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Attachment avoidance and fearful prosodic emotion recognition predict depression maintenance

Yu-Lien Huang[a], Sue-Huei Chen[b,*], Huai-Hsuan Tseng[c]

[a] Department of Psychology, Fo Guang University, Yilan, Taiwan
[b] Department of Psychology, National Taiwan University, Taipei, Taiwan
[c] Department of Psychiatry, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, Tainan, Taiwan

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ABSTRACT

Insecure attachment cognitions, emotion recognition biases, and their interaction are important contributors to depression susceptibility. The present study, with a prospective longitudinal design, investigated the role of negative emotion recognition in moderating the linkage from insecure attachment cognitions to elevated depressive symptoms. A sample of 96 depression-prone individuals completed measures for attachment anxiety and attachment avoidance, depression symptom severity, and a computerized facial and prosodic emotion recognition task twice with a four-week interval. Results revealed that the interaction between attachment avoidance and fearful prosodic emotion recognition significantly predicted subsequent depressive symptoms. More specifically, greater attachment avoidance with lower accuracy of fearful prosodic emotions at baseline predicted an increase of depressive symptoms over four-week interval. However, no moderating role of emotion recognition in the linkage from attachment anxiety to depression persistence was noted. The present study demonstrates that attachment avoidance and negative emotion recognition may together contribute to the maintenance of depression. The findings may be pertinent to attachment avoidance-related deactivating strategy that appears to be a specific cultural forbearance way for emotion regulation in collectivistic societies. Potential applications and future research are then suggested.

1. Introduction

Chronicity of depressive symptoms with frequent recurrences is often cited as the most prominent feature of depression. Negative cognition and cognitive biases are presumed to represent stable risk factors for depression (Beck, 1967) and contribute to depression persistence (e.g., Bouhuys et al., 1996; Hale III, 1998; Hankin et al., 2005; Huang and Chen, 2011). However, it remains unclear whether the interaction of negative cognition and cognitive biases may further contribute to depression persistence and need to be addressed.

Bowlby (1973) suggested that negative cognition developed originally in the context of insecure attachment relationships, in which attachment figures were insensitive to their child's needs. Repeated insecure experiences with insensitive attachment figures develop into negative mental representations of attachment relationships, in that the self is seen as unworthy and unlovable whereas others are seen as untrustworthy and unavailable. These negative cognitions have been further re-conceptualized into a two-dimensional structure of insecure attachment cognitions, i.e., attachment anxiety and attachment avoidance (Brennan et al., 1998). Attachment anxiety refers to the degree to which a person worries about being rejected or abandoned by others. Attachment avoidance refers to the degree to which a person distrusts others' goodwill and maintains distance from them. Insecure attachment cognitions in both dimensions pose a cognitive vulnerability to depression (Ingram, 2003) and significantly predict later depression (e.g., Hankin et al., 2005; Huang and Chen, 2011).

For individuals with depression, a cognitive bias to negatively process information in congruence with their mood state has been proposed to correlate to depression (Beck, 1976). During the processing of facial expressions, depressive individuals showed abnormally increased perception of negative emotions in faces (Bouhuys et al., 1999; Hale III, 1998; Luck and Dowrick, 2004) and negatively biased interpretation of facial expressions (Gollan et al., 2010; Leppänen et al., 2004) relative to healthy controls. In addition, depressive individuals have been found to exhibit lower sensitivity in identifying positive faces (Joormann and Gotlib, 2006; Yoon et al., 2009). Similar negative biases have been noted in prosodic modalities during emotion recognition, as evidence suggests that depressed patients perform poorly on prosodic

* Corresponding author.
E-mail address: shchen@ntu.edu.tw (S.-H. Chen).

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emotions (Péron et al., 2011), judge prosodic emotions to be more negative (Kan et al., 2004; Luck and Dowrick, 2004), attribute less intense ratings to happy prosody (Schlipf et al., 2013), and give higher ratings for negative emotions when hearing anger or happiness utterances (Péron et al., 2011).

A negative bias may render individuals vulnerable to greater depression (Bistricky et al., 2011). A bias of increased perception of negative emotions in faces has been associated with depression relapse (Bouhuys et al., 1999); especially, the perception of sadness in facial emotions has been found to be the best predictor of the persistence of depression (Hale III, 1998). The prosodic biases were also related to the severity of the depression (Péron et al., 2011). These negative biases emerging in facial and prosodic emotions could play a role in the maintenance of later depression.

Both insecure attachment cognitions and biases of facial and prosodic emotions are separately linked to the continuation of depression, but whether the two factors may interact together to contribute to depression persistence is unclear. In the cognitive model of depression (Beck, 1987), depression-prone and depressed individuals negatively process incoming information via depressive cognitions, which could serve as a maintenance factor for depression. Bistricky et al., (2011) further pointed out the prominent role of biases of nonverbal emotion processing in depression, as these biases may cause impaired interpersonal functioning with negatively constructing social environment being viewed as less rewarding and more unpleasant. Based on the cognitive-interpersonal model of depression (Gotlib and Hammen, 1992), interpersonal factors of negatively perceiving social interactions, along with insecure attachment cognitions, may work together to maintain depressive symptoms. That is, biases in nonverbal emotion processing may play a moderating role in the relationship between attachment and depression. More biases may interact with higher insecure attachment cognitions to predict subsequent depressive severity.

Moreover, there are cultural differences in insecure attachment cognitions and nonverbal emotion processing. Cross-cultural studies found that individuals in collectivistic societies such like China, Korea, Japan, and Taiwan reported greater attachment anxiety compared with people in individualistic societies such like United States, Canada, and Western European (Agishtein and Brumbaugh, 2013; Li, 2013; Schmitt et al., 2004). Li (2013) also found that individuals in collectivistic and individualistic societies displayed different ability to recognize facial emotions, in which Chinese and German participants had the same performance to recognize happy faces, but Chinese participants had a higher accuracy on sad emotions and a lower accuracy on anger and fear emotions than German ones. Within this context, we expected that higher attachment anxiety and negative emotion recognition might play prominent roles in depression maintenance in a Taiwanese sample.

Taken together, the present study aimed to investigate the possible moderating role of negative emotion recognition in the relationship between insecure attachment cognitions and subsequent depressive symptoms in a prospective design with two occasions (Time1 and Time2, respectively) separated by a four-week interval. Three hypotheses were examined: first, to examine higher insecure attachment and negative emotion recognition were associated with more depressive symptoms at Time1 and at Time2 (H_o1); second, to examine the potential role of emotion recognition in the relationship between insecure attachment and subsequent depressive symptoms while controlling for baseline depressive symptoms (Time1), including a positively moderating effect of negative emotion recognition, that is, the interaction between attachment anxiety and higher negative emotion recognition accuracy would predict subsequent depressive symptoms at Time2 (H_o2); and no moderating effect of emotion recognition, that is, the interaction between attachment avoidance and negative emotion recognition accuracy would not predict subsequent depressive symptoms at Time2 (H_o3).

2. Methods

2.1. Participants and procedure

Participants were 158 undergraduate and graduate students from two universities in northern Taiwan, who were recruited via Internet advertisement. There were 92 women and 66 men, ranging in age from 18 to 29 (M = 20.73, SD = 2.38). After their informed consent was obtained, participants were administered two questionnaires for assessing attachment and depressive symptoms and a computerized emotion recognition task. The same measures were administered within a four-week interval. Upon completion, each participant received monetary reimbursement for participation ($TWD100, i.e., $USD3.5). In all, 96 (61%) participants completed all measures on two occasions. The protocol of the present study was approved by the Institutional Review Board of the Department of Psychology, National Taiwan University.

The final sample consisted of 58 women and 38 men, ranging in age from 18 to 29 (M = 20.73, SD = 2.38). There were no differences in terms of gender ($X^2(1) = 0.48$, $p = 0.488$), age ($t(156) = 1.17$, $p = 0.243$), and overall facial ($t(156) = 0.63$, $p = 0.532$) and prosodic emotion recognition ($t(156) = -0.09$, $p = 0.931$) between completers and non-completers, but completers had higher scores on the Beck Depression Inventory–Second Edition (BDI-II) ($t(156) = 2.55$, $p = 0.012$), attachment anxiety ($t(156) = 2.60$, $p = 0.010$), and attachment avoidance ($t(156) = 3.01$, $p = 0.003$) than did non-completers. For the final sample, the average score of the BDI-II assessed at Time1 was 13.44 (SD = 8.86), suggesting that the present sample was appropriate for examining hypotheses related to proneness to depression.

2.2. Measures

2.2.1. Attachment

The Revised Adult Attachment Scale (R-AAS; Collins, 1996), an 18-item, 5-point (1 = not at all characteristic of me, 5 = very characteristic of me) self-report scale, was adapted to assess insecure attachment cognitions. The R-AAS is composed of two subscales: anxiety and avoidance (Collins and Feeney, 2004). The Chinese version of the RAAS (RAAS-C) has shown good internal consistency and test-retest stability in a Taiwanese population, with Cronbach's alpha coefficients of 0.85, 0.79, and 0.84 as well as 2-week test-retest reliabilities of 0.85, 0.79, and 0.85 for attachment anxiety, attachment avoidance, and total scale, respectively (Huang and Chen, 2011). In the present study, good internal consistency was reported, with alpha coefficients of 0.83 and 0.81 at Time1 for attachment anxiety and attachment avoidance, respectively.

2.2.2. Depressive symptoms

The Chinese version of the Beck Depression Inventory–Second Edition (BDI-II; Chinese Behavioral Science Corporation, 2000), a 21-item, 4-point (0 to 3) self-report scale, was used to assess the existence and severity of depressive symptoms during the past two weeks (e.g., sadness, pessimism, loss of energy). Excellent internal consistency has been reported in other Taiwanese samples, with alpha coefficients of 0.94 and split-half reliability of 0.91 (Lu et al., 2002). In the present study, the alpha coefficients were 0.90 at Time1.

2.2.3. Facial and prosodic emotion recognition

For measuring facial and prosodic emotion recognition ability, the present study adapted 48 facial photos and 48 vocal clips with four basic emotions (i.e., 12 items for each basic emotion: happiness, sadness, anger, and fearfulness) from the Taiwanese version of the Diagnostic Analysis of Nonverbal Accuracy-2 (DANVA-2-TW; Chen, 2006), which is adapted from the original versions of Diagnostic Analysis of Nonverbal Accuracy-2 (Nowicki and Carton, 1993—faces;

Baum and Nowicki, 1998—voices). Each photo and clip attains at least 80% agreement on emotional categories. Each photo was displayed for 500 ms on a laptop screen in full-screen display and a resolution of 1024 × 768, and each vocal clip was delivered by an earphone for 2–5 s. Upon the presentation of each emotional face, participants were asked to make a forced choice from the four emotional categories. The DANVA-2-TW has satisfactory inter-rater and test-retest reliability (Tseng et al., 2012, 2013). In the present study, the inter-rater reliabilities of facial and prosodic emotional recognition were 0.75 and 0.83 at Time1, respectively.

2.3. Scoring

The accuracy values of facial and prosodic emotion recognition were ratios of correctly answered items within each emotion category, ranging from 0 (completely inaccurate) to 1 (completely accurate). The index of the overall accuracy rate of facial/prosodic emotions was the average of four facial/prosodic emotion recognition rates. The average overall accuracy of facial emotions and prosodic emotions was the index of the overall accuracy rate of emotion recognition. In order to avoid response biases, we computed corrected accuracy of estimating the joint probability of both response frequency and stimulus frequency for each emotion (i.e., unbiased hit rates; Hu) according to the method outlined by Wagner (1993).

2.4. Statistical analyses

The associations among insecure attachment cognitions (i.e., anxiety and avoidance), depressive symptoms, and accuracy of facial and prosodic emotion recognition were analyzed by correlation analyses (Pearson *r*). Effect sizes of correlation are reported with the standard as follows: 0.10, small; 0.30, medium; and 0.50, large (Cohen, 1988). A series of hierarchical multiple regressions were employed to explore the moderating effect of accuracy of facial and prosodic emotion recognition of each emotion on the relationship between insecure attachment and depressive symptoms. Before doing the regressions, the scores of attachment anxiety and avoidance and accuracy of facial and prosodic emotion recognition were mean-centered to reduce the multicollinearity effect (Aiken and West, 1991). The Benjamini-Hochberg procedure was used to adjust *p*-values for multiple tests in follow-up analyses. Effect sizes of multiple regressions (f^2) are reported with the standard as follows: 0.02, small; 0.15, medium; and 0.35, large (Cohen, 1988). All statistical analyses were performed in SPSS version 20.0 for Windows.

3. Results

3.1. Associations of attachment, depression, and emotion recognition

Table 1 presents the means, standard deviations, and Pearson correlations of all variables. As shown, attachment anxiety (An^{T1}) and attachment avoidance (Av^{T1}) at Time1 correlated positively with depressive symptoms at both Time1 (BDI^{T1}) and Time2 (BDI^{T2}). An^{T1} correlated negatively with accuracy of recognition of sad and fearful facial emotions at Time1 ($F.S.ACC^{T1}$ and $F.F.ACC^{T1}$), as well as accuracy of recognition of overall facial emotions at Time1 ($F.O.ACC^{T1}$). BDI^{T2} correlated negatively with accuracy of recognition of fear prosodic emotions at Time1 ($V.F.ACC^{T1}$) and accuracy of recognition of overall emotions at Time1 ($FV.O.ACC^{T1}$). The effect sizes of the aforementioned correlations were within the small to medium range. Due to insecure attachment (i.e., An^{T1} and Av^{T1}) and emotion recognition (i.e., $V.F.ACC^{T1}$ and $FV.O.ACC^{T1}$) were significantly correlated with BDI^{T2}, these four variables were entered into the following regression analysis.

3.2. Moderating effects of emotion recognition on attachment anxiety and depression

In the first regression analysis, the outcome variable was depressive symptoms at Time2 (BDI^{T2}). Depressive symptoms at Time1 (BDI^{T1}) and attachment avoidance at Time1 (Av^{T1}) were entered in the first step as control variables. Attachment anxiety at Time1 (An^{T1}) as a predictor, and accuracy of recognition of fear prosodic emotions at Time1 ($V.F.ACC^{T1}$) or accuracy of recognition of overall emotions at Time1 ($FV.O.ACC^{T1}$) as moderators, were entered in the second step, and their interaction was entered in the third step, with corrected *p* value. After controlling for BDI^{T1}, the interactions between An^{T1} and $V.F.ACC^{T1}$ / $FV.O.ACC^{T1}$ were not significant on predicting BDI^{T2}.

3.3. Moderating effects of emotion recognition on attachment avoidance and depression

The same procedure was repeated for the second regression analyses to predict BDI^{T2} with attachment avoidance at Time1 (Av^{T1}) as a predictor, and accuracy of recognition of fear prosodic emotions at Time1 ($V.F.ACC^{T1}$) or accuracy of recognition of overall emotions at Time1 ($FV.O.ACC^{T1}$) as moderators, depressive symptoms at Time1 (BDI^{T1}) and attachment anxiety at Time1 (An^{T1}) as control variables with corrected *p* value. As shown in Table 2, when accuracy of fearful prosodic emotion recognition at Time1 ($V.F.ACC^{T1}$) was entered as a moderator, the incremental contributions of the interaction between Av^{T1} and $V.F.ACC^{T1}$ was significant on BDI^{T2} ($\beta = -0.19$, $t(90) = -2.58$, $p = 0.012$, corrected $p = 0.048$, 95%CI[−22.11, −2.86]).

As shown in Fig. 1, the simple slope of attachment avoidance on depressive symptoms at Time2 was significant under the condition of low accuracy of fearful prosodic emotion recognition at Time1 ($V.F.ACC^{T1}$) ($\beta = 0.36$, $t(90) = 3.08$, $p = 0.003$, 95%CI[1.28, 5.94]), indicating that individuals with high attachment avoidance reported more depressive symptoms at Time2 than individuals with low attachment avoidance under the condition of low accuracy of fearful prosodic emotion recognition at Time1. But under the condition of high accuracy, the simple slope of attachment avoidance on depressive symptoms at Time2 was not significant ($\beta = -0.07$, $t(90) = -0.58$, $p = 0.566$, 95%CI[−2.92, 1.61]), suggesting that attachment avoidance was unrelated to depressive symptoms at Time2 under the condition of high accuracy of fearful prosodic emotion recognition at Time1.

4. Discussion

The present prospective study aimed to examine whether the interaction between insecure attachment cognitions and negative emotion recognition contributed to depression persistence. The results showed that fearful prosodic emotion recognition did play a significant moderating role in the relationship between attachment avoidance and depression persistence over a four-week period. However, the moderating role of emotion recognition in the linkage from attachment anxiety to depression persistence was not found.

As expected, higher insecure attachment and negative emotion recognition were associated with more depressive symptoms at Time1 and at Time2. Individuals with greater attachment anxiety and avoidance reported more depressive symptoms, while individuals with greater attachment anxiety tended to be less accurate in recognizing sad and fearful faces at Time1. In addition, the individuals who were less accurate in recognizing fearful prosodic emotions at Time1 reported more depressive symptoms at Time2. The findings reveal that higher insecure attachment and negative facial and prosodic emotion recognition play significant roles in the maintenance of depression in a Taiwanese sample.

However, in contrast to our third hypothesis, results showed that fearful prosodic emotion recognition played a negatively moderating

Table 1
Means, standard deviations, and Person correlations of all variables (n = 96).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BDI^{T1}	–														
2. BDI^{T2}	0.65***	–													
3. An^{T1}	0.41***	0.46***	–												
4. Av^{T1}	0.39***	0.40***	0.25*	–											
5. $F.H.ACC^{T1}$	0.01	−0.16	−0.11	0.00	–										
6. $F.S.ACC^{T1}$	−0.16	−0.12	−0.22*	−0.11	0.28**	–									
7. $F.A.ACC^{T1}$	−0.06	−0.14	−0.17	−0.09	0.36***	0.70***	–								
8. $F.F.ACC^{T1}$	−0.11	−0.14	−0.22*	−0.01	0.41***	0.47***	0.55***	–							
9. $V.H.ACC^{T1}$	0.04	−0.07	0.01	0.01	0.21*	0.22*	0.33**	0.31**	–						
10. $V.S.ACC^{T1}$	−0.03	−0.13	−0.03	−0.15	0.14	0.29**	0.32**	0.35**	0.46***	–					
11. $V.A.ACC^{T1}$	0.01	−0.18	−0.05	−0.06	0.24*	0.23*	0.40***	0.30**	0.51***	0.59***	–				
12. $V.F.ACC^{T1}$	−0.12	−0.21*	−0.10	−0.11	0.22*	0.38***	0.40***	0.45***	0.43***	0.59***	0.51***	–			
13. $F.O.ACC^{T1}$	−0.11	−0.18	−0.24*	−0.07	0.59***	0.79***	0.86***	0.82***	0.35***	0.37***	0.39***	0.48***	–		
14. $V.O.ACC^{T1}$	−0.04	−0.19	−0.06	−0.10	0.26*	0.36***	0.46***	0.45***	0.73***	0.83***	0.81***	0.82***	0.50***	–	
15. $FV.O.ACC^{T1}$	−0.09	−0.21*	−0.18	−0.10	0.50***	0.68***	0.77***	0.74***	0.61***	0.67***	0.68***	0.74***	0.88***	0.85***	–
M	13.44	12.89	3.15	3.09	0.83	0.64	0.60	0.70	0.84	0.76	0.73	0.74	0.69	0.77	0.73
SD	8.86	8.61	0.86	0.85	0.12	0.16	0.19	0.20	0.13	0.14	0.14	0.17	0.13	0.12	0.11

Note. T1 = Time1; T2 = Time2; BDI = Beck Depression Inventory; An = attachment anxiety; *Av* = attachment avoidance; F.H.ACC = Accuracy of happy faces; F.S.ACC = Accuracy of sad faces; F.A.ACC = Accuracy of angry faces; F.F.ACC = Accuracy of fearful faces; F.O.ACC = Accuracy of recognition of overall facial emotions; V.H.ACC = Accuracy of happy clips; F.S.ACC = Accuracy of sad clips; F.A.ACC = Accuracy of angry clips; F.F.ACC = Accuracy of fearful clips; F.O.ACC = Accuracy of recognition of overall prosodic emotions; FV.O.ACC = accuracy of recognition of overall emotions.

* $p < 0.05$.
** $p < 0$ 0.01.
*** $p < 0.001$.

Table 2
Moderation effect of fearful prosodic emotion recognition on attachment avoidance predicting depressive symptoms at Time2 (BDI^{T2}) (n = 96).

Predictor	*B*	*SE B*	*β*	ΔR^2	R^2	f^2
Step1				0.46***	0.46***	0.85
BDI^{T1}	0.54	0.08	0.55***			
An^{T1}	2.32	0.84	0.23**			
Step2				0.03†	0.49***	0.96
Av^{T1}	1.42	0.83	0.14††			
$V.F.ACC^{T1}$	−5.48	3.81	−0.11			
Step3				0.04*	0.53***	1.13
Av^{T1} x $V.F.ACC^{T1}$	−12.49	4.84	−0.19**			

Note. *B* = the unstandardized beta; *SE B* = the standard error for the unstandardized beta; *β* = the standardized beta; ΔR^2 = the incremental increase in the model R^2 resulting from the addition of set of predictors; R^2 = a measure of the proportion of variability the dependent variables that is predicted by the model independent variables; f^2 = the effect size. T1 = Time1; T2 = Time2; BDI = Beck Depression Inventory; An = attachment anxiety; Av = attachment avoidance; V.F.ACC = Accuracy of fearful clips.

† $p = 0.075$.
†† $p = 0.091$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

role in the relationship between attachment avoidance and depression persistence over a four-week period. Only in individuals with lower fearful emotion recognition accuracy did attachment avoidance predict depression persistence. Those individuals high in attachment avoidance are characterized by the use of a deactivation strategy to minimize emotions (Mikulincer and Shaver, 2003, 2016), which is similar to a forbearance strategy in collectivistic culture. Collectivism-oriented individuals who adopt a forbearance strategy may inhibit negative emotions as a way to maintain interpersonal harmony as well as to avoid interpersonal conflicts or to burden others (Yeh et al., 2006). This might reflect in both perceiving and expressing negative emotions (e.g., Chiang, 2012), and result in lower fearful emotion recognition accuracy in our Taiwanese sample. But using forbearance coping may cause difficulty in emotion regulation. For example, forbearance has been found to have a positive correlation with psychological distress (Wei et al., 2012). This may explain why depression persisted in individuals with attachment avoidance.

In addition, poor recognition of fear has been found to correlate with core scheme regarding self as weak and other as dominant and powerful (Csukly et al., 2011). Through the lens of negative cognitions, the deficit in recognizing negative emotions may deteriorate depressive individuals' interpersonal functioning via constructing a social environment as being dominated by others and thus less pleasant and rewarding (Bistricky et al., 2011). Within the context of the cognitive-interpersonal model of depression (Gotlib and Hammen, 1992), when depressed individuals exposed to a negative social environment, their negative cognitions may interact with the interpersonal environment to further persist depressive symptoms.

Moreover, in contrary to our second hypothesis, we did not find evidence for the moderating role of emotion recognition in the linkage from attachment anxiety to depression persistence. We observed negative correlations between attachment anxiety and the recognition of facial emotions without an interaction effect on depression persistence. Anxiously attached individuals are characterized by ambivalent feelings towards others, namely, hoping for their support and doubting their availability in times of need at the same time (Hazan and Shaver, 1987). Despite their strong needs to seek extreme closeness with others, such individuals have exaggerated worry about their unavailability and fear of rejection. The ambivalence may make it difficult for anxiously attached individuals to be consistently sensitive to others' emotions.

It is noteworthy that culture may also influence the process. Within a collectivistic culture, Taiwanese with higher attachment anxiety may tend to use a forbearance strategy, instead of an expected activating strategy, to regulate emotions and to withhold their emotions for maintenance of harmony in interpersonal relationships (Wang, 2008). This may also contribute to the finding of negative correlations between attachment anxiety and accuracy of recognizing sad and fearful faces in the present study.

More intriguingly, a significant result emerged only in prosodic emotions, and not in facial emotions. A possible explanation is the difference in the presentation durations of facial and prosodic stimuli. The shorter presentation of facial emotions (i.e., 500 ms) and the longer presentation of prosodic emotions (i.e., 2,000–5,000 ms) may

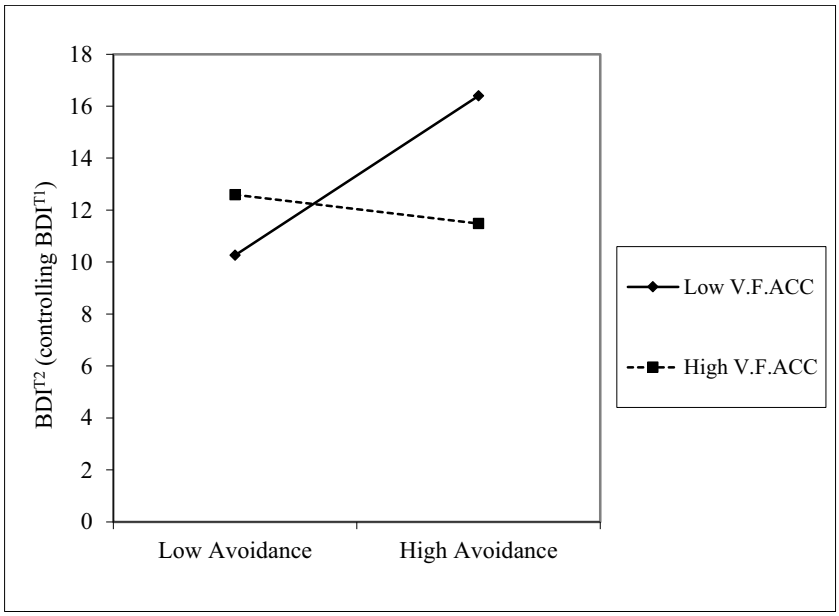

Fig. 1. The interaction between attachment avoidance and fearful prosodic emotion recognition predicting on BDI^{T2} after controlling BDI^{T1}.
Note. Each regression lines (at low and high accuracy of fearful prosodic emotions) were plotted at low (−1 SD from the mean) and high (1 SD from the mean) levels of attachment avoidance to predict four values of BDI^{T2} after controlling BDI^{T1}. T1 = Time1; T2 = Time2; V.F.ACC = Accuracy of fearful clips.

respectively reflect the initial automatic versus later conscious processing of emotional information. Compared to the shorter duration of facial emotions, the longer duration of prosodic stimulus makes it easy for participants to elaborate emotional stimuli. This prolonged elaboration process may facilitate avoidance responses (Tseng et al., 2017). Avoidantly attached individuals' were proposed to display vigilant response at an initial stage, and then avoidance from negative or threatening information at a later stage, when they process emotional information (Maier et al., 2005; Niedenthal et al., 2002). This avoidance response may account for the reduced accuracy of fearful prosodic emotions among individuals high in attachment avoidance in our study.

Moreover, cognitive biases at later, more elaborative stages of information processing, in particular over a longer time course (> 1,000 ms), are thought to confer vulnerability to depression (De Raedt and Koster, 2010). For example, dysphoria has been specifically associated with biased attention toward sad cues at the duration of 1,000 ms, but not at 300 ms (Oehlberg et al., 2012). In line with the above-mentioned observation, we found that individuals with high attachment avoidance reported more depressive symptoms within the context of prosodic emotions that were presented for over 1,000 ms, reflecting the existence of negative biases in prosodic emotion recognition in depression.

Our study has several limitations. First, the four-week interval between the two assessments may be not sufficient to capture the chronic course of depression; longer follow-up intervals will be needed. Second, generalizing the findings to clinical cases should be done with caution because the study did not include clinically diagnosed patients, small sample size, and the relatively high dropout rate. Nevertheless, the non-completers and completers had similar demographic data and the average BDI-II score of our final sample assessed at Time1 was around 14, which is close to the cutoff point of depression. This may justify the adequacy of our study sample for examining the maintenance of depressive symptoms, and might not significantly affect the direction of the results except less powerful as it should be. The current results should be interpreted with caution, as a possible selection bias that the completers had more initial depression and higher insecure attachment might exist. Additionally, the study used faces and voices without attachment relationships. For future research, the faces and voices of people in attachment relationship are recommended.

To conclude, this study demonstrates that, in depression-prone individuals with high attachment avoidance, lower accuracy of fearful prosodic emotions significantly predicts the continuation and increase of depressive symptoms over a four-week interval. Helping depression-prone or depressed people to remedy their emotion recognition biases may benefit their communication with others, and in turn, reduce the risk for deterioration of depression.

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Declarations of interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2018.12.119.

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