Relationship between Types of Anxiety and the Ability to Recognize Facial Expressions

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INTRODUCTION

- Anxiety is related to cognitive biases, such as attentional bias (allocating attentional resource to threat stimuli)[1] and interpretation bias (interpreting ambiguous stimuli as threatening) [2].
  - The relationship to the cognitive biases depends on types of anxiety.
    - **Trait anxiety** is a stable anxiety-proneness and related to attentional bias[1].
    - **Social anxiety** is , in social situation, fear of being judged by others and very feeling self consciousness, and related to interpretation bias[3].

The relationship between the cognitive bias and types of anxiety is likely to influence on recognition of facial expressions in each type of anxiety.

- Trait anxiety and recognition of facial expressions
  - Attentional bias in high trait anxiety arises at earlier stage in information processing[4], therefore trait anxiety could amplify intensity of threatening stimuli, such as anger and disgusted faces, in order to make them salient.

People with high trait anxiety are likely to evaluate intensity of facial expressions excessively, especially when angry or disgusted faces were presented and to react to negative expressions fast.

- Social anxiety and recognition of facial expressions
  - Social anxiety interprets ambiguous stimuli like behavior or facial expression of others as threatening.

Socially anxious people are likely to recognize negative expressions more accurately compared with other expressions, or to miscategorize a neutral or positive expressions as a negative one.

- Features of the present study
  - Three intensity level (20%, 40%, 100%) of facial expression were used.
  - We measured categorization accuracy, evaluation of intensity level, reaction time as well as miscategorization proportion.
  - We calculated not only Pearson correlation but also partial correlation in order to control mutual influence of each type of anxiety.

METHOD

- Participants: Undergraduates at two university in UK n = 138 (107 females) , Mean age = 20.2 ± 2.8 years old
- Material: A total of 144 face images were used.
  - Gray-scale western Caucasian expressive face pictures, consist of 4 female and 4 male, were selected Karolinska Directed Emotional Faces [5].
  - 6 facial expressions (happy, sad, fear, angry, disgust, and surprise)
  - 3 intensity level (20%, 40%, 100%) by morphing the emotional face with the neutral face [6]
- Questionnaires
  - Trait Anxiety: The State-Trait Anxiety Inventory From Y-II (STAI-t; 20 items and 4-point scale) [7] and The Beck Anxiety Inventory(BAI, 21 statements with a 4-point scale) [8]
  - Social anxiety: The Brief Fear of Negative Evaluation Scale(BFNE; 12 items and 5-point scale) [9]
- Procedure for collecting behavioral data (Figure 1)

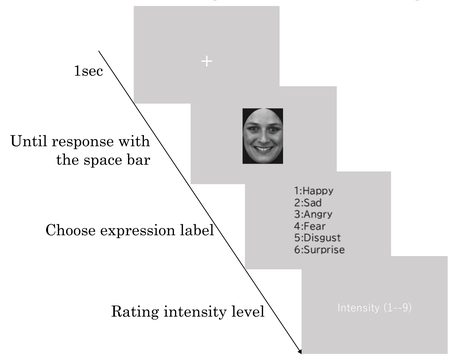

Figure 1 The procedural of the self-paced expression categorization task.

RESULTS

- Effects of anxiety on facial expression categorization performance
  - Calculated Pearson correlation between the score of questionnaires (BFNE, BDI, STAI-t) and the response of three indexes(categorization accuracy, intensity rating, reaction time)
  - **Categorization accuracy:** At the 20% intensity level, **BFNE** scores correlated positively with accuracy for recognizing the **fearful expression** (r = .169, p = .049), and **STAI-t** scores correlated negatively with accuracy for recognizing the **sad expression** (r = .179, p = .038).
  - **Intensity rating:** At the 100% intensity level, **STAI-t** scores correlated positively with intensity rating of **angry expression** (r = .178, p = .039).
  - **Reaction Time: BAI** scores correlated with reaction time of recognizing **fearful expression** at 40% and 100% intensities (r = -.207 and -178, p = .016, .039 respectively).

- The results of partial correlation
  - As Table 1 shows, the correlations between the score of each type of anxiety were high, then we calculated partial correlation to control mutual influence of anxieties.
  - Used BFNE score as a control variable to reexamine the correlation between the results of expression categorization test and BAI and STAI-t, and used STAI-t score as a control variable for BFNE.

Table 1 Correlations between Questionnaires and Alpha Coefficient

	BFNE	BAI	STAI-t
BAI	.32 **	-	
STAI-t	.55 **	.59 **	-
Alpha coefficient	.87	.91	.84

There were no significant correlations between each anxiety measurement and the expression categorization accuracy, the intensity rating, or the reaction time.

- Categorization bias and anxiety
  - We used categorization bias scores to identify systematic errors in facial expression categorization task. The bias scores were obtained by computing the percentage of the trials in which the participant categorized a displayed expression using one of the six emotion labels and averaging across the stimuli and participants (Table 2).

Table 2 Categorization bias scores in each facial expression

Displayed expression	Categorized expression (%)					
	Happy	Sad	Anger	Fear	Disgust	Surprise
Happy	**78%**	7%	4%	3%	6%	2%
Sad	2%	**78%**	7%	5%	8%	0%
Anger	2%	16%	**72%**	2%	7%	1%
Fear	6%	20%	5%	**42%**	6%	21%
Disgust	3%	11%	17%	2%	**67%**	1%
Surprise	5%	17%	3%	14%	2%	**59%**

- Analyzed partial correlations between the categorization bias and anxiety scores (Table 3).
- **BFNE** scores were correlated with higher tendency of miscategorizing **sadness as anger** and lower tendency of miscategorizing **surprise as disgust**.
- **BAI and STAI-t** scores were positively correlated with mistaking **surprise for disgust**.

Table 3 Partial Correlation (r) between the Categorization Bias Score and Anxiety measures.

	Happy	Sad	Anger	Fear	Disgust	Surprise
BFNE						
Happy	-.02	.01	-.08	.00	.09	.01
Sad	-.07	-.03	**.18** *	-.01	-.06	-.04
Anger	-.08	.10	-.06	.16	-.08	-.03
Fear	-.05	-.01	.03	.00	-.05	.05
Disgust	-.05	-.06	-.02	.06	.06	.01
Surprise	-.01	.09	-.10	.10	**-.19** *	-.07
BAI						
Happy	-.09	.05	.11	-.03	.09	-.07
Sad	.03	-.02	.11	.06	-.10	-.08
Anger	-.01	-.13	.12	-.16	.05	-.04
Fear	-.04	-.01	-.11	.09	-.01	-.05
Disgust	-.06	.01	.04	-.05	.01	-.11
Surprise	-.04	.02	-.10	-.11	**.17** *	.11
STAI-t						
Happy	-.01	-.14	.10	.07	.01	.01
Sad	.14	-.08	.09	.02	-.03	-.01
Anger	.00	-.11	.13	-.11	.00	-.10
Fear	.01	-.13	-.04	.01	.09	.07
Disgust	.07	-.13	.05	-.07	.07	-.13
Surprise	-.02	-.10	.04	-.07	**.22** **	.08

CONCLUSIONS

As we expected, we found a positive correlation between trait anxiety (STAI-t) and intensity rating of angry expression, whereas found a negative correlation between trait anxiety (BAI) and reaction time opposite to the expectation. Social anxiety related accurate recognition of fearful expression.

However, after we used partial correlation, there were no significant correlation between anxiety measurement and facial expression categorization performance. This means that the results obtained in the present study and previous studies could have mixed the effect of several subtypes of anxiety.

As far as the results obtained through partial correlation are concerned, trait anxiety related not to excessive evaluation of intensity of negative expressions and not to fast reaction time to them. Both trait anxiety and social anxiety related to miscategorization. The miscategorization of surprise face as disgusted face, which found in trait anxiety (both BAI and STAI-t), could mean that trait anxiety might influence on the interpretation of pleasant dimension described in the multidimensional theory[10]. On the other hand, because we found the miscategorization of sad face as anger face in social anxiety (BFNE), social anxiety might influence on the interpretation of arousal dimension.

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