

Children with autism can express social emotions in their drawings

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Objectives: The study aimed to examine the ability of children with an Autism Spectrum Condition (ASC) to depict social (pride and shame) vs. basic (happiness and sadness) emotions in their human figure drawings.

Methods: Eleven children with a formal diagnosis of an ASC matched on gender and verbal mental age with 11 children with typical development (TD) participated in a series of tasks examining their emotional understanding, as well as their ability to depict a person experiencing the emotions under investigation and a person with no emotions. Drawings were assessed for their overall emotional expressiveness and the types of graphic cues employed to express emotions.

Results: Results showed that children with ASC produced less expressive drawings of basic emotions than their controls. However, they did not differ from the control group in their overall expressiveness in drawing social emotions, despite their reduced performance in tasks assessing understanding of social emotions. Additionally, children with ASC used significantly less graphic cues to depict emotions than children with TD, while some qualitative differences between the two groups were observed.

Conclusion: The study underlines the value of drawing as a tool to investigate emotion understanding in children with ASC

Keywords children, autism, drawings, social and basic emotions

Up to date the drawing skills of children with autism spectrum conditions (ASC) have been examined from a developmental perspective in an attempt to establish whether their drawings follow a similar developmental pattern to that observed in children with typical development (TD) (Charman and Baron-Cohen 1993; Eames and Cox 1994). Additionally, other researchers have focused on drawings of autistic savants which demonstrate an extraordinary drawing ability to represent reality in a visually realistic way (Selfe 1985). Despite the growing body of research exploring the expressive drawing skills of children with TD, that is their ability to convey emotions through their drawings, relevant evidence in the area of ASC remains scarce. Jolley and his colleagues (2013) attributed this lack of research to the well-established assumption that children with ASC do not have the ability to draw expressively, as a result of their significant weaknesses in socio-emotional understanding. In their pioneering study, Jolley *et al.* (2013) examined a group of children and adolescents (6–18 yrs) with ASC, who were asked to draw a happy and a sad picture. Their drawings were rated for their expressive quality, that is the extent to which they depicted the intended emotion, as well as for the depiction

of themes related to people or representing social scenes. Surprisingly, they found that the drawings of children with ASC had the same level of overall expressiveness to those of children with moderate learning difficulties and children with the same mental age. On the other hand, while they did not detect any differences between the two groups in the total number of the depicted themes of people, they observed that children with ASC tended to produce qualitatively different, that is less advanced or even incomplete representations of the human figure, by often depicting only the face and included fewer social scenes in their drawings than their matched control children.

Children's emotional development comprises their ability to express, recognize, and understand basic and social emotions. Basic emotions, such as joy/happiness, sadness, anger, and fear, emerge during the first months of life (Lewis 1995) and are associated with distinctive physiological reactions and universal facial expressions (Ekman 1992). On the other hand, social emotions, such as embarrassment, shame, pride, and empathy, have been also described as 'self-conscious' emotions (Lewis 1995; Tracy *et al.* 2007), since their experience requires self-awareness, comprehension of rules, as well as the development of own standards for the assessment of behavior (Lewis 1995; Denham 1998) and thus they are considered to appear in children's lives later than basic emotions.

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It has been well-established that social–emotional difficulties remain as one of the core features in the identification of autism (for a review see Begeer *et al.* 2008; Nuske *et al.* 2013). Interestingly, a range of methods assessing the relationship between the comprehension of social emotions and other cognitive processes in children with ASC have generated disparate findings. Specifically, children with ASC have been found to produce narratives of their personal experiences of social emotions (pride, shame, embarrassment, guilt) that were less contextually appropriate and coherent than the comparison group (Capps *et al.* 1992; Losh and Capps 2006), as a consequence of their limited theory of mind (Baron-Cohen *et al.* 1993). However, Hillier and Allinson (2002) did not find any group differences in the ability of individuals with low-functioning autism to attribute embarrassment to protagonists when presented with written scenarios. Similarly, in the study by Hobson *et al.* (2006) children with ASC did not differ from the children in the comparison group in the recognition of social emotions (pride, shame, and embarrassment) in the videotaped and photographed expressions of actors and the description of personal experiences of pride and guilt. Williams and Happé (2010) confirmed these findings: children with high-functioning autism were not different from children in the comparison group in their ability to recognize social (pride, guilt, and embarrassment) and non-social emotions in video clips (taken from the Mind Reading: An Interactive Guide to Emotions by Baron-Cohen *et al.* (2004)) and describe their own experiences of these emotions. Williams and Happé (2010) concluded that ‘children with autism probably can understand (even) social emotions in certain contexts’ (p.310). Considering the conflicting evidence and the persistent difficulties of persons with ASC in emotion processing in their daily lives, we need to look to other ways to explore the recognition and understanding of social emotions in autism.

Empirical findings on the recognition of basic emotions in autism are also inconsistent; while earlier research supports that children with ASC are as capable as children with TD to recognize basic emotions (Castelli 2005), recent evidence postulates that children with ASC present a significant limitation in this domain (Fridenson-Hayo *et al.* 2016). Research exploring recognition of positive vs. negative emotions has also revealed mixed findings in autism (Wallace *et al.* 2008; Tracy *et al.* 2011). However, in the meta-analytic review by Uljarevic and Hamilton (2013), individuals with ASC, regardless of age, were found to have intact ability in the recognition of happiness in contrast with their difficulties in the recognition of negative emotions, such as sadness, fear, and anger.

Comparing children’s with ASC ability to understand basic vs. social emotions, the former has been found to be easier than the latter (Capps *et al.* 1992; Heerey *et al.* 2003). The superior ability of children with ASC in understanding basic emotions can be attributed to the fact that this level of emotion understanding does not require false-belief understanding, which represents an

area of difficulty for the majority of children with ASC (Harris 1989). Within this framework the reported ability of children with ASC to produce expressive happy and sad drawings (Jolley *et al.* 2013) could be explained with their greater ease to understand basic emotions (Heerey *et al.* 2003; Castelli 2005; Rutherford and Towns 2008). The present study aims to expand this line of enquiry by exploring the ability of children with ASC to depict social emotions.

Drawing expressiveness in children with TD has been studied by examining mostly their ability to depict basic emotions, such as happiness, sadness, fear, and anger (Jolley *et al.* 2004; Picard *et al.* 2007), while recently Bonoti and Misailidi (2015) have attempted to investigate their depiction of social emotions, such as pride, shame, and jealousy. Within this research tradition, it has been argued that while drawing a human figure, children denote mood using a variety of graphic cues (Brechet *et al.* 2007, 2009), which include (a) *facial expressions*, which refer to children’s ability to modify the facial features of the figure (e.g. upturned mouth to denote sadness), (b) *posture* which comprises alterations to the limbs or the body posture (e.g. lifted arms to express happiness), and (c) *context* which corresponds to alterations of the general frame of the drawing (e.g. the addition of a gift to denote surprise).

In regards to the representation of basic emotions in the drawings of children with TD, alterations of facial expression have been reported as the most commonly used indicator (Cox 2005; Brechet *et al.* 2007) from the age of four years (Brechet *et al.* 2009). By the age of seven years, children seem to have acquired a sufficient repertoire of graphic cues to convey emotions in their drawings and as they grow older they shift from the use of facial expressions to modifications of the posture or alterations of the context (Golomb 1992; Picard *et al.* 2007; Picard and Gauthier 2012). With respect to the ability to depict social emotions, the only relevant study (Bonoti and Misailidi 2015) so far has shown that children with TD depicted social emotions primarily through contextual cues (e.g. an award to denote pride) and secondarily by facial alterations (e.g. facial blushing to express shame), while they used less frequently postural cues (e.g. hands covering the face to depict shame). This ability was apparent from the age of four years, although they used fewer expressive cues in their drawings than children aged from six to eight years. Interestingly, their drawings of social emotions were less expressive compared with those of basic emotions.

The current study

The purpose of this study was to explore the ability of children with ASC to depict social emotions in their drawings, as opposed to basic emotions. Our decision to focus on children in middle childhood (rather than adolescents or adults) with ASC was associated partly with the paucity of research in this age-group, but primarily with our intent to trace developmental differences or similarities

in the expression of basic and complex emotions around the ages that an advanced level of social understanding has been acquired.

Prior to the administration of drawing tasks, we attempted to investigate children's understanding of basic and social emotions, through tasks traditionally administered in the area of emotional development. Following Williams and Happé's recommendation (2010), we asked participants to define and describe previous personal experiences of basic and social emotions as well as to recognize emotions in images with facial expressions (Capps et al. 1992; Ashwin et al. 2006). Additionally, we used a series of scripts describing emotions (Hillier and Allinson 2002; Brechet et al. 2009; Widen and Russell 2010) to investigate children's emotional understanding.

To attain the main aim of this study, children were asked to draw a person experiencing basic and social emotions such as happiness, sadness, pride, and shame as well as a person with no emotion (Picard et al. 2007; Misailidi and Bonoti 2014). Happiness and sadness were selected, as they represent the two most efficiently depicted emotions from an early age (Brechet et al. 2009; Picard and Gauthier 2012) and are associated with clear facial and postural expressions (Ekman 1992). On the other hand, pride and shame were chosen on the grounds of recent empirical evidence demonstrating that they have distinct, recognizable non-verbal expressions (Tracy and Robins 2004; see also Bonoti and Misailidi 2015). For example, Tracy and her colleagues suggested that pride is displayed with smile, visible expanded posture, and raised arms, while shame is represented with head sloped down, drooping shoulders, and moving hands to cover the face (Tracy and Robins 2004; Martens et al. 2012).

Drawing from existing research in this area, it was expected that compared with children with TD, children with ASC: (a) would present lower ability to define and describe personal experiences of social emotions, (b) would be able to recognize social emotions in images and to understand social emotions in scripts, (c) would show similar overall expressiveness in their drawings of basic emotions, but would present limited overall expressiveness in their drawings of social emotions, and (d) would use fewer expressive indicators in their drawings of basic and social emotions and would also present qualitative differences compared to their matched controls.

Method

Participants

In total 22 children participated in the present study (see Table 1). Eleven children with a formal diagnosis of

ASC (10 boys, 1 girl) and a mean age of 135.91 months ($SD = 15.95$, $Q: 118-190$ mo) were matched with 11 typically developing children on sex (10 boys, 1 girl) and verbal mental age ($Q = 9:1-13:2$). Verbal mental age was measured with the Greek version of the Peabody Picture Vocabulary Test-Revised (Dunn and Dunn 1981; Simos et al. 2011). There were no significant group differences on chronological age ($t(20) = 1.86, p = .07$) and receptive vocabulary ($t(20) = -0.36, p = .72$). Eight children had a diagnosis of Asperger syndrome or high-functioning autism and one child had an additional diagnosis of ADHD. At the time of data collection, two children with ASC were attending special schools and the remaining nine participants were enrolled in regular schools with variable levels of support: five children had in-class teaching assistants, one child was receiving remedial support in a separate classroom, and three children did not have any specialized support in school.

Tasks

In alignment with the aims of the study, four tasks were designed to examine the ability (i) to define and experience emotions, (ii) to recognize emotions in facial expressions, (iii) to understand emotional scripts, and (iv) to draw expressively.

Task 1: definition and experience of emotion

The experimenter would ask two sets of questions for the definition and the description of a personal experience related to each emotion. At first, the experimenter asked participants to give a definition for each emotion by posing the following question «*What does X (i.e. happiness, sadness, pride, shame) mean for you?*» (Losh and Capps 2006; Williams and Happé 2010). Following the child's response, the experimenter offered a basic definition for each emotion (i.e. «*Someone is happy when s/he feels good about something and is satisfied*»). Next, the experimenter asked the child to report a time in which s/he felt each emotion (*Can you tell me a time you felt X [i.e., happy sad, proud, ashamed]?*). Following the suggestion by Losh and Capps (2006), when children could not describe an appropriate personal emotional experience, the experimenter would offer an example describing her personal experience reflecting that feeling. In the case of children who found it hard to respond or said that they have never felt similar to the experimenter's personal experience, additional probing questions (e.g. *What made you feel proud?*) were used as part of the task administration.

Task 2: emotion recognition

In this task each child was shown two sequences of three images for each emotion (2 sets x 4 emotions), presented in random order on a laptop. Following Misailidi and Bonoti (2008), we chose to display a sequence of three, instead of two images for each emotion to ensure that children's responses were not based on the exclusion method,

Table 1 Participants' characteristics

	<i>N</i>	Age in months <i>M</i> (<i>SD</i>)	Verbal score <i>M</i> (<i>SD</i>)
TD	11	135.91 (15.95)	45.00 (14.83)
ASC	11	151.54 (22.76)	42.63 (16.14)

which is usually the case when two images are presented simultaneously. All images had been selected from 'Mind Reading: The Interactive Guide to Emotions' (Baron-Cohen *et al.* 2004). In each tab the position of the target emotion would be random to avoid any selection bias. As an introduction to this task, the experimenter would say to the child: «I will show you images of some people on the computer screen. Everyone feels something. Please look at the pictures very carefully». Then the child would look at the images and the experimenter would ask the following question: «Which person feels X (i.e. happy, sad, proud, ashamed)?», which would also be presented in large font at the top of the computer screen and above the captions with the images.

Task 3: emotion understanding

To further investigate children's emotional understanding, we used 16 scripts (four for each emotion) derived from children's daily life, which were adapted from previous research (Ribordy *et al.* 1988; Hillier and Allinson 2002; Brechet *et al.* 2009; Widen and Russell 2010; Dedikousi *et al.* 2013). Depending on the child's gender, the name of the protagonist of the script would change. The scripts were presented in random order on a computer screen. In the beginning the experimenter would say «We will hear about some events that happened to a child (George/ Mary). I would like you to tell me how you think s/he felt when these events happened». For example, the feeling of pride was the following: «At the school festival, George/Mary sings a song alone. At the end, everybody gives him/her congratulations for his/her performance». Next, the experimenter would ask «What do you think George / Maria feels?» and three images (male or female, depending on the child's gender) with different facial expressions from Mindreading (Baron-Cohen *et al.* 2004) were presented. The experimenter asked the question while pointing to the different facial expressions. Children responded by pointing to an image.

Task 4: emotion depiction

Following Bonoti and Misailidi's (2015) recommendation, each child was asked to complete five drawings with figures experiencing happiness, sadness, pride, shame, and last a neutrally characterized human figure (control drawing). Participants were given five pages of white paper A4 size and six colored pens (red, yellow, green, brown, blue, and black). Children were asked to draw the emotional drawings in random order with the following verbal prompt: "Draw a person who feels XXXX. Please, make the person as XXXX as possible, so everybody can understand that s/he is XXXX". In the drawing task no time limit was set for its completion. Then, the experimenter asked him/her to draw a neutral person giving the following verbal prompt «Now imagine that a person does not feel anything. Please, draw a person who feels nothing». This drawing served as a control condition for detecting

changes children would make in the other drawings conveying specific emotions.

Administration procedure

Following parental consent, participants were tested individually in their home at a convenient time for the family. The length of the session with each child was roughly an hour. The first author administered first the Peabody Picture Vocabulary Test-R, followed by the tasks exploring their ability to define, experience, recognize, understand, and depict basic and social emotions.

Scoring procedure

Following relevant research (Losh and Capps 2006; Williams and Happé 2010), in the first task two of the authors rated children's definitions of emotions as correct (1 point) or incorrect (0 point), in accordance with the pre-set criteria for each emotion (e.g. the definition of happiness was rated as correct when its content included reference to a positive emotional state of well-being, contentment, or joy) and no disagreements were observed between the raters. Participants' self-reported emotional experiences were assigned a score of 2 when they described situations that caused the emotion under investigation, a score of 1 when they described events which triggered similar emotions, and a score of 0 was assigned to a response referring to an inappropriate emotion or when the child did not give any response. In the second task, participants' responses were rated as correct (1) or incorrect (0) (Heery *et al.* 2003) (two sets for each emotion, range 0–2), while children's responses in the emotional scripts' task were rated as correct (1) or incorrect (0) according to Brechet *et al.* (2009) (four scripts for each emotion, range 0–4). Following Bonoti and Misailidi (2015), children's drawings were scored on (a) the quality of expression, i.e. the extent to which the drawing expressed the emotions in question, and (b) the quantity of expression, i.e. the type and amount of indicators used for the depiction of each emotion. Specifically, two independent raters were asked to (a) estimate on a five-point scale (1: not at all to 5: very much) the extent to which each drawing conveyed the target emotion and (b) compare each emotional drawing with the control in order to detect the presence (1 point) or the absence (0 point) of facial, postural and contextual cues used for the depiction of the emotions under investigation (for a detailed description of those cues see Bonoti and Misailidi 2015) (range 0–3 for each emotion). Reliability between raters was proved to be high in assessing the quality of expression ($r = .85$ happy, $r = .87$ sadness, $r = .79$ pride and $r = .76$ shame, all $ps < .001$) whereas inter-rater agreement in identifying the graphic cues ranged from 86% to 98%. Disagreements were evaluated by a third blind independent rater, who was invited to indicate which of the two scores accorded with his view (Jolley *et al.* 2004; Bonoti and Misailidi 2015). Data were analyzed using the non-parametric Mann–Whitney U-Test to assess

group differences, since the assumptions regarding the normality of data distributions were not met.

Results

Definition and experience of emotion

Fisher exact test did not detect any statistically significant differences in children’s definition of happiness ($p = .21$), sadness ($p = .47$), shame ($p = .36$), and pride ($p = .39$), as well as in their personal narratives for happiness ($p = 1.00$), sadness ($p = .59$), shame ($p = .78$), and pride ($p = .09$). Similarly, when the Mann–Whitney test was used to explore group differences in the definition and experience of basic vs. social emotions, no statistically significant differences were found (all $Us > 48$, all $ps > .07$).

Recognition of emotions

We calculated separately children’s scores in the emotion recognition task, yielding two (one for basic and another for social emotions) composite scores (range 0–4). Table 2 presents group mean scores and standard deviations of children’s performance in their recognition of basic and social emotions. As expected, no significant group differences ($U = 60.50$, $p = 1.00$) emerged in the recognition of basic emotions. However, statistically significant group differences emerged in the recognition of social emotions ($U = 37.50$, $p = .05$), with children with TD achieving overall higher scores than children with ASC. However, when the Mann–Whitney test was performed to explore group differences for each emotion (range of values 0–2), no statistically significant group differences were found in their ability to recognize happiness, sadness, shame, and pride (all $Us > 49.50$, all $ps > .07$).

Understanding of emotional scripts

Children’s scores in tasks examining their ability to understand basic emotions (see Table 2) were added separately from those assessing understanding of social emotions through scripts, resulting in two composite scores (range 0–8). As expected, the analysis showed significant group differences in terms of children’s understanding of social emotions ($U = 37.00$, $p < .05$), with children with TD attaining higher scores than children with ASC, but not in

the understanding of basic emotions ($U = 55.00$, $p = .32$). When group comparisons were performed for each emotion separately, significant group differences emerged only in their understanding of shame ($U = 37.00$, $p < .05$) with children with TD having higher scores than children with ASC, but not in the understanding of happiness, sadness, and pride (all $Us > 55.00$, all $ps > .32$) (see Table 3).

Quality of expression of emotions in drawings

Two composite scores were calculated by adding separately (see Table 2) raters’ scores of overall expressiveness of drawings of basic emotions from scores assessing the quality of expression of social emotions (range 0–10). Group comparisons revealed statistically significant differences in the expressiveness of basic emotions ($U = 30.50$, $p = .03$) with children with TD having higher scores than children with ASC, but not in the expressiveness of social emotions ($U = 37.00$, $p = .12$). When group comparisons were examined for each emotion separately (range 0–5), the analysis revealed significant group difference (see Table 3) only in the overall expressiveness of sadness in drawings ($U = 33.50$, $p = .04$), with children with TD depicting sadness in their drawings more effectively than children with ASC, but not in the drawings of happiness, shame, and pride (all $Us > 38.00$, all $ps > .11$).

Quantity of expression of emotions in drawings

The amount of expressive cues (i.e. facial, postural and contextual) used for the depiction of basic and social emotions were added separately (see Table 2) and resulted in two composite scores (range 0–6). Significant group differences in the number of expressive indicators were found in the drawings of basic emotions ($U = 24.50$, $p = .01$) as well as social emotions ($U = 26.50$, $p = .02$). As expected, children with TD used more expressive indicators in the depiction of basic and social emotions than children with ASC. When the quantity of drawing expression was examined separately for each emotion (range 0–3), the analysis showed significant group differences in the number of expressive indicators (see Table 3) used for all emotions. As expected, children with TD used more expressive indicators than children with ASC in the depiction of all emotions (happiness, $U = 31.50$, $p = .02$, sadness, $U = 27.50$, $p = .01$, shame, $U = 28.50$, $p = .02$, and pride, $U = 30.50$, $p = .03$).

Qualitative differences between groups

Taking into account the documented qualitative differences in the expressive drawings of children in both groups (Jolley et al. 2013), we attempted to examine further whether similar differences would be observed in our study. To this end, we identified specific characteristics (i.e. drawing of a single face, depiction of social scenes, and presence of color), included in the emotional drawings of each group. Table 4 presents for each group the number of drawings including the above characteristics across the 44

Table 2 Mean Scores (and standard deviations) of children’s performance by group, task, and type of emotions (basic vs. social)

	TD	ASC
Recognition of basic emotions	3.91 (0.30)	3.90 (0.30)
Recognition of social emotions	3.91 (0.30)	3.27 (1.01)
Understanding of basic emotion	8.00 (0.00)	7.82 (0.60)
Understanding of social emotion	7.91 (0.30)	7.09 (1.22)
Quality of expression of basic emotions	8.64 (0.92)	7.64 (1.12)
Quality of expression of social emotions	6.18 (3.03)	4.27 (1.85)
Quantity of expression of basic emotions	3.64 (1.57)	2.09 (0.30)
Quantity of expression of social emotions	3.09 (1.81)	1.45 (1.13)

Table 3 Mean scores and standard deviations of children's performance by group, task, and emotions

	Happiness		Sadness		Pride		Shame	
	TD	ASC	TD	ASC	TD	ASC	TD	ASC
Images	2.00 (0.00)	2.00 (0.00)	1.91 (0.30)	1.91 (0.30)	2.00 (0.00)	1.54 (0.82)	1.91 (0.30)	1.73 (0.47)
Scenarios	4.00 (0.00)	3.91 (0.30)	4.00 (0.00)	3.91 (0.30)	4.00 (0.00)	3.91 (0.30)	3.91 (0.30)	3.18 (1.07)
Quality of expression	4.27 (0.47)	3.91 (0.54)	4.36 (0.50)	3.73 (0.79)	3.27 (1.55)	2.45 (1.21)	2.90 (1.64)	1.82 (0.75)
Quantity of expression	1.82 (0.87)	1.09 (0.30)	1.82 (0.87)	1.00 (0.00)	1.82 (0.98)	1.00 (0.77)	1.27 (0.90)	0.45 (0.52)

Table 4 Specific characteristics depicted for each emotion by group

	Happiness		Sadness		Pride		Shame	
	TD	ASC	TD	ASC	TD	ASC	TD	ASC
Face	1	7	2	7	2	7	2	7
Social scenes	3	0	4	0	5	1	5	0
Color	7	3	4	5	4	3	7	4

drawings produced (11 children X 4 drawings). This comparison shows that children with ASC drew more often a single face of the human figure ($N = 28$) than their typically developing counterparts ($N = 7$). Furthermore, almost none of the children with ASC depicted social scenes ($N = 1$) in their drawing compared to the children with TD ($N = 17$). Finally, it was observed that children with ASC included color in their drawings ($N = 15$) less often than the group of children with TD ($N = 22$). Representative drawings of both groups are presented in Fig. 1.

Discussion

The present study was designed to investigate the ability of children with ASD to depict basic and social emotions in their drawings. To attain this aim, children participated in a series of tasks aiming to evaluate their ability to understand and depict the emotions under investigation. In agreement with other studies, findings revealed that children with ASC were similar to children with TD in their ability to define and describe personal experiences of basic and social emotions (Capps *et al.* 1992; Williams and Happé 2010). Furthermore, both groups did not present greater ease in defining and reporting experiences of basic emotions, despite our relevant hypothesis and previous findings (Fridenson-Hayo *et al.* 2016) suggesting that processing of social emotions constitutes a challenging task for both groups of children. It is possible that our participants were in middle childhood, in which age the abilities under investigation have been well-established. Future cross-sectional or longitudinal research should assess whether children with ASC of different age-groups present developmental differences in their emotion understanding.

Regarding emotional understanding, children with ASC seemed to be as capable as their typically developing counterparts in recognizing the facial expression and emotional understanding through scripts of basic emotions (Heerey *et al.* 2003; Castelli 2005; Wright *et al.* 2008). On

the other hand, children with ASC showed significantly lower performance than children with TD children in both tasks assessing the recognition and understanding of social emotions. Our findings are consistent with previous research (Capps *et al.* 1992; Heerey *et al.* 2003; Rutherford and Towns 2008; Wright *et al.* 2008) demonstrating that children with ASC with the same chronological age and verbal mental ability as the participants of this study, lack higher theory of mind skills, which in turn affects their understanding of advanced emotions (Baron-Cohen *et al.* 1993; Baron-Cohen 2000). However, they do not support other findings documenting a similar level of comprehension of social emotions between children with TD and children with ASC (Hillier and Allinson 2002; Williams and Happé 2010).

Our initial assumption was that the overall expressiveness in the drawings of children with ASC would be similar in the depiction of basic emotions and relatively limited, compared to the expressiveness of children with TD in the depiction of social emotions. However, our findings showed group differences in the depiction of basic emotions, in contrast with Jolley *et al.* (2013) findings. These differences were more evident in the depiction of sadness, than in the drawings of happiness. The often reported finding that happiness is the easiest emotion to be depicted (Cox 2005) could probably explain why both groups of children showed similar expressiveness. However, the greater difficulty of children with ASC in recognizing a negative (i.e. fear) rather than a positive emotion (i.e., happiness) (Uljarevic and Hamilton 2013) could offer an alternative explanation for the lower expressivity of their sad drawing.

Surprisingly, children with ASC exhibited the same level of overall expressiveness in the depiction of social emotions as their typically developing counterparts. More precisely, their drawings of social emotions were not rated as less expressive than the drawings of their controls, despite their decreased performance in tasks assessing recognition and understanding of social emotions. The two groups differed in the depiction of basic emotions but did not differ in the depiction of social emotions. This unexpected finding may, however, reflect typically developing children's greater difficulty to depict social rather than basic emotions (Bonoti and Misailidi 2015). Moreover, our findings suggest that the depiction of social emotions in drawings at this age is not autism-specific and

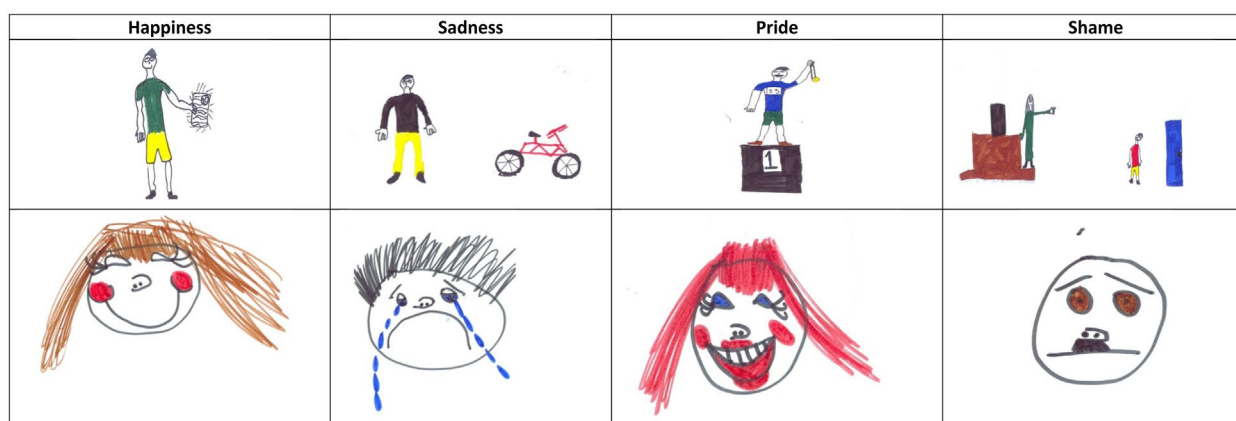


Figure 1 Representative drawings produced by a child with TD (CA = 158 months, VS = 60) and a child with ASC (CA = 138 months, VS = 54).

drawing offers another way to express understanding of others' social emotions, compared to previous research utilizing video clips or pictorial stimuli for assessing the same processing skills. Adopting Williams and Happé's (2010) suggestion we might assume that drawings provide a context in which children with ASC can express their comprehension of social emotions similarly to their typically developing counterparts.

With regard to the quantity of the graphic cues used by both groups to depict emotions, the results confirmed our hypothesis, since children with TD used significantly more graphic cues to depict happiness, sadness, shame, and pride than children with ASC. These findings are consistent with those by Jolley *et al.* (2013), who reported that children with TD included in their drawings more evidence that signaled happiness and sadness than children with ASC. The fact that children with ASC used fewer graphic indicators for the depiction of emotions may be attributed to their reported difficulties in understanding and expressing emotions (Begeer *et al.* 2008; Nuske *et al.* 2013). Brechet *et al.* (2009) proposed the existence of a link between the ability to understand and depict emotions in children with TD. It remains to be explored whether this link also applies for children with ASC. Furthermore, an alternative interpretation of the poor use of graphic indicators in the drawings of children with ASC could be associated with their weak handwriting skills, which have been related with difficulties in fine motor control and visual-motor integration (Kushki *et al.* 2011). In the present study, we did not assess children's graphic skills prior to the investigation. Future research can throw further light into the connection between drawing expressiveness and graphic skills in children with ASC.

Considering the specific graphic indicators used by the two groups it was observed that most children with ASC depicted the emotions by changing the facial expressions, as found in the study of Jolley *et al.* (2013), in which children with autism depicted happiness and sadness mainly with a happy or sad face. Jolley *et al.*

(2013) attributed this tendency to the exposure of children with ASC to various educational programs which aim to familiarize them with the main characteristics of each emotion and how emotions are reflected in facial expressions. Furthermore, the reported limited interest of children with ASC for the social world (Celani 2002; Lee and Hobson 2006) which may result in restricted practice in drawing human figures (Lim and Slaughter 2008) and has been also confirmed by the preference of autistic savants to draw inanimate objects (Cox 2005), may function as an inhibitory factor for the design of an integrated human figure (Jolley *et al.* 2013). Moreover, there is always a possibility that children with ASC were influenced by the images used in the recognition and understanding tasks, where the emotions were depicted with facial expressions. This tendency, however, was not observed in the drawings of the children with TD, although they had been exposed to the same images.

Moreover, the findings of this study showed that children with ASC did not use cues related to the body posture or context to express emotions, unlike children with TD who frequently used the body and context. Regarding the contextual cues, an interesting fact is that, both in previous research (Jolley *et al.* 2013) and in the present study, no children with ASC had designed social scenes for the display of emotion, a finding, which seems to support their impairment in social interaction (Lombardo and Baron-Cohen 2010). Additionally, children with ASC avoided the use of bodily postures to illustrate social emotions, despite the fact that postural cues are considered as a primary means of non-verbal expression of shame and pride (Tracy and Robins 2004; Martens *et al.* 2012). In contrast, some children with TD included postural cues in the depiction of shame, for example, a hand covering the face or the head facing down and in the depiction of pride, for example, the head tilted upward or body to be standing with his chest out. ACS children's difficulties in understanding emotional body language (Fridenson-Hayo *et al.* 2016) might explain the lack of postural cues in their drawings.

Following the discussion of the key findings of this study, we need to address its shortcomings. One of the main study limitations is the small number of participants with ASC, which is associated with pragmatic reasons. The recruitment of children with ASC had been a challenging process in the geographic region this study was conducted. Given the low number of school-age students with a verified diagnosis of ASC in that area, we made our best efforts in contacting staff in regular and special schools as well as private professional therapists who could distribute information about the research project to parents of children with ASC. Another limitation is related with the control groups. In our study, ACS children were matched to children with TD on verbal mental age. The inclusion of more control groups (i.e., children with TD matched on chronological age, or mental age matched children with moderate learning difficulties) could offer us a more comprehensive understanding (Jolley 2010) of the ability to depict social vs. basic emotions in children with ASC. A third limitation is that we did not measure factors, such as concentration and fatigue, which may have interfered with participants' task performance. Finally, the repeated presentation of the same pictures of facial expressions through the various tasks may have influenced the performance of children with ASC (Gross 2004). Future research in the area of ASC should attempt to disentangle the possible influence of the repeated use of the material on children's drawing performance either by assessing children's emotional understanding through non-pictorial means, or by exploring their drawing expressiveness separately from pictorial stimuli.

Nevertheless, the present study seems to provide a promising framework for the investigation of the expressive drawing skills of children with ASC in relation to a range of basic and social emotions. Taken into account that emotional processing in children with ASC is considered to be mediated by age and cognitive intelligence (Lozier et al. 2014), a future study should include participants of different ages and levels of cognitive functioning. For example, this line of inquiry can be extended by exploring the drawing abilities of individuals with ASC who may have greater difficulties in the recognition and understanding of emotions as a result of their lower cognitive skills (Begeer et al. 2008).

The findings of this study carry implications for clinical and educational practice. The divergence of findings between expressive drawings and emotion recognition tasks with respect to basic and social emotions in the group with ASC indicates that drawing can be used as an alternative way of gaining deeper insights into the development of emotion concepts in school-age children with ASC. Drawing is a kind of individual expression but it can also be a communicative tool (Golomb 1992). As such, it can provide a complementary method for expressing and communicating internal representations of emotions

in verbal and non-verbal individuals with ASC. It is a non-threatening and non-intrusive context compared to a testing situation requiring social interaction with the child. Thus, interventions targeting emotion understanding could incorporate expressive drawings of basic and social emotions as an outcome measure but also as a means for facilitating the understanding of emotion concepts.

In conclusion, the findings of this study confirm and extend the previous research findings concerning the ability of children with ASC to depict basic and social emotions (Jolley et al. 2013). Furthermore, this study underlines the value of drawing as a useful tool to investigate emotion understanding in children with ASC, taking into account the major group differences in the drawing tasks. Overall, our findings seem to support that the weaknesses of children with ASC in emotional development are less evident in their drawings, than in their performance in tasks assessing recognition and understanding of emotions. This may indicate that drawings can be deployed as an alternative method for evaluating the understanding of emotions in children with ASC, moving beyond the traditional experimental paradigm.

Contributors

PK conceived the study; obtained ethics approval; collected and analysed the data; and wrote parts of the article. FB conceived and designed the study; analysed the data; and wrote parts of the article and revised the article. SM designed the study; wrote parts of the article and revised the article.

Disclosure statement

No potential conflict of interest was reported by the authors.

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