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Symptoms of Anxiety and Depression Modulate the Recognition of Facial Emotion*

Síntomas de ansiedad y depresión modulan el reconocimiento de emociones

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ABSTRACT
Previous studies have shown that depression and anxiety are associated to changes in the recognition of facial expression. In the present research, a non-clinical sample was evaluated with respect to trait and state anxiety and depression symptoms. In the experimental task, participants evaluated facial expressions of happiness, anger, sadness, and fear, presented at four intensities (25, 50, 75, and 100%), as well as the neutral face. Results showed that the trait anxiety was associated with a better recognition of anger, fear, and happiness. For depression, we only found differences between groups for emotional attribution to neutral faces, in which participants scoring high in depression were more likely to attribute fear to neutral faces. Findings indicate an improvement of the recognition of happiness, anger, and fear in trait anxiety, whereas symptoms of depression and state anxiety were associated to changes in the evaluation of neutral faces in non-clinical individuals.

Keywords
anxiety; depression; facial expression; emotion.

RESUMEN
Estudios han demostrado que la depresión y la ansiedad están asociados a cambios en el reconocimiento de la expresión facial. En la presente investigación, una muestra no clínica ha sido evaluada con respecto a la ansiedad rasgo y estado y los síntomas de depresión. En la tarea experimental, los participantes evaluaran expresiones faciales de alegría, ira, tristeza y miedo, presentadas en cuatro intensidades (25, 50, 75 y 100%), y el rostro neutro. Los resultados mostraron que la ansiedad rasgo se asoció con un mejor reconocimiento de la ira, miedo y alegría. Para la depresión, sólo se encontraron diferencias entre los grupos para la atribución emocional a rostros neutros, en el que los participantes que puntuaran alto en depresión eran más propensos a atribuir miedo a rostros

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neutros. Los resultados indican una mejora del reconocimiento de la alegría, ira y miedo en la ansiedad rasgo, mientras que los síntomas de depresión y ansiedad estado están asociados a cambios en la evaluación de rostros neutros en individuos no clínicos.

Palabras clave
ansiedad; depresión; expresión facial; emoción.

Facial expressions of emotions (FEE) can convey information about the emotional states. They have an adaptive value in the context of social interactions and can inform us about feelings and trends of action of others individuals in a social environment (Frith, 2009; Schmidt & Cohn, 2001). The recognition of facial expressions is advantageous in the contexts of cooperation as well as in potentially agonistic encounters and it is considered a universal component of non-verbal communication (Darwin, 1872).

Evidences indicate that brain regions involved with social cognition and facial expressions recognition partially overlap. For example, the amygdala can be activated by FEE as well as in theory-of-mind tasks involving judgments of FEE (Baron-Cohen et al., 1999). While there are connections between social functioning and recognition of facial expressions, it is known that both can be affected by some disorders (Torro-Alves et al., 2016; Stein, Goldin, Sareen, Zorrilla, & Brown, 2002).

The link between the recognition of FEE and depression and anxiety is not well established yet. A recent meta-analysis concluded that both anxiety and major depression disorders led to impairments in the recognition of facial expressions in adults, but not in children with anxiety disorders (Demenescu, Kortekaas, den Boer, & Aleman, 2010). However, other studies fail to find this connection. For example, non-clinical trait anxiety did not predict the performance of recognition of FEE in a task requiring speeded judgment (Cooper, Rowe, & Penton-Voak, 2008).

Biases in judgment of neutral faces are another example of maladaptive social functioning. For example, evidences suggested that ambiguous expressions can be interpreted as threatening stimuli by socially anxious people (Lira Yoon & Zinbarg, 2007). By using a forced-choice procedure, Alves, Rodrigues, Souza, and Sousa (2012) found that men with symptomatology related to social anxiety tend to attribute anger to neutral faces, whereas women with social anxiety tend to attribute sadness as compared to controls.

Previous studies suggest that depression and anxiety interfere with the recognition of FEE and lead to biases in judgments of neutral faces (Brasilino, Barbosa, Lacerda, Santos, & Torro-Alves, 2014). In the present study, a non-clinical sample was evaluated with respect to trait and state anxiety, and depression symptoms. We used in the task facial expressions of happiness, anger, sadness, and fear, presented in four intensities (25, 50, 75, and 100%). In addition, the attribution of emotions to neutral faces was also investigated.

Methods

Participants

A total of 150 undergraduate students participated in the study: 112 women and 38 men. Participants being over 18 years of age and having normal vision were used as inclusion criteria.

Materials and procedure

The procedure was carried with 10 participants each time. The participants were instructed to complete both the trait and state sections of the Brazilian version of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970) and the Beck Depression Inventory (Beck, Rush, Shaw, & Emery, 1979). After this, the task of identification of emotions in photographs was carried out. Ten PC were used in this task. A slide presentation was previously prepared using the NimStim Emotional Face Stimuli Database (Tottenham et al., 2009). We used the software Morpheus Photo Animation Suite 3.10 to compose faces of happiness, sadness, fear, and

anger varying in emotional intensity from the neutral to the expressive face in steps of 25%. Adobe Photoshop 7.1 was used to improve the quality of the images. Photographs of surprise and disgust were also composed, however, not all intensities of these expressions were presented in the experiment, so we decided to exclude them from data analysis. A total of 40 images was analyzed, comprising 4 emotions (happiness, sadness, fear, anger), versus 4 intensities (25, 50, 75, and 100%), versus 2 genders of the face (male and female), plus 10 neutral faces.

The slides were sequentially numbered and each slide showed a photograph of a male or female person posing a neutral face or an emotion. The photographs were randomly sequenced and each slide lasted for 2 s. Participant responded in a recording sheet indicating the emotion after each face presentation. The researcher assisted the participants in the task, which was entirely completed by all of them.

Data analyses

Pearson correlation coefficients were determined between trait and state STAI and BDI scores at one side, and recognition of facial expression of emotions and attribution of emotions to neutral faces at the other side.

Additionally, we formed two groups with participants with scores more than one standard deviation below or above the mean for trait and state STAI and BDI scores. These groups were compared in recognition of facial expression of emotions and attribution of emotions to neutral faces by means of unpaired t tests. The significance level was set at $p < 0.05$.

Results

Correlations

Table 1 shows Pearson correlation coefficients. Moderate to high positive correlations were found between BDI and trait or state anxiety scores in STAI. Both anxiety scores were also positively correlated.

TABLE 1
Pearson correlation coefficients

	STAI-Trait	STAI-State	BDI
STAI-Trait	-	0.66 ***	0.66 ***
STAI-State	0.66 ***	-	0.52 ***
BDI	0.66 ***	0.52 ***	-
Happiness	0.22 **	0.11	0.14
Sadness	-0.08	-0.12	-0.07
Anger	0.23 **	0.16 *	0.1
Fear	0.2 *	0.08	0.06
Neutral-Happiness	-0.07	0.01	0.03
Neutral-Sadness	-0.03	-0.11	-0.1
Neutral-Anger	0.1	0.12	0.14
Neutral-Disgust	0.11	0.11	0.05
Neutral-Surprise	-0.14	-0.1	-0.09
Neutral-fear	0.14	0.14	0.1

Notes* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: own work.

Low positive significant correlations were found between STAI trait anxiety scores and recognition of facial expressions of happiness, anger, and fear (Table 1). No correlations were found between STAI trait anxiety scores and attribution of emotions to neutral faces. Low positive significant correlations were found between STAI state anxiety scores and recognition of facial expressions of anger (Table 1). Again, no significant correlations were found between STAI state anxiety scores and attribution of emotions to neutral faces.

No significant correlations were found between scores in the BDI and recognition of facial expressions or attribution of emotions to neutral faces (Table 1).

Comparison between groups scoring low or high in the scales

Table 2 shows comparisons between groups scoring low or high in STAI trait or state and in the BDI scales.

TABLE 2

Recognition of facial expressions and attribution of emotions to neutral faces by extreme groups with respect to STAI-trait, STAI-state, and BDI

	STAI-Trait		STAI-State		BDI	
Group (n)	Low (28)	High (35)	Low (24)	High (28)	Low (23)	High (17)
Happiness	7.9 ± 0.6	9.2 ± 0.3*	8.4 ± 0.7	9.1 ± 0.4	7.8 ± 0.7	9.1 ± 0.4
Sadness	4.5 ± 0.4	4.3 ± 0.3	5 ± 0.5	4.6 ± 0.4	5.2 ± 0.5	4.5 ± 0.5
Anger	7 ± 0.5	8.1 ± 0.3*	7.6 ± 0.5	7.9 ± 0.3	7.1 ± 0.5	7.9 ± 0.4
Fear	2.9 ± 0.4	4.1 ± 0.3*	3.2 ± 0.4	3.5 ± 0.3	3.3 ± 0.5	3.5 ± 0.4
Neutral-Happiness	1.3 ± 0.3	1.3 ± 0.3	1.3 ± 0.4	1.3 ± 0.3	1.4 ± 0.3	1.1 ± 0.3
Neutral-Sadness	4.3 ± 0.6	4.1 ± 0.5	3.8 ± 0.6	3.2 ± 0.5	4.2 ± 0.6	3.2 ± 0.6
Neutral-Anger	0.8 ± 0.2	1.2 ± 0.3	0.7 ± 0.2	1.5 ± 0.5	0.8 ± 0.3	1.1 ± 0.3
Neutral-Disgust	0.3 ± 0.1	0.5 ± 0.2	0.3 ± 0.2	0.6 ± 0.3	0.3 ± 0.1	0.7 ± 0.3
Neutral-Surprise	2.1 ± 0.5	1.6 ± 0.3	3.2 ± 0.6	1.8 ± 0.4*	2.6 ± 0.4	2.2 ± 0.5
Neutral-fear	1.2 ± 0.2	1.3 ± 0.2	0.8 ± 0.2	1.7 ± 0.4*	0.8 ± 0.2	1.7 ± 0.4*

Notes* $p < 0.05$, ** $p < 0.01$

Source: own work

The group presenting high STAI trait anxiety scores, as compared to the 'low' group, recognized faces of happiness, anger, and fear significantly better ($t_{[61]} < -2.19$, $p < 0.05$). Both groups did not significantly differ in recognition of sadness faces. The attribution of emotions to neutral faces did not discriminate the groups. When 'low' and 'high' groups were formed according to STAI state anxiety scores, these groups showed opposite results in attribution of fear or surprise to neutral faces: the 'high' group attributed more fear ($t_{[50]} = -2.13$, $p < 0.05$) and less surprise ($t_{[50]} = 2.21$, $p < 0.05$) than the other group.

When the participants were grouped as 'low' or 'high' in respect to their BDI scores, no differences were found in recognition of facial expressions. The only difference they showed was that participants of the 'high' group were more likely to attribute fear to neutral faces ($t_{[38]} = -2.15$, $p < 0.05$).

Discussion

The present results suggest that non-clinical trait anxiety is associated with moderately better recognition of anger, fear, and happiness. State anxiety was found to induce the interpretation of neutral faces to a lower degree as surprise and to a higher degree as fear. Such bias of interpreting neutral faces as fear was also found in the group with more symptoms related to depression.

Anxiety is an emotional functioning triggered by potential threat, which can be identified by the detection of cues related to a previous aversive experience, or can assume the form of novel (and, thus, unpredictable) situations (Gray & McNaughton, 2003). As related to the possible eminence of a dangerous situation, an important feature of anxiety is a shift of attention toward the surrounding environment (Horley, Williams, Gonsalvez, & Gordon, 2004). Indeed, vigilance to possible dangers is assumed in many theoretical conceptions about anxiety (see, for example, Mathews, 1990). People which more thoroughly function anxiously, i.e. people scoring high in trait anxiety, are expected to have experienced hypervigilance in many occasions (Garner, Baldwin, Bradley, & Mogg, 2009; Mogg & Bradley, 1998). It is possible that this hypervigilance provided these people with more opportunities of learning even subtle features of emotional expressions. This would explain the positive relationship between trait anxiety and recognition of anger, fear, and happiness found in the present study. The fact that high scores in state anxiety in the present study do not replicate a similar relationship with recognition of FEE is explainable throughout the same line of reasoning, by the observation that people scoring high in state anxiety are not expected to experience anxiety as frequently as those scoring high in trait anxiety.

Some previous studies also found relationship between improved detection of emotional signals and anxiety/fear (Torro-Alves et al., 2016). For example, high arousal unpleasant pictures triggered faster responses by people identified as fearful than by their non-fearful counterpart (Bradley & Lang, 1999). In a procedure more

similar with the present one, participants scoring high in the State-Trait Anxiety Inventory recognized fear faces better than those scoring low (Surcinelli, Codispoti, Montebarocci, Rossi, & Baldaro, 2006). It is worth to note, however, that our results are discrepant with those pointing to a lack of relationship between trait anxiety and recognition of emotional faces (Cooper et al., 2008) and those pointing to impairments (Demenescu et al., 2010). One could consider our technique as more sensitive for detecting differences related to trait anxiety, if so, this can be attributed to using pictures of faces only subtly expressing the emotions.

Cross-cultural studies have shown some confusion in the recognition of fear and surprise facial expressions (Ekman, Sorenson, & Friesen, 1969). Curiously, we found that individuals scoring high in state anxiety tended to attribute to neutral faces more fear and less surprise compared to individuals with lower scores. This result supports the idea that anxiety can bias emotional attribution. The increase of the attribution of fear to neutral faces in individuals scoring high in nonclinical depression is also noteworthy because it may indicate a negative bias by these people in evaluating social signals.

Our main results are: (1) some degree of association between symptoms of anxiety (trait) and recognition of FEE (anger, fear, and happiness); and, (2) biases in the attribution of emotions to neutral faces in people scoring high in state of anxiety or in symptoms of depression. The recognition of FEE and the attribution of emotions to neutral faces are facets of the social functioning (Adolphs, 2003). Indeed, in congruence with our results, subjects with social phobia are reported to present increased amygdala activation due to the view of angry (Stein et al., 2002) and neutral faces (Birbaumer et al., 1998). Our results suggest that, aiming at a better understanding of some anxiety and depression disorders, seeking for biases in the recognition of FEE and in attribution of emotions to neutral faces can be heuristic.

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Notes

* Research article.