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Interpretation bias of high trait anxiety Chinese military servicemen in ambiguous military scenarios

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Abstract

Converging evidence reveals the negative interpretation bias in anxiety. Given that anxiety is a severe psychological problem among Chinese military personnel, the present study examined whether high trait anxiety military personnel showed negative interpretation bias in real-world situations and whether their interpretations were influenced by self-relevance.

The sample included 24 high trait anxiety (H-TA) and 22 low trait anxiety (L-TA) Chinese military servicemen. Participants completed 20 open-ended ambiguous scenarios by deciding how much they believed in the positive and negative ending of each sentence. The 20 scenarios were designed according to real life in military and half of them were self-relevant and the others were non-self-relevant.

A 2(group) ×2(self-relevance) ANOVA of positive and negative endings revealed that compared to L-TA, H-TA believed more in negative continuations and less in positive continuations. Moderate correlations were found between samples' believes in positive and negative endings and their trait anxiety scores. Military personnel showed more positive interpretation biases in non-self-relevant scenarios than in self-relevant scenarios.

These findings are the first to show interpretation bias in military situations, and interventional strategies to modify servicemen's interpretation bias could be designed according to military situations.

Abbreviations: ANOVA = analysis of variance, H-TA = high trait anxiety, L-TA = low trait anxiety, STAI = state-trait anxiety inventory, TA = trait anxiety.

Keywords: interpretation bias, military personnel, trait anxiety

1. Introduction

Military servicemen have to tackle with pressures due to deployment, high intensity physical training, and separation from families. As a result, they face stressful circumstances to a far greater extent than civilians. These continuous pressures on the combatants lead to stressful responses. It has been noted that high trait anxiety servicemen are more prone to develop anxiety state, which will compromise their combat capacity and lead to

serious problems such as suicide and desertion.[1] Therefore, the mental health and life stressors of military personnel need to be studied. A recent study has shown that negative cognitive bias correlates with the mental health and trait anxiety of Chinese plateau military personnel,[2] indicating the importance of monitoring the biased cognitive processing of servicemen and servicewomen.

Interpretation bias refers to the recursively assignation of threating meanings to ambiguous stimuli that could have various possible interpretations.[3] Various of literatures have proved the key role of negative interpretation bias in social phobia and generalized anxiety disorder.[4,5] Except for clinical anxiety disorder, anxious state or the proneness to be anxious can also lead to interpretation bias. According to Spielberger,[6] there is an important distinction between trait anxiety and state anxiety, with trait anxiety reflecting the propensity of an individual to be anxious, while state anxiety representing current transit anxiety level.[1] A study has proved that both state and trait anxiety have causal relationship with interpretation bias.[7] However, the vast majority of studies to date have focused on interpretation bias in social anxiety population but not in trait anxiety individuals; except for social scenarios, interpretation bias in other situations is seldom studied. In real life, there are a lot of ambiguous scenarios in the military, and for the military servicemen and servicewomen, negative interpretation in these situations can lead to serious consequences. Therefore, the present study focused on anxiety and interpretation bias in military; and high and low trait anxiety servicemen were selected to explore the link between trait anxiety and interpretation bias.

Open-ended ambiguous scenarios approach is a well-established method to assess interpretation bias in depression,[8] and anxiety disorder.[9] It provides a nuanced context and offers insight into individual differences in sensitivity to context effects. Therefore it is a holistic and ecologically valid approach.[10] In one of the earliest studies using this approach, Hirsch and Mathew showed interview anxious subjects 8 ambiguous interview descriptions with different probe words.[11] The probe words could end the sentence with threatening/non-threatening meanings or grammatically impossible endings Subjects task was to judge whether the probe word of each sentences was "grammatically possible" as quickly as possible. Reaction time and accuracy were calculated as dependent variables. The measurement approach of Hirsch and Mathew was within reaction time paradigms and assumed that the first response to come to mind is equivalent to the endorsed response. On the other hand, some other studies used the off-line approach, namely ambiguous scenarios were presented first and rating of interpretations showed afterwards. Butler and Mathews first designed 10 questions of ambiguous scenarios to test off-line interpretation bias.[12] Later, Stopa and Clark developed Ambiguous Social Situation Interpretation Questionnaire from Butler and Mathews format to assess negative interpretation in anxiety disorder.[13] In the questionnaire, there were 24 social and non-social ambiguous situations, and in each situation 2 questions were asked. The first question was an open-ended question "Why?" and the second question was to rate the belief of each experimenter-provided negative/neutral/positive explanations. Result showed that social phobia patients were more likely to interpret ambiguous social events in a negative fashion. Huppert et al[14] developed 80 open-ended sentences reflecting ambiguous social scenarios, and the last word of the 80 sentences was eliminated. The subjects task was to complete the sentences with 1 word. Result showed that high social anxiety group had negative interpretation bias. Woud et al[10] showed 7 ambiguous alcohol-relevant scenarios and 5 panic- or depression-relevant scenarios to alcohol-dependent patients and asked them to generate endings for each scenario. Results confirmed the alcohol-related interpretation bias in alcohol-dependent patients. In brief, open-ended ambiguous scenarios approach is a valid method of detecting interpretation bias in different populations. However, this method has not been used in studies of cognitive bias of Chinese military personnel, and the measurements of interpretation bias in previous studies[2,15] were not based on real situations in the military. The ecological validity of these studies needs to be improved. Also, some previous on-line studies failed to find evidence of negative bias.[11,16] In order to overcome these weaknesses, the current study was designed to test interpretation bias in military scenarios by the open-ended ambiguous scenarios approach and collected off-line answers.

Although interpretation bias plays a role in the development and maintenance of anxiety, some studies failed to find evidence of a negative interpretation bias in anxiety population. For example, Hertel and El-Messidi found that dysphoric undergraduates did not demonstrated negative interpretation bias if they thought about others before the interpretation task.[17] Some researchers even believed that negative interpretation bias was only obvious in the self-relevant ambiguous situations for the anxiety and depressed population.[18] However, a recent study using Chinese depressed undergraduates as subjects found that negative bias existed in both self-relevance and non-self-relevance situation.[19] As is pointed out by the researchers, the concept of

"self" in China is different from that in other cultures. Whether self-relevance is necessary in the development of negative interpretation bias for Chinese anxiety population needs further study.

To summery, the current study aimed to assess interpretation bias in military servicemen with high trait anxiety. To ensure the ecological validity of our study, we developed ambiguous situations according to daily life in the army and divided the situations into self-relevant and non-self-relevant ones. The off-line open-ended ambiguous scenarios approach was chosen because of its high validity.[12] We hypothesized that compared to low trait anxiety controls, high trait anxiety servicemen would show the tendency of negative interpretation in both self- and non-self-relevant ambiguous daily life situations.

2. Subjects and methods

2.1. Subjects

A total of 88 male soldiers of the Chinese People's Liberation Army from the same barracks were recruited for the present study. With reference to Pan et al,[1] the following inclusion criteria were used for eligibility for the study:

- age between 18 and 35 years;
- right hand dominance;
- normal visual acuity after correction.

Major exclusion criteria were as follows:

- mental disabilities according to DSM-V or neurocognitive impairment;
- history of use of psychotic substances;
- severe somatic diseases.

The sample's mean age was 24.11 years (SD = 3.80). The study protocol was approved by the local institutional review board at the authors affiliated institution. All the study participants were provided with written informed consent.

2.2. STAI

The State-Trait Anxiety Inventory (STAI) was used to assess trait anxiety and distinguish between high and low anxiety groups. STAI is a 20 items self-reported measure of both the state and trait anxiety. The Chinese version of STAI is of good validity and internal consistency.[20] Higher scores of STAI indicate great trait anxiety, individuals who scored in the top 27th percentile (TAI total >=45) were recruited as "high trait anxiety(H-TA)"; individuals who scored in the bottom 27th percentile (TAI total <=36) were recruited as "low trait anxiety(L-TA)". Thus the final participants consist of 24 H-TA and 22 L-TA male solider aged between 18 and 32, with the mean age of 24.11 ± 3.80. There was no age difference between H-TA and L-TA groups (H-TA: M=24.36, SD=3.91; L-TA M=23.88, SD=3.77). The participants were informed in advance that participation was completely voluntary and they were free to quit at any time.

2.3. Scenario task

Ambiguous military scenarios were developed in the following way: Firstly, we collected ambiguous military scenarios by open questionnaires, which were answered by 216 military personnel. Then we coded and classified the answers and rewrote the answers to open-ended sentences. The sentences were then
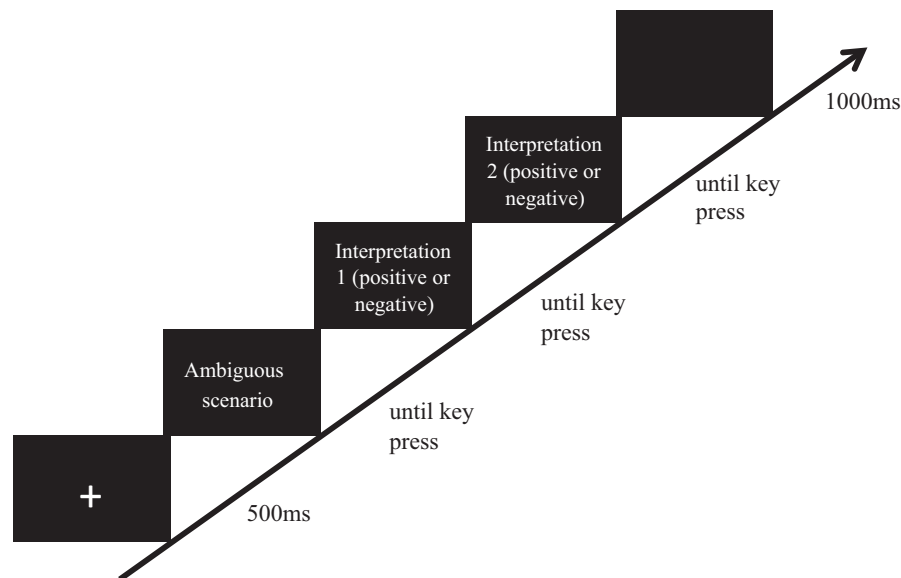
Figure 1. Sequence of events in the scenario task.

circulated to experts in military psychology who provided feedback. According to experts' comments, we revised the scenarios and recruited 285 soldiers to assess the ambiguity of the scenarios on a -5 to 5 scale. The sentence was scored −5 if it had negative meaning and +5 if it had positive meaning. According to the recommended criterion reported by Zhu,[19] ambiguous scenarios with the emotion valence scores between 3.05 and 4.9 (standard error between 0.447 and 1.930) were selected. Finally, 22 ambiguous military scenarios (11 self-relevant and 11 non-self-relevant) were selected in the current study. The scenarios were presented by open-ended sentences with 9 to 20 Chinese characters. All sentences described experiences within military situations. One example of self-relevant situations was: "I was selected to take psychological text, . . . "; one example of non-self-relevant situations was: "The monitor did not show in the morning exercise, ..."

The endings of the sentences could resolve the ambiguity in either a benign or threatening manner. With reference to Zhang[21] and Zhu,[19] we generated both positive and negative finals for each sentences. Twenty eight experts of military psychology were invited to evaluate the valence of each ending on a −5 to 5 scale. The ending was scored −5 if it was negative and +5 if it was positive. The average score of positive ending was 3.59 ± 0.51 and that of negative ending was -3.43 ± 0.70. There was a significant difference between positive and negative endings (t=34.84, $P < .001$).

For participants, the scenario task was introduced as a computer program. Each trail consisted of a white fixation cross against a black background for 500 ms, followed by 1 ambiguous scenario. Each scenario was presented in a random order. Subjects were instructed that the sentence would not disappear until they read the sentence and pressed the space key. A positive or negative ending was shown in the next 2 scenes, and it was the participants' task to evaluate the extent to which "the end would be most likely to come to your mind if you found yourself in a similar situation." Participants had to rate on a 1 to 5 scale with 1 meaning the least likely and 5 meaning the most likely, and

pressed the corresponding key. Thus higher scores indicated participants' stronger believes in negative or positive endings and corresponding negative or positive interpretation bias.[13,19] The order of negative or positive endings was counterbalanced across participants. A new trail was initiated 1000 ms after target offset. Participants' choices were recorded as independent variables. The entire process is shown in Fig. 1.

2.4. Statistical analysis

Data were expressed mean ± standard deviation and analyzed using the SPSS 21.0 software. The demographic variables were compared among the groups using independent-samples t test. Participants' choices were subjected to 2 2 × 2 mixture measurement of variance analysis with group (H-TA, L-TA) as between subject factor and self-relevance (self-relevant and non-self-relevant) as within subject factor. Associations between trait anxiety and interpretation bias were based on Pearson correlation analysis. Two side tests were used and P value < .05 was considered statistically significant.

3. Result

Table 1 shows the mean score of subjects' beliefs of positive and negative ends for each type of ambiguous events. For the positive endings, a 2(group) ×2(self-relevance) ANOVA revealed a significant effect of self-relevance, $F(1,44)=8.92$, $P<.05$, $\eta_p^2=0.17$, positive ending scores in self-relevant ambiguous scenarios were generally lower than in non-self-relevant events; the main effect of group was also significant, $F(1,44)=5367.43$, $P<.01$, $\eta_p^2=0.99$. Low anxiety group showed greater beliefs in positive endings than high anxiety group. There was no interaction effect.

For the negative endings, the main effect of group was also significant, $F(1,44)=752.87$, $P<.01$, $\eta_p^2=0.95$, indicating that high trait anxiety servicemen showed higher beliefs of negative interpretations than low trait anxiety controls. However, the main effect of self-relevance and interaction effect were not significant.

Means (SDs) of the positive and negative interpretation by low and high anxiety and self-relevance.

	L-TA (n=22)		H-TA (n=24)	
	Self-relevant	Non self-relevant	Self-relevant	Non self-relevant
Positive interpretation	4.37 ± 0.35	4.46 ± 0.38	3.87 ± 0.56	4.10 ± 0.39
Negative interpretation	2.09 ± 0.57	2.21 ± 0.54	2.74 ± 0.87	2.88 ± 0.57

L-TA stands for subjects of low trait anxiety.
H-TA stands for subjects of high trait anxiety.

To further analyze the relationship between trait anxiety and interpretation bias, we calculated bivariate correlations between STAI and beliefs in benign and negative endings. As shown in Table 2, these analyses revealed significant correlations between trait anxiety and interpretation bias. These results indicated that higher score of trait anxiety meant less positive interpretations but more negative interpretations.

4. Discussion

The purpose of the current study was to assess interpretation bias of Chinese soldiers in ambiguous military scenarios. We collected typical military situations by questionnaire investigation and invited military personnel to evaluate the ambiguity of each scenario. To ensure the valence of each experimenter-provided ending, experts were invited to make judgment. We examined interpretation bias using the open-ended ambiguous scenario approach in high and low trait anxiety Chinese soldiers. Evidence from ANOVA analysis confirmed that compared to low trait anxiety group, high trait anxiety servicemen interpreted ambiguous military situations more negatively. To our knowledge, this is the first study to examine interpretation biases in military scenarios, and our result is in line with previous findings that negative interpretation is closely related to anxiety.[14,18] Moreover, our results also showed that trait anxiety group were less likely to believe positive endings and higher level of trait anxiety indicated less positive interpretations. Previous studies had proved the relationship between social anxiety and impaired positive interpretation bias in social anxiety individuals in on-line and off-line task,[11,22] the current study extended the association to trait anxiety. Recently, by conducting cognitive bias modification of interpretations training in anxious individuals, researchers have successfully reduced anxious mood, social anxiety, and encouraged positive interpretations in different samples.[23] Future studies can train anxious military personnel to form positive interpretations with the same training.

In our study, self-relevance had a main effect on positive interpretation bias: when self was not involved in ambiguous situations, participants believed more in positive endings;

however, participants' negative interpretations were not influenced by self-relevance. This pattern of results is consistent with Wisco and Nolen-Hoeksema results that both dysphoric and non-dysphoric participants generated and selected significantly more positive interpretations for friends than for themselves.[8] Self-relevance showed different effect on positive and negative interpretations in current study, suggesting that positive and negative biases should be considered separately.[22] Including of both positive and negative endings in ambiguous scenario approach can avoid losing important information.

Our results suggest that therapeutic strategies design to decrease believes in negative interpretations and increase believes in positive interpretations both could benefit trait anxiety individuals. Ambiguous scenarios in the current study could also be developed as idiographic assessment tools to help find military personals of biased interpretations. CBM-I for anxious military servicemen and servicewomen can also use the scenarios in present study.

One limitation of this study is the use of a trait anxiety health sample instead of clinical samples. While the current results offer useful information regarding the association between anxiety and biased interpretations and the role of self-relevance, it would be useful to replicate the results in a sample of clinically anxious soldiers to ensure the generalizability of our findings. Another limitation may be that we used real-world situations to guarantee ecological validity, but memory bias could happen in these situations. We addressed this limitation by asking participants if they had any special memories related to each of the situations in the experiments, and no subjects showed signs of memory bias. However, it is important to replicate these results in hypothetical situations in future studies.

In conclusion, the current findings show that compared to the low trait anxiety group, high trait anxiety military servicemen believe more in negative interpretations and less in positive interpretations; participants believe more in positive interpretation in non-self-relevance situations than in self-relevance situations. Our findings indicate that modification of biased interpretations in anxious military servicemen should be implemented to improve their mental health.

correlations among trait anxiety and positive and negative interpretations.

	Positive interpretation		Negative interpretation		Overall Positive interpretation	Overall Negative interpretation
	Self-relevance	Non-self-relevance	Self-relevance	Non-self-relevance		
STAI	−.47[**]	.42[**]	−.39[**]	.53[**]	−.47[**]	.49[**]

STAI stand for score of State-Trait Anxiety Inventory.
[**] P<.01.

Author contributions

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