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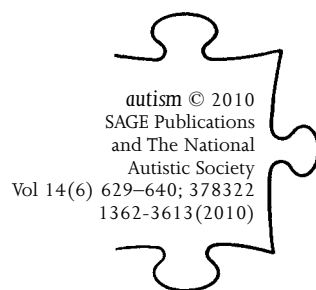
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Brief report

Understanding emotional transfer in children with autism spectrum disorders



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ABSTRACT The present study examined the understanding of emotional transfer in 11 children with autism, 20 children with PDD-NOS and 31 typically developing children, aged 6 to 12 years. Children were asked about their emotional responses to successive, conflicting emotional situations. All children reported that preceding emotional situations would influence their emotional response towards a successive situation. Children from the typically developing group reported a stronger influence of preceding negative versus positive emotions. However, children with autism reported equal effects of preceding positive and negative emotions, and children with PDD-NOS were relatively unaffected by the preceding emotions. These findings may indicate a scripted understanding of emotions in children with autism in contrast to a more personalized understanding of typically developing children.

KEYWORDS
autism;
high-functioning;
emotional transfer;
advanced emotion understanding;
emotion scripts

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The diagnostic criteria for autism spectrum disorders (ASD) include substantial impairments in the emotional domain (APA, 1994). In contrast to what one might expect given these criteria, several studies indicate that normally intelligent or 'high functioning' children with ASD (HFASD) are relatively unimpaired in their conceptual understanding of emotions: they recognize most emotions, and understand emotion causes or consequences

and even display rules at equal levels as mental and chronological age – matched typically developing children (Barbaro and Dissanayake, 2007; Begeer et al., 2007, Begeer et al., 2008). However, their understanding of emotions also stands out because of its peculiar nature. When these children talk about emotions, they generally lack spontaneity and often include superficial or scripted responses. They typically explain emotions with references to situational, materialistic or idiosyncratic rather than social and subjective causes (Adams et al., 2002; Hale and Tager-Flusberg, 2005; Lindner and Rosen, 2006; Losh and Capps, 2006; Peterson et al., 2005; Rieffe et al., 2007). Still, elementary knowledge of emotions is certainly not absent in children with HFASD. Therefore, the current study will focus on a more advanced aspect of emotional knowledge: the understanding of emotional transfer in children with HFASD.

Emotional transfer occurs when the emotional response to an earlier situation (such as the death of a pet) affects responses to later situations (such as a birthday present). At around three years old, typically developing children's initial reasoning about emotions is confined to the simple script that any given situation elicits a single emotion and a single behavioural response (Harris, 2002). The emotional impact of past situations is often ignored. However, children soon start to realise that simple emotion scripts are not always applicable. Most six year olds acknowledge that an initial situation can provoke an emotion that persists across situations and becomes concurrent with a later emotion (Lagattuta and Wellman, 2001), and 12 year olds generally regard emotions as mental states that are relatively independent from the situation from which they originated (Olthof et al., 1987). When considering the transfer of emotions from one situation to the next, typically developing preschoolers rate the possible impact of earlier negative emotions on subsequent emotions higher than the impact of earlier positive emotions. This understanding can be attributed to the disruptive nature of negative emotions: children learn from experience that negative emotions linger on longer than positive ones (Lagattuta and Wellman, 2001, 2002).

Children with autism have difficulty acknowledging the role of subjective mental states, as can be derived from the extensive literature on their impaired Theory of Mind development (Rajendran and Mitchell, 2007). This may hinder their understanding of emotions as independent mental states, which is in line with their tendency to provide situational rather than subjective explanations for emotions. Furthermore, they are less attentive to negative emotions than typically developing children (Ashwin et al., 2006; Bacon et al., 1998; Boraston et al., 2007; Pelphrey et al., 2002; Sigman et al., 1992), and less prone to learning about emotions from experience (Dissanayake et al., 1996). This may result in a poor apprecia-

tion of the persistent effect of earlier negative emotions by children with autism. In sum, their understanding of emotion transfer may be less adequate because they show less appreciation for the subjective and 'transferable' nature of emotions, and tend to derive less from experience, and more on rote learned, scripted ideas about emotions.

The presumed difficulties described above regarding the understanding of emotional transfer are all based on studies with autistic children. Little is known about children with PDD-NOS (pervasive development disorder not otherwise specified). Based on their diagnostic criteria, however, there is less ground to expect equal difficulties as in children with autism. The latter show more serious social impairments (Sicotte and Stemberger, 1999) and more stereotypical behaviour (Volkmar et al., 2000) than children with PDD-NOS. Therefore, children with autism may be more inclined to provide situational explanations for emotions and neglect the impact of previous experiences than children with PDD-NOS, who in turn may still lag behind compared to typically developing children.

In the present experiment we studied the understanding of emotional transfer in children with autism, PDD-NOS and typical development. Specifically, we tested whether these children differ in their tendency to account for the impact of an emotionally charged initial situation in their emotional reaction to a successive situation. We expected children with autism, compared to children from the PDD-NOS and comparison groups, 1) to show a weaker impact of the initial emotionally charged situation on their emotional responses to the successive situation, 2) to refer less to the initial situation than typically developing children, and 3) to be less sensitive to negative initial situations. Children with PDD-NOS were expected to perform worse than the comparison group, but better than the autism group on all accounts.

Method

Participants

Thirty-one children with HFASD were recruited from a child psychiatric centre (1 girl, 30 boys), including 11 children with autism and 20 children with PDD-NOS. The diagnostic classification of the children with HFASD was based on a three-month diagnostic assessment by a child psychiatrist, during which multiple informants also observed the children. The children with high-functioning autism showed a history of 'classical' autism and fulfilled established diagnostic criteria according to the *DSM-IV*. Children were classified as PDD-NOS if they met three or more criteria for autistic disorder according to the *DSM-IV*, and their impairments had an onset before

the age of 36 months, but the full set of criteria of an autistic disorder were not met (APA, 1994). IQ scores were obtained by the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986).

A comparison group of 31 typically developing children was recruited from primary schools around Amsterdam, the Netherlands (1 girl, 30 boys). Children from the comparison group functioned at an adequate level in regular elementary schools, and according to their teacher they showed intelligence within the normal range. Furthermore, at the time of testing, the policy of primary schools in the Netherlands was based on the out-placement of children with mental retardation to special education institutes (Driessen, 2002), which assured that the children from the comparison group functioned at a normal intelligence level. In order to control for possible group differences in short term memory span, the digit span task, a subtask of the Wechsler Intelligence Scale for Children-III (Wechsler, 2003), was administered to all children. No differences were found between comparison children, children with autism and children with PDD-NOS ($F_{(2, 59)} = 1.46, ns.$), confirming equal short-term memory abilities in children from each group (see Table 1).

Material

Two parallel sets of four stories were used, adapted from Olthof, Meerum Terwogt, Van Eck, and Koops (1987). Each story included two unrelated situations separated by a transition of location. For instance: showing your father good grades (initial situation), going to your room (transition), meeting your angry sister (target situation). In the first set of stories the affective impact of the initial situation was always opposite to the affective

Table 1 Details of the participants

	CA (years;months)	DS	VIQ	FSIQ
Autism ($n = 11$)				
Mean	9;4	9.45	108.9	108.6
SD	1;8	3.64	21.6	24.9
PDD-NOS ($n = 20$)				
Mean	9;2	8.00	96.7	96.1
SD	1;9	2.34	12.6	11.1
Comparison ($n = 31$)				
Mean	9;3	9.39		
SD	1;8	3.16		

Note. PDD-NOS = pervasive development disorder not otherwise specified; CA = chronological age; DS = Digit Span task; VIQ = verbal IQ; FSIQ = full scale IQ; SD = standard deviation.

impact of the target situation. In two of them the order was positive-negative (like in the example) and in the other two negative-positive. The parallel set of stories was exactly the same with the exception that the initial situations were in all cases replaced by a neutral situation (e.g. 'talking with your father' in stead of 'showing him good grades'). When the initial situation was affectively charged, its description was accompanied with a schematic facial expression; 'very happy' for positive and 'very sad' for negative situations. The neutral initial situation was accompanied with a 'just normal' facial expression.

Each participant was presented only four out of these eight stories. These stories were systematically varied in such a way that all children received one story in which the negative initial situation was followed by a positive one, and one story in which the positive initial situation was followed by a negative one. The remaining two were taken from the parallel set; that is, a neutral initial situation ending with a positive situation and a neutral initial situation ending with a negative situation.

Procedure

Parents and children were informed about the study and after receiving consent of both, each child was tested individually in a 40-minute session that also included tasks not reported here. First, the child was made familiar with the procedure of indicating an emotion by pointing to one of five schematic facial expressions: 'very happy', 'a little happy', 'just normal', 'a little sad' and 'very sad'. Children were then presented with the four stories. Following each story, children were asked two questions. First, they were asked to indicate how they would feel in the target situation by choosing one of the five schematic facial expressions that were laid out in front of them. Second, they were asked to explain their choice.

Scoring

Target appropriate affect Children's responses to the four questions about their emotion in the target situation could vary from 1 (very sad) to 5 (very happy). In the positive target situation, a score of 5 (very happy) was regarded appropriate; in the negative target situation a score of 1 was regarded appropriate. The scores in the negative target situations were inversed, so all children received a score that reflected the degree to which their answer matched the emotion depicted in each of the four situations. The four scores of the children were averaged to yield one score reflecting the 'average of appropriate affects', ranging from 1 (not appropriate to the target situation, e.g. feeling very sad in a happy situation) to 5 (very appropriate to the target situation, e.g. feeling very happy in a happy situation).

Reference to initial situation Each of the explanations was judged for their reference to the initial situation. For the two stories with an affectively charged initial situation and two stories with a neutral initial situation summed scores were calculated ranging from 0 to 2 which reflected the number of times the child referred to the initial situation within the affective or the neutral condition.

Results

Amount of target appropriate affect

A 3 (Group: autism, PDD-NOS or comparison,) \times 2 (Target situation: positive or negative) \times 2 (Initial situation: neutral or affectively opposite) analysis of variance showed a main effect for Target situation ($F_{(1, 59)} = 18.98, p < .001$), indicating that the positive target situations elicited more target appropriate affect than the negative target situations, and a main effect for Initial situation ($F_{(1, 59)} = 6.10, p < .02$), indicating that the affectively opposite initial situations, as expected, changed the appropriateness of the affect to the target situations more strongly than the affectively neutral initial situations. Interaction effects were found for Target situation \times Initial situation ($F_{(1, 59)} = 3.97, p = .05$), and Group \times Initial situation ($F_{(2, 59)} = 3.08, p = .05$). Post-hoc analyses of the Target \times Initial situation interaction indicated an impact of the initial affective situation in the positive target condition ($t_{(61)} = 3.25, p < .01, r = .38$), but not in the negative target condition. Post-hoc analyses of the Group \times Initial situation interaction, comparing the responses following neutral versus affective initial situations in children from the three groups, indicated that for children with autism the impact of the initial situation on their reported affect in a target situation was not influenced by the valence of the target situation ($t_{(10)} = 4.22, p < .01, r = .80$). This effect was not found for children from the comparison or PDD-NOS group.

Indeed, if we analysed children's responses for the positive and negative target situations separately, children from the comparison group indicated to feel less happy following a negative than a neutral experience ($t_{(30)} = 2.51, p < .02, r = .42$), but not less sad following a positive than a neutral experience. On the other hand, children with autism showed the impact of an affective versus a neutral initial situation in both conditions; that is, in the positive target ($t_{(10)} = 2.88, p < .02, r = .67$) and the negative target ($t_{(10)} = 2.39, p < .04, r = .60$) situation. Children with PDD-NOS reported to feel the same, irrespective of the initial situation (Table 2).

Table 2 Means and standard deviations of the 'amount of target-appropriate affect' scores as a function of Group (autism, PDD-NOS or comparison), Target situation (positive and negative) and Initial situation (neutral and affectively opposite). Range 1–5.

Group	Positive target situation		Negative target situation	
	Neutral initial situation	Negative initial situation	Neutral initial situation	Positive initial situation
Autism ($n = 11$)	4.27 (.79)*	3.36 (1.12)	3.64 (.92)**	2.91 (.70)
PDD-NOS ($n = 20$)	4.20 (1.15)	4.00 (1.12)	3.50 (1.19)	3.85 (.81)
Comparison ($n = 31$)	4.39 (.71)*	3.77 (1.12)	3.32 (.83)	3.45 (.85)

Note. Higher scores indicate more 'target situation appropriate' answers. PDD-NOS = pervasive development disorder not otherwise specified.

* Significantly different from the mean affect after a negative initial situation, $p < .05$.

** Significantly different from the mean affect after a positive initial situation mean, $p < .05$.

Reference to initial situation

In Table 3, the mean number of references to the initial situations is presented for the neutral and affective initial situation conditions. As can be seen, all children referred more often to the affective than to the neutral initial situation. A 3 (Group: autism, PDD-NOS or comparison) \times 2 (Target situation: positive or negative) \times 2 (Initial situation: neutral or affective) analysis of variance indicated main effects for Target situation ($F_{(1, 59)} = 9.24$, $p < .01$), and Initial situation ($F_{(1, 59)} = 28.07$, $p < .001$), an interaction effect for Target \times Initial situation ($F_{(1, 59)} = 13.04$, $p < .01$), and a near significant three-way interaction effect for Group \times Target situation \times Initial situation ($F_{(2, 59)} = 2.55$, $p < .09$). Children from the comparison

Table 3 Means and standard deviations of number of references to the initial situation as a function of Group (autism, PDD-NOS or comparison), Target situation (positive and negative) and Initial situation (neutral and affectively opposite). Range 0–1.

Target situation:	Positive		Negative	
	Neutral	Negative	Neutral	Positive
Autism ($n = 11$)	.09 (.30)*	.36 (.51)	.00 (.00)*	.27 (.47)
PDD-NOS ($n = 20$)	.00 (.00)**	.50 (.51)	.10 (.31)	.15 (.37)
Comparison ($n = 31$)	.07 (.25)**	.58 (.51)	.07 (.25)	.19 (.40)

Note. Higher scores indicate more references to initial situation. PDD-NOS = pervasive development disorder not otherwise specified.

**Significantly different from number of references to negative initial situations, $p < .01$.

*Marginally different from number of references to negative or positive initial situations, $p < .10$.

and the PDD-NOS group referred more often to negative initial situations than neutral initial situations in the positive target condition ($t_{(30)} = 5.04$, $p < .00$, $r = .67$ and $t_{(19)} = 4.35$, $p < .01$, $r = .62$ respectively), but they did not refer more often to positive initial situations than neutral initial situations in the negative target condition. Children with autism, on the other hand, showed a tendency to refer more often to both positive and negative affective initial situations than to neutral initial situations ($t_{(10)} = 1.94$, $p < .08$, $r = .52$ and $t_{(10)} = 1.94$, $p < .08$, $r = .52$ respectively). In fact, children with autism referred to positive and negative initial situations equally often ($t_{(10)} = .56$, ns.), while children from the comparison and the PDD-NOS groups referred more often to the negative than to the positive initial situations ($t_{(30)} = 4.35$, $p < .00$, $r = .62$ and $t_{(19)} = 3.20$, $p < .01$, $r = .59$, respectively).

Discussion

Children with HFASD and typically developing children both acknowledged that affectively charged initial situations influence emotional responses to later, conflicting situations. Compared to neutral situations, affectively charged initial situations had a higher impact on the reported affect in target situations, and were mentioned more often. However, separate comparisons between autism, PDD-NOS and typically developing children showed subtle differences.

Typically developing children indicated a higher impact of negative than positive initial emotions on a subsequently aroused opposite emotion. In other words, after a negative situation, they indicated to feel less happy in a later positive situation, but after a positive situation, they did not feel less sad in a later negative situation, confirming earlier findings on typically developing children (Gnepp and Gould, 1985; Harris et al., 1987; Olthof et al., 1987). These children also explained their feelings more often by referring to negative than to positive initial situations, which confirms earlier findings on more advanced understanding of negative than positive emotions in typical development (Lagattuta and Wellman, 2001, 2002).

Children with autism did seem aware of a higher saliency of affective over neutral initial situations. They indicated to feel differently following affective situations, and acknowledged affective situations more often than neutral situations. However, their responses did not reflect a differential impact of positive versus negative emotions. They seemed to infer the impact of affective situations irrespective of the valence of these situations, as if following a simple rule that 'previous emotions influence subsequent emotions'. This emotion script hypothesis is further supported by their equal number of references to both negative and positive initial situations.

Furthermore, this effect could not be explained by a higher tendency to perseverate in the autism group. Additional analyses on the perseveration of responses to the neutral initial stimuli indicated that the number of children that perseverated the initial stimuli (a neutral face) in their responses to the second scenario (i.e. also report a neutral face in the target situation) did not differ in children with autism (54%), PDD-NOS (40%) or typical development (45%) ($H(2) = .59$, ns.). Furthermore, no differences in perseveration effects were found for initial negative stimuli in a subsequent positive situation (children with autism (0%), PDD-NOS (0%) or typical development (3%) ($H(2) = 1.00$, ns.)) or initial positive stimuli in a subsequent negative situation (children with autism (0%), PDD-NOS (5%) or typical development (0%) ($H(2) = 2.1$, ns.)).

We could speculate that children with autism follow an atypical developmental route, since they are less responsive to negative emotions (Ashwin et al., 2006; Bacon et al., 1998; Boraston et al., 2007; Sigman et al., 1992). Early differences in experiences with (negative) emotions in children with autism could have resulted in a deviant development of the appreciation of emotions, and of the perseverant effect of these emotions. After all, if a child does not realize the salience of negative emotions, it would be logical to infer that both positive and negative earlier situations equally affect a feeling state experienced in a later situation.

In contrast to children from the autism and comparison groups, children with PDD-NOS did not show a correspondence between monitoring and justifying their affective state. They justified their affective state by referring to negative initial situations more often than positive situations. This indicates that they acknowledged the higher salience of negative emotions. However, they did not monitor different affective states based on preceding situations. Furthermore, children with PDD-NOS showed a larger variance in their monitoring of affective states following neutral initial situations. These findings could be related to the high number (>80%) of children with PDD-NOS who show one or more co-morbid externalizing (ADHD, ODD) or internalizing (anxiety, depression) diagnoses (de Bruin et al., 2007). Both externalizing and internalizing disorders have been related to impaired emotional processing abilities (Southam-Gerow and Kendall, 2002), in particular to the ability to report emotions (Hendryx et al., 1991) and to recognize facial emotional expressions (Guyer et al., 2007). This may have resulted in a heterogeneous response pattern (hence the large variation), but could also explain why some children with PDD-NOS were not able to monitor their affective state, while clearly acknowledging the impact of negative initial situations in their justifications. Furthermore, co-morbid externalizing diagnoses may have influenced the interpretations of – in particular negative – scenarios in children with PDD-NOS (Southam-Gerow

and Kendall, 2002). Thirdly, negative initial situations may not influence affective states because children with externalizing problems encounter negative situations relatively more often, and may actually be less sensitive to such situations, resulting in a lower transfer of negative emotions. However, these ideas are speculative.

Their co-morbid externalizing tendencies make children with PDD-NOS less indicative for the emotional functioning of children with 'classical' autism. However, most studies claiming to investigate autism do in fact study children with autism spectrum disorders, which often also include a large proportion of children with PDD-NOS. Emphasizing the differences in emotion responding between autism and PDD-NOS may increase our understanding of the heterogeneity within autism spectrum disorders and enhance our chances of tackling the core problems in the emotional functioning of children with ASD.

Future studies in this domain could be improved on various accounts. First, despite the extensive psychiatric assessment, the use of standardized autism questionnaires and more extensive measures of general and verbal intelligence would provide more explicit information regarding the severity of the diagnoses, co-morbidity and the cognitive abilities of children with autism and in particular those with PDD-NOS. Second, the current results should be replicated in a larger sample of children with ASD to confirm their reliability.

Children with autism seem to integrate successive internal emotional states in an atypical manner, relying on learned conventions about emotions, and possibly hindered by a general low attentiveness to negative emotions. Their failure to acknowledge the salience of negative over positive emotions has no equivalent in early typical development, and might be indicative of the unique logical quality of their understanding of emotions. While their ability to apply more logical rules to emotional situations may lead them astray, it may, if guided in the right direction, also be of great help in the absence of the emotional capacities that seem to come automatically or naturally to typically developing children.

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