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Emotion understanding and social competence in young children with Autistic Spectrum Disorders

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Abstract

It is still unclear how emotion recognition is related to social competence in young children in the autistic spectrum. This study examined the performance of ASD children in emotion recognition tasks compared to a control group of typically developing children, measured ASD children's ratings of social competence, compared to the control group and checked the association between emotion recognition and social competence in both the ASD and the control group. We examined 206 children between 5-5.5 years, 52 in the ASD group and 152 in the TD control group. Three components of emotion recognition were examined: emotion discrimination, emotion identification, and emotion attribution in situations. Two components of social competence were examined: peer relations and prosocial behaviors. The analysis revealed that ASD children performed lower than TD children in discriminating emotions and in identifying emotions; ASD children also performed less well than TD children in attributing positive emotions either verbally or visually to situations. ASD children were rated by their parents as having poorer peer relations and displaying less prosocial behaviors than TD children. For both ASD and TD children, emotion recognition was significantly positively related to social competence.

1. Introduction

According to the current Diagnostic Manual (DSM 5) there are six domains where Autism Spectrum Disorders (ASD) have their main deficits. The most significantly affected of all domains are those of social interactions and communication (Ketelaars et al., 2016). Lack of skills in these areas provokes an abundance of problems to children with autism. For instance, many ASD children may fail to react appropriately when their friend is sad or may not be picked by other children for play, as often as their peers of normal development. In addition to impaired social interactions, ASD children often face difficulties in understanding emotions through reading others' faces (Phillips et al., 2003). However, there is no consensus amongst scientists over whether all ASD individuals have impairment in recognizing emotions (Uljarevic & Hamilton, 2012).

Forming successful social interactions with peers and showing prosocial behaviors indicate children's social competence *(SC)*. Research proposes that the key to initiating and maintaining successful social interactions with others is the ability to perceive emotions through facial expressions, referred to as emotion recognition *(ER)* (Chasson & Jarosciewicz, 2014; Zeedyk et al.,2016). In typically developing children, the ability to read and understand emotions from face expressions can affect their reaction in challenging social situations and can influence their prosocial behavior (Wiefferink et al., 2012). In ASD children it has been suggested that impaired social behaviors, or low social competence levels appear due to a deficit in recognizing and responding to facial expressions of emotions (Wallace, Coleman & Bailey, 2008; Baron-Cohen et al., 2009, Williams & Gray, 2012).

Many scientific studies, which will be discussed thoroughly subsequently, have focused on assessing either emotion recognition *(ER)* or social competence *(SC)* in ASD children separately. There is limited research in associating emotion recognition difficulties with social competence in young autistic children. This study intended to: *(1)* assess the performance of young ASD children in emotion recognition tasks and measure ASD children's

social competence in two indices; *(2)* test for an association between emotion recognition and social competence in ASD children. ASD children's performance was compared to a control group of typically developing *(TD)* children.

1.1 Emotion recognition

Emotion recognition refers to the ability of successfully perceiving emotion cues (Eggum, 2011). Emotion recognition consists of components such as discriminating, identifying, matching, labeling and classifying representations of emotions (Wiefferink et al., 2012). As facial expressions are universal signals of communicating emotions, the most important part of ER ability is being able to read emotions displayed on faces (facial emotion expressions). Research has shown that emotion recognition through facial expressions is acquired differently by children of normal development than by autistic children (Williams & Gray, 2012).

For typically developing children the recognition of facial emotion expressions is an initial, quickly-acquired skill that develops during infancy and improves with age (Kuusiko et al., 2009; Tracy, Robins, Schriber & Solomon, 2011). Walker-Andrews (1998) has found that since the age of 4 months an infant shows perception of facial expressions for basic emotions such as anger, fear and sadness. As children develop and by the age of 4 years, they are able to accurately identify illustrations of happiness, sadness and anger and are also able to make a distinction between fear and surprise (Widen & Russel, 2003). 10-year-old children recognize emotion expressions at a similar level to an adult (Rump et al., 2009). However, it is unclear whether this skill continues to develop also during adolescence before reaching its highest level in adulthood (Rump et al., 2009). The ability to process facial expressions in TD children depends on the difficulty and type of the tasks developed for assessment, as well as on the intensity of the expressed emotion. Complete development of emotion recognition means

that an individual is capable of reading clearly visible and subtle facial emotion expressions with perfect accuracy (Ekman, 2003).

In the case of ASD children it remains inconclusive whether they lack or lag behind in the ability to recognize emotions compared to their TD peers. Many studies have been conducted to answer this question using a variety of methodologies and assessment tasks.

Regarding the type of emotion in examining emotion recognition, some studies reported difficulties for ASD individuals (e.g. Hobson, 1986; Lindner & Rosen, 2006) while other studies found no evidence for emotion recognition difficulties in ASD individuals (e.g. Gepner, Deruelle & Grynfeltt, 2001; Ozonoff, 1990).

Many research studies have checked emotion recognition in ASD individuals by checking the accuracy in identifying the basic emotions (Uljarevic & Hamilton, 2012). By 'basic emotions' we most commonly refer to: happiness, sadness, fear and anger. Williams & Gray (2012), for instance, examined basic emotion recognition and concluded that happiness is the most recognizable emotion by autistic individuals. Other studies on basic emotion recognition report that fear (Ashwin, 2006; Wallace, 2008) or anger (Williams & Gray, 2012) are the most challenging emotions to read for ASD individuals.

Fewer studies have been conducted to investigate emotion recognition in ASD individuals by grouping positive and negative emotions together. Findings from studies examining negative emotions disprove that ASD individuals show a deficit in negative emotion recognition like sadness, fear, anger, and disgust (Da Fonseca, 2009; Jones at al., 2011; Lacroix et al., 2009). They conclude that their performance is similar to the healthy population. Regarding positive emotions, it is implied by several studies that they are more easily distinguished by ASD individuals as compared to negative emotions, especially when presented along with a negative emotion (Bijlstra, 2010). For more complex emotions, Baron-Cohen et al. (1992)

suggested that autistic individuals showed much poorer performance in recognizing surprise than their peers.

Depending on the type of task, the performance of ASD individuals also varies. The most broadly used task to assess ER requires the identification of an emotion facial expression in a forced-choice paradigm, where the participant attributes one of the six basic emotions to the face expression (Jones et al., 2011). More specifically, in this task the participant is presented with a visual stimulus of emotion, e.g. a black and white photograph of a male or a female face that expresses an emotion. The stimulus, i.e. the face, is displayed until the participant responds with the name of emotion depicted (Jones et al., 2011). In emotion recognition tasks such as sorting emotions, where the participant distinguishes between two emotions, ASD individuals perform at a similar level to healthy control groups (Gepner et al., 2001). When labeling tasks are used for assessment (to match an emotion label to an emotion facial expression, or to produce an emotion label for the emotion facial expression), ASD individuals perform much poorer than the control group (e.g. Lindner & Rosen, 2006). All in all, it is often assumed that ASD individuals can perform sufficiently in the tasks, where they are asked to identify exaggerated static visual stimuli and where they have plenty of time to process them (Rump et al., 2009; Tracy et al., 2011).

To summarize the above, the results on whether ASD individuals are as competent as their healthy peers in recognizing facial emotion expressions are mixed. There is no consensus amongst researchers as to whether ASD individuals have a deficit in emotion recognition.

1.2 Social Competence

Social competence refers to the ability to engage skillfully in social interactions with others. Children who are socially competent are capable of having positive peer relations and displaying prosocial behaviors (Ketelaar, Rieffe, Wiefferink, & Frijns, 2012).

Peer relations

Typically developing children can understand and behave appropriately in various social contexts without problems from a very young age (Scanlon, 2007), and their ability to establish and maintain skillful peer interactions is progressing as they grow. In early childhood peer relationships depend greatly on the quality of play, the sharing of emotions and the sharing of favorite objects (Semrud-Clikeman, 2007). Early and middle childhood peer relations are based mostly on the number and quality of friendships and the sharing of experiences (school trips, sports activities, etc.). By middle childhood, more than one third of the children's social interactions involve peers (Gifford-Smith & Brownell, 2003). As children develop, peer relations change in content and quality (Parker et al., 1995). In late childhood and pre-adolescence the level of likability or acceptance by peers plays a significant role in forming quality relations with peers (Semrud-Clikeman, 2007).

Children in the autism spectrum are characterized by having deficits in social skills and communication of varying severity (APA, 2000). They often have difficulties in interacting with others or behave in a socially unacceptable manner. The struggles they exhibit in forming successful interactions and communicating with peers indicate impairment in social competence (Stichter et al., 2010). Studies have found that ASD children have poorer (Balcher et al., 2009), and fewer peer relations compared to their TD peers (Howlin, Goode, Hutton, & Rutter, 2004; Mazurek & Kanne, 2010). For example, Kasari et al. (2010) studied the social interaction of ASD children in the school context. They examined 60 ASD children using friendship and peer engagement scales, based on teacher observations/reports. Afterwards, they compared their performance to a matching group of TD children. The results showed that ASD children had less and poorer quality friendships at school compared to the TD children (Kasari et al., 2010).

Prosocial behaviors

Prosocial behaviors describe the voluntary and altruistic actions that aim to benefit another person (Eisenberg et al., 2006; Knafo & Plomin, 2006). Prosocial behaviors such as being friendly, helpful, sharing, comforting and cooperating are considered as indices for social competence.

Typically developing children demonstrate prosocial behaviors since the very first years of life. Toddlerhood (approx. 1 to 3 years of age) is characterized by a significant increase in prosocial behaviors display (Baillargeon et al., 2011) and preschool age (approx. 3 to 5 years) is when children's prosocial behaviors become intentional and recognizable (Hay & Cook, 2007). Baillargeon and his colleagues (2011) studied prosocial behaviors in toddlers at 41 months of age, based on their mothers' reports on the following prosocial behaviors: helping someone who had been hurt, comforting a child who was upset or crying and comforting children who felt sick. Only a minority of the tested children did not display any prosocial behaviors. Helping other children who were feeling sick was the least exhibited of the prosocial behaviors (22.8% of the children displayed this behavior). Comforting a child who was upset or crying was the most common prosocial behavior, with more than 90% of the children exhibiting it at 41 months.

Despite the increasing interest in the development of prosocial behavior in typically developing children, little is investigated about how these behaviors manifest in children with ASD. Travis, Sigman and Ruskin (2001) examined a sample of verbally adept school-aged ASD children in various aspects of social understanding and social behaviors. Prosocial behaviors were evaluated by sharing and helping tasks, e.g. help clear a table, clean up a spilled drink, share a snack (Travis, Sigman & Ruskin, 2001). Results showed that ASD children showed less prosocial behaviors than the TD children. In a more recent longitudinal study, Russel et al. (2012) investigated the social achievements of young ASD children. They hypothesized that ASD children's score in prosocial behavior manifestation

would be lower than that of the matched control group, which consisted of undiagnosed children with only some autistic traits. They found that at the preschool stage there were no differences in the manifestation of prosocial behaviors between the ASD and the non-ASD control group (Russel-Smith et al., 2012). However, the prosocial behaviors in these two groups changed in early school years, with the ASD group scoring at a lower level than the control group children.

1.3 Emotion Recognition and Social Competence

According to the theoretical model of Crick and Dodge (1994) for social competence, a person should be able to understand, process, and respond to social and emotion cues appropriately in order to have successful social interactions, hence be socially competent. That is, a person's ability to understand and recognize emotions can influence his/her social competence.

Previous research on TD children has suggested that the children's ability to accurately recognize emotions is a contributor to fluent social interactions (Bijlstra, 2010; Jones, 2001). Cassidy et al. (2003) checked the association of understanding emotions and social skills in young TD children. What they reported is that the ability of emotion recognition was positively related to peer relations and social competence, based on teacher reports. Furthermore, scientists have also proposed that the emotion recognition does not only enhance peer relations but also prosocial behaviors. Garner & Estep (2001) tested 82 TD preschoolers on social and emotion competence. Amongst others, they checked successful social interactions with peers (e.g., positive social initiations), the frequency of prosocial acts (e.g., comforting a distressed peer, praising another child's behavior, offering to share a toy, commenting about the feelings of another) and emotion recognition (matching faces to emotions: happy, sad, angry, afraid, surprise, neutral). Results demonstrated that recognizing emotions had a positive relation to successful peer interaction and manifestation of prosocial behaviors.

Limited research has examined the relation between emotion recognition and social competence in ASD children at a young age. But there are studies that have examined the association in ASD adolescents and adults. Similarly to what has been found in TD children, those studies suggest that ER is associated with social competence in the ASD population.

For example, Boraston (2007) investigated the association between emotion recognition accuracy and reciprocal social interaction in 11 high functioning ASD adult males (19-60 years old) as compared to a healthy, age- and IQ-matched control group. Results showed that social interaction ability was directly associated with recognizing sadness. Wallace et al. (2011) checked the association between facial emotion recognition skills and social communication skills, using the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005). They tested 42 high functioning ASD adolescents in accuracy and sensitivity in identifying emotion expressions and compared them to 31 TD adolescents, who were matched in age and IQ. They found that low sensitivity in identifying sad faces was correlated significantly to social communication impairments (Wallace et al., 2011). Most recently, Williams & Gray (2012) investigated the association between facial emotion recognition accuracy for specific emotions (happiness, sadness, anger, fear) and social skills in 42 ASD children between 4 and 7 years old, taking into consideration the severity of autism by the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000). What was reported is that only the accurate recognition of sadness was positively associated with better social skills. Also, they found that anger was the least accurately recognized emotion and happiness the most recognizable emotion (Williams & Gray, 2012)

1.4 Current study

The current study intended to enrich the scientific findings by further examining the recognition of facial emotion expressions, social competence,

and their relation in young children with ASD, in comparison to their TD peers.

The first aim of this study was to examine how well ASD children could recognize emotions, as compared to their TD peers. Following Wiefferink et al. (2012), we assumed that ER consists of 3 components: discriminating emotions, identifying emotions, and attributing emotions to emotion-provoking situations. In addition, following Tracy et al. (2011), who suggest that ASD individuals have the ability to perform in 'simple emotion recognition tasks', we expected that autistic children would show equal performance to their typically developing peers in discriminating emotions but lower performance in identifying and attributing tasks.

The second aim of the study was to compare ASD children with their TD peers in social competence. Following Ketelaar et al. (2012), we measured social competence with two indices: peer relations and prosocial behaviors. In line with previous research which found that ASD individuals have difficulties in forming successful peer relations (Kasari, 2010; Wang, 2011; Zeedyk, 2016) we hypothesized that the ASD group of children would have lower-quality peer relations compared to their TD peers. Following Deschamps et al. (2013), Russell (2012) and Best (2012), we expected ASD children to show less prosocial behaviors than their TD peers.

Following previous studies (Boraston, 2007; Cassidy et al., 2003; Garner & Estep, 2001; Wallace et al., 2011; Williams & Gray, 2012), we expected that emotion recognition was positively related to social competence in young ASD children as well as in TD children.

The age cohort of interest for this study was children aged 5 to 5.5. The study took place in the Netherlands, where children start school at the age of 4 years. This age group is considered crucial for social behavior manifestation (Best, 2012), and it is also when children with ASD are most likely to be diagnosed with ASD.

2. Method

2.1 Participants and Procedure

The complete sample consists of 206 children, 131 boys and 75 girls, aged between 5 and 5.5 years of age. The clinical group included 52 ASD children (Mean age = 67 months, SD = 13.4) who had received a clinical diagnosis, or were in the process of receiving a diagnosis by a specialized institution in diagnosing ASD in children and adolescents, the Centre for Autism in Leiden, the Netherlands. The diagnosis indicated one of the following disorders: autistic disorder, Asperger's syndrome, PDD-NOS. The diagnosis was issued by a psychologist or psychiatrist using parent reports and clinical observations.

The control group consisted of 152 typically developing children (Mean age = 60 months, SD = 19.08) who had not received any clinical diagnosis at the moment of the research. Only children with an IQ score above 70 participated in the study. TD children were tested by the SON-R (a standard non-verbal intelligence test) and IQ scores for ASD children were obtained by either school files or they were tested in the Centre for Autism. Of the 206 children who were tested, approximately 25% were diagnosed with autism (Table 1). The ASD children were older (t (204) = 2.31, p = .02), and had a lower IQ score (t (177) = 5.70, p < .001) compared to TD children. Additionally, there were more boys in the ASD group than in the TD group (x^2 = 20.05, p < .001; *see* Table 1).

The test sessions took place in a quiet room either at home, at school or at the institute. The procedure was recorded. All children were tested individually and each test session lasted for 30 minutes approximately. ASD children were tested by professionals who were experienced in working with the clinical group. TD children were tested by trained psychology students.

Table 1. *Participants' characteristics (N =206) with means and standard deviations (in parentheses).*

	TD children (*N* = 154)	ASD children (*N* = 52)
Age (Months)	60.34 (19.08)	66.96 (13.40)
IQ	113.53 (14.14)	99.15 (16.43)
Gender (Boys) – *N* (%)	84 (45.50)	47 (90.40)

TD children were recruited from public local Dutch primary schools, childcare facilities and playgroups. ASD children were recruited through their parents and the Centre for Autism.

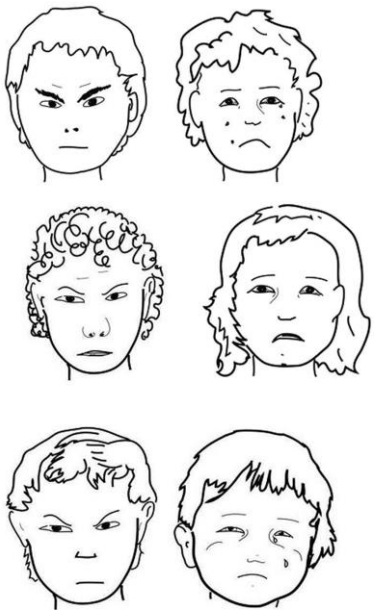
The Ethics committee of Leiden University and the Centre for Autism gave permission for the research project. All parents signed a consent form before any assessment or questionnaire.

2.2 Materials and Method

Emotion Recognition

Three behavioral tasks were developed and administered to assess ER in children (Wiefferink et al. (2012), Rieffe et al., 2012): Task 1 - discriminating emotion task, Task 2 - identifying emotion task, and Task 3 - attributing emotion task. The tasks were designed so as to be age appropriate and suitable to both the clinical and control group. All tasks were designed with minimal language requirements.

Figure 1 Illustration example of "angry" and "sad" facial expressions for Task 1 (adapted from Wiefferink et al. , 2012)



Task 1 - *Discriminating emotions*

This task tested how accurately a child could distinguish between facial expressions of different emotions. This task consists of a trial session and a

testing session. Each session has two difficulty levels. In the trial session, the child had to first discriminate between two objects (flower vs. car) and afterwards between two neutral faces (a face with glasses and a face with a hat). In the testing session, we first checked the child's ability to differentiate a negative from a positive facial expression, e.g. sad vs. happy. Then we checked if the child could differentiate facial expressions of the same valence, e.g. angry vs. sad. In both sessions the experimenter started with putting two example pictures on a piece of blank paper, e.g. a picture of an angry face on the top left corner and a picture of a sad face on the top right corner (see Figure 1). Afterwards the child was provided with six illustration cards, for instance, three illustrations of a sad face and three illustrations of an angry face, as presented in Figure *1*. The model illustration cards were computer-designed and depicted a randomly selected sketch of a 3-4-year-old boy in black and white. They were then non-verbally instructed to sort the cards and allocate them on the matching side of the example picture. Correct answers were counted with a maximum score of 3 points.

Task 2 - *Identifying emotions*

This task was implemented to test if children could associate the correct naming of emotions to emotional expressions. The children were displayed illustrations of emotional faces, two faces per emotion: happiness, anger, sadness, fear. The examiner asked the following question: "Who looks happy?". The child had to point to the correct facial expression. Afterwards the examiner asked: "Is there anybody else who looks happy?". The child was supposed to point to another illustration of a happy face. The same question was repeated for all the emotion expressions. Each correct pointing was awarded one point, and a child could earn maximally 2 points for each emotion expression.

Task 3 - *Emotion attribution in prototypical situations*

For each of the four basic emotions (happiness, anger, sadness and fear) two vignettes were designed. The vignettes displayed emotion provoking situations, e.g. Boy is given a present (happy), Boy falls from bicycle (sad/angry)). The examiner described the vignette orally and meanwhile showed an illustration which depicted the situation. The children were then asked to (1) state how the protagonist feels in the described situation and afterwards (verbal condition); (2) point to the correct facial expression card (visual condition). The scores were calculated as proportions of correct responses for the verbal and visual condition separately, because some children might not know the word for the emotion but could point to the correct facial expression. There could be more than one answer to the vignettes, depending on the context and the individual's functioning. For instance, in the situation where the boy falls from his bicycle, the boy could feel either angry or sad. Thus, an answer was scored as a correct answer if it belonged to the right emotion valence, i.e., negative (anger, sadness, fear) or positive (happiness).

Social Competence Scales

For the purposes of the current study, we used two scales from the *Strengths and Difficulties Questionnaire* (Goodman, 1999). We invited the parents to evaluate their children's peer relations and prosocial behavior. Each scale consisted of 5 items. One item from the 'prosocial behavior' scale is: '*Does the child share readily with other children toys, snack, pencils?'*. One item from the 'peer problems' scale is: *'Does the child have at least one good friend?'*. Parents evaluated their child's behavior on a rating system from 0 to 2: 0 for *'not true'*, 1 for *'somewhat true'*, and 2 for *'certainly true'*. Three of the five questions regarding peer relations were reversely scored. After scoring all items a mean score in both the scales was calculated. To check its reliability we used a Cronbach's alpha assessment (see Table 2).

Table 2. Reliabilities and means (standard deviations in parentheses) of prosocial behavior and peer relation scales.

	Reliability	TD (*M* (*SD*)	ASD (*M* (*SD*)
Prosocial behavior	.72 (*k* = 5)	6.85 (2.06)	3.69 (2.49)
Peer relations	.78 (*k* = 5)	8.90 (1.34)	5.04 (1.82)

*p<.05, **p<.01

It showed that the reliability of both rating scales (peer relations and prosocial behavior) was high (>.70 for scientific use). ASD children had lower-quality peer relations and showed less prosocial behaviors than TD children (t (189) = 8.73, p < .001) and (t (189) = 15.66, p < .001) respectively (Table 2).

2.3 Statistical Analysis

For the data analysis we used the IBM SPSS 22 statistical software package. Firstly, we used t-tests to compare ASD children and TD children in all variables. Secondly, we used mixed ANCOVA to assess ASD children's performance in each emotion recognition task in comparison with TD children. Since age differed between the two groups, we added the variable as the covariate. IQ data was scarce and was not included in the analyses as a second covariate. Finally, we used Pearson's correlation to check whether emotion recognition was associated with social competence. Fisher's r-to-z transformation was applied to check whether the correlations were different between the two groups.

3. Results

3.1 Emotion Recognition in ASD and TD children

3.1.1 Discriminating emotions

Children's mean performance in identifying objects was analyzed with a 2 (Difficulty: flower/car vs. face with glasses/ face with hat) x 2 (Group: ASD vs. TD) mixed ANCOVA, with age as the covariate. Table 3 presents the means and standard deviations of children's performances in discriminating the objects and neutral faces. One TD child had missing data for the glasses/hat condition, and thus was excluded from the analysis. A main effect was found for difficulty (F (1, 202) = 7.66, p = .006, $\eta 2$ = .04): both TD and ASD performed better in the flower/car task than the glasses/hat task. There was no main effect of group (F (1, 202) = 3.20, p = .08, $\eta 2$ = .02): ASD children and TD children did not differ significantly in their performances. There was no interaction effect of group and difficulty level (F (1, 202) = 0.96, p = .33, $\eta 2$ = .01), indicating that ASD children showed the same pattern of performance as TD children.

To assess whether the ASD children performed equally well in discriminating facial expressions than TD children, a 2 (Difficulty: positive/negative vs. negative/negative) by 2 (Group: ASD vs. TD) mixed ANCOVA was conducted on their mean performance with age as the covariate. One TD child had missing data, and thus was excluded from the analysis. Table 3 presents the means and standard deviations of children's performances in discriminating emotions. No main effect of difficulty level was found (F (1, 202) = 1.54, p = .22, $\eta 2$ = .008), meaning that performance was generally similar for discriminating positive vs. negative emotions and negative vs. negative emotions. A main effect of group was found (F (1, 202) = 4.50, p = .04, $\eta 2$ = .02), namely, ASD children performed less well in discriminating emotions. There was no interaction effect of group and difficulty level (F (1, 202) = 0.66, p = .42, $\eta 2$ = .003), indicating that ASD children showed the same pattern of performance as TD children.

Table 3. *Mean scores of correct responses and standard deviations (in parentheses) in the emotion discrimination task for ASD and TD children (range: 0–3)*

	TD children (*N* = 153)	ASD children (*N* = 52)	All children (*N* = 205)
Flower/Car	2.84 (0.56)	2.81 (0.66)	2.83 (0.58)
Glasses/Hat	2.68 (0.65)	2.60 (0.83)	2.66 (0.70)
Positive／negative emotions	2.30 (0.97)	2.16 (1.07)	2.27 (0.99)
Negative／negative emotions	1.90 (1.08)	1.88 (1.01)	1.89 (1.06)

3.1.2 Identifying emotions

In order to assess whether ASD children performed worse than their TD peers in correctly identifying the four basic emotions, a 4 (Emotion: happiness/sadness/anger/fear) by 2 (Group: ASD/TD) mixed ANCOVA was conducted on their mean performance with age as the covariate. 26 children had missing values (3 ASD children) thus were excluded from the analysis. Table 4 presents the accuracy of both groups in identifying the four basic emotions.

A main effect of emotion was found (F (3, 495) = 3.08, p = .03, $\eta 2$ = .02). Post-hoc t-tests with Bonferroni corrections showed that happiness was identified more accurately than anger (p < .001) and fear (p = .05), but equally to sadness (p = 1.00). Sadness was better identified than anger (p < .001), but not fear (p = .10). Anger and fear were identified equally inaccurately (p = .14).

A main effect of group was found (F (1, 165) = 6.96, p = .009, $\eta 2$ = .04), namely, ASD children generally performed less well in identifying the emotion expression compared to TD children. There was no interaction effect

of group and emotion (F (3, 495) = 0.75, p = .52, $\eta 2$ = .005), indicating that ASD children showed the same pattern of performance in identifying emotions as the TD children (see Figure 2).

Table 4. *Mean score of correct responses and standard deviations (in parentheses) in the Emotion-Identification Task (range: 0–2) for ASD and TD children*

	TD children (N = 127)	ASD children (N = 41)	All children (N = 168)
Happiness	2.41 (1.67)	2.65 (2.19)	2.48 (1.81)
Sadness	2.43 (1.75)	2.62 (2.21)	2.48 (1.87)
Anger	2.20 (1.94)	2.38 (2.34)	2.25 (2.05)
Fear	2.26 (2.02)	2.46 (2.31)	2.31 (2.09)

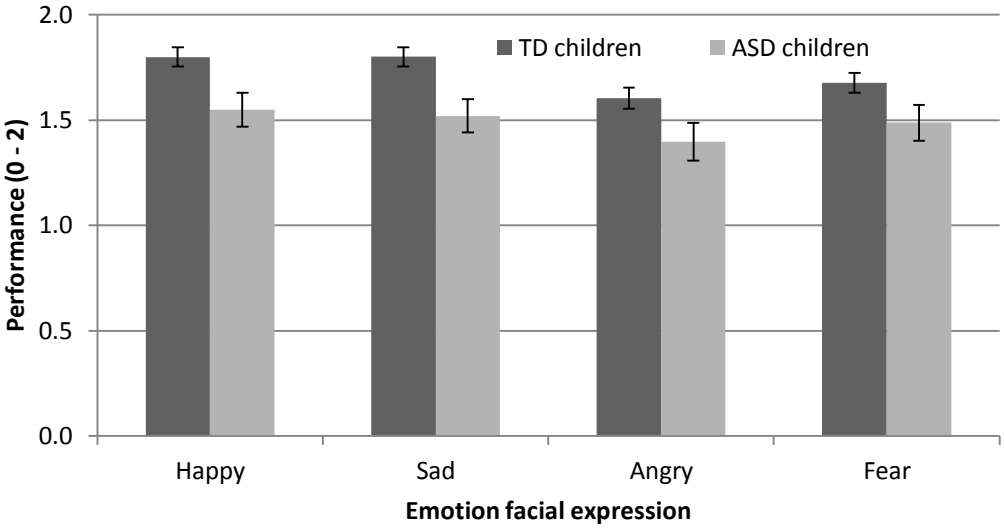


Figure 2. Performance in identification of happy, sad, angry and fear faces in ASD children and TD children.

3.1.3 Attributing emotions to prototypical situations

To investigate whether ASD children attributed emotions less well than their TD peers verbally and visually, two 2 (Valence: positive/negative) by 2 (Group: ASD/TD) mixed ANCOVAs were conducted separately for children's verbal and visual mean performances, with age as the covariate. Two ASD and three TD children had missing data and thus were excluded from the analyses. Table 5 presents the accuracy of both groups in attributing positive and negative emotions in verbal and visual conditions.

In the verbal condition, there was a main effect of valence (F (1, 201) = 9.88, p = .02, $\eta 2$ = .05): ignoring the group, for all children, positive emotions were more accurately allocated to the situations than negative emotions. A main effect of group was found (F (1, 201) = 3.97, p = .05, $\eta 2$ = .02), that is, ASD children generally performed lower in verbally attributing emotions to situations than TD children. The interaction effect of group and emotion was marginally significant (F (1, 201) = 3.71, p = .06, $\eta 2$ = .02). The trend was that ASD children attributed positive emotions slightly better than the

negative emotions, while TD children attributed negative emotions slightly better than positive emotions, (see Figure 3a).

In the visual condition, there was a main effect of valence (F (1, 200) = 6.03, p = .02, $\eta 2$ = .03): ignoring the group, for all children positive emotions were more accurately allocated to situation than negative emotions. A main effect of group was found (F (1, 200) = 4.04, p = .05, $\eta 2$ = .02), that is, ASD children generally performed less well in visually attributing emotions to situations than TD children. For visual performance there was a significant interaction effect between the valence of emotions and group (F (1, 200) = 6.46, p = .02, $\eta 2$ = .03), that is, ASD children attributed negative emotions slightly better than the positive emotions, while TD children attributed positive emotions slightly better than negative emotions, (see Figure 3b).

Table 5. *Mean score of correct responses and standard deviations (in parentheses) corrected for age, for the Emotion-Attribution Task (range: 0–1) for ASD and TD children*

	TD children (N = 151)	ASD children (N = 52)	All children (N = 203)
Verbal predictions			
Positive emotions	0.76 (0.39)	0.73 (0.40)	0.75 (0.39)
Negative emotions	0.73 (0.35)	0.75 (0.37)	0.74 (0.35)
Visual predictions			
Positive emotions	0.79 (0.36)	0.75 (0.41)	0.78 (0.38)
Negative emotions	0.75 (0.34)	0.77 (0.38)	0.75 (0.35)

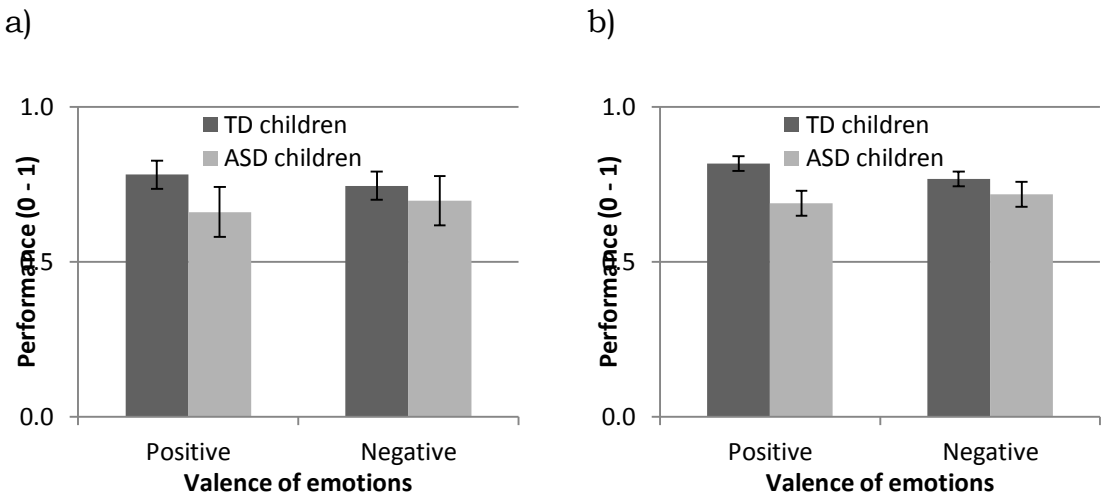


Figure 3. Performance on a) verbal and b) visual attribution of positive and negative emotions to situations for ASD compared to TD children.

3.2 Social Competence in ASD children compared to TD children

To assess whether ASD children had lower social competence ratings than TD children, we first calculated a total score of social competence by calculating the sum of the scores of the peer problem scale and the prosocial behavior scale. We also calculated the mean score of each scale. Table 6 shows the standard deviations of the mean scores of social competence and its components for the ASD compared to TD children. The *t*-test with the social competence score as the dependent variable and group as the independent variable showed that ASD children had lower social competence compared to TD children (t (189) = 14.31, p < .001). Analyzing the components separately, it was found that TD children showed more pro-social behaviors than those with ASD (t (189) = 8.73, p < .001). Furthermore, TD children demonstrated better peer relations than ASD children (t (189) = 15.66, p < .001).

Table 6. *Sum scores and standard deviations (in parentheses) of social competence, and its components pro-social behavior and peer relations for ASD and TD children.*

	TD children (*N* = 153)	ASD children (*N* = 52)
Social competence (total)	15.75 (2.79)	8.73 (3.34)
Pro-social behavior (total)	6.85 (2.06)	3.69 (2.49)
Peer relations (total)	8.90 (1.34)	5.04 (1.82)

3.3 Associations between emotion recognition and social competence for ASD children compared to TD children

To assess how children's performance in each emotion recognition task was related to their social competence, Pearson's correlations were used (see Table 7). For this purpose, we calculated a mean score for each of the three emotion recognition tasks (discrimination, identification and attribution), and we calculated a total score for social competence. Fisher *r*-to-*z* exact transformations were used to assess whether correlations were different for the ASD and TD children.

Pearson's correlations showed that, for both ASD and TD children (all Fisher *r*-to-*z* exact tests were non-significant), their performances in each emotion recognition task (discrimination, identification and attribution) were significantly and positively associated with social competence (Table 7). The results showed that better emotion discrimination, identification and attribution were related to higher social competence and vice versa.

Table 7. *Correlations between emotion recognition (discrimination, identification, attribution) and social competence (total), collapsed over group (ASD/TD), controlled for age.*

	Social competence
Emotion discrimination	.21**
Emotion identification	.32***
Emotion attribution	.23**

- *p < .05. ** p < .01. *** p < .001

4. Discussion

In this study we examined the ability to recognize emotions and to act in a socially competent manner in 5- to 5.5-year-old children with and without ASD. Additionally, we explored the association of the two abilities and whether the association holds for both ASD children and TD children.

With regard to emotion discrimination, the results demonstrated that ASD children performed equally well as TD children in discriminating objects and neutral faces, but they performed less well than their TD peers in discriminating facial emotion expressions. This is in contrast to some previous studies which suggest that ASD individuals can perform equally well as TD individuals in emotion recognition tasks (Da Fonesca, 2009; Grossman et al., 2000; Jones, 2001; Ozonoff, 1990). A possible reason for the conflicting findings might be the large variability in the sample across studies. Sample characteristics such as size and variability in participant characteristics limit the generalization of the results. Most of the previous studies referred here used samples with older participants, mainly adolescents and adults (Boraston, 2007; Sparrow et al., 2005; Wallace et al., 2011). The current study focused on a sample of young ASD children. ASD children could reach their maximum capacities in emotion recognition at an older age; by that time, their performance in discriminating emotions will

have approximated the performance of their TD peers. That also explains the findings of other studies for equal performance in emotion discrimination between ASD and healthy populations.

Regarding emotion identification, as we expected, findings showed that ASD children performed less well in associating emotion labels with facial emotion expressions. A probable explanation for this finding is that ASD children may have limited access to social learning. Social learning refers to the natural process of learning through interacting, imitating and observing others in a social context, without being instructed or reinforced (Bandura, 1979). For TD children, the social learning process starts at birth and continues through the life span. Social learning is shown to have positive effects in children's: emotion, attention and behavior regulation, decision-making skills, exhibiting of prosocial behaviors, expressing and understanding emotions of self and others. However, ASD children do not follow the natural tendency of TD in social learning, because they also have cognitive deficiencies, which prevent them from attributing social meaning to their environment. Consequently, their social learning is obstructed and ASD children cannot benefit from this learning process. Bidirectionally, because the ASD individuals' social learning is obstructed, their cognitive functions become severer.

Despite the general lower performance, our results showed that ASD children showed the same pattern of performance in identifying emotions as their TD peers. Focusing on the trends for identifying basic emotions, happiness and sadness were more accurately labeled than anger and fear in both groups. Anger and fear were identified equally inaccurately. This finding is partially in agreement with previous research. Williams & Gray (2012) have not reported sadness to be one of the most successfully identified emotions; however, they have concluded that happiness is the most accurately recognized emotion. Moreover, similarly, the current study findings partly agree with Williams & Gray (2012) in that they also reported anger as the least recognizable emotion but did not report the same for fear. The reason why some basic emotions were correctly identified while others

were incorrectly identified still remains unclear. Previous research has reported that there is no explanation regarding which emotions are easier to decode from facial expressions than others (Kuusiko, 2008). It may be that other factors affected the results. More research could enlighten the patterns of decoding emotions in ASD individuals.

Regarding attributing emotions to emotion-provoking situations, ASD children performed less well than their TD peers in both verbal and visual conditions. Possible explanations for this finding involve social exclusion and peer rejection. Limitations in the social domain may result in ASD children's inability to understand the emotion state of others. Lack of experience in real-life social situations may limit ASD children's practice in understanding the feelings of others. In the verbal condition for all children positive emotions were more accurately allocated to situations than negative emotions; similarly, in the visual condition for all children positive emotions were more accurately allocated to situations than negative emotions. In both conditions ASD children attributed negative emotions slightly better than positive emotions. This may indicate that ASD children tend to interpret emotions more as negative rather than positive. An explanation for this finding is that ASD children may have had many negative experiences and difficulties with their own negative feelings (e.g. aggressiveness) as to over-interpret others' feelings and intentions as negative.

With regard to social competence, results demonstrated that ASD children were less socially competent than their TD peers. Investigating each component of social competence we found that ASD children had poorer peer relations and displayed less prosocial behaviors compared to the TD children. This indicates that ASD children are impaired in social competence compared to their TD peers. This conclusion is in line with previous literature and confirms our expectation. Kasari et al. (2010) found that ASD children had fewer and lower-quality friendships compared to TD children. This finding may indicate that impaired social competence does not only relate to deficient emotion understanding but affects other aspects of life. School is a thriving context for social interactions. Phenomena taking place

in the school context, such as, marginalization, victimization and bullying can all be reasons why ASD children have poor-quality peer relations and show few prosocial behaviors. Lack of a protected environment where ASD children can practice their social skills, combined with the general preexisting impairments in social interactions and emotion understanding, hinders them from forming interactions with peers and exhibiting prosocial behaviors.

Regarding the relation between emotion recognition and social competence, results showed that all three components of emotion recognition (discriminating, identifying, attributing) were significantly and positively related to social competence and that this association holds for both groups (ASD and TD). That indicates that better emotion recognition is related to higher social competence and this association was found to be bidirectional. These findings validate our expectations regarding a positive correlation between emotion recognition and social competence and are in line with previous studies (Wallace et al., 2011; Boraston et al., 2007). An explanation for this finding is that the two types of functioning can influence one another. Emotion understanding contributes to the development of the ability to communicate successfully with others (Crick & Dodge, 1996). Children who are able to produce and perceive emotion expressions accurately are more likely to perform in a socially appropriate manner, as they can recognize process and respond to social signals.

Despite the implications of research, this study is characterized by a few limitations. One limitation is that due to the young age of the participants, only four emotions were tested and more complex ones, such as shame, disgust, pride, jealousy, etc. were not included. Also, the study did not include IQ as a covariate due to the large amount of missing data. Besides, parents' bias when answering the SDQ questionnaire could affect the results. Personal and emotional reasons might have led them to providing a not entirely objective answer. Moreover, factors such as socio-economic status could have influenced the validity of the answers in the questionnaire. We suggest that in a future study it is better to measure social competence

by using more than one measures, for example, also using teacher reports and observation lists. Finally, this study set out the first step by checking the correlation between ER and SC in the clinical group of ASD and for very young children. But to further explore how emotion recognition can influence social competence, future studies should conduct a regression analysis to provide more insight. Another direction for future research can be a longitudinal study on how the association between emotion recognition and social competence in ASD children changes over time.

To summarize, the current study assessed the emotion recognition ability and the social competence in a group of ASD children and compared them to TD children. Overall, ASD children were less capable in recognizing emotions compared to their TD peers. Similarly, ASD children had lower social competence. They were rated by parents as having poor quality of peer relations and as showing less prosocial behaviors than their TD peers. Moreover, the study explored the association between emotion recognition and social competence, and checked whether it holds for both groups. Our findings showed that emotion recognition is related to social competence in both groups. Our findings extend the existing knowledge regarding emotion recognition in ASD adolescents and ASD adults to young ASD children.

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