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Review

Emotional competence in children with autism: Diagnostic criteria and empirical evidence

Sander Begeer [a,*], Hans M. Koot [a], Carolien Rieffe [b], Mark Meerum Terwogt [a], Hedy Stegge [a]

[a] *Faculty of Psychology and Education, Department of Developmental Psychology, VU University Amsterdam, Van der Boechorststraat 1, 1081 BT Amsterdam, The Netherlands*
[b] *Faculty of Social and Behavioral Sciences, Leiden University, Leiden, The Netherlands*

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Abstract

The diagnostic criteria of autism spectrum disorders (ASD) include emotional impairments. However, scientific evidence for these impairments is varied and subtle. In this contribution, recent empirical studies that examined the emotional competence in children and adolescents with ASD are reviewed. Four aspects of emotional competence that are important to children's daily social functioning (expression, perception, responding, and understanding) are discussed, differentiating between mentally retarded and normally intelligent children and adolescents with and without ASD in natural and structured contexts. On various accounts, the emotional impairments of children with ASD that are found in scientific studies provide a more differentiated view on the impairments suggested by the diagnostic literature. Consistent empirical findings and gaps in the field are discussed. Theoretical and clinical recommendations for assessment procedures are suggested.
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Children and adolescents with autism spectrum disorders (henceforward 'children with ASD') are characterized by qualitative impairments in social interaction and communication and by restricted, repetitive and stereotypical patterns of behaviour and interests, all

* Corresponding author.
E-mail address: S.Begeer@psy.vu.nl (S. Begeer).

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present from early childhood onward and pervading every aspect of their subsequent development (American Psychiatric Association, 1995). Among the most striking features of this pattern of impairments is a profound emotional impairment. Leo Kanner even defined autism as an inability to 'form affective contact with people' (Kanner, 1943, p. 250).

Indeed, closer examination shows that the diagnostic criteria for ASD of the DSM-IV-TR (American Psychiatric Association, 2000), the International Classification of Diseases-10 (Sponheim, 1996), and leading assessment tools, such as the Autism Diagnostic Interview-Revised (ADI-R) (Rutter, Lecouteur, & Lord, 2003) or the Autism Diagnostic Observation Scale (ADOS) (Lord et al., 2000), all include qualitative impairments in emotional competence. The emotional competence of children with ASD has attracted extensive empirical research. The rapid growth of studies in this area emphasises an even increased interest over the last two decades. A search in Web of Science resulted in over 350 empirical studies on ASD and emotions in the period from 1986 to 2007. To date, this wealth of information has not been integrated and linked to the diagnostic criteria of ASD. In the current contribution empirical findings on the presence and the nature of the emotional impairments are reviewed and compared to the diagnostic criteria for an autistic disorder.

Defining emotional competence requires acknowledging the intertwining with social competence. Emotions are often understood as social processes (Salovey, 2003). Emotion is the primary medium of communication in infancy, and children's emotions are directly linked to their relations with others (Dunn, 2003). Throughout the lifespan most emotional experiences and responses are contextually anchored in social relationships, and emotions become meaningful in the interaction with other people (Ekman, 1992; Frijda, 1986; Saarni, 1999). Vice versa, emotions serve to regulate social interactions, and the way emotions are exchanged defines our social relationships. In short, emotions are dynamic processes that create and are created by the relationships with others (Halberstadt, Denham, & Dunsmore, 2001). Therefore, the definition of emotional competence entails the awareness that emotions are contextually embedded in social interactions, and the ability to spontaneously regulate these interactions by exchanging emotions in accordance with the requirements of the situation (Saarni, 1999).

In keeping with the above definition, the current review evaluates to what extent research findings on children with ASD confirm the impaired emotional competences that are suggested in diagnostic criteria. Because of the similarity between the DSM-IV-TR and ICD-10 for autism related categories (Volkmar, Lord, Bailey, Schultz, & Klin, 2004), and the wider use of the DSM classification system in research (Mezzich, 2002), this review will be confined to DSM criteria. More specific, the DSM qualifies the social impairments of an autistic disorder as manifested by "marked impairments in the use of multiple nonverbal behaviours such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction", "a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing or pointing out objects of interest" or "a lack of social or emotional reciprocity" (American Psychiatric Association, 1995, p. 72). Following the focus of recent scientific publications, empirical findings for the above criteria are divided over four domains: expressing emotions, perceiving faces and emotions, responding to emotions of others, and understanding simple and complex emotions.

Age, intellectual ability, and situational context are widely recognized influences of emotional competence in typical development (Zeman, Cassano, Perry-Parrish, & Stegall,

2006). The limited number of longitudinal studies in children with ASD indicate that their emotional competence progresses over time, and IQ influences the magnitude of this progress (Bieberich & Morgan, 2004; Dissanayake, Sigman, & Kasari, 1996; McGovern & Sigman, 2005; Seltzer et al., 2003). Unfortunately, studies on ASD are generally cross sectional, comparing normally intelligent, or high functioning children with ASD (HFASD) within a specific age range to chronological age (CA) and/or mental age (MA) matched typically developing children (Mottron, 2004). While these studies are indicative for abilities at specific age and IQ levels, they do not provide information about possible differences between children with and those without ASD in the *course* of development of emotional competence. Besides, neglecting research on the majority of individuals with ASD who are mentally retarded (MRASD) (Fombonne, 2005) would misrepresent the emotional competence of children with ASD.

The situational context is often suggested to have an impact on measures of emotional competence in ASD (Klin, Jones, Schultz, & Volkmar, 2003; Losh & Capps, 2006). Emotional competence can be measured in isolated, specific skills under explicit laboratory conditions, e.g., by focusing on children's attention to emotional expressions on a computer screen. However, it is highly debatable whether such measures can predict spontaneous behaviour under natural conditions, even in typically developing children (Parker et al., 2001). Therefore, when reviewing the literature on emotional competence it is pivotal to highlight under what conditions findings are obtained.

There are no consistent indications of a relation between emotional competence and ASD subtypes such as Asperger's syndrome, autism or pervasive developmental disorders not otherwise specified (PDDNOS). Therefore, to enhance clarity, findings on these specific groups were merged under the same denominator 'ASD' and research findings separately for mentally retarded and high-functioning children with and without ASD. In conclusion, general outcomes and limitations of empirical findings on emotional development in children with ASD are discussed, and preliminary suggestions are made for the incorporation of these findings into diagnostic guidelines.

Expressing emotions

To judge whether empirical findings confirm the DSM-IV criteria on impaired emotional expressive behaviour of children with ASD, we first summarize findings in typically developing and mentally retarded children at increasing ages, followed by findings on children with MRASD and HFASD.

The expression of emotional states has an incredible strong impact on social interactions. It signals internal states, which evoke reactions from the social environment. For example, crying in babies induces caring behaviour in the parents, which can be measured even on a hormonal level (Winberg, 2005). Similarly, smiling or laughter creates bonding, it invites the caregivers to repeat their actions. The typically developing human baby expresses what according to some can be considered its first emotion directly after birth—a cry. In the months that follow, babies produce discrete, recognizable expressions of emotion, including interest, disgust, sadness, anger and joy (Oster, 2003). In their first three years of life, infants increase their expressiveness and start to verbally express feeling states (Harris, 1989; Malatesta-Magai, Leak, Tesman, & Shepard, 1994). Note that preschoolers (i.e., aged 2–5 years) express positive affect almost exclusively in a social context (Snow, Hertzig, & Shapiro, 1987).

The socialization of emotional expressions starts in the first 3 years of life, when typically developing children can first be seen to mask or suppress their feelings (Malatesta & Haviland, 1982; Zeman et al., 2006). From that age, children are increasingly able to apply emotional "display rules", i.e., regulate the appropriateness of their expressive behaviour. They can generally explain this behaviour at around 6 years of age (Kieras, Tobin, Graziano, & Rothbart, 2005). The expression of complex emotions (e.g., shame, embarrassment, and pride) starts during toddler hood (Saarni, 1999).

In their first year of life, mentally retarded (MR) children, (in most studies generally consisting of children with Down syndrome or mixed aetiology), are more passive, smile less, make less eye contact and show facial expressions that are less clear and intense than typically developing CA-matched controls (Mercer & Glenn, 2004; Slonims, Cox, & McConachie, 2006). However, compared to MA-matched controls, MR toddlers (i.e., aged 1–2 years) show equal levels of attachment behaviour (Roach, Orsmond, & Barratt, 1999), and emotional expressive behaviour (Carvajal & Iglesias, 2002; Kasari, Sigman, Mundy, & Yirmiya, 1990; Knieps, Walden, & Baxter, 1994; Palomo, Belinchon, & Ozonoff, 2006). These findings can be related to particular strong attempts of children with Down syndrome to engage in social interactions (Kasari & Freeman, 2001). This tendency is opposite to the behaviour of children with ASD.

Children with ASD are generally studied at school age (i.e., 6–12 years) because reliable ASD diagnoses in toddlers are still relatively rare (Dumont-Mathieu & Fein, 2005). However, it is possible to use delayed diagnoses to study the expressive behaviour of young autistic infants. One-year old children, later diagnosed with MRASD, show similar affective expressiveness to typically developing or MR controls (Baranek, 1999; Palomo et al., 2006), and preschool aged children with MRASD and MA-matched control children are equally expressive during social interactions, or when watching video records of emotional expressions in others (Capps, Kasari, Yirmiya, & Sigman, 1993). However, older, school aged children and adults with MRASD are generally less expressive. They more often show neutral, flat or idiosyncratic expressions, all in comparison to MA-matched controls (Czapinski & Bryson, 2003; Hobson & Lee, 1998; Kasari et al., 1990; Loveland et al., 1994; Yirmiya, Kasari, Sigman, & Mundy, 1989).

More specific differences with typically developing children can be found in the expressiveness of children with MRASD during social interactions. School aged children with MRASD less often spontaneously share their affective expressions with others (Attwood, Frith, & Hermelin, 1988; Bieberich & Morgan, 2004; Snow et al., 1987), combine them with eye contact or give them in response to their caregiver's expressions (Dawson, Hill, Spencer, Galpert, & Watson, 1990). While showing the same frequency of laughter, they laugh less in response to social situations, and they share their laughter less with others (Reddy, Williams, & Vaughan, 2002). Their expressiveness is particularly lacking in unstructured situations, e.g., when the caregiver does not initiate the interaction (Kasari, Sigman, & Yirmiya, 1993). These findings are in contrast with the behaviour of MR children who typically show positive affect in anticipation of social interactions.

Evidence on emotional expressiveness in young infants with HFASD is unclear, but studies on older children generally indicate adequate expressive behaviour. Children and adolescents with HFASD do not differ from MA-matched controls in their ability to verbally express emotions (Jaedicke, Storoschuk, & Lord, 1994), and preadolescent (i.e., aged 9–12 years) children with HFASD were even found to express more positive affect than MA-matched control children (Capps et al., 1993). They are also able to report examples

of feeling states based on their own experience (Yirmiya, Sigman, Kasari, & Mundy, 1992), and show attachment behaviour (Gernsbacher et al., 2005; Rutgers, Bakermans-Kranenburg, van Ijzendoorn, & Berckelaer-Onnes, 2004).

However, more detailed studies suggest that autistic individuals process emotional experiences differently from non-autistic individuals. Autistic adults find it harder than controls to differentiate between emotions and describe their feelings (Hill, Berthoz, & Frith, 2004). This is sometimes referred to as alexithymia. A recent study of such 'alexithymic' traits showed that ten year old children with HFASD are generally less aware of their own emotions. They more often claimed not to feel an emotion and were less able to generate emotionally charged situations from their own experience (Rieffe, Meerum Terwogt, & Kotronopoulou, 2007). In short, children with ASD show similar elementary expressiveness and experiences, but may differ from typically developing children in both the inter- and intrapersonal integration of their emotions.

In conclusion, the early expressiveness and socialization of expressions that can be seen in typically developing children are delayed in MR children. During infancy their expressiveness is limited, but MR children show adequate affect during preschool years, and seem to acknowledge the social function of their expressive behaviour. The development of emotional expressiveness in ASD seems to show a reversed pattern compared to MR children. Infants with ASD are generally equally expressive as controls. Deviations become apparent in older children with MRASD, in particular with respect to the spontaneity of expressions and their social orientation. A remarkable lack of evidence for deviant expressiveness in HFASD children may be related to the structured context and the higher ages at which they were tested, but could also indicate basic expressive skills in these children. Thus, empirical evidence found for the influence of age, intelligence and context factors on the level of emotional expressiveness in children and adolescents with ASD refines the marked impairments of emotional expressive behaviour that are suggested in the diagnostic manuals. Infants with MRASD are difficult to distinguish from their typically developing peers, but later in development, poor spontaneity and social awareness of emotional expressiveness are featured in children and adolescents with MRASD. Children with HFASD show remarkable adequate emotional expressive skills. However, these data were generally obtained under laboratory conditions, and may present an overly positive perspective on emotion expressive skills of children with HFASD under natural conditions.

Perceiving faces and emotions

Impairments in the perception of emotions are not explicitly stated in the diagnostic criteria for autistic disorder. However, a limited ability to perceive faces and emotions can readily explain the DSM-IV criteria related to impaired emotional competence. Information about other people's emotional states can be found in their faces, voices, postures or gestures and all cross modal interactions between these forms of expression (Ekman & Friesen, 1975). However, to date most studies have focused on facial expressions, presumably because facial expressions are easily studied. Below, the perception of faces and the perception of emotions are discussed separately.

Typically developing neonates have a strong preference for human faces over other stimuli and recognize qualitative differences in facial expressions directly after birth (Bushnell, Sai, & Mullin, 1989). Their ability to perceive faces and emotions improves rapidly

during early infancy, followed by a more gradual improvement into adolescence (Pascalis, de Haan, & Nelson, 2002). Thus, typically developing infants are attentive to facial expressions and recognize them very early in life.

Mentally retarded adolescents perform equivalent to MA-matched controls when remembering faces (Dobson & Rust, 1994) or perceiving human bodily movements (Moore, Hobson, & Anderson, 1995). Their perception of emotion is generally found intact, but when tasks make higher demands on information processing capacities, such as attention, abstraction and memory, MR individuals deteriorate relative to MA and CA equivalent controls. However, this decline in performance is not specific to emotion perception abilities (Moore, 2001). Compared to MA-matched controls, school aged children with Down's syndrome have shown specific difficulties in recognizing fear (Williams, Wishart, Pitcairn, & Willis, 2005) or anger expressions (Kasari, Freeman, & Hughes, 2001). This may be related to the finding that mothers of children with Down's syndrome often confine their conversation about emotions with their children to 'simple' and non-threatening feelings such as happiness and sadness (Tingley, Gleason, & Hooshyar, 1994).

Evidence for face recognition deficits in children with MRASD is conflicting. One-year-old children, later diagnosed with ASD, look less at faces and people (Osterling, Dawson, & Munson, 2002; Palomo et al., 2006), and at 3–4 years, children with MRASD are less attracted to human faces compared to both MA- and CA-matched controls (Dawson et al., 2002). School aged children with MRASD are less capable than MA-matched control children to recognize (Boucher, Lewis, & Collis, 1998), identify and remember faces. In contrast to MR children, the inability of MRASD children to recognize faces is not related to nonverbal or verbal deficits (Boucher & Lewis, 1992; Hauck, Fein, Maltby, Waterhouse, & Feinstein, 1998; Klin et al., 1999; Teunisse & de Gelder, 1994). Moreover, various studies with older participants show adequate facial identification by (pre) adolescents with MRASD compared to MA- and CA-matched controls (Celani, Battacchi, & Arcidiacono, 1999; Volkmar, Sparrow, Rende, & Cohen, 1989).

Explanations for abnormal strategies for encoding and representing faces in MRASD highlight their equal, and sometimes even superior ability to identify inverted faces (Tantam, Monaghan, Nicholson, & Stirling, 1989; Teunisse & de Gelder, 2003), which is usually interpreted as a sign of their fragmented perceptive style. The idea is that they are hardly confused by the inverted face because, unlike typically developing children, they focus on small fragments that are recognized equally easy as when presented upright. However, this interpretation is still open to discussion (Jemel, Mottron, & Dawson, 2006; Lopez, Donnelly, Hadwin, & Leekam, 2004).

The 'marked impairments in the use (...) of facial expression' in the diagnostic criteria of the autistic disorder (APA, 1995, p. 72), do not imply that children with MRASD are 'blind' to emotional expressions. Indeed, empirical findings show an inconsistent combination of competences and impairments. At school age, children with MRASD recognize emotions in faces, distinguish between different emotions, and are interested in realistic, moving images of emotions (Castelli, 2005; Davies, Bishop, Manstead, & Tantam, 1994; Ozonoff, Pennington, & Rogers, 1990; Prior, Dahlstrom, & Squires, 1990). Moreover, just like their typically developing peers, they attend to negative emotional expressions more than to neutral expressions (Corona, Dissanayake, Arbelle, Wellington, & Sigman, 1998). Still, despite these abilities, they are also found to be less adequate at matching and categorizing faces on the basis of expressions (Braverman, Fein, Lucci, & Waterhouse, 1989; Celani et al., 1999) or across different modes (gestured, vocal or facial) of expression

(Hobson, 1986a, 1986b; Hobson, Ouston, & Lee, 1988), and show less attention to negative emotions than control children (Sigman, Kasari, Kwon, & Yirmiya, 1992). Impairments are not confined to visual stimuli. While being able to perceive vocal information and name vocally expressed emotions, school aged children with MRASD, relative to MA-matched controls, show a poor ability to match vocally and facially expressed emotions. This could reflect an impaired ability to integrate cross-modal facial and vocal information (Boucher, Lewis, & Collis, 2000). Different levels at which scientific tests tap into these integrative abilities and resemble natural conditions may partly explain the inconsistency of the above described findings.

Compared to CA matched typically developing controls, individuals with HFASD show face perception deficits on various accounts. At school age, their perception of facial identity is impaired (Davies et al., 1994), and adolescents and adults with HFASD show a poor memory for faces, but not for non-facial stimuli like buildings (Blair, Frith, Smith, Abell, & Cipolotti, 2002). The finding that impairments are specific to facial stimuli suggests that these differences are not attributable to verbal impairments.

Like those with MRASD, the perceptive style of children with HFASD is often characterized by a focus on discrete details. They often fail to integrate separate pieces of facial information into a coherent entity, i.e., by integrating separate stimuli into a complex emotional expression. This enhanced local and impaired global style of processing information is referred to as weak central coherence (Happé & Frith, 2006). However, impairments of HFASD individuals in global processing have been disputed (Mottron, Dawson, Soulieres, Hubert, & Burack, 2006), and global processing of faces has been found in adolescents and adults with HFASD (Lahaie et al., 2006).

Specific perceptive differences are also suggested in the attention to different parts of the face. Typically developing (pre) adolescents attend more to faces in general (Schultz, 2005), to eye, nose and mouth regions (Dalton et al., 2005; Klin, Jones, Schultz, Volkmar, & Cohen, 2002b; Lindner & Rosen, 2006; Pelphrey et al., 2002), and to eyes relatively to mouths. In contrast, children with HFASD attend more to mouth than eye regions (Gross, 2004; Joseph & Tanaka, 2003; Klin et al., 2002b). Still, information from the eye region is not wholly ignored, as recent evidence showed that 10- to 15-year-old children with MR- and HFASD do take information from the eye region into account when judging facial expressions (Back, Ropar, & Mitchell, 2007).

Compared to CA matched typically developing control groups, some studies have shown deviations in the perception of simple emotional expressions of anger, happiness, sadness and fear in children with HFASD (Bolte & Poustka, 2003; Bormannkischkel, Vilsmeier, & Baude, 1995; Davies et al., 1994; Piggot et al., 2004). However, most studies fail to show any deficits at all in the perception of simple emotions by children with HFASD (Adolphs, Sears, & Piven, 2001; Capps, Yirmiya, & Sigman, 1992; Gross, 2004; Grossman, Klin, Carter, & Volkmar, 2000; Ozonoff et al., 1990; Prior et al., 1990; Robel et al., 2004; Travis & Sigman, 1998). Therefore, an unequivocal impairment in emotion perception of HFASD is difficult to determine.

The lack of consensus in studies on elementary perception of emotions has been attributed to different assessment methods employed (Hobson, 1991). However, individuals with HFASD show a recurring tendency to comply to task demands based on cognitive inference of adequate responses, rather than on their natural propensity (Capps et al., 1992; Gopnik, Capps, & Meltzoff, 1993; Klin, Jones, Schultz, Volkmar, & Cohen, 2002a; Klin et al., 2003; Losh & Capps, 2006). Because analysing and inferring required responses is

possible when explicit cues are presented in the task information, a danger exists that emotional competence in HFASD is overestimated when studies rely too heavily on data from explicit experimental tasks.

Despite the inconsistency of findings on global perceptive abilities, various studies do suggest consistent deviations in subtle perceptive abilities. For instance, (pre) adolescents with HFASD show poor perception of subliminally presented emotional expressions (Kamio, Wolf, & Fein, 2006), and take longer to respond to facial expressions (Piggot et al., 2004), which seem to trigger anxiety in them (Ashwin, Wheelwright, & Baron-Cohen, 2006). Deviations are especially apparent when only the eye regions or vocal cues are presented, or when emotional expressions are shown in combination with contrasting emotion words (Grossman et al., 2000). Another recurring finding is the impairment of children with HFASD to identify 'complex' emotions such as pride and jealousy, which is generally attributed to a poor understanding of subjective states (Alcantara, Weisblatt, Moore, & Bolton, 2004; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Gervais et al., 2004; Golan, Baron-Cohen, & Hill, 2006; Rutherford, Baron-Cohen, & Wheelwright, 2002).

Explanations for perceptive difficulties vary from cognitive to motivational and integrative abilities. Some studies suggest that HFASD children are sensitive to social or emotional cues in HFASD but misinterpret their meaning (Adolphs et al., 2001; Boucher et al., 2000; Dawson, Webb, & McPartland, 2005; van der Geest, Kemner, Camfferman, Verbaten, & van Engeland, 2002). Others imply shortcomings in HFASD children's automatic sensitivity to facial expressions or their intrinsic motivation to perceive emotions, and rather suggest that their cognitive assessment of emotions is basically intact (Begeer, Rieffe, Meerum Terwogt, & Stockmann, 2006; Behrmann, Thomas, & Humphreys, 2006; Wang, Dapretto, Hariri, Sigman, & Bookheimer, 2004). Despite these controversies, there is increasing agreement on the specific difficulties of these children to integrate information, for instance when vocal, facial, bodily and situational cues are presented simultaneously (Koning & Magill-Evans, 2001). This limited ability to integrate information has also been found when school aged children with HFASD process information on single faces. Their tendency to rely on specific features of a face rather than globally processing facial information has been found an important cause of their poor emotion recognition (Gross, 2005). Deviations in the processing of emotional cues from faces can thus follow from more general (facial) perceptual problems in ASD (Pelphrey et al., 2002; Sasson, 2006).

In short, typically developing children are perceptive of faces and emotions in early infancy and acknowledge the social value contained in them. Impairments in the perception of faces and emotions in mentally retarded children are generally confounded with their poor cognitive skills. Compared to their MA-matched counterparts, children with MRASD show poor recognition and memory for faces at early age, but seem to gain basic skills later in development, suggesting a delayed development in their elementary perception of faces and emotional expressions. Specific impairments are suggested in their integration of expressive information from different sources. Compared to CA-matched controls, children with HFASD show an adequate perception of simple emotions, which may, however, be the result of a different style of processing emotional information. The cognitive and motivational factors that underlie these differences is in strong need for further empirical evidence to demarcate the emotion perceptive impairments of children with ASD.

Responding to emotions of others

According to the DSM-IV, autistic disorders are defined by qualitative impairments in social interaction which may be manifested by impaired responsiveness to emotions in others. We should therefore expect to find empirical evidence for impairments in children with ASD on this domain. However, responding to others' emotions is a complex ability that strongly depends on social and cognitive skills that are highly confounded with age and intelligence.

Responding to other people's emotions plays a crucial role from the very beginning of life. New born babies can be observed imitating facial expressions within their first hour of life (Meltzoff & Prinz, 2002). A few weeks after being born, children start smiling in response to a human face, and at about three months of age, they generally smile at human faces (Lagattuta, 2005; Saarni, 1999). After about ten weeks they respond to angry, happy or sad faces with corresponding expressions. In contrast to newborn infants, 2-to-3 month-olds decrease their positive affect when an interaction partner becomes unresponsive (Bertin & Striano, 2006). Thus, within the first three months of life, children learn to tune their emotional expressions to responses of others.

Around their first year of life, children start to alter their behaviour based on emotional responses of others. For example, one-year-old children stay closer to their mothers when the latter show a fearful rather than a happy expression (Vaish & Striano, 2004), and in the beginning of their second year of life, they alter their approach of an object based on the emotional response of their caregiver (Moses, Baldwin, Rosicky, & Tidball, 2001). This 'shared attention' with another person towards a third party, which may be another object, event or person, is associated with positive affect in typically developing children (Jones, Collins, & Hong, 1991; Jones & Hong, 2005; Kasari et al., 1990).

Reciprocal or empathic responses to others' emotions are already present at birth, and gradually become more frequent and complex during infancy. Young infants respond to distress in others by showing personal distress, but are not likely to act toward the distressed person. Toddlers and preschoolers can be seen to try to actively manipulate the emotions of others, by showing comforting (Roth-Hanania, Busch-Rossnagel, & Higgins-D'Alessandro, 2000; Zahnwaxler, Emde, & Robinson, 1992), or teasing behaviour (Jackson & Tisak, 2001).

Mentally retarded children, in particular children with Down syndrome, are known for their high degree of social responsiveness (Ruskin, Kasari, Mundy, & Sigman, 1994). Compared to MA-matched controls, MR toddlers and preschoolers are equally attentive to other people (Baranek, 1999; Osterling et al., 2002), and to others' faces and show positive affect when engaging with others (Kasari, Freeman, Mundy, & Sigman, 1995). They respond to distress in others by showing concern and offering comfort (Sigman et al., 1992), and their physiological reactions to distress in others are similar to MA-matched controls (Corona et al., 1998). While thus performing relatively adequate in real-life situations, their understanding of emotional responding is poor, and presumably associated with their mental retardation and impaired pragmatic language abilities in natural situations (Kasari, Freeman, & Bass, 2003).

Structured observations of video recording of behaviour during the first year of life of infants later diagnosed as ASD (with mixed IQs) indicate that they are less oriented to others in their affective behaviour and are less attentive to faces than control infants, both with and without mental retardation (Baranek, 1999; Maestro et al., 2002, 2005; Osterling

et al., 2002; Palomo et al., 2006; Werner, Dawson, Osterling, & Dinno, 2000), though toddlers with ASD are sensitive to eye movement (Chawarska, Klin, & Volkmar, 2003). A bit later, at around two to five years of age, it appears that shared attention and language are hardly apparent in children with ASD (Mundy, Sigman, & Kasari, 1990; Travis, Sigman, & Ruskin, 2001; Warreyn, Roeyers, & De Groote, 2005). At preschool age, children with MRASD show poor emotional coordination and timing of affect during social exchanges compared to MA- and CA-matched controls (Scambler, Hepburn, Rutherford, Wehner, & Rogers, 2007), and show a limited ability to modify their emotional reactions in response to others (Konstantareas & Stewart, 2006). At school age, they respond to emotional expressions with less concern and comforting behaviour and generally share affect less often with others (Corona et al., 1998; Dawson et al., 2004; Kasari et al., 1990; Sigman et al., 1992). Prompting increases their attention to faces (Sigman & Ruskin, 1999), but does not increase their comforting behaviour (Bacon, Fein, Morris, Waterhouse, & Allen, 1998). This strongly reduced responsiveness to others' emotions has been shown to be stable over a 5-year period (Dissanayake et al., 1996).

Evidence for an impaired physiological basis to respond to emotions in MRASD is not straightforward. At school age their arousal in response to pictures of distress in others, measured with heart rate or skin conductance responses, is similar to CA- and MA-matched controls (Blair, 1999), but preadolescents with MRASD show less arousal in response to another persons eye gaze (Kylliainen & Hietanen, 2006), or distress (Corona et al., 1998).

School aged children with HFASD have been shown to possess various separate skills that are required in emotional responsive behaviour. They are able to name others' emotions, respond to emotional displays and take others' perspective (Capps et al., 1992; Peterson, Wellman, & Liu, 2005). Indeed, when given directions, they do respond appropriately to others' emotions. Their pro-social responses to a distressed interaction partner increased when they were prompted by a third person's reactions towards the distressed partner (Bacon et al., 1998; Loveland & Tunali, 1991). However, they fail to activate these skills on their own account, and compared to MA- and CA-matched controls their verbal responses to emotions of others are less empathic, i.e., in congruence with the emotions displayed by someone else (Capps et al., 1993; Doussard-Roosevelt, Joe, Bazhenova, & Porges, 2003; Yirmiya et al., 1992). This poor responsiveness to others' emotional states is also found in adults with HFASD, though HFASD participants with above average IQs ($M = 120$) showed adequate abilities to infer feelings of others in real life interactions (Ponnet, Buysse, Roeyers, & De Corte, 2005; Ponnet, Roeyers, Buysse, De Clercq, & Van der Heyden, 2004).

Some studies have found evidence for reflex or physiological bases of the impaired ability to respond to emotions in HFASD. For instance, adults with HFASD do not automatically mimic facial expressions the way their CA-matched controls do (McIntosh, Reichmann-Decker, Winkielman, & Wilbarger, 2006), while this capacity can already be observed in typically developing new born babies (Meltzoff & Prinz, 2002). Furthermore, school aged children with HFASD show lower heart rates than typically developing controls in response to others' emotions (Corona et al., 1998). However, impaired emotional responsiveness is not confirmed in skin conductance measures of preadolescents with HFASD (Ben Shalom et al., 2006), or eye-blink magnitude (Bernier, Dawson, Panagiotides & Webb, 2005).

To summarize, typically developing children automatically respond to emotions and use these responses in their interactions with others from early infancy. Although poten-

tially impaired compared to CA-matched controls, mentally retarded children are generally equally sensitive to emotions in others compared to MA-matched controls. Similar to MRASD, children with HFASD are responsive to others' emotions, but compared to CA-matched typically developing children, their responses are less empathically adequate. Measuring physiological responses seems a promising way to examine automatic responding to emotions, but results so far have not indicated cohesive impairments in ASD.

The above findings confirm the general impairments stated in the diagnostic literature with regard to emotional sharing and emotional reciprocity. However, age, IQ, motivation and the explicitness of task demands improve the performance of children with ASD. It seems particularly important to stress whether responses are based on isolated explicit requests in structured situations, which is generally the case in empirical research, or informants' observations of spontaneous behaviour in unstructured situations, as generally relied on in diagnostic assessment procedures.

Understanding simple and complex emotions

While the DSM-IV criteria focus on behaviour rather than cognition, related assessment tools such as the ADI-R (Rutter et al., 2003) or the ADOS (Lord et al., 2000) strongly rely on children's abilities to describe and explain emotions. This can be problematic, because children's adequate understanding of emotions thus decreases the likelihood of an ASD diagnosis. Recent years have seen a vast increase in studies on the understanding of emotions in ASD.

Signs of understanding emotions can be seen in the first two years of typical development. As early as nine months of age, typically developing infants have been found to relate other people's emotional expressions to other people's actions (Barna & Legerstee, 2005), and when they start talking they generally also start to comment on their own and others' emotions (Wellman, Harris, Banerjee, & Sinclair, 1995). At three years of age, children primarily connect emotions to external causes: they understand that a present generally evokes happiness, and the death of a pet will make you sad. From this age on, they increasingly distinguish between different emotions. Negative experiences are generally "bad" according to 2-year-olds, but older preschoolers can differentiate between being "sad" and "angry", and acknowledge that it is possible to have two emotions simultaneously (Rieffe, Meerum Terwogt, & Cowan, 2005).

The development of the understanding of emotions is closely related the development of two cognitive skills: imagination and Theory of Mind (ToM). Imagining others' emotions (e.g., attributing emotions to a doll) can be observed in children's play around their second year of life. From the second year onwards, imagination can cause intense emotions (Harris, 2000; Harris, Brown, Marriott, Whittall, & Harmer, 1991). The capacity of 2- to 3-year-olds to carry out imaginative games of pretence is indicative of their ability to comprehend that others have wishes, beliefs and feelings much as they have themselves (Harris, 1989).

The knowledge that emotions are not just connected to objective situations, but to a person's representations of these situations is a major advancement during preschool years (Cutting & Dunn, 1999; Wellman, Phillips, & Rodriguez, 2000). The understanding of representations, or mental states, in oneself and others, is commonly referred to as ToM knowledge, i.e., the ability to attribute mental states such as emotions, intentions, desires

and beliefs to yourself or to other individuals (Baron-Cohen, Tager-Flusberg, & Cohen, 1993; Leslie, 1987). Starting at around 18 months, typically developing children become knowledgeable about the connection between desires and emotions (Lagattuta, 2005; Repacholi & Gopnik, 1997; Wellman et al., 2000), while the link between beliefs and emotions is generally acknowledged at 5 years old (Rieffe et al., 2005).

ToM knowledge is particularly linked to the understanding of 'complex' emotions including surprise, embarrassment, shame, guilt and pride. These emotions all involve the appraisal of others' thoughts. The understanding of complex emotions can not be seen before children are about age four when knowledge of mental states is acquired. Typically developing children fully use and understand social emotions when they are about 10–12 years old (Draghi-Lorenz, Reddy, & Costall, 2001; Frith, 2003; Gilbert, 2004; Mills, 2005; Saarni, 1999; Tracy, Robins, & Lagattuta, 2005).

At school age, MR children generally label emotional expressions or match them with each other or with descriptions of situations. However, as soon as tasks include more distracting or ambiguous stimuli, they fall behind MA-matched controls (Moore, 2001). Unlike their cognitive abilities, their recognition of emotions does not improve during preschool years, suggesting early developmental delays (Kasari et al., 2001). Specific difficulties are found in the understanding of surprise and fear of school aged children with Down's syndrome (Williams et al., 2005; Wishart & Pitcairn, 2000). MR children and adolescents show a poor understanding of mental states, but MR adults perform similar to MA-matched controls (Charman, Campbell, & Edwards, 1998). While thus showing an elementary understanding of emotions, their cognitive impairments prevent a deeper understanding of emotions.

When asked explicit questions about emotions, from around 10 years old children with MRASD and MA-matched controls show a similar understanding of simple emotions in prototypical situations, e.g., 'birthdays' or 'hurting yourself', or desires, e.g., '(not) getting what you want' (Baron-Cohen, 1991; Fein, Lucci, Braverman, & Waterhouse, 1992). While surprisingly little is known about the link between imagination and emotional competence in children with MRASD, their impairments in ToM development are well documented. They show pervasive problems in their understanding of desires, thoughts and beliefs (Baron-Cohen, 2000; Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998). In the light of these findings, it is unsurprising that emotions caused by desires and beliefs, e.g., being angry because you *believe* or *want* something, are poorly understood in school aged children with MRASD (Baron-Cohen, 1991; Serra, Loth, van Geert, Hurkens, & Minderaa, 2002). A poor concern for others' mental states is also reflected in the use of complex emotions in preschoolers with MRASD, who showed pride in similar situations as typically developing children, e.g. when mastering a new skill, but failed to monitor the reaction of their audience, thereby passing over the social function of pride (Kasari, Sigman, Baumgartner, & Stipek, 1993).

As can be expected, children and adolescents with HFASD show various signs of a basic understanding of emotions. At school age, they recognize emotional expressions, name emotions, understand emotion related contexts and causes, and even refer to complex emotions such as pride or embarrassment at equal rates as their typically developing peers (Capps, Sigman, & Yirmiya, 1995; Capps et al., 1992; Davies et al., 1994; Downs & Smith, 2004; Peterson et al., 2005). Furthermore, they acknowledge that emotional states in others influence their behaviour (Begeer, Meerum Terwogt, Rieffe, Stegge, & Koot, 2007). Beyond the understanding of simple emotions, school aged children with HFASD

show difficulty acknowledging multiple or mixed emotions, particularly within the negative spectrum, i.e., feeling angry and sad simultaneously (Rieffe et al., 2007). They particularly distinguish themselves from CA-matched controls by their lack of spontaneity and the peculiar nature of their comments on emotions, which have been characterized in different studies as materialistic, idiosyncratic, including less references to social causes (Baron-Cohen, 1991; Dennis, Lockyer, & Lazenby, 2000; Jaedicke et al., 1994; Losh & Capps, 2006; Rieffe, Meerum Terwogt, & Stockmann, 2000; Rieffe et al., 2007), superficial or scripted (Adams, Green, Gilchrist, & Cox, 2002; Hale & Tager-Flusberg, 2005), dependent on explicit context information (Begeer et al., 2007) and uninformative or lacking in pragmatics (Beversdorf et al., 1998; Hadwin, Baron-Cohen, Howlin, & Hill, 1997).

While children with HFASD show a delayed development of ToM knowledge, their abilities do improve over time and they generally acknowledge others' mental states when they reach pre-adolescence (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Bauminger & Kasari, 1999; Bowler, 1992; Dahlgren & Trillingsgaard, 1996; Happé, 1995; Steele, Joseph, & Tager-Flusberg, 2003). However, their understanding of complex emotions like shame, embarrassment or jealousy is poor, which may be related to impaired imagination and ToM skills. After all, a child may feel hurt or sad when falling down, but will only feel embarrassed when it imagines what somebody else thinks about the event. Children with HFASD generally fail to imagine the content of others' mental states on reality, and consequently fail to explain how complex emotions arise from these mental states (Bauminger, 2004; Buitelaar & van der Wees, 1997; Buitelaar, van der Wees, Swaab-Barneveld, & van der Gaag, 1999a). Interestingly, they may be able to explain the impact of an audience's perspective on their own actions when they are asked about it explicitly, but do not spontaneously mention such audience effects when explaining self-conscious emotions (Baron-Cohen, Spitz, & Cross, 1993; Bauminger, 2002; Heerey, Keltner, & Capps, 2003; Hillier & Allinson, 2002). These findings suggest a poor concern for others' perspectives in children with HFASD, but also a poor ability to generalize the demonstrated knowledge of mental states to explanations of specific situations. In a similar way, children with HFASD are capable of explaining emotional display rules on a conceptual level, but fail to apply their knowledge when explaining specific situations. The sequence of the development of display rules in children with HFASD suggest strong reliance on rote solutions (Dennis et al., 2000; Peterson et al., 2005).

The cognitive skills of children with HFASD aid their performance on tests of emotion understanding. Correlations between measures of IQ and emotional competence have been found in children with MRASD and HFASD (Bolte & Poustka, 2003; Davies et al., 1994; Happé, 1995; Kamio et al., 2006; Kasari, Chamberlain, & Bauminger, 2001a; Pelphrey, Morris, McCarthy, & Labar, 2005; Yirmiya et al., 1992), and are rarely found in typically developing children (Dawson et al., 1990; Kasari et al., 1993). Verbal competence seems more influential in the success of children with ASD on emotional tasks below a certain threshold (Happé, 1995), while above this threshold, nonverbal competence seems to play a more important role (Buitelaar, van der Wees, Swaab-Barneveld, & van der Gaag, 1999b).

In conclusion, typically developing children's understanding of situational causes and consequences of emotions increases rapidly during preschool years. Their understanding of subjective aspects of emotions develops alongside their imagination and ToM abilities. The delay in MR children's understanding of emotions does not extend beyond their cognitive impairments. Compared to MA-matched controls, MR children and adults show a

relatively adequate understanding of emotions. In contrast, children with MRASD clearly differ from controls matched on their MA. They fail to show an understanding of emotions beyond the simple acknowledgement of prototypical causes, and their impairments seem related to their poor imagination and ToM skills. Where typically developing children with low and high IQs may gain a better understanding of emotions through experience, children with MRASD show little progress during the preschool years. Individuals with HFASD provide atypical, theoretical responses to emotions and their emotional understanding is correlated to their cognitive skills. This suggests that they infer responses to emotions from verbal and conceptual information rather than personal experience (Capps et al., 1992; Frith, 2004; Kasari et al., 2001; Lindner & Rosen, 2006). To improve diagnostic procedures of children with HFASD in particular, a strong focus on the analysis of the reasoning process that results in children's responses about emotions is necessary.

Conclusions and recommendations

Summarized findings

Children with ASD are diagnosed according to criteria that specify impaired emotional competence. Therefore, one might expect confirmation for these impairments based on empirical investigations of the emotional competence in these children. With the danger of oversimplifying the wide variety of findings, confirmation for impaired emotional competence in ASD seems highly dependent on age, context and intelligence. These factors are presented in Table 1 by differentiating between research findings on children versus adolescents, laboratory versus natural context, and MRASD versus HFASD.

In 1943, Leo Kanner emphasized the lack of affective contact with people in children with ASD. In typical development, the evidence for innate affective abilities is indeed overwhelming. Newborn babies display, perceive and respond to a range of emotions. Early signs of understanding emotions can be observed within their second year of life. In a similar way, MR children function on a par with MA matched typically developing controls, suggesting that the impact of mental retardation on elementary emotional competence does not extend beyond a developmental delay. Surprisingly, signs of elementary emotional skills are also found in children with ASD, as can be seen in Table 1. Both children with MRASD and HFASD adequately express simple emotions, attend to faces, perceive facial expressions, and at school age they respond to others' emotions and understand situational causes of simple emotions at equal rates as MA-matched controls. Therefore, in anticipation of future research, it can be concluded that innate affective abilities are not wholly absent in ASD.

However, the above findings are generally found in laboratory studies. This is unfortunate, because the full definition of emotional competence entails the ability to spontaneously regulate natural social interactions by exchanging emotions in accordance with the requirements of the situation (Saarni, 1999). Typically developing young infants show an astonishing ability to use emotions in their social functioning, even during their first half year of life. They can modify their emotional expressions based on social contexts, monitor others' responses on their affective displays and imitate others' emotional expressions. Again, impairments of MR infants in this respect seem to be strongly determined by their cognitive abilities. In contrast, despite their basic emotional skills, infants with

Table 1
Tentative diagnostic criteria for emotional competence in children and adolescents with MRASD and HFASD

Domain	Age	Context	MRASD[c]	HFASD[d]
Expression	Child[a]	Laboratory	*Adequate* nonverbal expressiveness	*Adequate* verbal and nonverbal expressiveness
		Natural	*Adequate* expressiveness during social interactions; *Impaired* sharing and social awareness of expressions, which deteriorates in unstructured situations	*Adequate* verbal and nonverbal expressiveness
	Adolescent[b]	Laboratory	*Adequate* identification of inverted faces; *impaired* nonverbal expressiveness	*Adequate* verbal and nonverbal expressiveness
		Natural	*Impaired* expressiveness and spontaneity; strong dependence on others' initiatives	Unknown
Perception	Child	Laboratory	*Conflicting* evidence for impaired face recognition, fragmented processing of facial information and recognition of simple emotions; *impaired* integration of emotions in social context and of facial, vocal and gestured emotions	*Adequately* attentive and perceptive of faces and simple emotions; *conflicting* evidence for fragmented perceptive style; *impaired* perception of obscured simple emotions, complex emotions, motivation and Theory of Mind skills
		Natural	*Impaired* attending and recognizing of faces and emotions	*Adequate* perception of simple emotions
	Adolescent	Laboratory	*Adequate* identification of and memory for faces; *conflicting* evidence for perception of emotions; *superior* perception of inverted faces; cognitively inferred responses; *impaired* perception of emotions in voices	*Adequate* perception of simple emotions; *conflicting* evidence for global perceptive style of facial and emotional information; *impaired* integrative abilities, speed of processing and perception of complex emotions
		Natural	Unknown	Unknown
Responding	Child	Laboratory	*Impaired* responsiveness to others' emotions; *conflicting* evidence for physiological responses to others' emotions	*Adequate* elementary responsiveness to others' emotions; *impaired* empathical accurateness
		Natural	*Impaired* coordination and accurateness of responses to others' emotions	*Impaired* spontaneous empathic responses.
	Adolescent	Laboratory	*Impaired* physiological responses to others' emotions	*Adequate* responses to isolated explicit requests; *impaired* spontaneity of responses in unstructured situations and physiological responses to others' emotions
		Natural	Unknown	*Impaired* spontaneous empathic responses

Understanding	Child	Laboratory	*Adequate* understanding of simple emotions; *impaired* explanations of emotions, and understanding of complex and belief based emotions; correlations between cognitive abilities and emotional understanding	*Adequate* recognition, labelling, and explanations of simple emotions and emotional display rules; scripted, superficial and idiosyncratic explanations; *impaired* understanding of complex, multiple or mixed emotions and impaired spontaneity of explanations; correlations between cognitive abilities and emotional understanding
		Natural	*Impaired* understanding of social context of complex emotions	Unknown
	Adolescent	Laboratory	*Adequate* understanding of situational causes of simple emotions and emotional display rules, *impaired* understanding of complex and belief based emotions	*Adequate* reference to complex emotions; scripted accounts of own emotional experiences; *impaired* understanding of social aspects of complex emotions
		Natural	Unknown	Unknown

[a] 0–12 years.
[b] 12–21 years.
[c] Mentally retarded autism spectrum disorders.
[d] High functioning autism spectrum disorders.

MRASD miss this early susceptibility to social cues in their emotional development, even when compared to MA-matched controls. At school age, when they become more involved in unstructured social situations, their inability to use emotions to their own social advantage becomes particularly striking. Their expressiveness is not socially oriented, they fail to integrate emotional information in complex social contexts, strongly depend on others to structure their social exchanges, display remarkable poor responsiveness to others' emotions and their limited awareness of mental states prevents a more advanced understanding of emotions. While diagnostic criteria emphasize that ASD are related to emotional impairments in a social context, many empirical studies have measured single, elementary emotional skills in children with ASD. This partly explains the adequate performances of children with ASD on laboratory studies that focus on specific elementary skills, in contrast with their poor performances in a natural context, as can be seen in Table 1.

Children with HFASD seem to acquire many skills that are absent in children with MRASD. Around 10–13 years of age, slightly later than typically developing children, children with HFASD show emotion recognition and responding skills, shared attention and imaginative abilities, are able to reason about emotional aspects of daily life, acknowledge others' subjective states, and are even able to reflect on complex emotions. At first glance, these findings suggest developmental delay rather than fundamental disabilities in HFASD. However, on second glance, the skills gained by children with HFASD seem foremost present on an abstract level, measured in contexts where explicit cues are provided, e.g., selecting pictures of facial expressions, naming emotions, or responding to explicit expressions of emotions. This need for an explicit context may be explained by the different process by which children with HFASD arrive at their adequate, though abstract responses to emotions compared to typically developing children. Their responses are guided by a relatively late-acquired, explicit understanding of emotions, which is highly dependent on intellectual abilities, and especially useful in the psychological laboratory where low pace, absence of time pressure, clear verbal instructions and explicit cues present an ideal situation for cognitive-based responses.

Despite the impressive abilities of individuals with HFASD to infer adequate responses to emotions, their analytic skills are usually insufficient to ensure adequate behaviour in a natural context. Besides the obvious fact that diagnosticians classify the behaviour of these children as autistic, this suggestion also emerges from empirical studies that extend their focus to children's functioning in complex real life situations. Here, strong deviations were shown in children with HFASD on variables like reaction time to emotion stimuli and coordination of spontaneous responses. Studying the emotional competence of HFASD in a natural context is time and cost consuming, but may be the only way to illuminate the subtle impairments that deregulate the everyday life functioning of these children. Currently, natural behaviour has been significantly neglected in empirical research, in particular in HFASD adolescents.

General outcomes and limitations of empirical findings

Several general outcomes can be seen in the summarized empirical findings on emotional competence in ASD. First, they seem to be in command of adequate elementary responses in the domains of emotion expression, perception, responses and understanding emotions. Moreover, to date, physiological measures failed to find strong evidence for

cohesive emotional impairments in children with ASD. It could be speculated that we currently lack evidence for a 'primary' emotional impairment in ASD: these children seem to at least possess a potential for emotional responses. More consistent are findings indicating that these children fail to show emotional *competence*: they fail to regulate their social interactions by exchanging their emotions in accordance with the requirements of the situation (Saarni, 1999). If further evidence is found for intact elementary emotional responses in non-social situations, but impaired emotional responses in social situations, this provides an important qualification for the nature of the emotional impairments in autism. Second, while elementary skills are available to children with ASD, poor integration of these skills has repeatedly been denominated as a bottleneck in their daily emotional functioning. Their failure to integrate separate abilities has been attributed to cognitive and motivational factors, but also to the explicitness of environmental cues. Longitudinal studies on homogeneous samples might untie these intertwining factors.

Despite these suggestions, the current empirical studies on ASD are generally cross sectional and primarily focus on school aged children with normal IQs. The possibility to establish early reliable diagnoses of ASD increasingly allows for longitudinal analyses of developmental differences in autism, which is, after all, defined as a disorder of development. This may shed more light on the underlying processes of emotional competence in ASD. The onset of the currently suggested cumulative integrative problems may be detected at specific ages. More specifically, the development of reasoning skills could be tracked in children with HFASD to elucidate the pivotal influence of cognitive compensation skills in their emotional development. Only the systematic investigation of children's functioning from infancy to adulthood will provide the normative information on children's development that is required to improve diagnostic and treatment decisions.

Incorporation of empirical findings in diagnostic guidelines

Empirical findings have yet to explain the enigma of emotional competence in autism. Still, it would seem unfortunate if the empirical findings available to date would not be incorporated in diagnostic guidelines of the emotional competence of children with ASD. Such improvements are possible by focusing on specific diagnostic information, in addition to the DSM criteria, but also by reformulating some of the current DSM criteria.

First, the DSM does not provide enough information to form homogeneous clinical samples. This problem may be solved by additional diagnostic research on three accounts. First, a systematic account of the severity of autistic symptomatology can be obtained by employing standardized diagnostic instruments that focus on both direct and parental observation of the child's natural behaviour, e.g., by combining the ADOS-G and the ADI-R (Risi et al., 2006). This severity may even be determined separately for the three behavioural domains of social interaction, communication and restricted interests and activities. In the general population low intercorrelation is found for this triad of autistic impairments (Happé, Ronald, & Plomin, 2006). By definition, children with ASD show deficits in all three domains. Still, specific accounts on the level of functioning within each domain further clarifies the structure of their impairments. Second, it would be informative to divide children with ASD according to their adaptive social and communication functioning following the Wing and Gould classification of active-but-odd, passive or aloof subtypes (Wing & Gould, 1979). This classification provides information about

the amount of social input that is sought and encountered by a child, which is a substantial influence on the development of emotional competence, in particular in children with HFASD (Beglinger & Smith, 2001). Third, the clear impact of intelligence on a defining diagnostic feature such as emotional competence gives ground to arguing for a differentiation between diagnostic categories of mentally retarded ASD and normally intelligent ASD. This would include an addition that is comparable to the current criteria for Asperger's syndrome which specify no delays in cognitive or language development, thus coinciding with normal IQ (Meyer & Minshew, 2002).

During the two decades of scientific study covered by this review, the core diagnostic criteria for autism have changed very little (APA, 1987, 1995, 2000). Adaptations could be suggested to more specifically capture emotional impairments of ASD. A main addition would be to differentiate between spontaneous and scripted behaviour. While the DSM does specify the absence of 'spontaneous (...) social and emotional reciprocity' (APA, 1995, p. 72), it includes no information on the required context of this behaviour or the presence of scripted or conceptual emotional responses. This issue is applied in the ADOS, which deliberately varies social pressure in order to demonstrate a possible lack of spontaneous sharing of emotion and engagement (Lord et al., 2000). In a similar way, the DSM could specify whether the diagnostic criteria apply under natural or structured conditions. This could hypothetically be formulated as 'spontaneous social and emotional reciprocity is lacking, but reciprocal responses appear under structured situations which allow for scripted responses'. This addition is important to diagnosticians who may be misled by the cognitive compensation skills of children with HFASD. Furthermore, a possible future differentiation between emotional deficits in social and non-social contexts and our understanding of the developmental pathways of emotional competence in specific subgroups may in time result in a further specification for the criteria related to emotional competence in the DSM.

Gaining more specific information on the influence of age, intelligence, context, severity of autism and diagnostic subtype of autism is a clear goal for future research aimed to enhance our understanding of emotional competences of children with ASD. This advanced understanding should in time be incorporated in the diagnostic assessment of children with ASD.

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