Ew gross! Recognition of Expressions of Disgust by Children With Obsessive–Compulsive Disorder

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There is evidence suggesting that obsessive–compulsive disorder (OCD) in adults may be associated with an impaired ability to recognise the facial expression of disgust (Sprengelmeyer et al., 1997a; Woody, Corcoran, & Tolin, in press). It has been suggested that this impairment begins in childhood when the recognition of emotional expressions is being learnt (see Spengelmeyer et al., 1997a). This study compared the recognition of facial affect in children aged around 11 years with a diagnosis of obsessive–compulsive disorder (OCD; n = 11), other anxiety disorders (n = 20), and nonclinical children (n = 19), adapting the methodology of Sprengelmeyer et al. Disgust was most commonly misclassified as anger by children in all three groups. However, children with OCD did not show any evidence of a recognition deficit for disgust in comparison to either control group. Unexpectedly, however, children with OCD recognised expressions of surprise more accurately than nonclinical children. Recognition of disgust or any other emotion was not related to child self-reported anxiety symptoms. Given the observed differences in some studies with adults, future research may benefit by examining older adolescents and young adults to determine when these effects may first be noticed.

There has been increasing interest in the emotion of disgust and its potential role in obsessive–compulsive disorder (OCD; see Berle & Phillips, 2006, for a review). This interest has arisen for several reasons. First is the obvious link between disgust and contamination obsessions and washing/cleaning compulsions (Rozin, Taylor, Ross, Bennett, & Hejmadi, 2005). Disgust in OCD may be associated with unrealistic appraisals of the likelihood of disease transmission produced via contact with objects and events (Sprengelmeyer et al., 1997a). Sprengelmeyer and colleagues suggested that such appraisals may produce a weaker association between stimuli that evoke disgust in individuals with OCD and stimuli that evoke disgust in others. They speculated that if the recognition of facial expressions is learnt in a social context by experiencing the emotion of disgust and associating this emotional experience with the facial expression displayed by others, then

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individuals with OCD will be less likely to learn to recognise facial expressions of disgust. That is, given that individuals with OCD are likely to experience disgust when others do not, any learned association between the emotional experience of disgust and the corresponding facial expression shown by others would be weakened. Finally, abnormalities in the frontostriatal region and the basal ganglia have been linked to both the presence of obsessions and compulsions and to deficits in disgust recognition (Calder, Keane, Manes, Antoun, & Young, 2000; Gray, Young, Barker & Curtis, 1998; Sprengelmeyer et al., 1996, 1997b).

Sprengelmeyer et al. (1997a) investigated the link between the recognition of disgust and OCD by showing photographs of people displaying basic emotions (including disgust) to four different groups: (a) adults with OCD (n = 12), (b) adults with Tourette's syndrome without obsessions and compulsions (n = 7), (c) adults with Tourette's syndrome with obsessions/compulsions (n = 5), and (d) adults diagnosed with panic disorder or generalised anxiety disorder (n = 8). Adults with OCD recognised disgust significantly less accurately than happiness, sadness, surprise, anger or fear. Furthermore, this disgust recognition deficit was evident for every participant in the OCD group. Adults with OCD symptoms most commonly misclassified disgust as anger, the emotion it is most commonly confused with according to norms drawn from the general population (Ekman & Freisen, 1976). Adults with Tourette's accompanied by OCD symptoms also showed this specific deficit in the recognition of disgust, but not adults with other anxiety disorders or Tourette's with no OCD symptoms. Importantly, the deficit was not accounted for by the reluctance of participants' to choose disgust as a response or a lack of understanding of the term disgust.

Several studies have attempted to replicate the Sprengelmeyer et al. (1997a) finding using a similar experimental paradigm and apparatus and have produced inconsistent results (Bulhmann, McNally, Etcoff, Tuschen-Caffier, & Wilhelm, 2004; Parker, McNally, Nakayama, & Wilhelm, 2004; Rozin et al., 2005; Corcoran, Woody, & Tolin, in press). In one of the few studies to replicate the Sprengelmeyer et al. findings, Corcoran et al. found that OCD adults recognised disgust significantly less accurately than other emotions and demonstrated poorer recognition of disgust than adults diagnosed with panic disorder or nonclinical controls. In contrast to these results, most studies have failed to demonstrate a negative association between disgust recognition and obsessive–compulsive behaviours (Buhlmann et al., 2004; Parker et al., 2004; Rozin et al., 2005). One possible explanation for the lack of consistent findings may relate to the inclusion of participants with less severe OCD in some studies. Despite an absence of overall group differences in their study, Parker et al. (2004) showed evidence for a deficit in disgust recognition in a single patient who had especially severe levels of OCD. Consistent with Parker et al. (2004), Corcoran et al. (in press) also found that impaired disgust recognition was significantly associated with symptom severity and poorer functioning in OCD adults.

The explanation that Sprengelmeyer et al. (1997a) provided for their finding of a disgust recognition deficit in adults with OCD related to the initial onset of disorder. They reasoned that OCD generally has a childhood onset whereas the onset of panic disorder and generalised anxiety disorder tends to occur later in life, when the recognition of basic emotions has already been well established. Of course, there is ample evidence that generalised anxiety disorder at least begins at a very early age (Rapee, 2001), thereby raising doubt about the conclusions of Sprengelmeyer et al. Nevertheless, Sprengelmeyer et al. speculated that a deficit in

the recognition of disgust may originate in childhood, when facial expression recognition is being learnt. If emotion recognition is learnt by mapping self-experienced emotions to the facial expressions of others, and this learned association is likely to be weakened by a 'mismatch' of emotional experience in children with OCD and other's facial expressions, this disgust recognition deficit should be evident in children and adolescents with a diagnosis of OCD.

Therefore the aim of the current study was to examine whether the recognition of the facial expression of disgust is impaired in children with OCD in comparison to children with other anxiety disorders and nonclinical children. To facilitate comparison with adult research, we adapted the methodology of Sprengelmeyer et al. (1997a) for use with children. It was predicted that children with OCD would be significantly more likely to misclassify facial expressions of disgust than children with other anxiety disorders and nonclinical children. No significant differences between groups were predicted for any emotions apart from disgust.

Method

Participants

The *OCD group* consisted of 11 children (5 males, 6 females) aged from 7 to 15 years (M = 11.2, SD = 2.4). OCD was the primary diagnosis for most of this group (n = 8). The remaining three children in the OCD group had primary diagnoses of separation anxiety disorder, generalised anxiety disorder and major depression, with OCD as an additional diagnosis. The majority of children in the OCD group met criteria for an additional anxiety disorder (81%, n = 9). One child met criteria for an additional diagnosis of oppositional defiant disorder. The *other anxiety disorders group* (hereafter, OAD) was comprised of 20 children (8 males, 12 females) aged from 7 to 16 years (M = 9.0, SD = 2.2). The primary diagnoses of children in the OAD group were as follows: generalised anxiety disorder (n = 11), separation anxiety disorder (n = 6), specific phobia (n = 2), and posttraumatic stress disorder (n = 1). Approximately half of the OAD group (n = 9) met criteria for an additional anxiety diagnosis. Additional nonanxiety diagnoses included attention-deficit hyperactivity disorder (n = 2). Children in the two clinical groups presented for assessment and treatment at the Macquarie University Anxiety Research Unit, Sydney, Australia. The *nonclinical group* consisted of 19 children (8 males, 11 females) aged from 7 to 11 years (M = 8.9, SD = 1.4). Nonclinical children were recruited through a local primary school and had never sought treatment from a mental health professional.

Measures and Apparatus

Revised Child Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978). The RCMAS is a 37-item child self-report scale measuring anxiety. The RCMAS yields a total score as well as scores on three subscales: (a) physiological anxiety, (b) worry/oversensitivity, and (c) social concerns/concentration. This measure has acceptable test–retest reliability and validity (Reynolds, 1982; Reynolds & Richmond, 1985).

Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Versions (ADIS-C/P; Silverman & Albano, 1996). The ADIS-C/P are semistructured interviews designed to assess anxiety diagnoses and common comorbid disorders in children. The ADIS-C/P provides clinician-based combined diagnoses based on child and parent report of impairment and symptomatology. Primary diagnoses represent

the disorder currently causing the greatest life interference. Additional diagnoses include all other disorders where DSM-IV criteria are met. The ADIS-C/P has good to excellent test–retest reliability for combined diagnoses (Silverman, Saavedra, & Pina, 2001). Our clinic has found good to excellent interrater agreement for child anxiety diagnoses, with kappas ranging from .68 to .93 (Lyneham, Abbott, & Rapee, in press).

Photographic Images of Facial Emotion Expressions. This study employed the same photographic images utilised in previous studies, examining the impairment of disgust recognition in adults with OCD (Sprengelmeyer et al., 1997a; Woody et al., in press) to assess children's recognition of facial emotion expressions. These images feature the same man displaying facial expressions of surprise, anger, happiness, fear, disgust and sadness. Further stimuli were generated by placing each image of the six different facial expressions in an 'emotion hexagon', adjacent to the expression it was most likely to be confused with according to norms collated by Ekman and Friesen (1976). This resulted in the following sequence: happiness — surprise — fear — sadness — disgust — anger. Sprengelmeyer and colleagues created five morphed images for each continuum of this hexagon by blending two prototypical facial expressions (e.g., surprised, scared) in proportions. For example, the surprised–scared continuum was blended in the proportions 90:10 (e.g., 90% surprised, 10% scared), 70:30, 50:50, 30:70 and 10:90. This led to the creation of 30 morphed images altogether (5 images × 6 emotions). Five sets of the 30 morphed images were printed onto 10 cm × 10 cm cards. Children categorised 150 images in total.

Procedure

The measures used in this study were collected as part of a larger battery administered to parents and children who presented for assessment and treatment of their child's anxiety. The written informed consent of parents and verbal assent of children was obtained prior to the clinical assessment. Children in the two clinical groups were assessed for anxiety according to DSM-IV (American Psychiatric Association, 1994) criteria by postgraduate students in clinical psychology. Prior to these assessments, students received extensive training from experienced clinical psychologists. All diagnoses were based on both parent and child interviews, conducted by the same clinician. The majority of children in the two clinical groups (n = 22, 71%) were diagnosed on the basis of an unstructured clinical interview. However, six children in the OCD group (54.5%) and three children in the OAD group (15%) were assessed using the ADIS-C/P due to a changeover in clinic procedure. Children in the nonclinical group completed the RCMAS and the emotion recognition task in a quiet room at their primary school after the written consent of parents and verbal assent of children was obtained.

Before commencement of the recognition task, children aged 12 and under were tested to determine whether they understood the meaning of each verbal emotion term. If children were unable to explain an emotion term, they were supplied a definition of the word and an example of when someone might experience this emotion. For example, if a child could not explain the meaning of 'disgusted', the experimenter told them that disgusted is 'like how you would feel if you put on your shoe and it was full of green slime'. Participants were seated facing five boxes, each box labelled with one of the emotion terms: happy, surprised, disgusted, angry,

scared or sad. Children aged 12 and under were asked to read the label displayed on each box. For those children unable to read the label on any of the boxes, an experimenter read out aloud the emotion term displayed on the label while pointing to the corresponding box. Children aged 13 years and above were not tested for comprehension of or ability to read aloud the emotion terms. The experimenter explained to each child that she had some pictures that are all of the same man, except that he is displaying a different facial expression in each one. Participants were told that the man might look sad, happy, angry, scared, surprised or disgusted in each of the pictures.

Each child was first asked to categorise a set of five practice pictures. Children were asked to look at each picture and then place it in the box labelled with the emotion they thought looked most like the one shown by the man in the picture. For each practice picture, children were asked which emotion term they felt was 'most like' the man's facial expression and then asked where they wanted to put this picture. This was done to ensure that children were matching the emotion displayed by the man in the picture with the correct box. If the child identified any of the boxes incorrectly, the experimenter assisted the child to place the picture in the right box by pointing to the box the child wished to place the picture in and repeating the name of its emotion label.

Once each child was capable of identifying the emotion label on each box correctly, the boxes were emptied of the practice cards and he or she was handed the first set of 30 pictures to manually categorise as one of the six target emotions using the labelled boxes. Participants were instructed to work quickly and told that some faces may be more difficult than others to recognise. When participants completed sorting one set of pictures into the boxes, they were given the next set and asked to continue sorting in the same manner. This procedure continued until all five sets were sorted into the boxes. Boxes were arranged in random order from one participant to the next. Each set of picture cards was shuffled before each administration so that the cards were given to participants in a random order. The recognition task followed the same procedure for children in all three experimental groups.

Results

Demographic Characteristics

Groups were compared on age using a two-tailed between-subjects analysis of variance (ANOVA) with Bonferroni adjustments for post-hoc comparisons. Given three post hoc, between group comparisons, critical alpha was set at $p = .017$. There was a significant difference between groups with regard to age, $F(2, 49) = 5.71$, $p = .006$. OCD children were older than children in the OAD group, $t(49) = 3.037$, $p = .012$; and nonclinical children, $t(49) = 3.082$, $p = .010$. OAD and nonclinical children did not differ significantly in age, $t(49) = -.088$, $p > .017$. A chi-squared analysis revealed no significant difference between groups with regard to child gender, $\chi^2(2, N = 50) = .087$, $p = .958$.

Facial Emotion Expression Recognition Performance

Following the procedure of Sprengelmeyer et al. (1997a), images were divided into sets consistently recognised as each emotion on the basis of responses provided by an adult control group. Four morphed images were identified as being consistently recognized as each of the target emotions. Each image was presented to children

five times during the recognition task, leading to a maximum score of 20 correct responses for each emotion. Table 1 below shows the mean number of correct responses for each emotion for the OCD, OAD and nonclinical groups.

Two-tailed Mann Whitney *U* tests were conducted to determine any differences between groups with regard to the number of facial expressions of emotion correctly classified for each emotion term[1] (Table 1). There was no significant difference between OCD and either the OAD or nonclinical groups with regard to the number of facial expressions correctly recognised as disgust, or indeed any of the target emotions. The only significant difference between groups was that nonclinical children were significantly less likely to correctly recognise surprised expressions in comparison to OCD children (p = .014). Table 2 presents means and standard deviations for the number of incorrect categorisations of disgust as other emotion expressions. From this table it can be seen that children in all three groups were most likely to incorrectly classify disgust as anger. The proportion of incorrect categorisations of disgust as anger relative to the total number of incorrect categorisations of disgust as any other emotion (happiness, sadness, surprise, anger and fear) was calculated. A one-way ANOVA showed no significant difference in the proportion of incorrect categorisations of disgust as anger by group, F (2, 49) = 2.832, p = .069.

There were no significant differences between OCD (M = 15.20, *SD* = 4.59), OAD (M = 14.25, *SD* = 7.21), and nonclinical (M = 12.42, *SD* = 7.02) groups with

TABLE 1

Means and Standard Deviations of Correct Recognition Scores of Emotion

Emotion	OCD *M* ± *SD*	OAD *M* ± *SD*	Control *M* ± *SD*	*z*	Comparison
Disgusted	9.0 ± 6.7	9.9 ± 7.7	6.8 ± 6.8	–.650	OCD vs. controls
				–.582	OCD vs. OAD
				–1.159	OAD vs. controls
Angry	14.3 ± 4.5	14.4 ± 6.1	14.8 ± 4.0	–.325	OCD vs. controls
				–.325	OCD vs. OAD
				–.563	OAD vs. controls
Happy	19.0 ± 3.0	18.7 ± 4.5	18.2 ± 4.0	–.581	OCD vs. controls
				–.423	OCD vs. OAD
				–.256	OAD vs. controls
Surprised	17.2 ± 2.9	15.2 ± 5.1	12.2 ± 6.6	–2.422	OCD vs. controls*
				–1.292	OCD vs. OAD
				–1.669	OAD vs. controls
Scared	11.8 ± 5.8	10.3 ± 4.9	12.3 ± 4.9	–.022	OCD vs. controls
				–.663	OCD vs. OAD
				–1.284	OAD vs. controls
Sad	16.5 ± 5.8	18.1 ± 2.4	16.6 ± 3.4	–.897	OCD vs. controls
				–.086	OCD vs. OAD
				–1.489	OAD vs. controls

Note: *p = .014

TABLE 2

Means and Standard Deviations of Incorrect Recognition Responses of Disgust as Other Facial Emotion Expressions

	Group					
	OCD		OAD		Control	
Emotion	*M*	*SD*	*M*	*SD*	*M*	*SD*
Disgust — angry	8.7	7.1	6.7	7.1	11.5	6.5
Disgust — surprised	.0	.0	.9	1.5	.2	.5
Disgust — scared	.2	.6	2.1	2.8	.5	.8
Disgust — sad	.9	2.4	1.2	1.6	1.2	2.3
Disgust — happy	.0	.0	.9	3.8	.0	.0

Note: The maximum score for correct responses is 20 for each emotion.

regard to total score on the RCMAS, $F(2, 48) = .663$, $p = .520$. Correlations between total scores on the RCMAS and percentage correct answers for recognition of each of the six facial expressions were calculated for all participants as one group. The relationships were all non-significant at $p > .05$ (disgust $r = .03$, anger $r = .06$, sad $r = .14$, scared $r = .17$, surprised $r = –.02$, happy $r = –.04$).

Discussion

In the current study, children with OCD did not find facial expressions of disgust more difficult to recognise than children with other anxiety disorders or nonclinical children. These findings are consistent with most adult studies that have also indicated no disgust recognition deficit in OCD adults relative to controls (Buhlmann et al., 2004; Parker et al., 2004; Rozin et al., 2005). There was a general deficit in recognising disgust amongst the entire sample of children, with disgust typically incorrectly recognised as anger, consistent with past research in adult samples (Parker et al., 2004; Sprengelmeyer et al., 1997a). However, children in the three experimental groups did not differ significantly with regard to the number of disgust expressions incorrectly categorised as anger specifically. Thus, impaired recognition of facial expressions of disgust reported in some studies with adults (Sprengelmeyer et al., 1997a; Corcoran et al., in press) do not appear to extend to middle childhood, and the findings do not support the assertion that impairment in the recognition of disgust begins in childhood. Given the inconsistent results produced by adult studies employing a similar paradigm and apparatus, it is possible that the relationship between obsessive–compulsive behaviours and disgust recognition may be much more complex than first conceptualised by Sprengelmeyer et al. (1997a), with the effect only present under certain conditions, or in subgroups of individuals with OCD. For example, the findings of two adult studies have produced speculation that a disgust-recognition deficit may be more likely to be observed in individuals with particularly severe symptoms of OCD (Parker et al., 2004; Corcoran et al., in press). Future studies could include standardised clinician, parent and child self-report measures of OCD symptom severity to determine if there is a positive association between symptom severity in children with OCD and an impairment in the recognition of disgust.

Several methodological factors may have been responsible for the lack of significant differences between groups in facial recognition. First, the relatively low overall recognition of expressions of disgust may have limited detection of group differences due to floor effects on this measure. A similar argument might suggest that the task (which was designed for adults) was perhaps too difficult for children. Nevertheless, recognition scores were in the mid range (7–10 out of a possible 20) and were well above chance (3–4 out of 20). Thus the results do not suggest that the task was either too easy or too hard for the children, and there appears to have been ample room for lower recognition. Perhaps of greater concern is the relatively low power of the study. The OCD group had a particularly low *N* and this clearly limited the potential for detecting significant differences. Based on an overall sample of 50 and a 3-group comparison, there was sufficient power (.8) to detect only a relatively large effect size difference (.8). Thus, future studies using larger samples may be useful to detect smaller effects. Nevertheless, it should be pointed out that the original study by Sprengelmeyer et al. (1997a) was based on a very similar sample size. Third, the nonclinical comparison group scored surprisingly high on the measure of general anxiety, and was not significantly lower than the two clinical groups, thereby limiting its value as a nonanxious control. However, the hypothesis by Sprengelmeyer et al. was for a deficit in recognition of expressions of disgust associated specifically with OCD. In fact in the original study, adults with OCD showed worse recognition of expressions of disgust than did other anxious participants. Hence even high anxiety levels among the nonclinical group should not have limited the opportunity to demonstrate deficits among children with OCD. Fourth, the task used in this study differed from adult studies, where facial expressions were displayed on a computer screen and adults were asked to indicate what emotion they thought each facial expression represented. Instead, children were asked to manually categorise facial expressions, to minimise demands on verbal ability. Future studies should a more direct replication of the methods employed by Sprengelmeyer et al. through presentation of facial emotion expressions on a computer screen.

There was a significant age difference between groups, with children in the OCD group slightly older than children with other anxiety disorders and nonclinical children. Sprengelmeyer and colleagues did not elaborate on which age the deficit should become apparent. However, given they argued that a disgust recognition deficit begins in childhood, this deficit would be predicted to be present in older children and adolescents. Children's explicit recognition of emotional expressions develops gradually over time, not at one specific stage of development, with the ability to recognise the emotion of disgust developing later than for other basic emotions such as anger, happiness and sadness (Herba, Landau, Russell, Ecker, & Phillips, 2006; Herba & Phillips, 2004). It is possible that there may be a 'critical period' of emotion recognition during which obsessive–compulsive symptoms need to be present for the deficit to develop. The current study did not find any significant effects, but the children in the OCD group were aged around 11 years. As the effect has been demonstrated in adults (Sprengelmeyer et al., 1997a; Corcoran et al., in press), investigation of the recognition of disgust with slightly older populations, such as those in mid-adolescence and early adulthood may be worthwhile in order to determine at what age the effect does appear.

Corcoran and colleagues (in press) suggested that the stimuli used may also account for the elusiveness of this phenomenon, with the deficit only evident when

stimuli possess certain features. For example, facial expression intensity may influence recognition accuracy, as children's ability to recognise basic emotions, including disgust, has been shown to improve with increasing intensity of expression (Herba et al., 2006). Several researchers have also pointed out that recognition accuracy may differ across different forms of disgust expressions; for example, contempt versus nausea (Rozin et al., 1994; Corcoran et al., in press). In the current study adult faces were used in order to replicate Sprengelmeyer et al. But it is possible that facial expressions of children would be more salient to children than adult facial expressions. Hence, future studies might want to replicate this study, replacing adult with child expressions.

Finally, the present study findings may have been influenced by the comorbidity of OCD with other anxiety disorders, as well as mood and externalising disorders in the current sample, as is characteristic of this population (e.g., Last et al., 1991). Given the extremely limited research on facial emotion expression recognition in children from different clinical populations, it is difficult to draw conclusions with regard to how comorbidity may have influenced present study findings. To date only one other study has examined emotion recognition in anxiety-disordered children, finding a deficit in the recognition of disgust, anger and happiness in socially phobic children compared to controls (Simonian, Beidel, Turner, Berkes, & Long, 2001). A disgust recognition deficit in socially phobic children is understandable, given that complex emotions of shame, guilt and embarrassment are derived from disgust (Power & Dalgleish, 1997). One interesting direction for future research may be to investigate disgust recognition accuracy in other anxiety disorders that typically have their onset in childhood and/or adolescence, such as social phobia and certain specific phobias (e.g., spider phobia, blood-injection-injury phobia) which may be mediated, at least in part, by the emotion of disgust.

This study was the first to examine facial affect recognition accuracy in a sample of children with OCD. No evidence was found to support the assertion of Sprengelmeyer et al. (1997a) that a disgust recognition deficit begins in childhood. This null finding may indicate that the deficit is not present for children with OCD, or may be due to the relationship between disgust recognition and OCD being much more complex than initially conceptualised by Sprengelmeyer et al. (1997a). Further research with children, examining whether factors such as symptom severity that may influence the likelihood of obtaining the effect is needed. Research specifically focusing on anxiety disorders in childhood that may be mediated by disgust can build on fear-based models that have historically dominated this field and thus produce new directions in prevention and treatment (Berle & Phillips, 2006).

Endnote

1 These analyses were repeated excluding participants in the OCD group (n = 3) for whom OCD was not the primary diagnosis. The lack of significant differences between the OCD and either control group (OAD or nonclinical) with regard to the number of facial expressions correctly recognised as disgust, or any of the other emotions, was once again evident. However, in contrast to the initial analysis, there was no longer a significant difference between the OCD and nonclinical groups regarding the number of 'surprised' facial expressions correctly recognised, $z = -1.761$, $p = .078$.

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