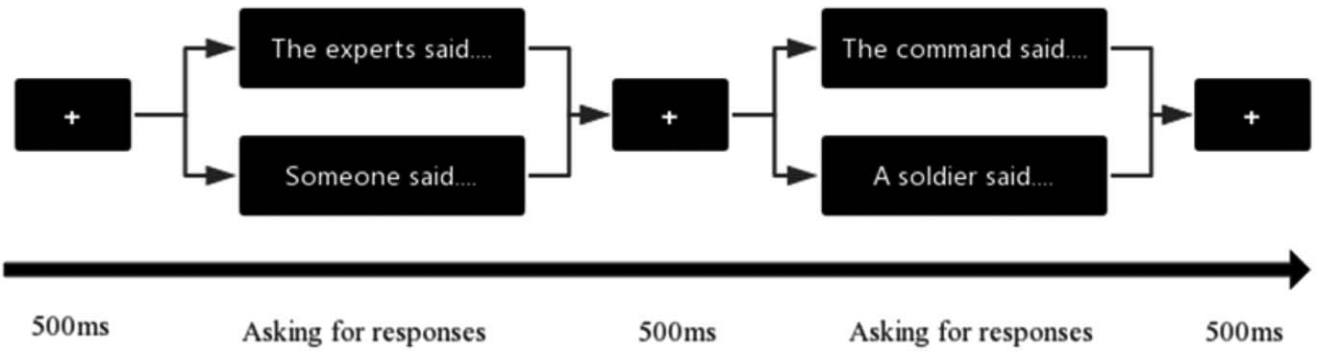


Figure 2. The procedure of paradigm for abidance.

Table 1

Correlations among social anxiety, interpretation bias, and abidance.

	Mean	SD	Social anxiety	Interpretation bias	Abidance	Age
Social anxiety	23.75	7.54	1			
Interpretation bias	2.10	1.02	−0.399†	1		
Abidance	2.98	0.51	−0.271*	0.310†	1	
Age	23.53	3.70	−.054	0.063	0.020	1

* $P < .05$.
† $P < .01$.

3. Results

3.1. Correlations among social anxiety, interpretation bias, and abidance

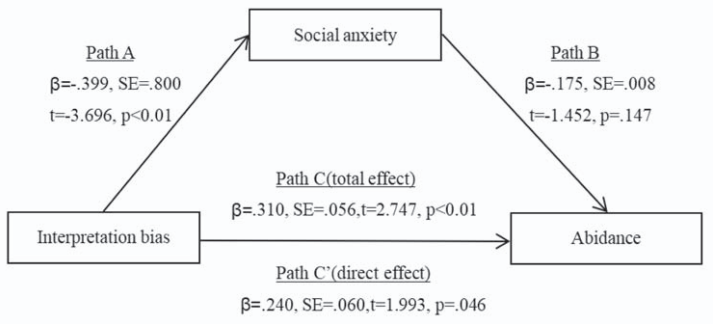
The score of IAT represented the level of social anxiety, while the results of AST and Paradigm of abidance respectively represented the interpretation bias and abidance of each soldiers, as mentioned in measures. Table 1 summarizes the means and standard errors of social anxiety, interpretation bias, and abidance of all soldiers and their correlations. The pairwise correlations were all significant, except these correlations with age. The significant negative correlation between social anxiety and interpretation bias indicated that more socially anxious soldiers showed more negative bias toward the interpretation for the military social scenarios ($P < .001$). Similarly, higher the social anxiety of soldiers, less tendency of abidance to others ($P = .021$). The interpretation bias also had a positive relation with abidance suggesting that soldiers with stronger positive interpretation bias could have more compliance to others.

3.2. Mediation analysis

The regression examined the relationship between social anxiety, interpretation bias, and abidance, and then a mediation model was built on the results shown in Figure 3. The interpretation bias significantly contributed to social anxiety (β = -0.399, SE = 0.800, t = -3.696, $P < .01$) and abidance (β = 0.310, SE = 0.056, t = 2.747, $P < .01$), while anxiety was not significantly linked to abidance (β = -.175, SE = 0.008, t = -1.452, $P = 0.147$). Therefore, we used the Sobel test to check if there was partial mediation effect of social anxiety on abidance. Sobel test revealed that the indirect effect of interpretation bias through social anxiety on abidance was significant ($z = 2.75 > 1.96$), indicating the significant mediating role of social anxiety.

3.3. Group analysis

The results of the IAS showed the average scores of our cohort was 23.75 (SD = 7.54). Participant score under 18 points was categorized into the LSA group, which accounted the 30% of the cohort (N = 22, Mean for social anxiety = 15.73, SD = 2.07), and those scored above 27 into HSA group accounted 31% of the total (N = 23, Mean = 33.22, SD = 3.95). A t test showed that there was a significant difference in participants' social anxiety (t = -18.70, $P < .001$). The difference of age in the 2 groups was not significant ($t = 0.097$, $P = .923$). Furthermore, a 2-way ANOVA was conducted with the interpretation bias as the dependent variable. The between-group factor was the group categorized by social anxiety and the within-group factors was the scenario type. Results showed neither scenario type [$F(1,45) = 0.784$, $P = .381$, $\eta^2_p = 0.018$] nor the interaction of social anxiety and the scenario type was significant [$F(2,45) = 0.11$,



Note. Path A shows the association between the independent variable (interpretation bias) and the mediator (social anxiety). Path B shows the association between the mediator (social anxiety) and the dependent variable (abidance). Path C depicts the relationship (total effect) between the independent variable and the dependent variable in the absence of the mediator. Path C'shows the direct effect of the independent variable on the dependent variable when the mediator is accounted for. Path AB shows the indirect effect, or the amount of mediation accounted for by the mediating variable.

Figure 3. The mediating effect of social anxiety on the relationship between interpretation bias and abidance.

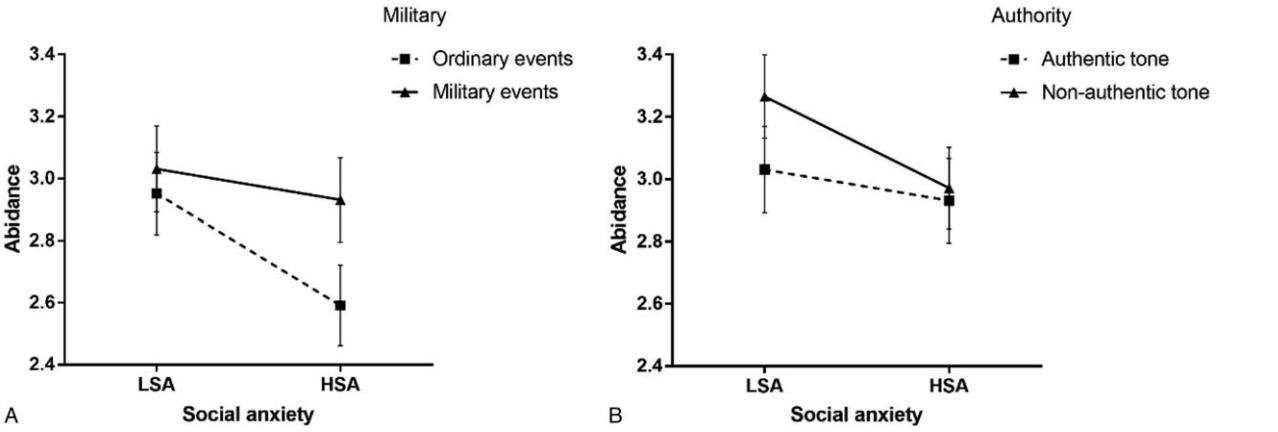


Figure 4. The main effect of military events and authority on the abidance in LSA and HSA groups.

$P = .916$, $\eta^2_p = 0.000$]; however, the main effect of social anxiety was significant [$F(1,45) = 10.595$, $P = .002$, $\eta^2_p = 0.198$]. Hence, either self-related or nonself-related military scenarios, LSA group had more positive interpretation bias than HSA (Mean difference = 0.905, $P = .002$, 95% CI = 0.344–1.468).

Following, a repeated measurements model of abidance in HSA and LSA groups was conducted with military scenarios or nonmilitary scenarios and authentic or nonauthentic expressions as the within-group factors. Results showed that the triple interaction was not significant [$F(3,45) = 2.784$, $P = .103$, $\eta^2_p = 0.061$] and the interactions between each pair of three variables were also not significant. The main effect of military environment [$F(1,45) = 17.268$, $P < .001$, $\eta^2_p = 0.287$] and the authority was significant [$F(1,45) = 16.496$, $P < .001$, $\eta^2_p = 0.277$]. The main effect of military condition and authority is shown in Figure 4, which vividly indicated in military environment either LSA or HSA soldiers would have a higher tendency to believe the authentic people and higher probability of abidance. However, the main effect of social anxiety was not significant as the P value was less than .05 [$F(1,45) = 2.652$, $P = .111$, $\eta^2_p = 0.058$], but LSA showed higher abidance than HSA responding to the former correlation results with marginal significance.

4. Discussion

This study utilized an ambiguous scenario task and a modified computer paradigm for abidance to measure the effects of social anxiety on interaction information processing in military soldiers. As the results show, social anxiety is significantly negatively associated with the positive interpretation bias and abidance. These findings are consistent with previous studies showing that high socially anxious individuals are more likely to favor negative interpretations compared to their low socially anxious counterparts.[29] Furthermore, in our study, we discovered that social anxiety played a mediating role in the relationship between interpretation bias and abidance. The group analysis also showed the effect of other factors on the information processing and their interaction with social anxiety, indicating that soldiers with higher social anxiety could have the persistent negative interpretation bias for social ambiguous scenarios through their own perspectives or others, and the less tendency to abide the opinion of nonauthentic peoples especially the nonmilitary personnel.

On the basis of the existing cognitive-behavior theory, the mediation model of relations among the social anxiety, interpretation bias, and abidance could be explained. Clark and Wells'[10] cognitive model of Social Anxiety Disorder has proposed that negative interpretation bias is a key factor that contributes to the maintenance of the disorder. A number of studies have demonstrated that high socially anxious individuals estimate higher probability and cost of social events when compared with low socially anxious individuals.[28,30] The relationship between interpretation bias and social anxiety in our study is consistent with these previous findings, proving that negative interpretation bias may importantly contribute to increasing the probability of perceiving negative evaluation pertaining to a social situation and then result in the arouse of anxiety. According to social rank theory, social rank is a subjective construct inferred by individual interpreting the aggregated ratios of information of the positive (acceptance) versus the negative (rejection) that an individual has elicited from others in a persist period where positive interpretation bias (a higher ratio of interpreted acceptance to rejection cues) could result in a relatively higher perceived rank. The perception that one is relatively inferior occurs when one perceives anther's ability to be more social attractiveness by positively interacting with people than his or her own ability due to the bias of negative results. Therefore, interpretation bias is related to the judgement of individual ability. Detailed analysis of interpretational behavior also provides evidence for this theory and suggests that individuals with HSA appear less confident, less affiliative, and less synchronous in social interactions than individuals with LSA.[31–33] Our study also supported the evidence by findings based on the military environment. Soldiers of stronger positive interpretation bias would like to seek advice from others, especially from the superior ones, which showed their more tendency to be affiliative and abide to the order. Hence, it is safe to say interpretation bias has substantial relation with judgement bias, among which social anxiety could be play a significant role.

Abidance is influenced by the social anxiety.[34] The reason could be that achieving affiliation-oriented goals is closely related to abidance by norms of social exchange with others, however, socially anxious people are characterized by the social avoidance so they might lack of the goals of affiliation and then are less likely to abide or conform. As has been showed in our results, low abidance in our HSA group indicates that soldiers' affiliation-oriented goals

could affect their abidance and be associated with their social anxiety level. Furthermore, social avoidance among individuals with HSA is not only showed in observable behavior, but also the internalized cognition and the social decision-making.[29,35,36] Avoidance in socially anxious people is greatly derived from the negative cognition bias as a coping way for alleviating anxiety and reducing the imbalance of their negative cognition. Simultaneously, both the negative interpretation bias and social anxiety could result less social conformity like unwillingness to abide. Therefore, social anxiety is a significant mediator in the process of the social information processing (judging and reacting), which has been ecologically verified in our results. Notably, aside from the ecological significance, our results suggest that therapeutic strategies design to moderate the interpretations bias by increasing the positive believe and decreasing the negative one could ameliorate the social anxiety. Ambiguous scenarios in the current study could be used as a measure for other studies about soldiers' cognitive bias and be developed as idiographic assessment tools to help find military personals of biased interpretations. These attained results could be of more use to the military psychologists who guard and care for mental health of the military personnel. They could learn that helping socially anxious soldiers' social avoidance through interpretation bias might be an effective and important therapy.

Specially, in our military cohorts, social anxiety has special independent effects on social information processing including cognition and behaviors within the context of military environment, as the interaction of social anxiety with other influencing factors for the interpretation bias and abidance was not significant. In the AST task, soldiers had the consistent tendency of interpretation bias in the self-related scenarios and nonself-related military scenarios, which was different with the former research showing ruminative or self-focused thinking by dysphoric people transferred to novel ambiguous situation encouraging more negative interpretations and better recall of personal interpretation.[37] Perhaps, it could be explained by the coexistent effect of depression in the studied participants rather than the single effect of social anxiety. Another reason was that range of level of social anxiety was limited in our cohort, as a result, the interaction effect was not notable. Unfortunately, in the paradigm for abidance, the main effect of social anxiety was not strongly significant to testify if the HSA group had less tendency of abidance than LSA group, as the sample size of anxious soldiers may be not perfect and the power of effect was respectively small. However, both the LSA and HSA groups had saliently less tendency of abidance under the condition of non-military scenario with nonauthentic expression like "somebody said...," which provided evidence for that the authoritative effects of one's expertise or one's high position in a hierarchy had remained significantly interacted on all soldiers' judgement. The result is similar to the studies with the background of organizational cultures that the superior would have potential effect on the subordinates resulting in the abidance and the hierarchy management.[38,39] In military, soldiers' abidance could be a way of adaptation and product of the deindividuation effects in military environment, and they might be more likely to adhere to commanders' opinion or other authentic-value information than anonymous individuals' views. Hence, soldiers' violation of the norms and orders could be caused by their social anxiety in some sense.

Some limitations deserve to be mentioned. First, the sample collected from a legion was a nonclinical sample of socially anxious soldiers. Future research should examine whether our findings could generalize to treatment-seeking individuals with a clinical diagnosis of social anxiety disorder. Second, the experimental situations based on military environment require validation considering other potential factors influenced the results. The data indicated that our military scenarios were effective, but more evidence was in need to determine the validity of this method. It is ecological to use a real-world situation to guarantee the research; however, there are a lot of controlled variables needed attention including the external and internal variables. Specially, cognitive bias like memory bias was controlled by asking participants if they had any special memories related to each of the situations in the experiments, and no subjects were found to show memory bias. Third, the design was pertained to a cross-sectional research; therefore, the causal relationship could not be concluded from our results. Statistical significance revealed in the study also should be interpreted cautiously. Besides, the induction and persistence of social anxiety were affected by considerable variables such as social support, depression, and self-esteem, which should be considered by evaluating the environmental influence. Future research should include more variables to improve the credibility of the current conclusions, and longitudinally study their effects. Finally, the neural mechanism underlying this behavioral pattern has not yet been revealed. Further studies should use fMRI, ERPs, etc, to explore these mechanisms for the cognitive-behavior model.

Although this study has limitations, it also provided a novel way of understanding abidance of soldiers with social anxiety. We emphasized the importance of relation between the social anxiety and social information processing and then figured out the role of social anxiety played in the relation between different processing step. Further, we analyze the association between other influencing factors for social information processing and social anxiety. Different types of self-involvement in the military scenarios did not contribute to the difference in interpretation bias of soldiers, while the type of authority affected the abidance. However, neither of them had interacted effect with social anxiety. These results helped us understand how soldiers with HSA showed different style of conforming influenced by their interpretation bias. Moreover, we should be aware of the influence of social anxiety which could be a mediated factor for less abidance of soldiers with negative interpretation bias, which may be intervened through the interpretation bias modification. Therefore, a cognitive training aiming to promote positive interpretation may help soldiers with HSA evaluate positively what is more suitable and adaptable for themselves and then have a higher sense of belonging in the military community, which also benefits the enhancement of military coherence.

Acknowledgment

The authors would like to acknowledge the volunteers who participated in the study and appreciate the endeavor of the military workers.

Author contributions

Yin Q.L., Dong W., and Chen A.B. contributed to the writing of this article and part of statistical analysis. Deng G.H. leaded the whole study, including putting forward this study, getting source and carrying out the study, and was the corresponding author. contributed to revise this article and part of statistical analysis.

Zhang X.M. and Song X.R. contributed to perform the investigation and collection of all data. Hou T.Y. and Cai W. were responsible for the reviewing and proofreading. We are all accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. We all agree to submit our research result in the article to this journal. All authors read and approved the final manuscript.

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