BRIEF COMMUNICATION

Do Anxious Boys and Girls Differ in Emotion Recognition Accuracy?

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Abstract

Introduction: Difficulty recognizing emotions may contribute to childhood anxiety and anxiety-related social difficulties. **Methods:** We examined the relationship between gender and emotion recognition accuracy in children with and without anxiety disorders. **Results:** Gender did not predict emotion recognition accuracy except for disgust. **Discussion:** Disgust recognition was significantly less accurate in clinically anxious girls than in clinically anxious boys. There was also a trend towards anxious girls being less accurate than non-anxious girls in recognizing disgust.

Key Words: anxious children, emotion recognition, gender, disgust

Résumé

Introduction: La difficulté à reconnaître les émotions peut contribuer à l'anxiété pédiatrique et aux difficultés sociales liées à l'anxiété. **Méthodes:** Nous avons examiné la relation entre les sexes et l'exactitude de la reconnaissance des émotions chez des enfants souffrant ou non de troubles anxieux. **Résultats:** Le sexe ne prédisait pas l'exactitude de la reconnaissance des émotions excepté pour le dégoût. **Discussion:** La reconnaissance du dégoût était significativement moins exacte chez les filles cliniquement anxieuses que chez les garçons cliniquement anxieux. Les filles anxieuses avaient aussi tendance à reconnaître moins exactement le dégoût que les filles non anxieuses.

Mots clés: enfants anxieux, reconnaissance des émotions, sexe, dégoût

Introduction

The ability to correctly recognize emotion is a requirement for successful communication and social interaction. Consequently, research attention has been directed to understanding the relation between the ability to process emotion and psychiatric disorders with features of social and emotional dysfunction, including anxiety disorders.

Children with anxiety disorders often have difficulty engaging in social interaction and are likely to experience teasing (Ledley et al., 2006), victimization (Crawford & Manassis, 2011), or rejection by peers (Strauss, Lahey, Frick, Frame, & Hynd, 1988). It is unclear if such social difficulty is related to their ability to process or recognize the emotional states of others. If so, understanding this ability would have important therapeutic implications.

Past studies attempted to compare the accuracy of emotion recognition in children with and without anxiety disorders; however, results have been inconsistent (Easter et al., 2005; Manassis & Young, 2000; McClure, Pope, Hoberman, Pine, & Leibenluft, 2003; Guyer et al., 2007; Melfsen & Florin, 2002; Simonian, Beidel, Turner, Berkes, & Long, 2001). This inconsistency may relate to moderating factors in these studies. For example, there is evidence that type of primary anxiety diagnosis (Lee et al., 2013) may be a moderator of the ability to recognize emotions in children with anxiety disorders. Gender is another potential moderator, as gender differences in processing of emotion have been found in anxious adults (Arrais et al., 2010) and in non-anxious children (McClure, 2000; Elfenbein, Marsh, & Ambady, 2002), but have not been studied in anxious children. For instance, women with social anxiety are more

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Table 1. Logistic regression analyses of gender and clinical status predicting emotion recognition accuracy

emotion	Anxious girls vs. Anxious boys			Anxious girls vs. Non-anxious girls		
	Odds Ratio	(95% CI)	P	Odds Ratio	(95% CI)	P
Relaxed	1.3	(0.4, 4.0)	0.7	0.6	(0.2, 2.0)	0.4
Bored	0.3	(0.07, 1.2)	0.08	0.2	(0.04, 1.1)	0.06
Tired	0.4	(0.1, 1.3)	0.1	0.5	(0.1, 1.8)	0.3
Surprised	0.2	(0.05, 1.0)	0.07	0.3	(0.06, 1.6)	0.2
Sad	0.6	(0.2, 2.1)	0.4	0.7	(0.2, 2.5)	0.5
Guilty	1.1	(0.3, 3.5)	0.9	0.8	(0.2, 2.8)	0.7
Ashamed	0.5	(0.1, 2.2)	0.4	0.4	(0.1, 1.4)	0.1
Angry	-	-	-	1.2	(0.1, 9.9)	0.9
Irritable	0.9	(0.3, 2.8)	0.8	1.2	(0.3, 4.1)	0.8
Jealous	0.9	(0.4, 2.7)	0.8	0.5	(0.1, 1.8)	0.3
Scared	0.5	(0.08, 3.4)	0.5	2	(0.3, 12.2)	0.5
Nervous	0.7	(0.2, 2.1)	0.5	0.9	(0.3, 2.9)	0.8
Disgusted	0.2*	(0.04, 0.8)	0.03	0.2	(0.04, 1.0)	0.05
Happy	0.8	(0.1, 5.8)	0.8	1.5	(0.3, 6.0)	0.6
Elated	3.1	(0.9, 11.0)	0.08	1.2	(0.3, 4.1)	0.8
Proud	0.9	(0.2, 3.1)	0.8	0.6	(0.1, 2.1)	0.4

The asterisk (*) represents a significant result

None of the anxious boys misidentified 'angry', resulting in an empty cell

hypersensitive to recognition of fear, sadness, and happiness than their male counterparts (Arrais et al., 2010). In children without anxiety disorders girls tend to be more accurate than boys in recognizing emotions (McClure, 2000), and this gender difference is consistent across cultures and age groups (Elfenbein et al., 2002). Studying gender differences in emotion recognition in anxious and non-anxious children may clarify the question of whether or not anxious children of either gender have deficits in this ability.

Studying patterns of emotion recognition may also help characterize certain types of psychopathology. For example, individuals with certain types of obsessive-compulsive disorder (OCD; Sprengelmeyer et al., 1997) or severe depression (Douglas & Porter, 2010) show deficits in the recognition of disgust. Similarly, the present study may reveal novel cognitive features of childhood anxiety disorders, which could then be studied further (e.g., with functional neuroimaging) to elucidate neural mechanisms of emotion processing in this population. Understanding these mechanisms may have important therapeutic implications in future.

We examine gender differences in emotion recognition ability in children with and without anxiety disorders using animated characters that are developmentally sensitive and provide dynamic displays of emotions. The main hypothesis is that girls with anxiety disorders will be more accurate in

the recognition of various emotions than boys with anxiety disorders, consistent with findings in non-anxious children.

Methods

Data were obtained from a previous study by Lee et al. (2013), which included 122 school-aged children, 6-11 years of age recruited at the Hospital for Sick Children in Toronto. The present study, however, excluded the primary diagnoses of specific phobia and post-traumatic stress disorder (PTSD). Primary diagnoses in the final anxiety group (n=58) were separation anxiety disorder (n=13), generalized anxiety disorder (n=35), and social phobia (n=10). There were 23 anxious boys, 35 anxious girls, 29 non-anxious boys, and 30 non-anxious girls. Of this final sample, 34.4% had a secondary comorbid anxiety diagnosis, and 8.6% had a comorbid non-anxiety diagnosis (e.g. attention-deficit hyperactivity disorder, learning disability). None had comorbid depression, and the mean CDI t-score for the group (M = 48.59, SD = 7.68) was in the non-clinical range. Diagnostic interviews were conducted by experienced clinicians, using the Anxiety Disorders Interview Schedule (ADIS; Silverman & Albano, 1996). Any child with ongoing treatments or with a presentation of psychosis or intellectual disability was not included in this study. Non-anxious controls of comparable age were recruited via flyers posted in the community from which clinical cases were drawn, and had to be free of any Axis I diagnosis on ADIS.

Emotion recognition accuracy was measured with Mood Assessment via Animated Characters (MAAC), a computerized self-report instrument, specifically designed for anxious children (Manassis et al., 2013). MAAC presents a child-friendly character expressing sixteen types of emotions (relaxed, bored, tired, surprised, sad, guilty, ashamed, angry, irritable, jealous, scared, nervous, disgusted, happy, elated, and proud) via facial, bodily, and contextual cues in dynamic motion. MAAC discriminates anxious from non-anxious children in that anxious children rate themselves significantly less positive and less calm than children without anxiety disorders (Manassis et al., 2013). For internal consistency, Cronbach's alpha values were reported for four empirically derived emotion factors: positive (0.83), negative (0.76), fearful (0.71), and neutral (0.55) (Manassis et al., 2013).

All children viewed each of sixteen emotion-specific animations, and were asked to identify the character's emotional states. The child's response for each emotion was scored for accuracy (0=incorrect, 1=close to correct, 2=correct). Inter-rater agreement on scoring was excellent (kappa=0.92, $p < 0.001$).

Statistical analysis
Ordinal logistic regression analyses were used to compare emotion recognition accuracy between the gender groups on each of sixteen emotions. Using the same method, accuracy was also compared between genders in non-anxious children and between anxious girls and non-anxious girls. Further, we measured state anxiety (T-score on the State-Trait Anxiety Inventory for Children) and depressive symptoms (T-score on the Children's Depression Inventory) to control for potential confounding factors and isolate the effects of anxiety disorder upon our findings.

Results

Boys with anxiety disorders vs. girls with anxiety disorders
Boys with anxiety disorders (n = 23, mean age = 8.88 years, SD = 1.05) and girls with anxiety disorders (n = 35, mean age = 8.51 years, SD = 1.25) were of comparable age, $t(56)$ = 1.84, $p = 0.25$, and showed comparable state anxiety, $t(44)$ = -0.31, $p = 0.76$, but depressive symptoms were higher in anxious girls (M = 50.48, SD = 8.01) than in anxious boys (M = 45.71, SD = 6.57), $t(46)$ = -2.21, $p = 0.03$, so depressive symptoms were added as a covariate in the analyses.

Ordinal regression analyses, including CDI t-score as a covariate, revealed that clinically anxious boys and clinically anxious girls were not significantly different in recognition accuracy on most of the sixteen emotions (Table 1). However, girls with anxiety disorders performed significantly worse than boys with anxiety disorders on the recognition of disgust ($p = 0.03$).

Boys without anxiety disorders vs. girls without anxiety disorders
Boys without anxiety disorder (n = 29, mean age = 8.25 years, SD = 1.36) and girls without anxiety disorder (n = 30, mean age = 8.34 years, SD = 1.38) were comparable for mean age, $t(57)$ = -0.25, $p = 0.80$, state anxiety, $t(42)$ = 0.62, $p = 0.49$, and depressive symptoms, $t(44)$ = 1.40, $p = 0.53$. The results of logistic regression analyses indicated that there was no significant gender difference on recognition accuracy for any of sixteen emotions.

Girls with anxiety disorders vs. girls without anxiety disorders
Girls with anxiety disorders and girls without anxiety disorders were matched for age, $t(63)$ = -0.55, $p = 0.59$, and state anxiety, $t(46)$ = -1.50, $p = 0.14$, but depressive symptoms were significantly higher in clinically anxious girls (M = 50.48, SD = 8.01) than in non-anxious girls (M = 45.17, SD = 4.97), $t(44.16)$ = -2.86, $p=0.006$, so these were controlled for in the analysis.

The ordinal logistic regression result, while controlling for CDI total t-score, indicated that clinically anxious girls and non-anxious girls did not differ in recognition accuracy for any of sixteen emotions (Table 1). Disgust recognition between groups did not differ significantly, but the difference came very close to significance level ($p = 0.051$) such that anxious girls showed a trend towards less accuracy than non-anxious girls in recognizing disgust.

Boys with anxiety disorders vs. boys without anxiety disorders
Boys with anxiety disorders and boys without anxiety disorders were comparable for age, t(50) = -1.84, $p = 0.59$, state anxiety, $t(40)$ = -0.44, $p = 0.66$, and depressive symptoms, $t(42)$ = -0.82, $p=0.52$. The ordinal logistic regression result was non-significant between the two groups for sixteen emotions.

Discussion
Although limited by modest sample size, our findings suggest that gender plays a minimal role in overall emotion recognition accuracy in children with anxiety disorders. The lack of gender difference in children without anxiety disorder in this study seems to be inconsistent with the result of a meta-analysis by McClure (2000) on facial emotion recognition, based on studies using static facial pictures. This difference suggests that school-age girls may not be more proficient than boys in emotion recognition when a combination of various dynamic, non-verbal cues for emotion are available as in our study. Non-anxious boys may make effective use of contextual cues to compensate for their difficulty with facial emotion recognition compared with girls. If so, the present results may be generalizable to real world social settings where various non-verbal channels of expression and contextual cues are available to children. Alternatively, our results may relate to the use of animated

characters. For example, Hoffmann et al. (Hoffmann, Kessler, Eppel, Rukavvina, & Traue, 2010) found that women recognize only subtle emotions better than men, but the female advantage disappears when recognizing highly expressive cues. Because animated characters tend to be more expressive than facial pictures, gender differences may diminish when using animated instruments. Further investigation is warranted regarding this issue.

Interestingly, girls with anxiety disorders in our study appear impaired in the recognition of disgust, often misidentifying disgust as anger. In children without anxiety disorders, however, boys and girls recognize all emotions, including disgust, at a comparable level. Perhaps anxious girls are particularly sensitive to the potential threat posed by angry expressions, and so prone to misidentifying negative emotions as anger. Biased attention to threat has been found in both genders in this population (Waters, Henry, Mogg, Bradley, & Pine, 2010). Alternatively, inaccurate recognition of disgust in school-age girls may be a novel feature of anxiety disorders in children. To address this possibility, future studies including clinical groups that also exhibit inaccurate recognition of disgust (e.g., OCD, depression) are warranted. Combining such studies with neuroimaging modalities would further elucidate the neural basis of disgust recognition in anxious girls compared with children from other clinical groups.

There are some limitations in our study. First, due to sample size constraints, it was not possible to examine gender effects on emotion recognition accuracy in children with each specific type of anxiety disorder. Future study of this issue with larger samples is indicated. Second, although anxious girls in our study showed a tendency to be less accurate in recognizing disgust compared with non-anxious girls, the group difference was not statistically significant. Therefore, caution is required in interpreting this finding. Third, MAAC utilizes a teenage animated character, and our findings may not be generalizable to identifying the emotional states of adults (or adult characters) or to real social settings. Fourth, including other clinical groups (e.g. OCD or bipolar disorder) that have shown impaired emotion recognition would clarify if inaccurate recognition of emotions, particularly decreased recognition of disgust in girls, is truly a specific marker for childhood anxiety. Finally, our findings are exploratory and we cannot draw firm conclusions. Nevertheless, they may guide future studies of gender differences in the recognition of emotion in children with anxiety disorders.

Acknowledgements/Conflicts of Interest

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