Social and emotional skills and understanding of children with autism spectrum disorders

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Introduction

Most introductions on autism, including the current one, start in the early 1940's, when Leo Kanner and Hans Asperger, independently of each other, provided the first descriptions of this disorder. However, accounts of 'autistic' features throughout history suggest that autism is not a modern phenomenon. A well documented historical case study from the year 1746, describes an adult man as suffering from 'silent madness'. His features meet the contemporary criteria of autism (Houston & Frith, 2000). The first recognition of an autistic child in a clinical setting dates from 1799, when John Haslam, a British apothecary, described a five-year-old boy, who did not speak until after his fourth year, who did not join other children in play, but rather played on his own with his tin soldiers, who exhibited a-typical pragmatics and spoke about himself in the third person. A paper published in the Journal für Kinderkrankheiten in 1846, still a century before Kanner and Asperger, includes a description of a group of children that resembled autistic features. These children were described as good-looking, but restless and sensitive, easily agitated, rarely learning to speak, focused on themselves, seemingly deaf, and showing little attention to their surroundings (Woolward, 1846). At the time, there was no concept of autism, so these autistic features could not be recognized as a belonging to a single syndrome. Still, they were apparent enough to be documented in a clinical journal (Baartman, 1984).

Presently, it is generally agreed upon that children with autism spectrum disorders (ASD) are characterised by abnormalities in three broad problem domains: interacting with other people, verbal and nonverbal communication, and flexibility in thought and action, all present from early childhood (Wing, 1988; American Psychiatric Association, 1994). The impairments of children with autism are particularly evident during social interactions, which will be confirmed by anyone who has been in close contact with an autistic child. He or she (but usually he) may tell you about dinosaurs for hours on end, failing to see the boredom on your face, or become extremely upset by a small change in the position of the furniture. The same child will probably not be interested at all in your view on dinosaurs, and the departure of a loved one may leave him unaffected. The a-typical use and knowledge of emotions in social interactions is a notable feature of children with autism, and will be the topic of the present thesis.

In this chapter, an overview is presented of social-emotional competence of high functioning children with autism. This overview provides the empirical and theoretical basis for the questions that led to the studies that are described in this thesis. In short, we intend to investigate skills and knowledge with regard to daily life social and emotional interactions of children with ASD. Our object of investigation can also be referred to as social-emotional competence: the resilience and self-efficacy in emotion eliciting transactions and the ability to reach the intended goals (Saarni, 1999). Based on the many studies that have been conducted on this topic, some of which will be outlined below, an interesting

dichotomy appears: when children with ASD are of normal intelligence, their knowledge of social and emotional interactions is often not impaired. However, they often fail to apply this knowledge, or act in accordance with this knowledge. This failure to apply knowledge, or act accordingly may be attributed to various factors. In the present thesis, we aim to examine more advanced knowledge of social and emotional situations in children with ASD, but also focus on their ability to act in daily life situations.

The present chapter will have a broad chronological order, ranging from the first signs of attention to emotions in neonates, to the understanding of complex social interactions in adolescence. Because of the width of the topic, it is aimed to focus on issues that are relevant to the main research questions of this thesis. During the early, pre-verbal infant stages, these issues would involve the first signs of social referencing and pretence, as well as the attention and responsiveness to faces and emotional expressions. The first signs of a cognitive understanding of social-emotional interactions can be observed when children reach school age, and start to show an insight in subjective mental and emotional states. This brings about a deeper understanding of emotions because in order to fully acknowledge the importance of emotional signals, one has to understand that emotional reactions are a reflection of a subjective reality. Acknowledging subjective mental states is highly relevant to understanding complex social and emotional interactions. Various studies will be discussed that have investigated this understanding in children with ASD. Towards the end of the chapter, an outline is presented of the competence as well as the restrictions in the social-emotional understanding and real life skills of normally developing children, and both mentally retarded and normally intelligent children with ASD. This outline will result in an elaboration on the questions that are investigated in the empirical chapters. However, before we go on to describe the social-emotional development of children with ASD, it is important to emphasise four influential factors.

First of all, intelligence plays a pivotal role. Social-emotional problems are particularly found in mentally retarded children from the autism spectrum (Kasari, Chamberlain, & Bauminger, 2001). It can be difficult to determine which elements of these problems should be attributed to intelligence, and which elements are due to the autistic disorder. While there is no consensus on the prevalence of normal intelligence in autism - estimations vary from around 30 percent of all children with autism to 90 percent of all children with ASD (Baird et al., 2000; Chakrabarti & Fombonne, 2001; Fombonne, 2003) -, recent studies mainly focus on normally intelligent children from the autism spectrum.

Secondly, besides mental age, chronological age has an impact on the performance of individuals with ASD. Although autism is a disorder with a poor prognosis, older children and adolescents often gain compensating skills, through education or experience. This is particularly true for high-functioning children from the autism spectrum, who in some cases can be so adapted – often in well-known and

predictable situations – that it seems as if they have overcome their disorder. These adaptive skills can sometimes obscure the fundamental problems that still exist in these children (Capps, Sigman, & Yirmiya, 1996; Vermeulen, 2002).

Thirdly, it is important how social-emotional competence is defined, and what methodologies are employed. In particular high-functioning children from the autism spectrum can show a striking difference between theoretical insights and practical skills (Travis, Sigman, & Ruskin, 2001). In test situations, these children often show a basic understanding of mental and emotional states in others, while they do not seem to use this understanding in their daily life interactions. This discrepancy may be partly due to the structured and straightforward test situations, which are in contrast with the complex, dynamic and unpredictable interactions in daily life, that require flexibility and spontaneity.

Fourthly, within the autism spectrum several subgroups can be distinguished. The prevalence of children with autism and Pervasive Developmental Disorders - Not Otherwise Specified (PDD-NOS) are highest. Children with PDD-NOS show similar social problems as children with autism, but in a milder form, since fewer of the symptoms of autism can be found in these children. Because an attempt will be made to provide an overview of findings that are most typical for ASD, the main focus will be on children with autism. However, where possible, we aim to elaborate on findings in children with PDD-NOS that deviate from those of children with autism. Furthermore, children with Asperger syndrome are difficult to distinguish from high functioning children with autism. Some authors even regard them as equivalent (Micali, Chakrabarti, & Fombonne, 2001; Mayes & Calhoun, 2003; Mayes & Calhoun, 2004). Therefore, both groups will be referred to as high functioning ASD (HFASD).

In order to appreciate competence of high functioning children with ASD, knowledge of normally developing children, as well as mentally retarded children with ASD is essential. Therefore, in this overview, short accounts of different domains of social-emotional competence in normal development will be followed by descriptions of the deviations or analogies of children with ASD. The descriptions of children with ASD are presented separately for mentally retarded and normally intelligent children.

Early precursors of social-emotional competence

Expressing emotions and responding to emotions are the earliest forms of social interaction and communication, and can be observed directly after birth (Hobson, 2002). However, at that time, a child is not yet able to understand the direction or intentionality of emotions. One of the precursors of this so-called 'intentional stance' (Dennett, 1987) can be observed when children start sharing their attention with others, around nine months of age. Children then start to be involved in triadic interactions; they look at an object with somebody else, and alternate their gaze between the object and the other person. Subsequently, at around 10 months, they learn to direct the attention of others,

e.g. by pointing, and also develop the ability to follow the directions of others (Carpenter, Nagell, & Tomasello, 1998). Sharing and guiding attention enables children to learn about other people's mental states. This social interactive process also requires pretence abilities; one has to imagine the content of other's mental states. Normally developing children show imagination (pretend play) about objects at around 19 months of age. Imagining mental states of others (e.g., attributing emotions to a doll) can be observed in children's play around their second year of life (Harris, 2000).

Deviations can be observed in the early stages of social-emotional behaviour of young children with ASD. About fifty percent of the parents of these children observe problems in the first year of their child's life, in particular if it concerns a second born child. The majority of parents have reported these observations to a general practitioner when the child is eighteen months old, but an official diagnosis in the autism spectrum is rarely made before the age of three (Siegel, Pliner, Eschler, & Elliott, 1988; Robins, Fein, Barton, & Green, 2001). This has resulted in a lack of direct empirical studies with very young children from the autism spectrum. We do have access to information on early autistic development through studies where parents retrospectively reported on the early years of their – now officially diagnosed - autistic child. A notable finding here is that early signs of social behaviour, such as eye contact, social smiles or responses to one's name, are in fact often observed in the first years of autism spectrum children (Frith, 2003). More detailed studies, based on structured observations of videotaped first birthday parties, indicated that children with ASD looked less at others or at objects others were holding, than control children, both with and without mental retardation (Osterling, Dawson, & Munson, 2002). Direct observations showed that shared attention and language are hardly apparent in two and five year old children with autism. These children did not point declaratively, to catch someone else's attention. As far as they did use pointing gestures, this concerned objects they desired. This imperative, instrumental pointing does not require an intentional stance (Leekam, Lopez, & Moore, 2000). Children with higher chronological or mental ages showed more shared attention, but their ability developed at a slower pace than in normal development (Leekam, Hunnisett, & Moore, 1998).

Spontaneous pretend play is hardly observed at all in young, mentally retarded children with ASD, even when compared to control children with equal mental age. This lack of pretend play, along with limitations in declarative pointing and gaze following at eighteen months appear to be strong predictors of an ASD (Sigman & Ungerer, 1984; Baron-Cohen, 1987). Older children from the autism spectrum do seem to understand the principles of pretence. Both children with and without ASD showed a similar ability for object related pretence (e.g., pretending a shoebox is a garage) (Harris & Leevers, 1993; Jarrold, Boucher, & Smith, 1996). Moreover, when they were stimulated to do so, six- to fifteen-year-old normally intelligent children with ASD showed as much pretend play as normally developing control children (Lewis & Boucher, 1988; Jarrold et al., 1996). Older children have also

been found to spontaneously display pretend abilities, but these were of a stereotypical nature (Wing & Gould, 1979). Though older children with HFASD thus seem to overcome some of their early limitations in pretence and social referencing, their abilities at later ages may still differ from those of normally developing children.

Perceiving emotions in oneself and others

Emotional states of other people can be observed in different ways. Voice, posture or gesture contain affective information, but emotions are particularly evident in facial expressions. Studies have shown that normally developing neonates are already able to perceive emotions in others. While they have a strong preference for human faces over other stimuli and recognise qualitative differences in facial expressions directly after birth (Caron, Caron, & Myers, 1985), most newborns also respond appropriately to emotional expressions of others, indicating that the meaning of these expressions reveals itself as well at this early stage (Harris, 1989).

Before turning to studies on facial expression of emotion, it is important to first note the ability of children with ASD to process general facial information. Children and adolescents with autism, aged eight to nineteen, showed no trouble identifying faces (Volkmar, Sparrow, Rende, & Cohen, 1989). Still, various studies indicate that younger children from the autism spectrum identified and remembered faces relatively poorly compared to normally developing children (Boucher & Lewis, 1992; Teunisse & de Gelder, 1994; Klin et al., 1999; Blair, Frith, Smith, Abell, & Cipolotti, 2002). Visual scan analysis showed that high functioning adults with autism were less attentive than controls to characteristic facial features, such as eye, nose or mouth regions. Children with ASD often focus on discrete details and fail to integrate separate pieces of information into a coherent entity. This is in line with a fragmented perceptive style of autism spectrum children that is referred to as weak central coherence, featuring a restricted tendency to see the central meaning of things (Frith, 2003). During facial perception, irrelevant details may grasp a child's attention, which will interfere with the integration of separate stimuli into a complex, abstract entity such as an emotional expression. Specific deviations in the processing of emotional cues from faces could thus result from more general (facial) perceptual problems in autism (Pelphrey et al., 2002).

One of the most intriguing examples of a-typical face perception in autism is their equal, and sometimes even superior ability to controls to identify inverted faces (Hobson, Ouston, & Lee, 1988d; Tantam, Monaghan, Nicholson, & Stirling, 1989; Teunisse & de Gelder, 2003). This 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 normally developing children, they focus on small fragments that are equally easy recognized as when presented upright. Furthermore, eight- to fourteen-year-old normally developing children attended more to eyes than mouths, in contrast to children with autism who

attended more to mouth than eye regions (Joseph & Tanaka, 2003). This latter finding may be a compensation for the autistic tendency of avoiding eye contact. A general insensitivity to social-emotional stimuli of children with ASD may be associated with an abnormal perceptual processing of socially relevant information. This hypothesis is confirmed by findings on auditory perception, autistic individuals showed difficulty in perceiving human speech in noise (Alcantara, Weisblatt, Moore, & Bolton, 2004; Gervais et al., 2004), and a poor ability to detect social or emotional information in voices (Boucher, Lewis, & Collis, 2000; Rutherford, Baron-Cohen, & Wheelwright, 2002). It has even been suggested that children from the autism spectrum may regard emotional expressions as no different than non-social stimuli like objects (Schultz et al., 2000). When looking at faces, they were found to use a part of the brain typically engaged when looking at objects (Hall, Szechtman, & Nahmias, 2003).

Differences in perception of emotions are strongly related to the cognitive level of the children. Impairments in the processing of emotional expressions are broad and pervasive in mentally retarded children from the autism spectrum. However, even these children are not 'blind' to emotions. They recognize emotions in faces, differentiate between different emotions, and are as interested as normally developing children in realistic, moving images of emotions. Moreover, just like their normally developing peers, they attend to negative emotional expressions more than neutral expressions. Still, despite these basic abilities, they are less adequate at matching and categorizing faces on the basis of expressions (Weeks & Hobson, 1987; Celani, Battacchi, & Arcidiacono, 1999) or across different modes (gestured, vocal or facial) of expression (Hobson, 1986a; Hobson, 1986b; Hobson, Ouston, & Lee, 1988), show relatively less attention to negative emotions (Sigman, Mundy, Sherman, & Ungerer, 1986; Sigman, Kasari, Kwon, & Yirmiya, 1992) and are less interested in social than non-social stimuli (Dawson, Meltzoff, Osterling, & Brown, 1998).

In contrast to the findings in mentally retarded children, high functioning children from the autism spectrum do not show a consistent deviation in their attention to emotions when compared with verbal IQ matched controls. Using the same methodologies that had shown differences in the lower IQ samples, no group differences were found in the attention paid to the basic emotions anger, happiness, sadness and fear by high functioning children with autism and controls (Prior, Dahlstrom, & Squires, 1990; Davies, Bishop, Manstead, & Tantam, 1994). Subtle differences were found when task complexity increased. 'Complex' emotions such as pride and jealousy were identified less well by high functioning children with autism than by controls, especially when only the eye regions or vocal emotions were presented (Baron-Cohen, Wheelwright, & Jolliffe, 1997; Rutherford et al., 2002), or when emotional expressions were shown in combination with contrasting emotion words (Grossman, Klin, Carter, & Volkmar, 2000). Findings with respect to complex emotions will be discussed later.

Recent findings suggest that autistic individuals may perceive and process their own emotions differently than non-autistic individuals. Autistic adults found it harder than controls to identify and describe their feelings and were more inclined to focus on external events than internal experiences (Hill, Berthoz, & Frith, 2004). A recent study of such 'alexithymic' traits showed that children with ASD were 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, submitted). Still, basic emotional reactions can be observed in autistic individuals of all chronological and mental ages (Frith, 2003). Furthermore, high functioning children and adolescents with autism were found to describe similar subjective experiences of affect (Jaedicke, Storoschuk, & Lord, 1994). Whether children with ASD differ in their perception of their own emotions, or in the way they reflect on and communicate their emotions are questions that remain to be answered.

In short, basic information processing differences, in particular with regard to the perception of faces, may be at the heart of the a-typical perception of emotional expressions in children with ASD. However, it is hard to define these perceptual problems exactly. Problems with perceiving emotions are apparent in mentally retarded children with ASD, who are less attentive and skilled in processing emotional expressions than control children. However, high-functioning children with ASD often show equal perceptive skills, or only subtle deviations when compared to normally developing controls.

Expressing emotions and responding to emotions of others

Responding to other people's emotions plays a crucial role from the very beginning of life. New born babies can be seen imitating facial expressions within their first hour of life (Meltzoff & Prinz, 2002). A few weeks after being born, children start showing a social smile when they see a human face, and after about ten weeks they respond to angry, happy or sad faces with corresponding expressions. Around their first year of life, children start to relate emotions to external events in their environment. This helps to develop an understanding of the external directedness of emotions, e.g. how emotions arise from and have an effect on the external context. For example, one-year-old children stayed closer to their mothers when the latter showed a fearful than a happy expression (Klinnert, Campos, Sorce, Emde, & Svejda, 1983). Children thus start to actively use emotions around their first year of life, while a fascination for emotions is present from birth. When they are around two years old, they start to become involved with the emotions of others, showing comforting or teasing behaviour. This implies that they do not only respond, but also try to manipulate emotions at this very early age (Harris, 1989).

Mentally retarded, school-aged children from autism and control groups showed equal numbers of emotional expressions during social interactions, or when watching videos of emotional expressions in others (Yirmiya, Kasari, Sigman, & Mundy, 1989; Capps, Kasari, Yirmiya, & Sigman, 1993). However, during social interactions, they were also found to show more neutral and incongruent facial expressions (Yirmiya et al., 1989), to exhibit less positive affect and to look less often at other people's faces than normally developing children (Kasari, Sigman, Mundy, & Yirmiya, 1990)), while they showed relatively more positive affect during play with objects (Snow, Hertzig, & Shapiro, 1987). Spontaneous emotional expressions were made less explicit and with fewer gestures, but instrumental gestures were used equally often as controls (Attwood, Frith, & Hermelin, 1988) and little attention was given to distress in others, even after being prompted to do so (Bacon, Fein, Morris, Waterhouse, & Allen, 1998). In sum, mentally retarded children with ASD show some ability in expressing and responding to emotions, but show little awareness of the social function of these emotional skills.

High functioning children and adolescents with ASD were able to name emotions, responded to emotions and showed some skills in perspective taking, but were less able to respond empathetically to emotions in others, and showed more inappropriate emotions (Yirmiya, Sigman, Kasari, & Mundy, 1992). They attended less to distress in others, but did so more after being prompted (Bacon et al., 1998). While these children were not indifferent to other people's distress, they had trouble showing intentional empathy, which requires the orientation to other people's mental states, as well as an understanding of the context, in order to respond appropriately (Frith, 2003). While the ability to express and respond to emotions is clearly available to high functioning children with ASD, their poor usage of these abilities may be due to a failure to grasp the pragmatic, intentional and interactive context of emotions. External cues seem to be helpful in triggering responses in these children.

Understanding objective and subjective causes of emotions

Besides perceiving and expressing emotions, understanding the causes of emotions is an important element of social-emotional competence. Normally developing children start to comment on emotions around their second year of life. From their third year, they connect emotions to external causes: a present leads to happiness, and the death of a pet will make you sad. The increase in the understanding of situational causes of emotional responses is crucial to social interactions, it makes the emotional behaviour of others understandable, and it enables children to infer or predict emotions. Generally speaking, children around the age of four have acquired a reasonable understanding of the situational aspects of basic emotions such as anger, sadness, fear and happiness, and are able to use these emotions in their daily life interactions (Harris, 1989). Basic emotions include corresponding expressions and behaviour, which makes it easy to identify and relate them to situational causes. After their fourth year, the understanding of emotions is refined, and children become aware of complex

emotions, including cognitive emotions such as surprise, and social or self conscious emotions such as embarrassment, shame, guilt, jealousy and pride. These emotions generally require an awareness of other minds and others' perspective on one self. Normally developing children learn about these emotions without formal teaching and usually understand these emotions when they are about ten to twelve years old (Ferguson, Stegge, & Damhuis, 1987; Harris, Olthof, Meerum Terwogt, & Hardman, 1987; Frith, 2003).

Both mentally disabled and high functioning children and adolescents with autism showed a similar understanding to control groups of situations and desires as causes of basic emotional reactions (Baron-Cohen, 1991). Furthermore, in response to hypothetical vignettes of daily life events, high functioning children with ASD, aged 10 to 12 years old, predicted emotions in protagonists in a similar way to control children (Rieffe, Meerum Terwogt, & Stockmann, 2000). Moreover, they generally provided the same possible causes for emotions as normally developing children, although they were more inclined to refer to materialistic or idiosyncratic than social causes (Rieffe et al., submitted; Jaedicke et al., 1994). We should however note that participants were on average ten-year-olds. Impairments in the understanding of mental states and emotions were found in younger children. Five-year-old children with PDD-NOS were found less adequate at predicting emotions based on beliefs or desires (Serra, Loth, van Geert, Hurkens, & Minderaa, 2002). Older mentally retarded children with ASD still showed difficulties understanding emotions that were caused by beliefs, which may be related to their impaired ability to acknowledge subjective mental states (Baron-Cohen, 1991).

Children with ASD often find complex emotions like pride or shame particularly difficult to understand, they find them hard to recognize and need to have them explained in detail. This difficulty is related to their poor estimation of others' judgements of themselves. Their use of complex emotions is often a-typical. For instance, mentally retarded children with autism, like normally developing children, showed pride at mastering a new skill, but they did not turn to their audience to monitor their reactions as the non-autistic children did (Kasari, Sigman, Baumgartner, & Stipek, 1993). High functioning children with ASD generally understood the significance of the presence of an audience, but often failed to mention this audience when explaining their own complex emotions. Furthermore, their explanations were often very general and accompanied by abstract examples ('I am proud when I do something well'), while non-autistic children gave more concrete examples. Children with HFASD also needed more time and encouragement to respond. Taken together, these findings suggest an understanding of complex emotions that is theoretical in nature, rather than based on children's own experience (Capps, Yirmiya, & Sigman, 1992; Baron-Cohn, Spitz, & Cross, 1993; Bauminger, 2002; Hillier & Allinson, 2002; Heerey, Keltner, & Capps, 2003).

Theory of mind and social-emotional understanding

The understanding of basic and complex emotions, both of one's own and of others, requires an understanding of subjective mental states. This is especially evident when children gain more in-depth knowledge about emotions. A main element of understanding mental states is the idea that our behaviour and our emotions are not guided by reality itself, but by our subjective representations of this reality. The understanding of such representations, or mental states, in oneself and others, is commonly referred to as Theory of Mind knowledge. The understanding of emotions or social interactions relies heavily on Theory of Mind understanding, because emotions are elicited by mental states, but also because emotions can be conceived of as a type of mental states.

Theory of Mind understanding ranges in complexity from the simple acknowledgment that others may have different desires from oneself to more complicated abilities to theorize about others' beliefs, thoughts, intentions or emotions. In school-aged children, Theory of Mind understanding is usually translated to the insight that someone's mental states have an impact on someone's behaviour. This understanding can be tested by presenting children with hypothetical story lines, where a discrepancy is created between the mental states of the story character (who, for instance, thinks an object is in one location), and the knowledge of the child (who has just witnessed the relocation of the object). Children are then asked to predict the behaviour of the story character (e.g. 'where will she look for the object?'). This example originates from the 'false belief' task, the most famous Theory of Mind task (Wimmer & Perner, 1987). Theory of Mind can be measured at different levels of difficulty. So-called 'first-order' tasks measure children's acknowledgment of someone else's mental states regarding a situation (e.g., 'where does X think that the object is?'). A 'second order' task measures the understanding of another person's mental states about the mental states of a third person, (e.g. 'where does X think that Y thinks that the object is?'). Normally developing children pass the first order tasks when they are about four years old. i.e. they respond that the story character will look in the wrong place, because he does not know about the changed location of the object. Second order tasks around their sixth year of life (Baron-Cohen, Leslie, & Frith, 1985).

The delayed Theory of Mind understanding of autism spectrum children is well documented (Baron-Cohen, 2000). Most mentally retarded children with autism generally fail both first and second order false belief tasks, even when their mental age is above four or six years, respectively (Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998). Most high functioning children with autism still fail these tasks at six years of age, but pass false belief tasks when they are around ten years old (Bowler, 1992; Happé, 1995; Dahlgren & Trillingsgaard, 1996; Bauminger & Kasari, 1999). This indicates that these children may be delayed in comparison to their normally developing peers, but do show an improvement over time (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Steele, Joseph, & Tager-Flusberg, 2003). Correlations were found in children with ASD between the performance on intelligence measures and

Theory of Mind measures (Frith, Morton, & Leslie, 1991) and on intelligence and social-emotional measures (Capps et al., 1992; Yirmiya et al., 1992). These correlations were not found in normally developing children. This suggests that high functioning autistic children rely more than normally developing children on their analytic reasoning abilities when responding to Theory of Mind and social-emotional tasks.

Because high functioning children with ASD 'solved' the classic false belief tasks more often purely by using analytic skills, various 'advanced' Theory of Mind tasks were developed in order to measure a more pragmatic, applied Theory of Mind competence. A first type of these Theory of Mind tasks focused on the understanding of daily life linguistics, where Theory of Mind understanding is reflected in children's insights in the speaker's and listener's intention. These tests prototypically include non-literal statements such as irony or sarcasm, for instance a remark about nice weather in a context where it is pouring with rain. Normally developing children's understanding of non-literal statements has been related to their mind reading skills, and a sharp rise in their comprehension can be demonstrated between five and six years of age (Dews et al., 1996). However, the usage of non-literal statements can already be found in jokes of two- and three-year-olds (Dunn, Brown, Slomkowski, & Tesla, 1991). High functioning children and adolescents with autism found it hard to catch the meaning of non-literal statements, and often showed restricted pragmatic abilities. They inferred and justified the true meaning behind sarcasm, irony or white lies more poorly than controls (Happé, 1994), even when they were able to pass second order Theory of Mind tasks (Jolliffe & Baron-Cohen, 1999; Kaland et al., 2002). Other tests of pragmatics show a poor understanding of humour and adequate language use in social situations (Tager-Flusberg, 1993), general conversational rules of politeness (Surian, Baron-Cohen, & Van der Lely, 1996), and of a faux pas in conversations (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999). Apparently, even normally intelligent children with ASD, who appear to understand Theory of Mind principles, fail to use this understanding when explaining pragmatic aspects of their communicative performance.

A second type of advanced Theory of Mind tasks focused on the application of Theory of Mind knowledge to daily life situations. In contrast to the above tasks, where relevant information was already selected and explicitly verbalized to the children, daily life situations require children to spontaneously select Theory of Mind relevant information, and integrate this information within a situational context (Klin, Schultz, & Cohen, 1993). In order to gain insight in children's in vivo Theory of Mind skills, several studies have used videotaped social interactions as stimulus material. This way, it was found that six- to fourteen-year-old normally intelligent children with autism recognized and understood inappropriate interactions less well than normally developing controls (Loveland, Pearson, Tunali-Kotoski, Ortegon, & Gibbs, 2001), and adults with autism were less able to explain awkward social situations than controls (Heavey, Phillips, Baron-Cohen, & Rutter, 2000). A

study using filmed recordings or real-life interactions showed that high functioning adolescents with autism were less empathically accurate than a control group, but did show a conceptual understanding of the situations and had no problems interpreting emotional expressions. Adolescents with autism were particularly poor at directing their attention to the appropriate sources of information (Roeyers, Buysse, Ponnet, & Pichal, 2001).

Summary and research questions

Qualitative differences can be found in the social-emotional development of high functioning children with ASD and normally developing children. Besides the apparent impact of autism, mental and chronological age are crucial to the nature and restrictions of social-emotional development. In Table 1, the relevant landmarks of social-emotional development are presented schematically. For each domain of development, the onset in normally developing children, as well as the main findings for mentally retarded and high functioning children with ASD are presented. Because all assets described for mentally retarded children with ASD are also apparent in high functioning children with ASD, the table only includes the additional findings for the high functioning children with ASD. The reported findings are by no means exhaustive, but they outline various typical differences between mentally retarded and normally intelligent children with ASD that are relevant to the research of the present thesis.

Generally speaking, mentally retarded children with autism appear to suffer from fundamental disabilities in emotional relatedness to others and in social cognition and behaviour. Developmental deficits could be presumed for this group, and, based on the many differences between the ASD groups, as summarized in Table 1, it could even be argued that mentally retarded and high functioning ASD should be regarded as separate diagnoses. High functioning children with ASD present an a-typical phenotype when compared to normally developing children. When these children reach preadolescence, at ten to thirteen years of age, they seem to have acquired many skills that are still absent in mentally retarded children with ASD at that age. High functioning children with ASD possess basic social referencing and pretence abilities, show elementary emotion recognition and responding skills, are able to reason about social and emotional aspects of daily life, pass simple Theory of Mind tasks, and are even able to reflect on complex emotions and social interactions. A remarkable conclusion, since the absence of these skills is often described as a general, core feature of autism.

Table 1. Relevant landmarks in social-emotional development of normally developing children and mentally retarded and high functioning children with autism spectrum disorders.

	Normally developing child (ND)	**Mentally retarded child with ASD**	**High functioning child with ASD**
Social referencing	-9 months: sharing and guiding attention -10 months: declarative pointing	-1st year: makes eye contact, shows social smile and responds to name -1st year: looks less at others than ND -1 to 2 years: little shared attention and language use -2-5 years: points imperatively, but limited declarative pointing. -9-11 years: lacks spontaneous social referencing	-2-5 years: limited declarative pointing, mainly imperative -4 year: shows some gaze following -from 6th year: shared attention and pointing present, but onset at later age than ND -8-11: lacks spontaneous social referencing
Pretend play	-19 months: object related pretend play -2 years: imagining mental states	-1-5 years: lacks of spontaneous pretend play, shows functional play	-from 5th year: capable of object related pretence -6-15 years: shows pretend play when stimulated
Expressing emotions	-1st month: expression of basic emotions and social smile	-all ages: basic emotional reactions -3-6 years: more flat/neutral and ambiguous expressions -5-11 years: equal number of emotional expressions during interactions, more neutral and incongruent expressions than ND	-all ages: basic emotional reactions and similar levels of attachment to ND -10-19 years: emotional expressions less explicit and less appropriate
Perceiving human faces	-1st month: preference of human over non-human stimuli -1st month: able to imitate facial emotional expressions	-Looks less at other peoples faces -4-11 years: poor identification and memory of faces -8-19 years: equally able as ND to identify faces	-12-15 years: superior ability to identify inverted faces -Adults: less attentive to characteristic facial features
Perceiving emotional expressions	-1st month: recognition of facial emotional expressions -8-14 years: attends more to eye than mouth region	-3-5 years: attends to negative emotions more than to neutral expressions, but less than ND -4-7 years: less interested in social- than non-social stimuli -5-15 years: interest in- and recognition of basic emotional expressions -6-16 years: poor matching of emotional expressions of others	-5-15 years: normal attention to basic emotions, sensitive to prompting -6-25 years: reports subjective emotional experiences similar to ND -8-14 years: attends more to mouth than eye region -8-59 years: poor perception of emotions in eye region- or voice -16-63 years: difficulty identifying and describing own emotions

Responding to emotions	-1st month: imitates facial emotional expressions -2½ months: appropriate response to emotional expressions of other people -2½-5 years: ability to differentiate between external expression and internal experience of emotions	-5-6 years: less positive expressions during social interactions, more during play with objects -9-11 years: little attention to distress in others	-1-2 years: less able to respond empathically to others' emotions -8-11 years: little attention to others' distress, but improving when prompted
Under-standing emotions	-1st year: relates emotions to external events, attends to caregivers' emotions to guide own action -2 years: active involvements with emotions of others' (teasing, comforting), comment adequately on own and others' emotions -3 years: connects emotions to external events	-10-20 years: understands emotions resulting from situations and desires, but not from beliefs	-7-23 years: often provides idiosyncratic or materialistic causes for emotions -9-16 years: able to name, explain and respond to emotions and to take perspective, less able to respond empathically
Complex emotions	-10 to 12 years: understanding and use of complex emotions	-4-6 years: enjoys mastery of skill, but shows no pride in mastery	-9-12 years: poor identification of embarrassment and shame -10-14 years: able to talk about complex emotions (surprise, embarrassment, pride, guilt) and label expressions, but provides more scripted, general responses, has a narrow repertoire, understands public aspect of complex emotions, but refers less to audience -13-17 years: expresses jealousy similar to ND, but shows a less coherent understanding of jealousy.
Under-standing mental states	-2-3 years: uses non-literal statements -4 year: passes first order ToM -5-6 years: comprehends non-literal statements -6 year: passes second order ToM	-4-16 years: fail first and second order ToM tasks -4-12 years: fails to comprehend non-literal statements	-9-11 years: impaired recognition of faux pas -10 years old: passes first and second order ToM tasks -some comprehension of non-literal statements, but restricted pragmatic abilities
Real life social cognition	-from 4th year: great deal of everyday life mind reading -from 5th year: understanding of self-conscious emotions (embarrassment), increasing social sensitivity, reciprocal communication 10-13 years: manages display of emotions, awareness of social scripts, generates multiple and accurate solutions for negative emotions		-6-14 poor recognition and understanding of inappropriate interactions -22-51 years: impaired understanding of awkward moments, understanding metaphorical expressions -17-46 years: less empathically accurate

High functioning children with ASD are impaired in their social-emotional understanding and skills in a number of ways. A recurring element in these restrictions is their failure to use their social-emotional intelligence in practice. There seems to be a contrast between the relatively strong elementary knowledge of these children and their poor practical skills in various social-emotional domains. While this issue has been described by various researchers (Capps et al., 1992; Klin, 2000), it has rarely been the direct object of empirical studies. Limitations in practical social or emotional skills were rather assumed in these children based on their diagnosis in the autistic spectrum, and contrasted with children's relatively good performance on experimental tasks. Only few studies have directly tested this asymmetry between understanding and skills of children with HFASD in the social-emotional domain.

The first aim of this thesis is to further investigate the social and emotional abilities of children with HFASD. We know that these children are capable of elementary Theory of Mind reasoning and have acquired knowledge about the basics of social and emotional interactions, but we know very little about their more advanced and applied skills and knowledge such as they may need in daily social-emotional interactions. In the first two studies, children's skills were studied by focusing on their ability to use and attend to relevant social and emotional information. Specifically, we tested children's ability to correct the mental state of a conversation partner in a direct social interaction (Chapter two), and to attend to emotional expressions (Chapter three). Children's applied social-emotional knowledge was investigated in the last three empirical studies, by focusing on their ability to reason about complex, naturalistic interactions. In these Chapters we investigated children's understanding of and experience with the social regulation of their own emotional expressions (Chapter four), children's ability to reason about the social consequences of emotional states of others (Chapter five), and their understanding of conflicting emotional states (Chapter six).

The second aim of the current thesis was to investigate possible factors that are involved in the transfer of understanding to behaviour in the social-emotional domain. We assumed that children with ASD are basically capable of responding appropriately in social situations, but often do not see the necessity of such responses. While normally developing children seem to select, attend to and respond to relevant information without difficulty, we hypothesized that children with ASD need to apply extra effort to put their responses in position or to make them 'online'. This process may depend on various factors. We looked at several ways to manipulate these factors, such as the motivation to respond or attend, and the relevance, explicitness and complexity of information. This way, we could investigate possible production deficits of social-emotional competence in high functioning children with ASD. Next, a brief summary will be presented of the children that participated and the tasks used in the five empirical studies included in this thesis.

The studies in this thesis

As can be seen in Table 1, the reviewed findings with regard to the high functioning ASD group include a relatively wide age range. The effect of age on social cognition is considerable (Yirmiya et al., 1998). In particular normally intelligent children with autism often gain skills through experience across their life that may result in performance similar to normally developing peers on social-emotional tasks, but are arguably not grounded in a comparable course of social-emotional development. Rather than focusing on performance of adolescent or adult individuals with ASD, whose abilities may be based on skills acquired through intensive and explicit training, in the present studies, we included preadolescent children, who are old enough to pass basic Theory of Mind and emotion recognition tasks, but still generally fail to apply their social-emotional skills spontaneously.

The participants of the five studies reported in the present thesis were all high functioning, preadolescent children with ASD and normally developing control children in the same age range. Different samples of children participated in all five empirical studies. The age of the children ranged from around seven to thirteen years old. The relatively large number of studies on normally developing children shows that children are normally able to comment on rather complex social and emotional interactions in these age ranges (Harris, 1989; Saarni, 1999). The children with HFASD, diagnosed with autism, Asperger syndrome or PDD-NOS were recruited from various specialized child psychiatric centres in the Netherlands. The verbal and nonverbal IQ of all the children with HFASD was within 'normal' range, with scores above 80. Control groups of normally developing children were recruited from primary schools around Amsterdam. While the normally developing control group was not explicitly tested for their intelligence, they functioned at an adequate level in regular elementary schools and according to their teachers they showed intelligence within the 'normal' range. Furthermore, teachers who selected the control children were explicitly asked to choose average students, in order to match the mean IQ scores of the autism group.

The first study, described in Chapter two, focused on the question whether children with HFASD use their knowledge about others' mental states in a real life situation, and, in particular, whether these children could be motivated to use this knowledge. It was hypothesized that mental state understanding would be present in children with HFASD, but that limited use of this understanding would be the effect of their limited motivation. In order to manipulate children's motivation to use their mental state understanding, we varied their interest to correct a false belief of their conversation partner during an in vivo interaction. Children were invited to carry out two simple tasks, one of which was rewarded. Sabotage of both tasks by a third party, in the absence of the experimenter, resulted in the experimenter appearing to have a false belief. We measured how long it took the children to correct the false belief of the experimenter, and whether they would perform differently in the reward versus the non-reward task. This study highlighted the role played by social and communicative

factors in the application of mental state understanding of high functioning children with ASD in real life situations.

A comparable approach was adopted in the study described in Chapter three. Again, we investigated the skills of children with HFASD on a specific domain of social-emotional competence under different conditions. Here, we studied their attention to facial expressions of emotions. The question was whether their attention to emotional facial expressions of children with HFASD could be prompted by focusing these children on the social relevancy of emotional expressions. It was hypothesized that children with HFASD, compared to normally developing control children, would spontaneously show less attention to emotional expressions, but that the addition of information on their social relevance would lead children from both groups to show an equal interest in emotional expressions. In order to test this hypothesis, children's attention was studied under two conditions. A non-primed condition was created by having children sort pictures of facial expressions while the feeling state of the depicted people did not have direct implications for the children. A primed setting was created by asking children to sort pictures based on their expectations of the future actions of the depicted people. This study allowed for the investigation of the role of the social relevance of emotional information on attention deficits in children with HFASD.

As outlined above, children with HFASD show a particularly restricted understanding of the social regulating role of emotions. The last three empirical studies of this thesis focused on various aspects of the understanding of the social function of emotions. In the fourth Chapter, we focused on the social regulation of emotional expressions in children with HFASD. A first question was whether children with HFASD and normally developing controls reported different experiences with the regulation of emotional expressions in their own daily life interactions. Secondly, it was investigated whether they show an understanding of how and why emotional expressions can be regulated, and whether they acknowledge that showing or concealing their emotional expression can influence the perspective of other people. While we generally expected children with HFASD to fall behind normally developing controls in their understanding of and personal experience with the regulation of their emotional expressions, their personal interest was expected to be related to their understanding of regulation strategies. Children's personal experiences were studied using a semi-structured interview. Children's understanding of the expressive rules of emotions was studied by questioning them about hypothetical social situations, where expressing emotions would have negative consequences to themselves, or to somebody else.

A common finding with regard to children with HFASD is their relatively well developed knowledge of emotions. However, little is known of their understanding of the usefulness of emotions in daily life. In the study described in the fifth Chapter, it was investigated whether children with HFASD deviate from

normally developing children in their understanding of the social consequences of emotions in other people. It was hypothesized that, in comparison to normally developing controls, children with HFASD would be less able to link mood with behaviour, and that this impairment would increase with the complexity of the information in mood states. Information about others' mood states often has to be derived from a multitude of sources, and children with HFASD are known to process social information in a restricted fashion. Therefore, we varied the complexity of the mood descriptions in the present study by presenting explicit and implicit descriptions of mood states, and by adding irrelevant information to the descriptions. Children were presented with explicit and implicit stories about daily life social interactions, and were asked to match the emotional states and behaviour of story characters. Responses were analysed for the match between emotions and behaviour of similar valence, but also for their justifications of mood consequences. Findings of this study will provide information about the nature of the theoretical knowledge of emotions in daily life social interactions in children with HFASD, as well as the usefulness of prototypical knowledge of emotions in dynamic social interactions.

Elaborating on the restrictions of theoretical knowledge in complex social interactions, in the study described in Chapter six we investigated the ability of children with HFASD to deal with conflicting social-emotional interactions. Children with HFASD have often been observed to rely on a strict understanding of prototypical social-emotional interactions. The question of this study was how children with HFASD would respond to descriptions of conflicting emotional behaviour or emotional experiences. Hypothetically, children with HFASD display a more rigid style of reasoning about social interactions than normally developing controls, and would therefore be more inclined to respond to one of the conflicting emotions, and be less able to integrate both emotions. In the present study, children were presented with short scenarios describing conflicting, successively aroused emotions. They were asked how they would respond, and to explain these responses. The reported findings can illustrate the cognitive, compensating strategies used by high functioning children with ASD in their reasoning about emotions in daily life.

In the final Chapter of this dissertation, we will discuss the empirical findings and provide a general account of the theoretical and clinical implications. Together, these studies will provide an insight in the social-emotional development of high functioning children with ASD. Besides comparisons of the performance of children with ASD with matched control groups, it is aimed to elaborate on the possible developmental pathways that lead to this performance, and the developmental explanations that can be given for a-typical responses of children with ASD. Since some chapters have already been published and others are, or will be, submitted for publication, they can be read as separate studies. However, some overlap in the introductions of the various studies will be inevitable.

2. Theory of Mind based action in children from the autism spectrum

Begeer, S., Rieffe, C., Meerum Terwogt, M. & Stockmann, L. (2003). Theory of Mind based action in high-functioning children from the autistic spectrum. *J Autism Dev. Disord., 33,* 479-487.

Introduction

Various studies have shown that high functioning children from the autism spectrum (HFASD) are impaired in their ability to understand representational mental states. These children have difficulty understanding that behaviour is usually regulated by mental states, such as *beliefs* (thoughts, expectations etc.), *desires* (wishes, preferences) and *intentions* and not by the objective reality (Baron-Cohen, Tager-Flusberg, & Cohen, 1993; Rieffe, Terwogt, Koops, & Hagenaar, 2000). This insight, currently known as the *Theory of Mind* (ToM), became known to a wide audience when it was applied by Premack and Woodruff (1978) in their study with chimpanzees. The developmental study of Theory of Mind skills however, in a sense, goes back to Piaget's work on children's thinking and egocentrism (Piaget, 1929; Carruthers & Smith, 1996). Problems in the human development of ToM are often associated with the social and communicative problems that characterize children from the autism spectrum – also known as pervasive development disorders (PDD) - (Wing, 1988). However, recent findings have shown that the application of ToM knowledge can depend on environmental factors or task variables (Serra, Minderaa, van Geert, & Jackson, 1999; Rieffe et al., 2000). In this study, we look at factors that can influence the application of ToM by children from the autism spectrum in a real life situation.

ToM competence is often investigated by testing children's understanding of false belief. In false belief tasks, participants are usually asked to predict the behaviour of a story character, given information about the false belief of this protagonist and knowledge about the real state of affairs. In order to pass such tasks children are required to acknowledge that a person's behaviour is determined by their beliefs about reality, even when these beliefs are wrong, rather than by reality itself. A well-known example of a false belief task concerns the famous doll Maxi. The participant in this task sees Maxi putting a candy bar into a green cupboard. Maxi then leaves the kitchen. Afterwards, in full view of the participant, but in Maxi's absence, Maxi's mother moves the candy bar to a white cupboard. Finally, Maxi returns to retrieve his candy bar. On answering the question of where Maxi will look for his candy bar, a majority of three-year-olds respond that Maxi will look in the white cupboard, the place where the candy bar actually is. They predict Maxi's behaviour based on their knowledge of reality. Most four-year-olds however take Maxi's false belief into account and correctly predict that Maxi will look in the green cupboard, where he will find that his candy is gone (Wimmer & Perner, 1983). In addition to this, most four-year-olds are able to create false beliefs in others (Sodian & Frith, 1992; Peskin, 1992). In sum, most four-year-olds appreciate the basic principles of Theory of Mind.

Children from the autism spectrum however show poor knowledge of ToM, even when they are older. Predictions of a person's behaviour or emotion are generally based on knowledge about reality, ignoring the (false) belief of the person in question. Moreover, these findings cannot simply be attributed to poor verbal abilities in Children with ASD (Baron-Cohen et al., 1985; Perner, Frith,

Leslie, & Leekam, 1989). The impaired capacities of children from the autism spectrum on the traditional false belief task are usually explained by referring to an impaired conceptual understanding. These children are said to be *mind-blind* (Baron-Cohen, 1995), meaning that they are incapable of discerning mental activities such as thinking, dreaming, hoping.

Studies into ToM and autism often rely on a limited range of tasks, with false belief performance usually taken as the sole indicator of ToM competence (Hughes et al., 2000). However, the false belief task may not be an entirely reliable indicator of a functional ToM (Meerum Terwogt-Kouwenhoven & Meerum Terwogt, 1993; Rieffe et al., 2000). Failing a standard false belief task does not necessarily indicate the absence of mental-state understanding. Other factors, such as poor linguistic competence or poor concentration abilities can hinder performance on the task. Thus, a child who fails the task could be wrongly assessed as having poor ToM (Siegel & Beattie, 1991). Interestingly, a study by Newton, Reddy & Bull (2000) has shown that false belief performance in normally developing children is a poor predictor of the application of ToM in everyday situations, such as the ability to create false beliefs in others and the ability to deceive. Impaired ToM knowledge may not be the only reason for failing a false belief task. Several factors are involved in children's performance on this task, and the ecological validity of the task is questionable. There is also evidence that high functioning children with ASD perform as well as control children of the same age on various types of ToM tasks (Dahlgren et al., 1996; Serra et al., 1999; Rieffe et al., 2000). This would be incongruent with their lack of ToM use in daily life, as suggested by their diagnosis in the autism spectrum. We suggest that ToM knowledge can be present in participants with HFASD, but may not be applied the same way as non-HFASD controls do.

The question arises of whether there are factors, which can encourage the application of ToM in Children with HFASD. Existing evidence to help us address this question is sparse. However, there is some evidence that certain variables – independent from the construct to be measured – interfere with the performance of Children with HFASD on other cognitive tasks. Successful performance on these tasks seems to increase with the regular reinforcement of any behaviour, regardless its nature, or the presentation of a well-known task in the middle of the task in question (O'Dell, Dunlap, & Koegel, 1983; Dunlap, 1984). Other factors which appear to facilitate performance are active participation in the task, for example, having the child decide which materials will be used, what activity will be done or what the content of the test will be (O'Dell & Koegel, 1981). In short, factors that increase involvement in the task seem to have a positive influence on the task performance of Children with HFASD.

To reiterate, the performance of children with HFASD on standard false belief tasks may be partly influenced by ToM independent variables such as linguistic skills, concentration abilities (Siegel et al.,

1991), and low task motivation (Koegel & Mentis, 1985). Moreover, the function of beliefs is usually not considered in these tasks; beliefs are intended to be an exact representation of reality (Searle, 1983), yet, in the case of false belief tasks, children are asked to reason based on beliefs that do not represent reality. This seems contradictory, because false beliefs are generally immediately corrected in daily life (Meerum Terwogt, Rieffe, Tuijn, Harris, & Mant, 1999). Since task involvement has a positive impact on the performance of Children with HFASD, and traditional false belief tasks lack ecological validity, the present study will consider the role of task involvement in correcting real life false beliefs. Correcting a false belief will be more likely to occur if someone's personal gain is at stake. The role played by this active engagement in the correction of false beliefs is the object of the present study. This real life setting and the emphasis on the actions of participants in direct interaction with the experimenter will provide us with an ecologically valid insight in their ability to apply ToM knowledge. After all, besides ToM understanding, the application of this understanding is of at least equal importance. A design similar to the one used in the Meerum Terwogt et al. (1999) study was chosen, in which we varied the participant's own interest to spontaneously correct a false belief in the experimenter.

In the absence of the experimenter, but in full view of the child, a confederate of the experimenter removed an essential piece of two elementary tasks to be carried out by the child. On return, the experimenter, who appeared ignorant of the sabotage, started prompting the child that he was about to begin with the task. We measured how long it took the children to correct the experimenter's false belief. Based on earlier ToM research, we expected that Children with HFASD would not intervene, or intervene less often than normally developing children, and wait longer before correcting the false belief of the experimenter on his return. After all, these children possess less intrinsic motivation to perform such tasks than normally developing children. By giving a reward for completion of one of the tasks, we expected to increase this task involvement, and consequently make the participants more likely to react in the rewarded than in the non-rewarded condition.

Within the autism spectrum several subgroups can be distinguished. The prevalence of children with autism and PDD-NOS is highest. PDD-NOS children show similar social problems as children with autism, be it in a milder form, since fewer of the DSM-IV symptoms can be found in these participants. According to a rough calculation, the prevalence of PDD-NOS children in Holland is four to five times greater than the prevalence of children with autism (van der Gaag & Verhulst, 1996). Nonetheless, the quantity of research with PDD-NOS children is substantially lower than the studies on children with autism; another reason to include both clinical groups in this study.

Method

Participants

Twenty-two children with a diagnosis within the autism spectrum participated in this study. The classification of these children was based on a diagnostic investigation, in which the children were observed by a psychiatrist (L.S.) during three months and classified according to the DSM-IV criteria (American Psychiatric Association, 1994). The HFASD group consisted of 12 children with PDD-NOS (mean age 9-7, range 7-3 to 12-0, 10 boys and 2 girls) and 10 boys with autism (mean age 9-6, range 6-8 tot 11-4, all boys). A control group of 27 children (mean age 9-9, range 9-1 to 10-9, 22 boys and 5 girls), of similar age, gender and intelligence, was recruited from primary schools around Amsterdam, the Netherlands. Intelligence scores of four children with HFASD were unknown. All other children with HFASD had a verbal and performance IQ of > 80, based on the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986). The difference between the mean full-scale IQ of the HFASD group (103.2, *SD* 7.55, n = 9), and the PDD-NOS group (93.1, *SD* 12.8, n = 11) was non-significant. The children from the control groups were not explicitly tested on intelligence. However, they functioned adequately in regular elementary schools, and according to their teachers they showed intelligence within the 'normal' range.

Material

The materials used for the two tasks consisted of an elementary jigsaw puzzle, intended for four-year-olds and a cassette player with a tape in it. The reward given for one of the tasks was a piece of candy, to be taken from a glass jar, centrally positioned on the test table. A video recorder was used to tape the reactions of the children.

Procedure

Children were taken outside the classroom individually by an experimenter and brought to a quiet room for a session of approximately 20 minutes. In this room, a confederate was introduced as a colleague who was working there due to a lack of office space. The confederate was not involved in the interaction between the child and the experimenter. Subsequently, the experimenter explained the two tasks to be executed; a jigsaw puzzle had to be made, and a story had to be told and tape-recorded. The participants were told only one of these tasks would be rewarded with a piece of candy; half the children were promised the candy for a quick completion of the puzzle, the other half for telling a distinctly pronounced story. The candy was to be taken from a glass jar, positioned centrally on the test table, within sight of the participants. The sequence of both types of task (puzzle/story) and reward (candy/no candy) was varied following a Latin square design (Cotton, 1993).

After introducing the task to the participants, the experimenter told them he was going to get a cup of coffee and that they would start the experiment on his return. Hereupon he left the room for a short

time. In the absence of the experimenter, but in full view of the child, the confederate got up and removed one essential item from each task, announcing, as if thinking aloud, that she was going to work somewhere else, and needed a piece of the puzzle and the tape from the cassette player. She then took the objects mentioned and left the room. On his return, the experimenter made it clear that he was unaware of the missing objects, behaving as if he did not know the confederate had taken two crucial items from the tasks. The experimenter prompted the child he (falsely) believed could begin the experiment, using cues, subtle hints (see Table 1) which made it increasingly clear to the participant that the experimenter (falsely) believed he could begin the task. For each task, we measured the mean number of prompts taken for the child to correct the false belief of the experimenter (see Scoring).

Scoring

The experimenter used a series of remarks (Figure 1), in order to make it increasingly obvious that he was going to start the experiment. This was also done to ensure the participants knew that he did not know anything about the items taken away by his confederate. Between each remark, the experimenter waited for 2 seconds. When participants had given no reaction after 6 prompts, the experimenter made an explicit remark about the absence of the item from the task at hand. If no response followed from the participant, we checked if they knew the confederate had taken away the items. In the case of a response during the successive prompts, the remaining prompts were dropped.

1	Experimenter returns and takes a seat
Story task	
2	'So, we'll begin with the cassette player'
3	'Then I can see how clearly you can tell the story'
4	'There, here's the cassette player'
5	'Okay, you can start, then I will turn the cassette player on'
6 (control)	'Hé, there's no tape, do you know how that happened?'
Puzzle task	
2	'So, we will start with the puzzle'
3	'Then I can have a look at how quick you can do it'
4	'There, here are the pieces of the puzzle'
5	'Okay, you can start, and I will start the stopwatch'
6 (control)	'Hé, it seems like there are not as many pieces in the puzzle anymore. Do you know how that can be?'

Figure1. Successive remarks of experimenter

Results

Before discussing the results it is important to note that children reacted more quickly in the second task than in the first task. This was because children often mentioned the item missing from the second task directly after mentioning the item missing from the first task. This artefact had no influence on the results, since the reward was equally distributed over the first and second task. The *type* of task (puzzle or story) had no influence on the children's reaction time.

Table 1 shows the mean number of prompts given to the clinical and control groups before they mentioned the missing items, by reward and the non-reward conditions. Notice that a low score shows a quick response to the false belief of the experimenter. From this table, it can be seen that the control group reacted more quickly than the clinical group in both the reward and the non-reward condition. In fact, more than half the control participants reacted immediately the experimenter returned. A plausible explanation for this finding seems to be that control children are less socially inhibited, and therefore react more spontaneously to the experimenter (whom they have only just met). The expected difference between the reward and the non-reward condition was not observed in either group. A 2 (Group: deviant or control) x 2 (Reward: yes or no) MANOVA with repeated measures on reward, revealed a main effect for Group ($F_{(1,45)} = 10.58$, $p < .01$). However, a main effect of Reward was not observed ($F_{(1,45)} = 2.62$, $p = .11$), nor was Reward found to interact with Group ($F_{(1,45)} = 0.41$, $p = .53$).

Table 1. Mean (SD) number of remarks from the experimenter, as function of Group (Control/HFASD) and Condition (No Reward/Reward)

	No Reward	Reward	Total over
Control group (n=27)	2.04 (1.72)	1.74 (1.63)	3.78 (2.98)
Autism group (n=22)	3.81 (2.30)	3.14 (2.38)	6.95 (3.86)

* $F_{(1,45)} = 10.58$, $p < .01$

Further examination of the results, sub-dividing the clinical group into a group with PDD-NOS and a group with autism, revealed a marked difference between the two subgroups. In the non-reward condition, both groups reacted relatively late in comparison to the control group (see *Figure 2*). In the reward condition the children with autism showed the same pattern, only reacting between the fourth and fifth prompt of the experimenter. The striking result came from the PDD-NOS children. It was found that the PDD-children's performances improved when they were rewarded compared to the non-reward condition, it taking them significantly fewer prompts to correct the experimenter, performing at the same level as the control group. A 3 (Group: control, PDD-NOS or autism) x 2 (Reward) MANOVA, splitting up the clinical group, revealed a main effect for Group ($F_{(2,46)} = 8.40$, $p < .01$), and the interaction effect for Group x Reward also reached significance ($F_{(2,46)} = 2.44$, $p < .05$).

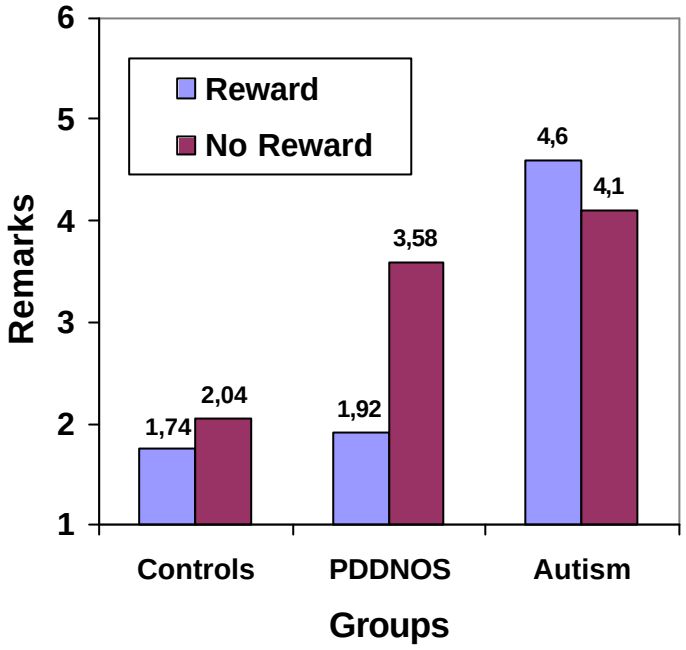

Figure 2. Mean amount of remarks by the experimenter, as function of Group (Controls, PDD-NOS or autism) and Condition (Reward/No Reward)

The speed with which the children intervene in correcting the false belief of a communicative partner has important implications for interpersonal interactions, and can indicate impaired or diminished ToM use. However, a late intervention, i.e. just before the experimenter draws explicit attention to the missing object, can still be an indication of ToM knowledge. It therefore seems to be of equal importance to look at whether ToM knowledge is applied at all by these participants. In an additional analysis we did not look at the number of prompts taken but only looked at whether or not the children intervened. The reactions of the participants were divided into two categories: a ToM category, consisting of children reacting prior to the experimenter's remark that the task was sabotaged (prompt 6) and a category of reactions after this remark, indicating no ToM knowledge.

Table 2 shows the results of this dichotomous scoring and confirms the earlier findings; all but one of the PDD-NOS children responded in the reward condition, whilst only half of them responded in the non-reward condition. The children with autism performed quite poorly, and were unaffected by the reward, whilst the control performed well in both conditions. A 3 (Group) x 2 (Reward) MANOVA once again revealed a main effect for Group ($F_{(2,46)} = 8.12$, $p < .001$) and an interaction effect for Group x Reward ($F_{(2,46)} = 8.18$, $p < .01$). In sum, even without consideration of the speed at which the experimenter's false belief was corrected, the PDD-NOS group still appeared to respond significantly

more quickly in the reward condition compared to the non-reward condition. In fact, there was only one child with PDD-NOS who did not respond in the reward condition.

Table 2. Reaction patterns (number and percentage) divided for spontaneous ToM applications, as function Group (autism, PDD-NOS and controls) and Condition (No Reward/Reward)

No-Reward condition	Autism	PDD-NOS*	Controls
Spontaneous ToM Application	6	6	24
	60.0%	50.0%	88.9%
No Spontaneous ToM Application	4	6	3
	40.0%	50.0%	11.1%
Reward Condition			
Spontaneous ToM Application	3	11	25
	30.0%	91.7%	92.6%
No Spontaneous ToM Application	7	1	2
	70.0%	8.3%	7.4%

*$F_{(2, 46)} = 9.16$, $p < 0{,}001$

Discussion

This study investigated the spontaneous application of ToM knowledge of children with autism and PDD-NOS in an everyday situation; correcting someone else's false belief. These children, as expected, were found to perform more poorly than normally developing children, matched for age, gender and intelligence, if they were not externally rewarded. About half the children of the clinical group did not intervene at all after the experimenter returned. They waited for the experimenter to find out for himself that items were missing from the task. Children from the control group showed a very different pattern; 90% of these children informed the experimenter about the change in the situation during his absence with half the children doing this directly on his return. These differences between groups from autism spectrum and normally developing populations were in agreement with the diminished or impaired ToM capacities of participants from the autism spectrum (Baron-Cohen, 1995; Happé & Frith, 1996). The attempt to increase the task interest of the children had the expected effect on PDD-NOS children only; their response rates were similar to the control children in the reward condition. Children with autism tended not to respond, independent of the prospect of a reward. A time-independent analysis of the results, merely focusing on if the children reacted at all, revealed the same pattern; PDD-NOS children made a significant shift in their performance when they were rewarded, controls responded well in both conditions, and children with autism did not tend to respond in either reward condition.

The question now is why the PDD-NOS, but not the children with autism were appreciative of the reward. We noted in the introduction that PDD-NOS children show less features of the DSM-IV criteria of autism than children with autism, as a result of which this diagnosis can be referred to as a 'milder' variant of autism. (Buitelaar, Van der Gaag, Klin, & Volkmar, 1999) remarked that PDD-NOS children are characterized by social handicaps which closely resemble those of children with autism, while showing significantly less problems in their communication, activities and interests. Furthermore, PDD-NOS children were deficient in ToM abilities, but to a lesser extent than children with autism in a study by (Sicotte & Stemberger, 1999). One of the explanations for this difference could be that PDD-NOS children possessed the competence for ToM reasoning, but did not use this knowledge as normally developing children do because of their delay in social interactions. Children with autism, on the other hand, could indeed be 'mind-blind' (Baron-Cohen, 1995), which would explain why these children did not perform better on the reward task than the non-reward task. In this case, we would not be dealing with one continuous dimension of autism underlying the whole autism spectrum, but instead we should distinguish fundamentally different groups. However, without an in-depth analysis, it should be acknowledged that age appropriate ToM applications have been shown in participants with autism as well. Rieffe and colleagues (2000) demonstrated three subgroups from the autism spectrum (autism, PDD-NOS and Multi Complex Development Disorder) were able to apply ToM based knowledge if asked to explain unusual emotional reactions of others. Still, more research is needed in order to investigate the status of differences between participants with PDD-NOS and autism. Only then can be decided whether a more fundamental distinction between these groups is justified, or whether they should be considered as different manifestations of the same underlying disorder.

When we considered the hypothesis that children with autism have the same dormant ToM competence as the PDD-NOS participants, the question became why these children did not apply their knowledge in either condition. On the one hand, the candy might not have been rewarding enough to raise the task motivation to a sufficient level, or even be unsuitable as catalyst of task motivation at all for these children. On the other hand, the study required children to initiate communication with the experimenter. Difficulties with initiating communication may have resulted in the impaired responding observed. After all, the children were confronted with an unknown adult man, whose actions they had to correct out of their own accord. The DSM-IV highlights an impaired ability to initiate and maintain communication as one of the characteristics distinguishing between a diagnosis as PDD-NOS and autism (Buitelaar et al., 1999).

The results of the present study might also be interpreted alternatively. Hypothetically, participants could give an adequate response without calling upon their ToM competence, a false positive

response. If that were the case, only communicative factors such as spontaneity (with 'spontaneous' children intervening quicker than 'non-spontaneous' children) or impulsiveness would be responsible for the differences in the responses of the children in this study. It would not have been these children's intention to correct the experimenter's false belief, but only to point out that 'something' had happened, 'That woman took something!'. Children would then have merely displayed joint attention, an ability often said to be precursive, yet not characteristic of full-grown ToM (Baron-Cohen, 1995). However, the fact that children's responses – directed at the returning experimenter – were in all cases explicit remarks about the missing items, showed an intention to inform the experimenter about the altered situation. If the children were merely commenting on the situation or trouble shooting, without the acknowledgement that the experimenter was unaware of the problem, one would also expect remarks that directly or indirectly indicated shared knowledge; 'But there is no tape, *is there*?' or 'But the tape is *still* missing!'. Nevertheless, these kinds of remarks were completely absent.

Moreover, even if the time to respond was not considered in the analysis, and we only looked at whether or not ToM knowledge was applied, participants showed the same response pattern as the earlier analysis that included the time aspect. That is, just like the controls, nearly all rewarded PDD-NOS participants intervened eventually, whilst only half the non-rewarded PDD-NOS participants intervened, resembling the reaction of the children with autism. Given the fact that the pattern remained, independent of the time taken to respond, it seems irrational to explain the results based on 'communicative spontaneity' alone. Where this factor may have played a role, it could not account for the improved responses of the PDD-NOS children in the rewarded condition without having to rely on ToM knowledge. It is more plausible therefore to explain the absence of adequate responses of the non-rewarded PDD-NOS children as false negatives; these children did posses the required ToM knowledge, but were not able to apply this knowledge the way normally developing children did. The PDD-NOS participants responded only if a reward was given and the consequences of their actions were obvious, whilst normally developing children responded without needing this catalyst.

In conclusion, the improved performance of the PDD-NOS group supported the hypothesis that the daily life application of ToM knowledge can be dependent on external factors, in this case a reward. This showed us that the application of ToM knowledge by PDD-NOS children may be different from normally developing children, but cannot be explained based on a fundamental lack of knowledge, as suggested in the 'mind-blindness' hypothesis. The discussion about the often-observed ToM problems in children with HFASD shifts from the degree in which ToM knowledge has developed to the availability of dormant ToM knowledge. PDD-NOS participants seemed to have the ability for ToM reasoning, but did not automatically use this ability. They could see, but did not know where to look.

Recently, a new trend of 'advanced' ToM tests has emerged, which pursue more subtle and ecologically valid indications of ToM. Besides laboratory studies that laid emphasis on a more pragmatic understanding of others' intentions, these tests also focused on actual ToM related behaviour. One approach was the use of filmed interactions, for instance of uncomfortable social situations; HFASD adults were found to answer questions about affective mental states of characters less accurately. Also, when footage was used of 'natural' interactions, between people who were unaware of being filmed, HFASD adults displayed less empathic accuracy than controls. The sensitivity of the latter test was even more impressive since a replication of the Strange Stories test (another 'advanced ToM' test) failed to find group differences in the same sample (Happé, 1994; Jolliffe et al., 1999; Heavey et al., 2000; Roeyers et al., 2001). Measures of ToM understanding have also been linked to actual ToM-related behaviour such as conversational abilities, specific social behaviour, peer interactions, pro-social behaviour and everyday social competence (Eisenmajer & Prior, 1991; Frith & Happé, 1994; Frith, Happé, & Siddons, 1994; Capps, Kehres, & Sigman, 1998). However, others failed to find a relationship between ToM understanding and ToM behaviour, in particular when controlling for linguistic competence (Fombonne, Siddons, Achard, & Frith, 1994; Travis et al., 2001).

The lack of group differences between HFASD and matched controls in tasks designed to measure ToM understanding administered under structured laboratory conditions could provide a biased view of ToM competence in HFASD participants for two reasons. First, their ToM competence could be overestimated due to the simplification of reality in these tasks. One of the core problems of Children with ASD is a lack in central coherence (Perner et al., 1989). They fail to filter reality into digestible pieces, and often focus too much on irrelevant information. The coherent information presented in structured laboratory tasks can guide participants in certain directions and thus overcome the problem of central coherence that is apparent in daily life. Second, the idea has been offered that HFASD arrive at ToM understanding through a reasoning process where normally developing children achieve the same understanding in a more intuitive way (Travis et al., 2001). The measures of ToM understanding often do not allow for a differentiation in the way at which the children arrive at their answers. Future studies of actual behaviour could be helpful here.

An important question is how ToM understanding is related to ToM behaviour. Travis et al. (2001) suggested a relatively direct link in HFASD participants between intuitive, nonverbal forms of social understanding and social behaviour. In contrast, they suggested a weaker link between consciously accessible, non-intuitive verbal social knowledge such as false belief understanding, and social behaviour. Non-intuitive social knowledge may fail to support social interaction, because it is slow and rigid compared to intuitive social knowledge (Bowler, 1992). This finding highlights the need for measures of more intuitive ToM understanding and for direct measures of actual ToM-related

behaviour. The present study has illuminated the variability of ToM-related behaviour. The finding that the application of daily-life mind-reading abilities in children with PDD-NOS varied depending on the interest in the task at hand indicated that the use of ToM understanding in real interactions could be activated. This seems to be an important issue in the discussion about the relation between ToM understanding and actual ToM behaviour in HFASD participants.

Future research needs to investigate other factors that are related to the application of ToM knowledge within the different subgroups of the autism spectrum. This is a clear break with the tradition, stemming from the more than 750 studies in which false belief tasks were used to measure ToM in the last 15 years (Hughes et al., 2000). The focus in these studies is usually on the revelation of 'true' ToM knowledge of test participants, rather than the application of this knowledge. Failing a false belief task should not automatically lead to the conclusion that ToM knowledge is not available or impaired, rather, the communicative and social factors that play a role in the expression of this competence should be considered.

3. Attention to facial emotional expressions in children with autism

Begeer, S., Rieffe, C., Meerum Terwogt, M. & Stockmann, L. (2005). Attention to facial emotional expressions in children with autism. *Autism.*

Introduction

Reading others' emotional expressions is essential to social interactions, because this information might help to explain and anticipate other people's actions. Processing facial information is likely to be one of the earliest facilitators of social engagements (Bushnell, Sai, & Mullin, 1989). According to Darwin (1872), the recognition and understanding of basic emotional expressions is an innate ability. Studies have indicated that, in normal development, young infants already spontaneously attend and discriminatively react to emotional expressions in others. For example, neonates already show recognition of qualitative differences in facial emotional expressions and ten-week-old babies also react appropriately to distinct expressions (Klinnert et al., 1983; Caron et al., 1985; Izard, 1994). Although it is hard to establish to what extent these young babies indeed understand these signals (Harris, 1989), these findings nevertheless imply that the processing of facial information is one of the earliest means for social involvement.

In contrast to other mental processes, emotions are often visible in facial expressions. As soon as children acknowledge that facial expressions tend to reveal something about people's inner states, attending to those expressions may become a stepping-stone for the development of the more general 'mind reading' (Baron-Cohen, 1995), which refers to the ability to attribute mental states (i.e. *desires*, which refer to wishes, hopes and needs, and *beliefs*, which refer to thoughts, expectations, convictions and ideas) to other people. Children who do not spontaneously attend to emotional expressions in others will often miss information that can be crucial to infer others' desires and beliefs, which in turn will hamper their understanding of other people's actions. For example, a sad face after unwrapping a birthday present indicates the receiver's discontent, because he or she might have hoped for something else. Insight into other people's mental states is thought to begin around two or three years of age, when children begin to show pretence or imagined psychological states (Harris, 1989). Moreover, mind reading stresses the importance of emotional information and thereby stimulates attention to emotional expressions even further (Hobson, 2002).

Due to their key role in social interactions, deficits in the perception of emotions have long been thought - at least partially – to account for the social disabilities that can be observed in children with autism spectrum disorders. Kanner (1943) originally described the autistic condition as insensitivity towards emotional expressiveness of others. Reduced attention to facial expressions of emotions in participants with autism has been found in various studies, in which participants were asked to sort or match emotion or non-emotion photographs (Tantam et al., 1989; Celani et al., 1999), or pair different ways of expressing emotions, such as vocal and facial (Hobson, 1986a; Hobson, Ouston, & Lee, 1988). However, several other studies failed to find evidence for an impaired attention to emotions, in particular when the participants with and without autism were matched on verbal intelligence

(Braverman, Fein, Lucci, & Waterhouse, 1989; Ozonoff, Pennington, & Rogers, 1990; Prior et al., 1990).

Generally, high-functioning children with autism seem to do well on emotion recognition concerning the basic emotions, happiness, anger, sadness and fear (Davies et al., 1994; Loveland et al., 1997), but they appear to be especially troubled when tasks involve more the complex emotions, such as surprise (Baron-Cohn et al., 1993), pride (Kasari et al., 1993), shame or embarrassment (Capps et al., 1992; Heerey et al., 2003), and jealousy (Bauminger, 2004). Moreover, when normally intelligent children with autism were compared with mental age matched controls, attention deficits were found when the complexity of the tasks was increased. For example, presenting only the eye-region of facial expressions, or combining expressions with mismatching emotion words, also led to poorer performances in children with autism (Grossman et al., 2000; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001).

Jennings (1974) specifically investigated attention to emotion in mentally retarded people with autism. In this study, participants were asked to categorise photographed human faces, which differed on both non-emotion (e.g. hats) and emotion (facial expressions) features. It appeared that the children with autism categorised the faces more often on non-emotion features than the control children. Elaborating on this experiment, Weeks and Hobson (1987) varied not only the emotion but also the identity of the depicted people, in order to test for emotion attention over different individual facial structures. A similar preference for non-emotion features was found in the majority of children with autism. However, both studies also showed that these mentally retarded participants with autism could sort photographed faces on emotion features when they were explicitly asked to do so. An important conclusion that can be drawn from these findings is that, although they might not give the same priority to facial expressions as typically developing children, even in mentally retarded children with autism the ability to perceive emotional expressions seems to be essentially intact.

The question then is why, in these studies, children with ASD applied this capacity to a lesser extent than their non-autistic, but equally retarded peers when they were asked to categorise the photographs. Possibly, the direct relevance of facial emotional expressions played a role in those settings. Participants usually construe their own reasons for focusing on certain aspects in a task and comply with their expectations of the task's demands (Orne, 1969). The priority that is given to facial expressions by typically developing children might stem from their acknowledgement that emotional information is pertinent - or at least could be pertinent - under almost all circumstances. Yet, participants in these studies are not dealing with real people, nor are there usually any references to future interactions. Therefore, a finding that children with autism tend to ignore emotional expressions under these artificial circumstances might indicate that they fail to apply their ability to read emotional

expressions in situations in which the value of such information is not immediately clear. Consequently, the results of the studies discussed may provide children's base-line attention to emotional expressions, but they do not necessarily imply that children with autism fail to attend to others' emotions when situations directly require it; much less that they are unable to attend to others' emotions.

Other studies have also found that external 'triggers' can activate latent abilities in children from the autism spectrum. Task performance of children with autism, known for their low task motivation (Koegel et al., 1985), was particularly facilitated when their task involvement increased. Children's performances improved, for example, when they were prompted by explicit instructions, when their active task participation was reinforced, or when their personal interest increased (O'Dell et al., 1983; Dunlap, 1984; Lewis et al., 1988; Volden, Mulcahy, & Holdgrafer, 1997; Rieffe et al., 2000; Begeer, Rieffe, Terwogt, & Stockmann, 2003). Therefore, the absence of social relevance in laboratory studies using the traditional sorting method might cause a relative underestimation of the ability to attend to emotion cues in children with autism. In this study, in which we focus on high-functioning children with an autism spectrum disorder, we examine a) whether the frequently noted lack of spontaneous attention to facial expressions can also be found within this high-functioning subgroup, and b) whether their attention to emotional information improves when the situation contains some elements that may prime the relevance of such information.

The current study included high-functioning (IQ > 80) children from the autism spectrum and typically developing control children, and aimed to compare children's attention to emotions in a 'neutral' setting in which the temporary feeling state of others did not have direct implications, with their attention to emotions in a setting where emotional information could have direct implications for their own well being. In both conditions, a sorting task was used, similar to the experiment in mentally retarded children with autism by Weeks and Hobson (1987). Children were presented with photographs of people who differed according to their facial expression of emotions (positive or negative), and two non-emotional features: moustaches and glasses (present or absent). In the neutral condition, children were asked, without any further explanation, to select pairs of photographs that were 'most similar'. In the primed condition, children were asked to pair the photos based on their expectations of the people's future actions. The likelihood of these actions could easily be linked to basic action tendencies that were part of the expressed emotions (e.g. people with positive emotional expressions tend to be generous; people with negative emotional expressions are more likely to punish you). Moreover, the actions that children were asked about involved their own interests; because they were asked to group the two people that they thought would act positively or negatively towards them. This element of personal relevance was expected to prompt their engagement and increase their task motivation. Therefore, it was expected that the high functioning children with ASD in this study

would be less attentive to facial emotional expressions than their typically developing peers in the neutral condition, but that children from both groups would show equal attention to emotional expressions in the primed condition.

Method

Participants

Three groups of participants (all boys) were tested, two groups from the autism spectrum and a control group. The first group included 11 boys with classic autism (mean age 9-9, range 7-4 to 12-9), the second group included 17 boys with PDD-NOS (mean age 9-1, range 7-3 to 11-9). The children with autism and PDD-NOS were recruited from a specialized child psychiatric centre providing both inpatient and outpatient care for children with disorders in the autism spectrum. A normally developing control group included 31 boys (mean age 9-6, range 8-0 to 10-7). The control group was recruited from two primary schools around Amsterdam, the Netherlands.

The diagnostic classification of the children from the autism spectrum was based on a three months diagnostic assessment by a child psychiatrist, during which multiple informants, psychologists and educationalists, also observed and tested the children in the group and in school. The children with high-functioning autism showed a history of 'classical' autism and fulfilled established diagnostic criteria according to the DSM-IV. Children were classified as PDD-NOS when they met three or more criteria for autistic disorder according to the DSM-IV, and when their impairments had an onset before the age of 36 months, but the full set of criteria of an autistic disorder were not met (American Psychiatric Association, 1994). The verbal IQ scores (Mean: 99.8, *SD*.: 16.0) and nonverbal IQ scores (Mean: 94.4, *SD*.: 17.3) of the children were within 'normal' range, based on the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986) or the RAKIT intelligence test (Bleichrodt, 1988). The autism subgroups of children with PDD-NOS and autism did not significantly differ on verbal and nonverbal IQ. The typically developing control group was not explicitly tested for their intelligence. However, they functioned at an adequate level in regular elementary schools, and according to their teachers they showed intelligence within the 'normal' range.

Materials

The experiment consisted of four trials, two trials per condition (neutral and primed). During each trial, using a laptop computer, children were presented with combinations of four black-and-white photographs showing male faces. The neutral condition consisted of the first two trials, whereas the primed condition consisted of the last two trials.

After an introduction to make them familiar with the sorting procedure (see Procedure), children were instructed as follows: *'That went very well. Now we will do a very similar game. I'll show you pictures*

of four people. These pictures are different in some ways, and the same in other ways, just like the previous task. You may choose again which two of the four pictures are most similar according to you'. This was repeated in the second trial with another set of photos.

In the third trial, the positive primed condition, children were instructed as follows: *'Now, I will show you four pictures again. But this time I want to ask you something different. Which two are most likely give you a sweet?'* and in the fourth trial, the negative primed condition, children were asked: *'Imagine all of the men in the pictures are teachers. Which two teachers are most likely to tell you off?'*

The photograph combinations were randomly chosen from a database, containing a total of 49 photos of 16 different individuals. Each child was presented with random photo combinations of four different individuals (see Figure 1). For each presentation, the photos were arranged in such a way that any categorization of two photos would correspond to one of three possible selection features: glasses (present or absent), moustache (present or absent) and valence of emotional expression (happy or angry). The common feature of the two photos chosen by the subject in the first presentation (e.g. a subject chooses two faces with glasses) was subsequently entered in the computer by the experimenter. The computer then automatically created a second random combination of four different photos that were equal on the feature selected after the first presentation (i.e., no one wore glasses this time). After this combination was displayed in a second presentation, again two photos could be paired based on one of the two remaining features (i.e., moustache and emotional expression). Each trial included two presentations and the total amount of presentations was eight. The computer program was written for the purpose of this experiment.

The photos were taken from the Yale Faces database (Belhumeur, Hespanha, & Kriegman, 1997). Weeks and Hobson (1987) reported interpretative problems due to a high saliency of a non-emotion feature (gender). To ensure an equal distribution of salience among the selection features in the present experiment, we conducted a pilot study among college students (n=15), in which the salience of selection features was judged for different combinations of four photographs. The combinations that evoked equal distributions of common features in the selected pairs (i.e., moustache, glasses and emotional expression were chosen as selection criterion with equal frequency) were used in the actual experiment.

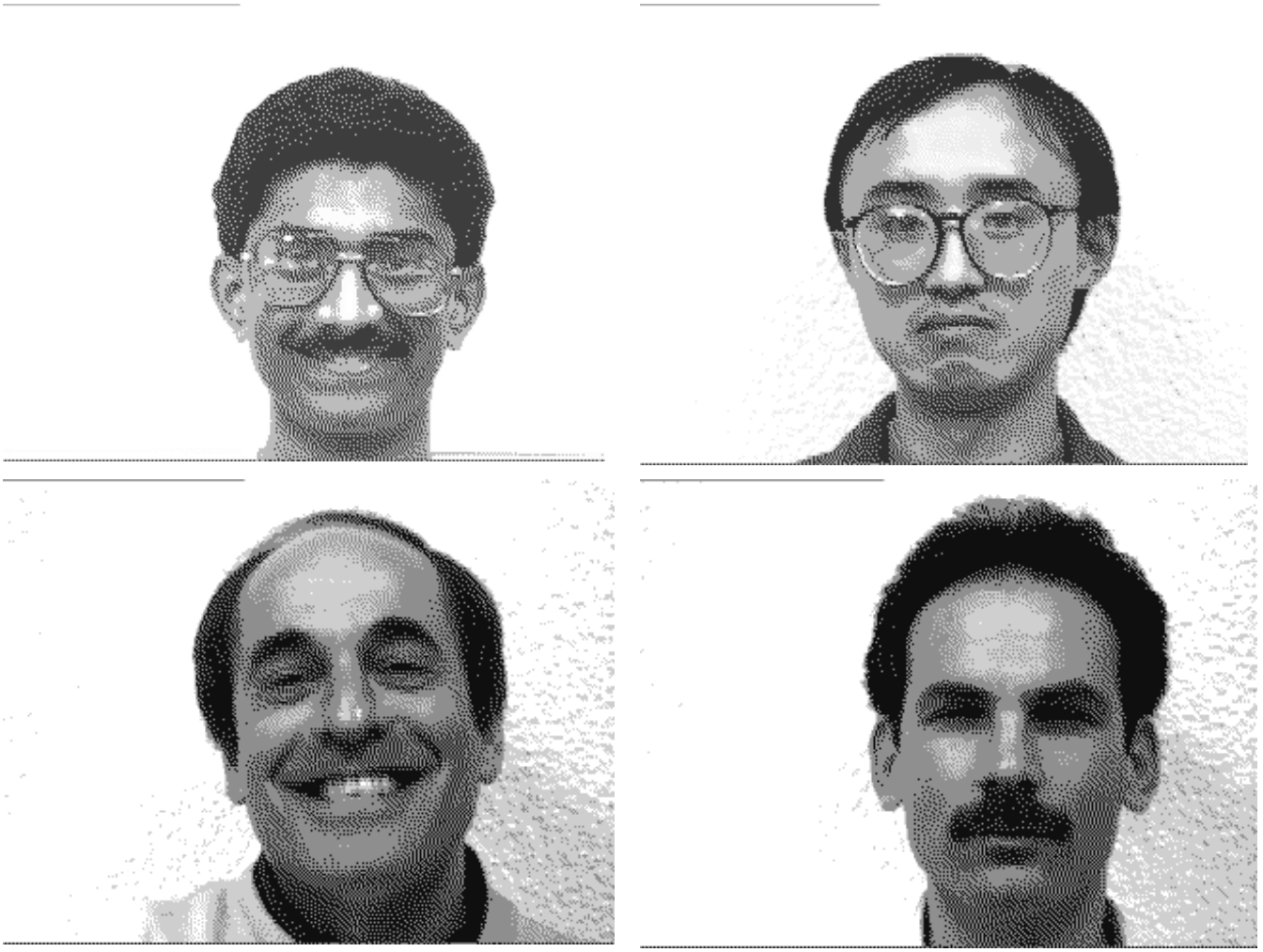

Figure 1. Example of photograph combination in the first presentation, with three possible selection features (glasses, moustache and emotional expression).

Procedure

A male experimenter tested the participants individually for about 15 minutes. First of all, a training task was presented, designed to illustrate the principle of the actual task. Four geometric figures were shown, which differed on three features: shape (square/rectangle), colour (grey/black) and size (big/small). Participants were asked to select two figures that were most similar according to them, in the following way: '*We'll play a game now. I will show you four pictures of figures. All you have to do is tell me which two pictures are most similar according to you*. Children had two opportunities to select pairs of figures. When children paired two figures containing feature X, indicating their first preference for that feature, the next presentation of figures would consist of four figures varying only with respect to the remaining two features. Children were asked again to select two similar figures. The next pair that was selected revealed children's second preference among the three features, as well as their least preferred feature. During this training, participants did not need to verbalise which features the pairs had in common. This training procedure was practised twice. The actual experiment followed the exact same procedure, but photographs of faces replaced the geometric figures.

Following the scoring-system designed by Weeks and Hobson (1987), children received a score of 2 when they selected two faces with similar emotional expressions during the first presentation of three selection features (direct emotion selection). A choice of faces with similar emotional expressions during the second presentation with two criteria to choose from was scored 1. Children who gave no priority to emotional expressions at all were scored 0 (no emotion selection). Children's scores over two trials for each condition could thus vary from 0 to 4.

Results

All children understood the sorting procedure of the geometric figures on different features in the introductory task and were admitted to participate in the second part of the study. Table 1 shows the frequencies of children's emotion selections as a function of Group (HFASD and control) and Condition (neutral and primed).

Table 1. Frequency of responses in which emotion was used as selection criterion as a function of Group and Condition.

		Emotion priority in selection				
		4	3	2	1	0
Neutral condition*	HFASD group (n=28)	2 (7%)	1 (3%)	3 (11%)	3 (11%)	19 (68%)
	Control group (n=31)	4 (13%)	4 (13%)	4 (13%)	5 (16%)	14 (45%)
Primed Condition	HFASD group (n=28)	16 (57%)	6 (22%)	4 (14%)	2 (7%)	0 (0%)
	Control group (n=31)	22 (71%)	4 (13%)	3 (10%)	2 (6%)	0 (0%)

* Between-group difference, $p < .05$.

Note: 4 = emotion selection after first presentation of both trials, 3 = emotion selection after first presentation of one trial and second presentation of other trial, 2 = emotion selection after first presentation of one trial or after second presentations of both trails, 1 = emotion selection after second presentation of one trial, 0 = no emotion selection.

A clear majority of the children with HFASD and nearly half of the control group never sorted the photographs they were presented with on the basis of the emotional expression in the first two trials. Children with HFASD sorted the photos less often on the basis of the emotion expressions than children from the control group in the neutral condition. A non-parametric Mann-Whitney U test confirmed this finding ($U = 328.5$, $p < .05$, one-tailed).

The primed condition elicited more attention to emotional expressions in both groups and all children sorted the photos at least once on their emotional expression. As predicted, no group difference was found in this primed condition. Children with HFASD showed attention to the facial emotional expressions of the people in the photos as frequently as children from the control group (U = 378.0, p = .16, one-tailed). Children's attention to positive or negative emotional expressions were also analysed separately. No group differences were found in attention to positive (happy) (U = 411.0, *n.s.*) or negative (angry) (U = 354.5, *n.s.*) emotions of children with HFASD and typically developing children.

These results indicate that the explicit addition of social relevance to the instructions resulted in equivalent performances between the clinical and the non-clinical groups. However, based on Table 1 it is unclear whether the priming condition led to similar incremental or discrete increases in preference scores for all children. Therefore, we calculated increment scores between the neutral and primed conditions for each child. The frequencies of increment scores in Table 2 show that approximately one third of the children in both groups did not select on emotion in the neutral condition, but immediately did so in a primed condition (increment is 4). A fairly large number of control children (23%) did not show any increment or even showed a decrease.

Table 2. Frequency of increase in emotion selection between neutral and primed condition as a function of Group

	Increase in emotion priority in selection					
	-1	0	1	2	3	4
HFASD group (n=28)	0 (0%)	2 (7%)	4 (14%)	7 (25%)	6 (21%)	9 (32%)
Control group (n=31)	2 (7%)	5 (16%)	4 (13%)	6 (19%)	3 (10%)	11 (36%)

Additionally, the results in Table 1 do not reveal the different ways in which a child could receive a score of 2 or 3. For instance, a score of 2 was given for selecting on emotion expressions after one first presentation, but also for selecting on emotion after two second presentations. As can be seen in Table 3, the number of direct, indirect and absent emotion selections of children with HFASD and controls are relatively similar in the primed condition, but differ in the neutral condition. This suggestion is partly confirmed, because children with HFASD more often than the controls failed to select on emotion alone in the neutral condition (U = 328.5, $p < .05$, one-tailed). None of the other frequencies of emotion selections differed between children from the HFASD or the control groups.

Table 3. Mean frequency of direct, indirect or no emotion selections as a function of Group (HFASD and Control)

		Emotion selection		
		Direct (after first presentation)	Indirect (after second presentation)	No emotion selection
Neutral condition	HFASD group (n=28)	6 (11%)	8 (14%)	42 (75%)
	Control group (n=31)	13 (21%)	15 (24%)	34 (55%)
Primed condition	HFASD group (n=28)	40.5 (72%)	8.5 (15%)	7 (13%)
	Control group (n=31)	50 (81%)	6.5 (10%)	5.5 (9%)

Besides differences in attention to emotional features, we could expect to find a higher degree of salience for the moustaches than the glasses in the HFASD group. Earlier studies have shown that high-functioning children with HFASD recognize facial information from the mouth regions better than information from the eye regions (Langdell, 1978; Joseph et al., 2003). However, in the present experiment, no differences were found between children from the HFASD spectrum or controls in preferential patterns for eye regions (i.e., glasses, $U = 365.5$, $p = .27$) or mouth regions (i.e., moustaches, $U = 432.5$, $p = .98$).

Although no explicit hypotheses were formulated with respect to the subgroups within the HFASD spectrum, an extra analysis was carried out in order to look for possible differences between children with autism and PDD-NOS. Mutual differences between children with classic autism (n=11) and children with PDD-NOS (n=17) were not found in either the neutral or the primed condition (see Table 4) ($U = 75.5$, $p = .31$, and $U = 81.5$, $p = .53$, respectively).

Table 4. Frequency of responses in which emotion was used as selection criterion as a function of Group (PDD-NOS and Autism) and Condition (Neutral and Primed)

		Emotion priority in selection				
		4	3	2	1	0
Neutral condition	Autism group (n=11)	1 (9%)	0 (0%)	1 (9%)	0 (0%)	9 (82%)
	PDD-NOS group (n=17)	1 (6%)	1 (6%)	2 (12%)	3 (18%)	10 (59%)
Primed Condition	Autism group (n=11)	6 (55%)	1 (9%)	3 (27%)	1 (9%)	0 (0%)
	PDD-NOS group (n=17)	10 (59%)	5 (29%)	1 (6%)	1 (6%)	0 (0%)

Note: 4 = emotion selection after first presentation of both trials, 3 = emotion selection after first presentation of one trial and second presentation of other trial, 2 = emotion selection after first presentation of one trial or after second presentations of both trails, 1 = emotion selection after second presentation of one trial, 0 = no emotion selection.

Finally, in order to control for a possible relationship between the attention to facial emotional expressions and intelligence levels, we correlated the measures of both variables in the autism spectrum group. The correlations between attention to emotions and verbal intelligence scores (primed condition: $r_{(28)} = -.28$, *n.s.*, non-primed condition: $r_{(28)} = -.17$, *n.s.*) or non-verbal intelligence scores (primed condition: $r_{(28)} = -.03$, *n.s.*, non-primed condition: $r_{(28)} = .15$, *n.s.*) did not reach significance level.

Discussion

In correspondence with the results of Weeks and Hobson (1987), who studied mentally retarded children with ASD, the present experiment showed that also high-functioning children from the autism spectrum paid little attention to facial emotional expressions in other people. The current group of children from the autism spectrum gave less priority to emotion features as a selection criterion for the photographed faces than their typically developing peers. Instead, they more often selected photographs that were similar on non-emotion features, such as the presence of glasses or a moustache. However, this group difference only appeared in the 'neutral' condition, when circumstances bore no relation to possible relevance of emotional factors.

As expected, this difference between the autism spectrum and control groups disappeared when children were asked to focus on likely behavioural outcomes of the expressed emotion states. Children from both groups equally often sorted the presented photographs on emotion features when they were asked to select them according to possible future actions of the portrayed people. These findings

suggest that children with HFASD are able to pair a positive or negative facial expression with a positive or negative social consequence when asked to make a socially relevant decision. Yet, whereas typically developing children were relatively attentive to emotional expressions in both conditions (note that we specifically ensured that the selection features were equally salient) children with HFASD only took them into full account when the relevance of the emotional expressions was triggered by situational determinants. The variability of performances in both groups of children highlights the impact of task demands on children's attention to emotional expressions.

An important question is whether the present results could be attributed to differences in intellectual abilities between children with HFASD and typically developing children. Unfortunately, we could not directly answer this question since intelligence levels were not formally assessed in the control group. However, the existence of this relation seems unlikely in the present study. First, no correlations were found between the intellectual abilities and attention to emotions in the autism spectrum group, despite the fact that the variance of IQ scores in the HFASD group was relatively high. These results are in line with a recent study which failed to find correlations between cognitive abilities and recognition of self-conscious emotions in normally intelligent children with HFASD (Heerey et al., 2003). Furthermore, teachers who selected the control children were asked to choose average students, and the mean IQ scores of the HFASD group were indeed average. However, the lack of information on the intellectual abilities of the control group means that caution is required in the interpretation of the results of the present study.

The higher tendency of typically developing children to process emotional information under all circumstances - even when the situational context fails to show a direct relevance – suggests an automatic mechanism (Darwin & Ekman, 1872). As argued in the introduction, infant behaviour indeed suggests that children already intuitively understand some of these processes from the beginning of life (Caron et al., 1985). It is difficult to make out from our results whether children from the autism spectrum also have this kind of intuitive understanding. If they do, however, their understanding seems to be less available when it is not explicitly required by the situation. Children with HFASD might naturally ignore other people's facial expressions when there is no direct need for them to deal with this kind of information. However, they also seem to be less aware that others' emotional states might *become* relevant. They do not seem to have acquired the knowledge that the chance that this will happen is relatively large compared to the possibility that knowledge about trivial elements like glasses or moustaches will become useful.

On the other hand, one could also argue that, even after attention to emotions is triggered in children with HFASD, their style of processing emotional information might differ fundamentally from typically developing children. In particular, high-functioning children with ASD are often said to

cognitively compensate for their lack of 'natural' attention to emotions, sometimes referred to as the logico-affective hypothesis (Hermelin & O'Conner, 1985). Within this approach, it could be argued that the high functioning children have sufficient intellectual skills to appreciate the functionality of emotional expressions and attend to the social information that is contained within them. Their processing style can be considered as 'analytic and verbally mediated' rather than 'holistic and intuitive' (Grossman et al., 2000), and this may be related to a weak central coherence in children with ASD. These children have been observed to exhibit problems integrating information into a meaningful whole (Happé, 1993; Frith, 2003). Indirect empirical support for a relation between weak central coherence and face processing can be seen in the finding that children with ASD read emotional expressions more quickly than typically developing children when faces are presented upside down (Langdell, 1978; Hobson, Ouston, & Lee, 1988), suggesting a piecemeal rather than holistic processing of facial information. Based on the present study, a definite answer on the nature of the processing style of emotional expressions in children with ASD cannot be provided. However, the same study carried out with mentally retarded children might provide more insight into this issue.

Earlier findings of a preference for mouth over eye regions in face processing of children with ASD (e.g., Joseph et al., 2003) were not confirmed in the present study. However, our task may not have been sensitive enough to illuminate these differences, as we did not use eye-track technology to measure the visual fixations of the children.

Still, irrespective of the exact manner in which they process information about emotions, even in these relatively bright children with ASD, attention to emotions is triggered less spontaneously than in their typically developing peers. The substantial increase of attention to emotions in the priming condition suggests that the addition of social relevancy to the task resulted in a qualitative shift to a new set of processing criteria rather than enhancing a strategy that was already being employed. This indicates a production deficit in the HFASD group: these children are neither blind nor short-sighted to emotional cues, but they do need assistance in deciding when and where to look. It also raises the question of whether ASD subgroups of children differ in their sensitivity to social priming, especially with respect to interventions.

The problem remains that it will be hard to provide the children with explicit instructions about how to make use of emotional expressions in social situations that are ambiguous, as is often the case in day-to-day situations. Besides clarifying these contextual factors, a further goal would be to indicate, and possibly facilitate, the kinds of social and interpersonal experiences in children with HFASD that make emotional expressions automatically salient in typical development. Without a clearly defined context, as was the case in the neutral condition, we can conclude that emotional expressions are no more meaningful than glasses or moustaches to children with HFASD. Frith (2003) recently argued

that all three major approaches to autism can be unified by supposing a different kind of self-awareness in autism: ‘an awareness that is *all* self and does not include the reflection of the self in other selves’ (p. 210). Awareness of and attention to emotional reactions in other people are an essential element in this missing ‘looking glass self’ (Cooley, 1902).

4. Emotional display rules in children with autism

Introduction

Expressing emotions has an important interpersonal function. Whether a child will show its anger to someone else, or choose to hide how afraid it feels, has important consequences for the relationship with the other person. The strategic expression of emotions regulates the establishment and maintenance of interpersonal relationships (Gnepp & Hess, 1986; Cole, 1986; Zeman & Garber, 1996). The social guidelines of emotional expressions are referred to as emotional display rules. Understanding and using such display rules is generally regarded as one of the main achievements in the children's emotional maturation (Saarni, 1999). Children who use display rules are rated more competent by teachers and parents than children who do not use these rules (McDowell, O'Neil, & Parke, 2000), and the use of display rules has been linked to preserving self-esteem in threatening and stressful situations and emotional relief (Laux, 1986).

Children with ASD are known for their a-typical emotional development. They lack the ability to emotionally interact with others, have problems understanding emotions, and are less attentive to emotions in others (Kanner, 1943; Sigman et al., 1986; Hobson, 1986a). Furthermore, these children are also known for their meta-cognitive problems. Though high functioning children with ASD may possess basic Theory of Mind (ToM) skills, these individuals particularly seem to lack the ability to use their ToM understanding in real-life social interactions (Klin et al., 1997, see also Chapter one and two). The strategic expression of emotions is a typical real-life action that is related to the subtle application of ToM knowledge. The affective and meta-cognitive problems of children with HFASD would suggest that they have an impaired ability to use and understand emotional display rules. The functional regulation of emotional expressions during social interactions requires emotional skills, i.e., a child needs to control its own emotional expression and has to be able to adequately attend to and recognize the emotional state of the interaction partner. Regulating emotional expressions also requires an understanding of others' subjective mental states. Hiding your 'true' feelings manipulates the perspective of another person on your emotional state. Without awareness of the other person's perspective, display rules will be of little use. In sum, both the Theory of Mind deficits and the a-typical emotional development of children with HFASD would predict impairments in their display rule abilities. However, little is known about their capacities in this domain. In this chapter we focus on both the self-reported use of display rules and the understanding of display rules in children with HFASD.

In normal development, children's display rule skills gradually improve during early and middle childhood. This development is steered by increasing social repercussions of inadequate use of display rules (Gnepp et al., 1986; Zeman et al., 1996). For example, the explicit expression of sadness over an unwanted gift will raise different responses from the social environment when it is shown by a three-year-old or by a ten-year-old child. Expressions that are acceptable for a three-year-old may be

regarded as inappropriate for a ten-year-old. As they grow older, children are held more accountable for being able to regulate and manage their emotional-expressive behaviour (DePaulo, 1992). In normal development, children start to hide their true feelings at approximately three or four years of age (Saarni, 1979; Cole, 1986).

Signs of an understanding of display rules emerge later. From around six years-of-age, children can properly explain how their expressions mask their 'true' emotional state of mind and create an effective self-presentation. When children grow older they become more aware of the limitations of their abilities to hide emotions. Whereas eleven-year-old children are normally quite convinced that they are able to mask their true emotions, fifteen-year-olds sometimes express their doubts that they will be successful in misleading a keen observer (Harris, Olthof, & Meerum Terwogt, 1981; Meerum-Terwogt, Schene, & Koops, 1990).

There are different ways to hide your feelings. Emotions may be masked, minimized or substituted in facial expressions, posture and other non-verbal clues, but also in verbal expressions. Contrary to the non-verbal expressive components of emotions, verbalizations are, almost by definition, conscious actions. Using verbal display rules is required from younger children, and children are generally instructed how to regulate their verbal display in a direct way ('don't say that!'). But even if the child manages to withhold verbal content, the more automatic non-verbal correlates of an emotional state can easily give the child away if it does not really feel what it claims to feel. One has to become aware of these involuntary phenomena in order to suppress them (Ekman & Friesen, 1975). Besides, compared to the direct feedback on their verbal statements, adults are less likely to explicitly instruct children how to apply facial display rules. Therefore it is not surprising that normally developing children were found to understand verbal display rules at around six years-of-age and facial display rules at around eight years-of-age (Gnepp et al., 1986).

Display rules can be applied for various reasons. First, children need to acknowledge the audience for whom they control their emotional expressions. The understanding of the role of an audience develops relatively early. Six-year-olds report more display rules in the presence of peers than parents, most commonly in order to avoid negative social interactions (Zeman, & Garber, 1996). When the audience is acknowledged, there may still be different reasons for using display rules. Broadly speaking, children may want to protect their audience or themselves by using display rules. Children are often told to modify their emotional expressions to spare the feelings of someone else. Such pro-social display rules can already be observed in toddlers who, for example, hide their disappointment over an unwanted gift behind a thankful smile (Cole, 1986). Display rules can also be applied for self-protective reasons, for example hiding your fear to avoid becoming the object of derision by others. Just as overt socialization pressures to use display rules are higher for verbal than facial expressions,

this pressure is also higher for pro-social than self-protective display rules. An increase in the understanding of both pro-social and self-protective display rules can be observed in children between the ages of six to ten years old, but pro-social display rules are generally understood better, and at earlier ages than self-protective display rules (Gnepp & Hess, 1986).

Various observational studies have shown that children with autism express emotions in atypical ways. They display fewer positive emotions in social contexts, and produce less and less appropriate affect in their facial and gestured expressions than normally developed children. This suggests a restricted ability to control their emotional expressions (McGee, Feldman, & Chernin, 1991; Langdell, 1978; Attwood et al., 1988; Kasari et al., 1990). Furthermore, they showed a poor understanding of white lies (Happé et al., 1996; Jolliffe et al., 1999), and were less able to explain how their deception involved the manipulation of others' beliefs (Happé, 1994; Yirmiya, Solomonica-Levi, & Shulman, 1996; Jolliffe et al., 1999; Heavey et al., 2000; Roeyers et al., 2001). To our knowledge, only one experimental study of display rule understanding has been conducted with children with autism. This study was based on 8 children with ASD. Most of these children had IQ scores of 80 or above, but some of them did not score in the normal intelligence range. Findings indicated that these children were less able to indicate real and deceptive emotions and provided poor explanations for deceptive facial expressions compared to normally developing controls (Dennis, Lockyer, & Lazenby, 2000). However larger sample sizes with normally intelligent children, and a more detailed investigation of the strategies and reasons for display rules are needed to provide a better view of the experiences with and theoretical understanding of display rules in children with HFASD.

In the present study, the personal experience with emotional display rules and the conceptual understanding of these rules were studied in high functioning, school-aged children with ASD and normally developing children. It was hypothesized that children with HFASD, compared to normally developing children, would show restrictions in both their experience with and their understanding of emotional display rules. To test these hypotheses, two studies were conducted. In the first study, we asked children about their personal experiences with display rules. A second study focussed on children's conceptual understanding of display rules.

Study 1: Display rule interview

In the first study personal experiences with display rules were explored in high functioning children with HFASD and normally developing control children. A semi-structured interview was conducted about children's ability to control their display of basic emotions such as anger, fear, sadness and happiness (Rieffe et al., 2005). Children were encouraged to report examples of their personal experiences with emotional display rules. These examples were then used for further questions about

the type of situations that elicit display rules, the strategy used, the reasons behind using display rules and the effect of their display rule use on the perspective of others. We expected children with HFASD to report less use of display rules. Specifically, we expected them to provide fewer examples of situations that elicit display rules, and to refer less often to the perspectives of other people when they do report display rules.

Method

Participants

Twenty-five children from the autism spectrum and 36 control children participated in the interview. The children from the autistic spectrum consisted of 8 children with autism or Asperger syndrome (*M* = 12-4, *SD* = 2-2; all boys) and 17 children diagnosed as PDD-NOS (*M* = 11-2, *SD* = 1-8; 16 boys, one girl). They were recruited from three different psychiatric centres in the Netherlands. These children were matched as closely as possible on age, gender and intellectual functioning with normally developing control children. The control group consisted of 36 children (*M* = 10-1, *SD* = 0-6; 33 boys and 3 girls, recruited from two primary schools around Amsterdam, the Netherlands.

The diagnostic classification of the children in the autism spectrum groups was based on a three months diagnostic assessment, during which multiple informants also observed the children in the group and in school. The children with high-functioning autism showed a history of 'classical' autism and met the established diagnostic criteria (American Psychiatric Association, 1994). Children with PDD-NOS met at least three of the DSM-IV criteria for autistic disorder, whereas their impairments had an onset before the age of 36 months. The mean IQ scores of the HFASD group were: verbal: 99.9 (*SD*: 18.7); non-verbal: 95.0 (*SD*: 15.9; unknown for three children); total 98.7 (*SD*: 17.6), based on the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986) or the RAKIT intelligence test (Bleichrodt, 1988). Differences between the mean IQ scores of children with autism and PDD-NOS were non-significant. The teachers of the control group children characterized their intellectual abilities invariably as 'normal'. Written parental consent was obtained for all participants.

Procedure

Children were interviewed individually in a separate room at school. Each question was asked four times, concerning anger, sadness, happiness, and fear, respectively. Each emotion was first introduced using schematic drawings of facial emotional expressions. Children were asked whether they ever experienced the emotion, and to indicate which expression matched the emotion. The sequence of emotions was not varied. All children reported to sometimes experience these emotions and had no trouble identifying the appropriate expressions. See Figure 1.

1. Have you ever been angry while you tried not to show your anger to other people? *(If not:* would you be able to if you tried? *Affirmative: rest of the questions in future tense. Negative: rest of the questions about a hypothetical child, that has tried to mask anger)*
2. When was it that you did not show your anger?
3. How did you avoid showing your anger? What did you do?
4. Why did you not want to show your anger in that situation?
5. Did you succeed, do you think that others noticed you were angry?

Figure 1. Interview questions for anger.

Scoring

Question 2

Children's descriptions of display rule situations were assigned to the following categories:

Personal situations: The child made specific references to subjective personal experiences (e.g. 'The other day my brother broke something of mine and I got angry but did not want to show it')

General situations: The child referred to abstract, prototypical situations without mention of personal experience (e.g. 'When something happens and I don't succeed, then sometimes I want to cry but I don't show it').

No Situation: The child did not refer to display rule situations.

Children's responses to question 2 were also scored according to their references to the audience in the display rule situation.

Peers: The child explicitly referred to peers as audience figures for whom the display rules were applied.

Adults: The child explicitly referred to adults as audience figures for whom the display rules were applied.

Question 3

Children's explanations of their display rule strategy were assigned to the following categories:

Emotion regulation: the experienced emotions were deliberately diminished, or disappeared, and neutralization was not necessary. For example 'Then I just think of something else and it doesn't bother me anymore'

Substitution: the experienced emotions were masked by showing another emotion. For example 'then I am angry on the inside and attempt to look happy'.

Neutralization: the experienced emotions were masked by acting normal, or not showing the emotion, without substituting other emotions. For example: 'then I just don't join them, and pretend like there is nothing wrong' 'Then you get tears in your eyes and you wipe them away immediately'.

Avoidance: leaving the situation, so changing the display is not necessary anymore. For example: 'I just left for a minute'.

Question 4

The motives mentioned for masking emotions were assigned to one of the following categories:

Social norms: expressing the emotion is not appropriate in the situations. For example: 'You are not supposed to be angry at a birthday party'

Pro-social: the child wants to protect the social relationships or attempts to prevent that somebody else gets hurt. For example: 'Because it's not nice for him, and it will ruin his day'

Self-protective: the child expects negative consequences for itself when it will not mask the emotions. For example: 'Then they will start picking on me'

Categorizing of all questions was carried out by two independent raters. Interrater reliability, calculated over all ratings, ranged between .90 and 1.00. Discrepancies were solved by discussion.

Results

For each emotion (anger, sadness, happiness, and fear) questions 1 to 5 (Figure 1) were presented to the children. Because few systematic differences were found between answers to the question interviews on the different emotions, the data analyses were performed on category scores that were summed over the four emotions. Repeated tests were always analysed with Bonferroni correction.

Question 1: Ability to use display rules

When asked whether they were able to use display rules for each emotion, it was counted how often children responded positive (maximum score is 4). A t-test did not show any difference between the HFASD and the control groups (M = 3.12, (SD = 1.01) and M = 3.36, (SD = .99) respectively, $t_{(59)}$ = .93, *n.s.*). The majority of children from both groups indicated that they would be able to use emotional display rules.

Question 2: Nature of the situation

Responses to the question when children would use display rules were scored in the exclusive categories specific situation, general situation, no situation / no response. Responses to the four different emotions were added. In Table 1 it can be seen that children with HFASD more often than control children failed to mention a situation at all ($t_{(33)}$ = 4.73, p < .001). Furthermore, the children from the HFASD group mentioned general situations equally often, but personal situations less often compared to control children ($t_{(59)}$ = 3.03, p < .01).

Table 1. Proportions (SD) of type of display rule situations as function of group. Range 0-1.

	No**	General	Personal*
HFASD (n = 25)	.25 (.26)	.50 (.29)	.25 (.27)
Controls (n = 36)	.07 (.16)	.45 (.33)	.48 (.33)

*$p < .01$. **$p < .001$.

Because the presence of an audience is essential to using display rules, children's explanations for display rule use were also scored for references to persons for whom the emotional expression was modified. Children's references could be attributed to more than one category. The proportion scores in Table 2 indicate that the HFASD group less often referred to an audience than children from the control group ($t_{(59)} = 4.14$, $p < .001$). When the type of audience was analysed - peers or adults -, children from the control groups appeared to refer more often to peers than to adults ($t_{(35)} = 3.84$, $p < .001$), confirming earlier findings (Zeman et al., 1996). Children with HFASD referred to adults and peers equally often ($t_{(24)} = 1.42$, $p = .168$). Compared to control children, children with HFASD mentioned peers less often ($t_{(59)} = 3.51$, $p < .001$), while no group difference was found in the references to adults.

Table 2. Mean (SD) proportions of references to audience as function of group (HFASD, Controls). Range 0-1.

	Total**	Peers**	Adults
HFASD (n = 25)	.41 (.35)	.28 (.30)	.17 (.29)
Controls (n = 36)	.75 (.29)	.58 (.34)[#]	.25 (.27)[#]

**$p < .001$.

[#]Peers versus Adults, $p < .001$.

Question 3: Display rule strategies

The strategies that children mentioned in response to the question how they would mask their emotion differed between children from the HFASD and the control groups. Table 3 shows the distribution of the responses. Children's responses could be attributed to more than one category. Children with HFASD more often mentioned substitution than control children ($t_{(59)} = 2.86$, $p < .006$), while neutralization was mentioned less often by children with HFASD than control children ($t_{(59)} = 3.25$, $p < .002$). The other strategies were mentioned equally often by children from both groups.

Table 3. Mean (SD) distribution of strategies of emotional display as function of group (HFASD, Controls). Range 0-4.

Group	Substitution**	Neutralization**	Avoidance	Emotion regulation	No response
HFASD (n = 25)	1.41 (1.38)	1.87 (1.26)	.48 (.71)	.28 (.68)	.36 (.70)
Controls (n = 36)	.62 (.77)	2.84 (1.07)	.48 (.77)	.32 (.72)	.15 (.38)

**$p < .001$.

When children referred to substitution, neutralization or avoidance, it was also analysed how children would mask their emotional expression (verbally, facially, or behaviourally). The modes of masking did not differ between the groups. Children from both groups referred to verbal displays less often than to facial or behavioural displays ($M = .14$, $SD = .25$; $M = .53$, $SD = .39$ and $M = .45$, $SD = .37$, respectively). T-tests confirmed these observations ($t_{(60)} = 5.72$, $p < .001$ and $t_{(60)} = 5.62$, $p < .001$, for verbal versus facial, and verbal versus behavioural, respectively).

Question 4: motives

The fourth question concerned the motives for using display rules of the children. These categories were not exclusive, children's responses could be attributed to more than one category. Both groups mostly referred to self protective motives ($p < .001$). Pro-social motives were mentioned more often by control children than by children with HFASD ($t_{(59)} = 3.38$, $p < .001$), while children with HFASD more often than controls could not think of any motives to mask their emotions ($t_{(59)} = 3.12$, $p < .003$). Additionally, it was also analysed how often children referred to others' emotions as a motive for using display rules. Children with HFASD mentioned others' emotions less often as a motive than children from the control group ($M = .03$, $SD = .08$ and $M = .14$, $SD = .18$, respectively; $t_{(59)} = 2.77$, $p < .007$).

Table 4. Mean (SD) number of references to motives for masking emotions as function of group. Range 0-1.

Group	Normative	Pro-social**	Self protective	No reason**
HFASD (n = 25)	.11 (.18)	.04 (.13)	.54 (.33)	.32 (.32)
Controls (n = 36)	.13 (.17)	.20 (.21)	.57 (.32)	.12 (.19)

**$p < .001$.

Question 5: Success

The responses to the question on the success of the emotional concealment were scored as follows: 0 = no success; 1 = sometimes / a little; 2 = success. Both groups indicated equally often that they would succeed in masking their emotions for others (M = 1.14).

Discussion

In this first study, children with HFASD and control children report that they are able to use emotional display rules in around 75% of their responses. No group differences were found in this respect. However, children with HFASD more often than controls failed to provide examples of display rule situations. When children with HFASD did mention these situations, their descriptions were less personal than those of normally developing children: audience figures were described less often, and examples of situations that elicit display rule use were confined to prototypical situations rather than personalized experiences. Furthermore, control children more often mentioned peers as audience figures than children with HFASD. Control children also mentioned peers relatively more often than adults, conform earlier findings in developmentally normal children (Zeman et al., 1996), while children with HFASD mentioned adults and peers equally often as audience figures in their reported display rule situations. This could be due to a more instrumental use of display rules in children with HFASD, directed at gaining something or avoiding punishment, which may be more apparent with an adult audience. For a peer audience, display rules may be used more to regulate different aspects of the interpersonal relationship, rather than at personal gain or avoiding punishment. The lower number of references to such social display rules in children with HFASD is in line with our expected findings of a low prevalence of spontaneous pro-social motives in the HFASD group, while self-protective motives were mentioned equally often as control children.

No group differences were found in the modes of emotional displays. The majority of answers included facial or behavioural display rules and to a lesser extent verbal display rules. This is in contrast to findings that verbal display rules usually appear earlier in development than facial display rules (Gnepp et al., 1986). The salience of facial masking could be due to the fact that all emotions were introduced by using schematic drawings of emotional expressions, and children were explicitly asked what they would do to mask their emotions. This may have primed facial and behavioural over verbal masking strategies. Furthermore, children with HFASD more often reported to substitute their emotion, while normally developing children more often said to neutralize their facial affect. Substitution responses are observed more often in younger than older children, which can be explained by the difficulty of keeping a 'poker face' that is involved in neutralization (Jones, Abbey, & Cumberland, 1998). The responses of children with HFASD thus resembled those of younger children, which indicate a possible lag in development. Finally, children from both groups reported similar expectations of their success in misleading their audience about their true emotional state. In short, the

findings of this self-report study indicated that, while children with HFASD generally acknowledged display rules, their reports were more abstract, and included less pro-social motives than control children. They seemed to grasp the concept of display rules, but reported less personal experiences in their responses. They rather referred to abstract aspects of display rules situations.

Spontaneously generating responses seems to be a bottleneck in the social-emotional functioning of children with ASD. This was apparent in the studies described in Chapter two and three. However, in these studies it was also shown that, once focused or motivated, children with HFASD were able to respond appropriately. The results of the present study largely depended on children's ability to actively provide examples of emotion eliciting situations from their personal lives. Possible differences in the experience with emotion eliciting situations or the ability to generate adequate examples of such situations may cause an underestimation of their actual understanding of display rules. In order to standardize the situations that children responded to, a second study was designed, where questions were asked about hypothetical situations. This also allowed for a controlled study of the understanding of pro-social and self-protective display rules.

Study 2: Display Rule Stories

Introduction

In the second study, children's display rule understanding was studied using a structured method. Children were presented with explicit descriptions of hypothetical interpersonal interactions. This way, their conceptual understanding of display rules was measured, rather than their more personal experiences with display rules situations. The display rules stories described emotion-eliciting events, as well as motives for masking the display of emotion. Children were questioned about their responses to these hypothetical situations including their verbal and facial expression of emotions, and their understanding of the motives and consequences of these expressions. The display rule stories included either pro-social or self-protective motives for controlling emotional expressions. Again, the children with HFASD, compared to the normally developing children, were expected to report fewer display rules, provide less appropriate explanations for display rules. Furthermore, due to their impaired awareness of others' subjective perspectives, children with HFASD were also expected to show restrictions in their understanding of pro-social display rules.

Method

Participants

This second study included 25 boys from the autism spectrum, 12 with autism, 13 with PDD-NOS (mean age: 11.2, *SD*.: 1.9; all boys). The participants were recruited from the same child psychiatric centre as the children from the first study, according to the same diagnostic procedures. The control

group included 25 normally developing children (mean age: 10.5, *SD*.: 0.8; all boys), and were recruited from primary schools around Amsterdam, the Netherlands. The mean IQ scores of the HFASD group were: verbal: 97.1 (16.3); non-verbal: 92.9 (17.2); total 96.5 (17.7). Children from the control groups were matched as closely as possible with children from the HFASD group on age, gender and verbal intelligence.

Procedure

Four display rule stories were read to the children. These stories included scenarios that were designed to elicit two different basic emotions: happiness and anger. These emotions were chosen because they are likely to elicit concrete reactions that are compatible with pro-social and self-protective motives for controlling their display. For each emotion, two different stories were designed, following a similar theme. The happiness and anger stories were described with either a pro-social or a self-protective storyline. See Figure 2 for short outlines of pro-social and self-protective anger stories. The display rule stories were read in counterbalanced order, alternating between pro-social versus self-protective and anger versus happiness stories. Note that the scenarios were kept fairly similar except for the motives provided for controlling emotions, and that the emotions were explicitly described. The audience figures with whom the children were hypothetically interacting were peers, since normally developing children have been found to control their emotional expression more in the presence of peers than adults (Underwood, Coie, & Herbsman, 1992; Zeman et al., 1996); see also Study one, this chapter). The display rule stories were administered in a quiet room in the children's schools by one experimenter.

Pro-social anger story:
You are making a drawing in school. It turned out really well. Then your classmate accidentally spills a glass of water over it. It is ruined. You are really annoyed. Your classmate asks you: you don't really mind, do you? You know this classmate is very clumsy. He is often picked on because of this. He is really upset and nearly crying.

Self-protective anger story:
You are making a clay statue in school. It turned out really well. Then your classmate accidentally bumps it over. It is ruined. You are really annoyed. Your classmate asks you: you don't really mind, do you? You know this classmate sometimes bullies you and you hope he will leave you in peace today.

Figure 2. Story outlines used in study 2.

The children were asked six questions after each story, listed in Figure 3. We first asked children about their facial expressions, because we expected them to have more trouble indicating their facial

than their verbal appearance, and we did not want their verbal answers to interfere with the facial expression they would choose. Children could indicate their facial expressions by pointing out drawn pictures of happy, sad, angry, fearful or neutral faces, which were presented in front of them in random order. Experienced emotions could be indicated using the same pictures. Children's explanations for choosing a facial expression were coded in different categories (see Scoring). Questions 5 and 6 were only asked if the experienced and expressed emotions differed from each other.

Question 1: '*What look would you have on your face?*'
Question 2: '*How would you feel?'*
Question 3: '*Why do you have this look on your face?'*
Question 4: '*What would you say?*'
Question 5: '*Does your friend know how you feel?'*
Question 6: '*Why does (or doesn't) s(h)e know?*'

Figure 3. Questions asked after each story

Scoring

Children's answers to the stories were scored for (1) the use of display rules, (2) the explanations for the use of facial display rules, and (3) the estimated success and explanation of success.

(1) The use of display rules.

The display rules were computed based on separate questions about experienced and expressed emotions. This way we could investigated children's ability to come up with a discrepancy between experienced and expressed emotions on their own account. Including explic it references to hiding true emotions in the storyline would already focus children on the possibility of controlling emotional expressions (see for example Zeman et al., 1996; Dennis et al. 2000). The following categories were distinguished:

Facial display rules. The child's answers contained both a reference to the experience of the emotion as intended by the story content (e.g. anger or sadness) and a reference to a different facial expression (e.g. happiness). This facial expression had to serve as a functional alternative for the experienced emotion within the storyline, such as a neutral expressions or expressions of opposite valence (e.g. experiencing sadness while showing a fearful face would not be scored as facial masking).

Verbal display rules. The child gave a verbal reaction that concealed their experienced emotion. Again the responses had to include a functional alternative to the experienced emotion, in line with the story content (e.g. 'I say that it's ok and I don't mind').

No display rule situation. The emotional experience reported by the child was different from the one intended in the story line, and would not result in a desire to control the expression (e.g. a neutral response to a ruined drawing).

(2) Explanations of the use of facial display rules.

Explanations were scored in accordance to their appropriateness for the story. Appropriate explanations in the pro-social story conditions would be answers referring to pro-social elements (e.g. 'I don't show how angry I am because I feel sorry for him and he will start to cry if I do'), while appropriate self-protective answers would have to refer to self-protective elements (e.g. 'I don't show how angry I am because otherwise he may beat me').

(3) Estimated success and explanation of success.

Estimated success of the children's control of emotional display was scored according to children's responses to the question whether the audience figure would know their true feeling (question 5). Answers were assigned to the categories: yes, no, and don't know. The subsequent answers to the question why the audience figure would (not) know the child's true feeling (question 6) were scored regarding type of answer and assigned to the following categories: verbal ('because I said so'), facial ('they can see that on my face') and residual.

Responses to the first two questions were based on forced choices between schematic facial expressions. Responses to the last four questions were tape recorded, transcribed and categorized by two independent raters. Interrater reliability exceeded 80%. Discrepancies were solved by discussion. Interrater reliability between the coders was monitored using Cohen's kappa for 10 randomly selected transcripts. Kappa's were .85 for the explanation of the facial expression, 1.00 for verbal expression, .85 the responses to the audience figure's knowledge of the child's emotion (question five), and .83 for the explanation of this knowledge (question six).

Results

In order to measure children's understanding of emotional display rules in hypothetical situations, we first needed to check whether the described situations elicited the intended emotional experience. In the positive condition, a neutral feeling was reported in two answers of control children and four answers of children with HFASD, and a child from the control group reported fear once. All other answers referred to positive emotions, as intended. In the negative condition, 'feeling normal' was reported in one HFASD answer and one control answer. A child with HFASD reported happy once. All other answers contained the expected negative emotions. Unfortunately, when computing the display rules in the pro-social and self-protective conditions, three children with HFASD and two control children did not report to experience the expected emotions in both stories within one condition. Scores of these children could not be included in further analyses. In the remaining group, some children said they would not experience the emotions as intended by the stories in only one of their responses. These children were assigned the score of their other answer within that story condition. This occurred one time in controls and two times in children with HFASD.

When presented with the explicit situations in the display rule stories, children with HFASD showed a basic understanding of display rules that closely resembled the responses of controls. All children reported more display rules in the pro-social than in the self-protective condition, and no group differences could be observed (see Table 5). A 2 (Group: HFASD versus control) x 2 (Expression: facial versus verbal) x 2 (Condition: pro-social versus self-protective) MANOVA with repeated measures on Expression and Condition, revealed main effects for Expression ($F_{(1,43)} = 21.56$, $p < .001$) and Condition ($F_{(1,43)} = 77.66$, $p < .001$), but not for Group. An interaction effect was found for Expression x Condition ($F_{(1,43)} = 10.04$, $p < .01$). Post hoc paired samples t-tests indicated that the facial masking was reported more often than verbal masking in the self-protective condition ($t_{44} = 4.81$, $p < .001$), but not in the pro-social condition. The low report of verbal, self-protective display rules was found in all children.

Further examination of the results revealed that children with HFASD, in contrast to normally developing children, reported different levels of facial control of emotions in pro-social and self-protective situations. A significant three-way interaction for Group x Expressions x Condition ($F_{(1,43)} = 5.65$, $p < .05$), led to post-hoc paired samples t-tests which revealed that facial display rules were reported more often in the pro-social than in the self-protective condition by children with HFASD ($t_{(21)} = 2.93$, $p < .01$) while normally developing children reported the same amount of display rules across both types of situations. With respect to the verbal control of emotions, it appeared that all children reported more pro-social than self-protective display rules (Children with HFASD: $t_{21} = 5.23$, $p < .01$; Controls: $t_{(22)} = 6.65$, $p < .01$). The relative high report of facial display rules in a pro-social

but not in a self-protective situation, which was apparent in children with HFASD but not in controls, indicates high saliency of pro-social situations in children with HFASD.

Table 5. Mean (SD) proportion of reported display rules as function of Group, Expression and Condition. Range 0-1.

		Pro-social		Self-protective	
		Facial	Verbal	Facial	Verbal
HFASD	(n=22)	.77 (.26)	.70 (.30)	.52 (.36)	.27 (.34)
Controls	(n=23)	.70 (.25)	.78 (.30)	.67 (.36)	.22 (.36)

An understanding of display rules also entails knowing why people control their emotional expressions, and what its consequences are. To investigate this more elaborated display rule understanding, various explanatory questions were included in the study. The explanation of facial expressions (question 3) was scored for appropriateness, which was other-protective in the pro-social condition and self-protective in the self-protective condition. In all children, the pro-social situation elicited more appropriate explanations than the self-protective situations. A 2 (Group: HFASD or control) x 2 (Motive: Self-protective or Pro-social) MANOVA with repeated measures on Motive, revealed a main effect for Motive ($F_{(1,43)} = 15.19$, $p < .001$), indicating more appropriate explanations in the pro-social ($M = .42$) than in the self-protective ($M = .20$) condition. No group differences were found.

The estimated success of the attempt to control emotional display (question 4) was rated by asking children whether the audience figure would know their true feeling. Overall, children mainly reported that the audience figure would know how they felt (58% of controls, 55% of children with HFASD, *n.s.*). No difference was found between the pro-social and the self-protective conditions. When asked why the audience figure would or would not know how the children felt (question 5), most children referred to facial expressions (22% of controls and 13% of children with HFASD, *n.s.*).

Discussion

Overall, children with HFASD showed an understanding of hypothetical display rules situations, both verbal and facial, that was unexpectedly similar to normally developing children. However, the motives for display rules were found to interact with children's diagnoses and modes of expression. Verbally, all children reported more pro-social than self-protective display rules. Facially, the control group showed equal levels of display rules in both motive conditions, while children with HFASD reported more use of display rules in the pro-social than self-protective situation.

Unlike the interview findings of the first study, children with HFASD did not differ from normally developing children in their explanations and justifications of their display rules use in the second study. While pro-social stories generally incited more appropriate justifications than self-protective stories, the references of children with HFASD to the motives for using display rules corresponded with the references of normally developing control children. Furthermore, both groups indicated similar success ratings of their display rule use. The explicit descriptions seem to have provided children with HFASD with the necessary cues to describe and justify emotional display rules to a similar level as their normally developing peers.

In short, the structured investigation of children's display rule understanding seems to have compensated some of the shortcomings of the open interview technique that was used in the first study. When children are presented with hypothetical situations, rather than having to come up with examples from their personal experience, children with HFASD showed few differences in their understanding of display rules.

General Discussion

In the present study, children with HFASD and normally developing controls were interviewed about their personal experiences with display rules (Study 1) and questioned about structured, hypothetical display rule situations (Study two). Both studies suggest that children with HFASD are generally aware of social rules for how and when to express or control their emotions.

However, the understanding of display rules seems to rely more on knowledge about prototypical situations in children with HFASD than in normally developing children. In the interview, children with HFASD illustrated their use of display rules more often by referring to prototypical situations. In contrast, normally developing children referred more to their subjective daily life experiences. Similar tendencies of high functioning children with ASD to reason about emotions in terms of abstract, prototypical scripts rather than personal experiences have been shown in earlier studies. This 'theoretical' approach to emotions can be related to attempts to cognitively compensate for an impaired intrinsic and automatic awareness and understanding of emotions (Jaedicke et al., 1994; Capps et al., 1992; Kasari et al., 2001).

In response to the hypothetical, explicitly described display rules situations of the second study, children from both groups justified their display rules just as much as normally developing control children by referring to motives, consequences and modes of expressions. The good performances of children with HFASD may be a result of a basic ability to pick up cues from the scenarios and respond appropriately. Still, their ability to recognize the appropriate story elements indicates that children with HFASD have mastered the basic principles of display rules. The question is whether these

children will also apply such principles in daily life. Though Study 1 also suggested a general understanding of display rules in these children, here children with HFASD referred relatively less to pro-social motives than normally developing children. They even often failed to provide any motives at all. The lack of pro-social display rules, and the low prevalence of audience figures, in particular peers, in the responses of children with HFASD suggest a poor awareness of others' subjective states compared to normally developing children. The problem seems to lie in the generation of these types of responses, because, as was shown in the second study, their understanding of the concept of pro-social motives is in place. The combined findings of both studies indicate the presence of display rule knowledge in children with HFASD. However, this knowledge seems to be applied in real life less on their own account, or less consciously than in normally developing children. Again, their spontaneous use of, apparently present, knowledge, seems to be a bottleneck in the functioning of children with HFASD.

In fact, when presented with explicit cues about motives for using display rules, which was the case in the second study, children with HFASD reported even more pro-social than self-protective facial display rules. In contrast, control children reported a similar frequency of facial displays for both motives. A tendency towards pro-social motives in children with HFASD may be due to socialization pressures. Young children often receive explicit feedback from their environment on pro-social behaviour. More importantly, this feedback is often formulated in behavioural guidelines: 'Don't laugh at him!'. Children with HFASD may benefit from these overt social guidelines and develop a good understanding of pro-social display rules. In contrast, modifying emotional expressions based on self-protective motives often has to be learned by children on their own account, which, for children with HFASD, is the hard way. After all, feedback may be harsh for a child that has not acquired self-protective display rules, but the guidelines are often not explicitly formulated. This may provide extra difficulty for the child with HFASD.

A cognitive factor may also play a role here. Display rules that are justified based on a concern for others' evaluations of oneself require second order recursive cognition: you *think* about what he or she *thinks* about what you *feel*. The concern for others' evaluations of oneself is more likely to occur in self-protective than in pro-social situations. The latter situation calls for first order cognition, you think about what he or she may feel (Harris, 1989; Banerjee & Yuill, 1999). High-functioning children with HFASD generally pass second order false belief tasks, which implies an understanding of recursive rationales about mental states. However, generating and applying this ability may be difficult for children with HFASD. Their lower report of self-protective versus pro-social facial display rules in the second study provides preliminary ground for a lack of applied recursive understanding in children with HFASD. They may recognize and understand self-protective situations less well, because of their poor awareness of others' recursive perspectives on themselves. This is in contrast with the interview

findings, where children with HFASD did report self-protective display rules to a similar extent as control children. They seem to show a basic concern for their own well being, which would be in line with the result of the first two chapters. However, when pro-social and self-protective situations were standardized and compared, the lower reference to self-protective strategies may still indicate a lack in recursive understanding. This idea is further supported by the absence of detailed audience descriptions the interview responses of children with HFASD. Still, no decisive answers can be provided about the role of recursive cognition in the display rules understanding of children with HFASD.

In sum, the present study established an elementary understanding of emotional display rules in high functioning children with HFASD. Differences between children with HFASD and matched controls were mainly found in their ability to spontaneously provide full illustrations of personal use and motivations of display rules. However, based on hypothetical situations they showed an equal understanding of the context and reasons for using display rules as normally developing children. Overt socialization pressures seem to play an important role in the acquisition of display rules in children with HFASD. Future studies will have to decide on the exact role of motivation, socialization and recursive understanding in display rule use of children with HFASD. Their problematic translation of display rule knowledge to active use of display rules calls for investigations of real life display rule behaviour in these children.

5. Do children with autism acknowledge the influence of mood on behaviour?

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Introduction

Autism has often been related to poor emotional skills (Hobson, 2002). In particular mentally retarded children with autism spectrum disorders (ASD) have been found to be less attentive to emotional expressions in other people, to communicate emotions in a less appropriate fashion and to be less aware of the subjective nature of emotions than children without ASD (Kasari et al., 1990; Kasari et al., 2001). However, in high-functioning children with autism spectrum disorders (HFASD) the understanding of emotions is often quite adequate. Though we do not know much about possible delays in their early development, at around ten years of age, children with HFASD show elementary abilities such as recognizing emotional expressions, name emotions, and a general understanding of emotion related contexts and causes (Davies et al., 1994; Dahlgren et al., 1996; Capps et al., 1996; Rieffe et al., 2000). In short, these children display a general understanding of emotions. An advantage of the awareness of others' mood states is the possibility to anticipate and comprehend their behaviour. Though children with HFASD recognize and understand emotions in others, it is unclear whether these children know how emotions are related to behaviour of others. In the present study we focused on children's use of information about mood states in predicting and explaining other people's behaviour.

Consequences of moods are hard to capture in strict rules. For instance, father may start complaining about the rubbish in the house when he is mad, or he may start reading the newspaper, whishing not to be disturbed. The multitude of possible social consequences of someone's mood state requires a probabilistic understanding of moods, e.g., understanding that when your dad is angry he *usually* wants to be left alone. Normally developing children seem to be able to deal with information about mood states from a young age. They are capable of using the general rule that a negative mood leads to negative behaviour and a positive mood leads to positive behaviour at around six years of age (Harris et al., 1981; Meerum Terwogt, 2002). At this age, they also tend to be overconfident about their ability to infer emotions (Gnepp & Klayman, 1992) and are naively optimistic about their ability to mentally regulate their emotions (Olthof, 2004). Most ten-year-olds spontaneously provide other people's moods as reasons for their social actions, thereby showing a general understanding of the correspondence between mood and action tendencies (Meerum Terwogt, 2002) These children were also found to be less determined about the behavioural consequences of mood states, and more inclined to consider alternative responses (Gnepp et al., 1992).

Studies on children with HFASD suggest a poor understanding of the usefulness of information about emotions in their social functioning. First, compared to normally developing children, they were less accurate in their understanding of social or person specific causes of emotions (Baron-Cohen, 1991; Serra et al., 1995; Rieffe et al., 2000). They often preferred to relate emotions to concrete events (e.g. going on a trip) rather than to reaching an intended goal or to social interactions (Jaedicke et al.,

1994). Second, children with HFASD often try to compensate their lack of social-emotional competence by searching for 'rules' of social-emotional interactions (Capps et al., 1992; Grandin, 1995). The rigidity and rule-bound thinking of these children is particularly evident during social interactions (American Psychiatric Association, 1994; Zelazo, Jacques, Burack, & Frye, 2002). Unfortunately, strict rules for the causal connection between mood and behaviour do not exist. This relationship is characterized by different degrees of freedom, and an adequate understanding of this relationship requires the acknowledgment of the directive but not imperative impact of mood on behaviour. Assessing this undetermined, uncertain effect of mood might be problematic to children with HFASD. Third, another bottleneck in the understanding of mood consequences in children with HFASD could be the detection of mood states themselves. In daily life, information about moods often has to be derived from a multitude of sources in daily encounters. Besides explicit sources like other people's personal reports, or bodily emotional expressions, many relevant cues about mood states are often implicitly present in the situational context. Children with HFASD often disregard context cues and process information in a more piecemeal manner (Frith, 2003). This may hamper their ability to detect mood states, particularly in a more implicit and complex context.

To our knowledge, no studies have examined a differential understanding of social mood consequences between children with HFASD and normally developing children. Therefore, in a first study, we assessed the understanding of the social consequences of other people's moods in these children. It was hypothesized that children with HFASD would be less able than normally developing children to infer social consequences of others' mood states. In a second study we addressed the impact of the context in which mood information was presented on the understanding of mood consequences. The ability to infer social consequences of mood states was expected to deteriorate in children with HFASD when the descriptions of the mood states were presented less explicitly.

Study 1: Inferring behaviour based on explicitly described mood states

Normally developing children acknowledge the impact of positive or negative mood states on others' behaviour when they are around six years of age (Harris et al., 1981; Meerum Terwogt, 2002). In the present study we addressed this understanding in children with HFASD. Based on descriptions of mood states of hypothetical story characters, children were asked to infer the behaviour of these characters. The described mood states were either positive (happy) or negative (angry). Behavioural acts included positive (helping) and negative (bullying) behaviour. This way, the valence of the action tendencies of positive and negative mood states corresponded with the behavioural acts.

However, the ability to link mood states and actions of story characters (for example, positive mood and positive behaviour) is not necessarily a reflection of an understanding of mood as causing the

behaviour. It could be possible that children simply matched the story elements based on the equality in valence. In order to study whether children actually acknowledged mood as a cause of the behaviour, we also asked children to explain the protagonists behaviour. This way we assessed children's references to mood states or mood related story elements in the explanations of their responses.

Furthermore, we also studied children's indications of the certainty with which mood states resulted in behavioural outcomes. Firstly, we assessed children's appraisal of the nature of the impact of mood on behaviour by analysing their references on terms indicating a probabilistic impact of mood on behaviour (e.g., 'Bill *might have* done it because he was angry' or 'Bill was angry so *maybe* he did it'). Secondly, children who acknowledge this probabilistic relation will possibly try to find alternative explanations for the behaviour. Since the described mood states were the only relevant piece of information in the stories, these alternative explanations would have to be generated by the children themselves, based on assumptions that went beyond the stories content. For this reason, children's explanations were also coded for the inclusion of additional information.

We expected that children with HFASD would, in comparison to their normally developing peers (1) be less able to correspond mood and behaviour (positive mood with positive behaviour and negative mood with negative behaviour), (2) give fewer mood related explanations, (3) refer less often to the probabilistic impact of mood on behaviour, and (4) explain their responses less often by referring to additional information.

Method

Participants

A total of 64 children (in two groups) were recruited for the first study. Thirty-two children, 31 boys and 1 girl, with HFASD participated (mean age 9.7, *SD* 1.7). These participants were recruited in the Netherlands from two child psychiatric centres (Paedologisch Instituut, Duivendrecht and Leo Kannerhuis, Oosterbeek) and two schools specialised in autism spectrum disorders (Professor Waterinkschool, Amsterdam and the Berg en Bosch school, Bilthoven). The diagnostic classification of the children in the autism spectrum groups was based on assessments by a child psychiatrist, and on reports of multiple informants who observed the children in the group and in school. The children fulfilled established diagnostic criteria (American Psychiatric Association, 1994). A control group of 32 normally developing children, 31 boys and 1 girl (mean age 9.8, SD 1.4) was recruited from primary schools in the Amsterdam region, the Netherlands. The mean IQ scores of the HFASD group were: verbal: 104.3 (*SD* 18.0), (unknown for three children); non-verbal: 99.4 (*SD* 17.3), (unknown for 8 children); total: 101.3 (*SD* 15.7), (unknown for one child). The verbal and performance IQ of the clinical group was based on the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986) or

the RAKIT intelligence test (Bleichrodt, 1988). The children in the control group were not explicitly tested for their intelligence. According to their teachers they showed intelligence within the 'normal' range.

Material

The material consisted of four stories. In each story, two different characters were described: one in a positive mood, and one in a negative mood. Black-and-white line drawings of the story characters, including facial expressions, accompanied the stories. Children were asked which one of these characters they estimated to carry out either a positive (2 stories) or negative (2 stories) act towards a third character and explain the behaviour of this character (Figure 1 and 2).

Kees has been in a fight with his brother today. Kees is angry and moody. What's the look on Kees' face? (Point out on one of two pictures)

Joost has won a ballgame at school today. Joost is happy and cheerful. What's the look on Joost's face? (Point out on one of two pictures)

This is Pieter. Pieter's bicycle broke down. Pieter wants to ask someone to help him fix his bicycle. Both Kees and Joost are friends of Pieter. Both Kees and Joost are very good at fixing bicycles. What do you think, who will Pieter ask to help him fix his bicycle? Why do you think so?

Figure 1: Example of a positive behaviour story

Ricardo's game boy broke and can't be fixed anymore. Ricardo is angry and moody. What's the look on Ricardo's face? (Point out on one of two pictures)

Iwan made a nice clay statue. He is going to give it to his mother. Iwan is happy and cheerful. What's the look on Iwan's face? (Point out on one of two pictures)

This is Steven. At school, Steven saw that someone flattened his bicycle tyre. Now he has to walk all the way home. Neither Ricardo nor Iwan are friends of Steven. Both Ricardo and Iwan often tease other children. What do you think, which of these two boys flattened Steven's tyre? Why do you think so?

Figure 2: Example of a negative behaviour story

Procedure

The children were tested individually in a quiet room at their school or institute in one session of approximately 25 minutes by one experimenter. They were asked to listen to the stories and look at the pictures, which accompanied the stories. The four stories were presented in four different sequences, alternating between positive and negative stories. These sequences were equally distributed over de HFASD and control groups. The children were assured that there were no right or wrong answers, and that the only important thing to tell was who they thought was the most likely actor, and explain their choice. Sessions were audio-recorded and transcribed later.

Coding

Mood-action correspondence. Transcribed responses to the first question ('who will be asked to help/who will do something nasty') were scored as 'mood-corresponding' when the story character with a positive mood description was assigned positive behaviour or the character with a negative mood description was assigned negative behaviour. Mood-corresponding responses were awarded one point; non-mood corresponding responses were awarded no points. All children received total scores ranging from 0 to 2, reflecting their summed scores of congruent mood-action responses per condition (positive or negative).

Mood related explanations. All transcribed explanations were coded in two categories: inclusion of a reference to mood (e.g., 'Ricardo did it because he was angry') or inclusion of a reference to the cause of the mood (e.g., 'Ricardo did it because his game boy broke down'). Explanations that included at least one reference to mood or mood cause were awarded one point in one or both of these categories. Categories were not exclusive, i.e., a single response could score in both categories, (e.g., the response 'Ricardo did it because his game boy broke and he was angry') scored in both the mood and the mood cause category. This way, all children received two scores per condition (positive or negative story), varying from 0 to 2. One score reflected the number of references to mood, the other score the number of references to mood causes.

Probabilistic impact of mood on behaviour. In order to quantify the child's acknowledgment of the uncertainty of the relation between mood and behaviour, we counted the number of responses in which children included probabilistic terms, e.g.: '*Maybe* Kees did it because he was angry' 'Kees was angry so he *probably* did it', or explicit indications of the uncertainty of the effect of mood on behaviour, e.g.: 'he *could have* done it, *'both might* have done it', 'I *think* Kees did it'. All explanations that included at least one of the above elements were awarded one point. Since no hypotheses were formulated for the effect of story type on these types of references, the analyses were conducted for all four stories together. Therefore all children received one score that varied from 0 to 4.

Additional explanations. Children's explanations that included spontaneously added information were coded in three different categories. First, a 'mood and consequence' category included responses with complete explicit explanations of possible consequences of mood states. This category included all full explanations of behavioural consequences of mood states (e.g.: 'Ricardo did it because he was angry and when you're angry you feel like doing something nasty'). Responses in this category reflected a comprehensive ability of children to reason about behaviour based on mood premises. Second, a 'relevant supplement' category included all responses in which information was added to the story content but remained within the causal chain of events as described in the story (e.g., 'Ricardo flattened Steven's tyre because Ricardo was angry because his game boy was broken, and he thought Steven broke his game boy'). Third, an 'irrelevant supplement' category included responses with added information that was irrelevant to the described story and could apply to both characters (e.g., 'Ricardo flattened Steven's tyre because he had more time to do it'). Explanations that included at least one of the above references were awarded one point for the category in question. Again, since no hypotheses were formulated for the effect of story type on these types of references, the analyses were conducted for all four stories together. Therefore all children received one score that varied from 0 – 4.

Using the codes described above, two raters, blind to the diagnosis of the children, independently coded transcripts until reliability consistently exceeded 80%. Any disagreements between the raters were resolved by discussion. Interrater reliability between the coders was monitored using Cohen's kappa for 10 randomly selected transcripts. Kappa's were .78 for mood references, .80 for mood cause references, 1.00 for probability understanding, and ranged from .75 to .90 for additional explanations.

Results

Mood-action congruence. Within each condition, the chance level score for corresponding mood-behaviour responses was 1, based on two stories with a chance level of .5. Inspection of Table 1 indicates that the mean number of corresponding mood-behaviour responses was far above chance level ($p < .001$), in particular in the positive behaviour condition, for both the HFASD and comparison group. A 2 (Group: HFASD and control) x 2 (Story content: negative behaviour and positive behaviour) analysis of variance showed no main effect for Group. Children with and without HFASD equally often matched mood states of story characters with corresponding behaviour. A main effect for Story content was found ($F_{(1,62)} = 11.06$, $p < .01$), indicating that more children related positive behaviour with positive mood states than negative behaviour with negative mood states. No Group by Story content interaction effect was found.

Table 1. Mean (SD) number of responses that included mood corresponding behaviour for children with HFASD and control children in the positive and the negative behaviour conditions (Range 0-2).

	Negative behaviour condition	Positive behaviour condition
HFASD (n=32)	1.47 (.84)	1.91 (.30)
Control (n=32)	1.56 (.72)	1.84 (.45)

Mood related explanations. In the analysis of mood related explanations, stories were collapsed over the two story content conditions, because these conditions did not interfere with the results. Inspection of Table 2 suggests that the majority of children from both groups referred to moods in their responses, and that children with HFASD referred even more to mood states than children from the control group, while the opposite pattern can be observed for the reference to mood cause. A 2 (Group: HFASD and control) x 2 (Reference: mood and behaviour) analysis of variance showed a main effect for Reference ($F_{(1,62)} = 144.93$, $p < .01$) and an interaction effect for Group x Reference ($F_{(1,62)} = 9.17$, $p < .01$). While children from both groups referred to moods more often in their responses, children with HFASD appeared to refer even more to moods than children from the control groups. However, when the interaction effect was followed up by post hoc t-tests, only a trend was observed ($t_{(62)} = 1.90$, $p < .06$). Children from the control group did refer more often to the cause of the mood ($t_{(62)} = 2.85$, $p < .01$).

Table 2. Mean (SD) number of responses that included references to mood or cause of mood for children with HFASD and control children (Range 0-4).

	Mood	Cause
HFASD (n=32)	3.44 (1.01)	.25 (.67)
Control (n=32)	2.88 (1.34)	.97 (1.26)

Probabilistic impact of mood on behaviour. In their responses to the stories, children with HFASD ($M = .38$, $SD = .75$, range 0-4) referred significantly less often to probability terms in their explanations of the causal relation between mood and behaviour than children from the control group ($M = .88$, $SD = 1.01$) ($t_{(62)} = 2.25$, $p < .03$).

Additional explanations. In Table 3 it can be seen that children from both groups scored relatively often in the Mood and consequence category and that children with HFASD provided fewer responses than control children in all categories. These suggestions are confirmed by a 2 (Group: HFASD and control) X 3 (Nature of explanation: Mood and consequence, Relevant supplement and Irrelevant supplement) analysis of variance, which indicated a main effect for Group ($F_{(1, 62)} = 4.00$, $p < .05$), and a main effect for Nature of explanation ($F_{(1, 62)} = 3.73$, $p < .03$). No Group by Nature of explanation

interaction effect was found. However, separate post-hoc ANOVA's only indicated a group difference in the relevant supplement category ($F_{(1, 62)} = 8.52$, $p < .01$).

Table 3. Mean (SD) number of responses in categories mood and consequence, relevant supplement and irrelevant supplement for children with HFASD and control children (Range 0-4).

	Mood and consequence	Relevant supplement	Irrelevant supplement
HFASD (n=32)	.59 (.91)	.03 (.18)	.31 (.69)
Control (n=32)	.81 (1.40)	.56 (1.01)	.38 (.91)

Correlation between intelligence and understanding of mood related behaviour within the HFASD group. In order to provide an indication of a possible confounding effect of intelligence on the performances of children with HFASD on the current scales, we calculated the correlation between verbal and non-verbal IQ scores and the task performance of children with HFASD. No correlations were found between the IQ scores and the various task variables, such as the number of correct responses in the negative ($r_{(32)} = -.13$, *ns*.) or positive ($r_{(32)} = -.01$, *ns*.) conditions, the number of explanations that contained mood ($r_{(32)} = -.10$, *ns*.) or mood cause ($r_{(32)} = -.18$, *ns*.) information, the number of references to the probabilistic connection between mood and behaviour ($r_{(32)} = -.01$, *ns*.), and the additional explanations, as reflected in the number of references to mood and behaviour ($r_{(32)} = .27$, *ns*.) and the number of relevant additions ($r_{(32)} = -.08$, *ns*.).

Conclusion

The majority of children from the HFASD and the control group seemed to acknowledge the impact of mood on behaviour. They adequately matched explicit descriptions of story characters' moods with subsequent behaviour. While all children preformed better in the positive story conditions, no group differences were found in the extent to which children matched descriptions of positive and negative mood with descriptions of positive and negative behaviour, respectively. However, differences between children with HFASD and normally developing control children became apparent in their explanations of story character's actions. While the majority of all children referred to the mood state when explaining the story character's behaviour, children with HFASD, unexpectedly, referred to mood states even more than children from the control group. The latter, in turn, more often referred to the cause of the mood state. Thus, like control children, children with HFASD clearly seemed to explicitly acknowledge mood as a possible moderator of behaviour. The lower frequency of mood references in the normally developing group seemed counterintuitive and did not coincide with their more frequent reference to mood causes. An explanation for this finding may be that the impact of the explicitly mentioned mood state was considered so obvious that mentioning this again would be

redundant. This assumption does imply that this effect would disappear when the nature and the presence of the mood component would be described less explicitly. This implication will be addressed in Study two.

The probability of the impact of mood on behaviour was estimated differently by children with HFASD than normally developing children. Children with HFASD less often mentioned the uncertain, variable influence of mood on behaviour. The fact that normally developing children more often mentioned these terms seems to be in line with the broader explanations they provided. They gave additional information in their explanations of the story character's actions more often than children with HFASD, and the added elements originated more often from their personal interpretations and went beyond the described events. Children with HFASD, on the other hand, more often tended to stick to the information presented in the original story, which is in line with their poorly developed imaginative abilities (American Psychiatric Association, 1994). The above findings were independent of the intellectual levels in the HFASD group.

Study 2: Inferring behaviour based on implicitly described mood states

Based on the findings of the first study, we argue that explicit mood state information enabled high-functioning children with HFASD to reason about the social consequences of mood in a similar manner to control children. Moreover, children with HFASD seemed to acknowledge the importance of mood information, since they actively presented mood states as reasons for the story character's behaviour. However, in the first study, mood information was presented explicitly to the children. Explicit information is often absent in daily life situations, and the results of our first study may therefore not be generalizable to real life situations. We addressed the issue of the explicitness and the obscurity of information about moods in a second study.

In daily life, someone's mood state often needs to be derived from implicit sources of information. The inductive reasoning that is necessary to infer mood states from situational information was studied in a second study. The first question of this study was whether children with HFASD are able to correspond implicit mood descriptions with behavioural responses equally well as control children. Children were offered implicit mood stories which suggested mood states by describing mood-eliciting events that occurred to story characters. A second question regarded the issue that mood states often have to be derived from different sources of information. The ability to derive abstract information from various sources seems to be poorly developed in children with HFASD. This may be related to their often reported difficulties in distilling relevant information in daily life, in particular during social-emotional interactions (Hobson, 2002; Frith, 2003). Therefore, besides the implicitness of information, we also varied the quantity of information that was presented.

In this second study, two kinds of stories were included: short story versions, which resembled the stories from Study 1, and long story versions in which extra, distracting information was included. To control for a general ability to infer behavioural predictions from non-mood information, stories with implicit information about non-mood eliciting events were also included in the long story condition. We expected children with HFASD to make less corresponding combinations of moods and behavioural responses and to refer less often to moods as causes of behaviour than normally developing children. These group differences were expected to increase in the long story versions, compared to the short story versions.

Participants

A total of 58 children were recruited for the second study. The first group included 29 children with HFASD (one girl, 28 boys, mean age: 11.1, *SD* 2.2). These were all different children than those participating in study 1. Participants were recruited from two child psychiatric centres (Paedologisch Instituut, Duivendrecht, the Netherlands and Leo Kannerhuis, Oosterbeek, the Netherlands) and one school specialised in autism spectrum disorders (Berg en Bosch school, Bilthoven). The diagnostic classification of the children in the HFASD groups was based on assessments by a child psychiatrist, and on reports of multiple informants who observed the children in the group and in school. The children fulfilled established diagnostic criteria (American Psychiatric Association, DSM-IV, 1994). The second, comparison group included 29 normally developing children (one girl, 28 boys, mean age: 11.0, (*SD* 1.1), which were also different children than the control group that participated in Study 1. This control group was recruited from primary schools in the Amsterdam region, the Netherlands. The verbal and performance IQ scores of all children were based on the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986) or the RAKIT intelligence test (Bleichrodt, 1988). The mean IQ scores of the HFASD group were: verbal: 94.54 (*SD* 17.0) (unknown for 3 children); non-verbal: 91.5 (*SD* 16.7) (unknown for 2 children); total 94.1 (*SD* 18.0) (unknown for 3 children). The children in the control group were not explicitly tested for their intelligence, but according to their teachers they showed intelligence within the 'normal' range.

Material

Mood stories. Children were presented 8 stories in which mood-eliciting events were described that occurred to two story characters. No information was given about the consequent mood of the story characters. In every story, one character experienced a positive event; the other character experienced a negative event. Four stories then continued with the description of a positive act, the other four stories with a negative act. Children were asked which one of the first two characters would be most likely to have committed the described (positive or negative) act, and explain why. The stories were presented in four short (see Figure 2) and four long (see Figure 3) versions, equally distributed across the positive and negative behaviour stories. The longer versions contained added information about the

story characters. Children were again presented drawn story characters, but these had blank facial expressions.

Bob lost his judo match today. He trained really hard for it.
(Show picture Bob)
Tom did really well in the gymnastics class today. He was the best man of the team.(Show picture Tom)

Your bicycle is broken. However, when you come home after school, you find that someone has fixed your bike. Bob and Tom are both friends of yours. Bob and Tom are both very able to fix a bike, and one of them has fixed the bike.

What do you think, which one of these boys has fixed your bike? Why do you think so?

Figure 3: Example of a short story in the positive behaviour condition

Steven and Jan are both living in your street. Jan got new colour markers last week. He took them with him to school. When he wanted to draw a painting today, he found that someone did not put the lids to back on the markers. Now they are all dried out.
(Show picture Jan)

Steven always wanted to have a dog. His parents used to say that he wasn't allowed to have a dog, but Steven's aunt's dog had puppies. Steven's aunt cannot keep all the pups, so this week, Steven is allowed to pick one of them.
(Show picture Steven)

Jan and Steven both have the same bike. Yesterday you asked both of them if you could borrow their bike. When you come home, you see that a bike is standing in your garden. You do not know whose bike it is. Jan and Steven are both friends of yours.

What do you think; did Jan or Steven lent you his bike? Why do you think so?

Figure 4: Example of a long story in the positive behaviour condition

Control measures. In order to control for possible differences between children with HFASD and normally developing children in the general ability to infer information from implicit sources, we designed two additional stories with implicit non-mood information that could be used to predict behavioural outcomes (e.g.: 'Lisa lives on a farm, Wendy lives in a flat, who has fed the rabbits in the

schoolyard?'). These stories were comparable to the long story versions, and included positive or negative behaviour.

Procedure

The procedure was similar to that used in Study 1, with the following changes. Children listened to a total of 10 stories: four positive, four negative and two control stories. Both positive and negative stories were presented in two long and two short versions. Control stories were presented only in long versions. The stories were presented in four different sequences, alternating between positive and negative, short and long and control stories. The different sequences were equally distributed over the participants. Sessions were tape-recorded and transcribed later.

Coding *Mood-action congruence.* The congruence of mood and action were scored identical to study 1. The responses were scored as corresponding if the characters in the positive and negative mood inducing situations were identified as the actors in the positive and negative behaviour conditions respectively. Corresponding answers were given a score of 1, non-corresponding answers were scored as 0. Within the long and short story version conditions a total score ranging from 0 to 4 was computed to reflect their summed corresponding answers.

Mood-related explanations. Similar to Study 1, children's explanations were coded for references to the moods or mood cause of story characters. All explanations that included references to mood or mood cause were awarded one point. For each condition (long or short) total scores were computed, ranging from 0 to 4, the first one to reflect the summed number of references to mood, the second to reflect the summed number of references to mood cause.

Probabilistic impact of mood on behaviour. Also similar to Study 1, the number of responses in which children included terms that referred to the uncertainty of the impact of mood on behaviour were counted. All explanations that included at least one of the probability terms (see scoring Study 1) were awarded one point. Analyses were performed over all eight stories together. The score range of this variable was 0 - 8.

Additional explanations. Explanations that included spontaneously added information were assigned to the same three categories as in Study 1: 'mood and consequence', 'relevant supplement' and 'irrelevant supplement'. The analyses were conducted for all eight stories together. Therefore all children received one score that varied from 0 – 8.

Using the codes described above, two raters, blind to the age and diagnosis of the children, independently coded transcripts until reliability consistently exceeded 80%. Interrater reliability between the coders was monitored using Cohen's kappa for 10 randomly selected transcripts. Kappa's

were .70 for mood references, .76 for mood cause references, 1.00 for probability understanding, and ranged from .75 to .85 for additional explanations. Any disagreements between the raters were resolved by discussion.

Results

Mood-action congruence. The HFASD group inferred the matching behaviour to positive and negative mood remarkably well. Table 4 indicates that children in both HFASD and control groups scored well above chance ($p < .001$) identifying actors whose behaviour and moods were of equal valence. The scores are collapsed over the positive and negative behaviour conditions, because, as in Study 1, no effect of story valence was found. Contrary to our expectation, children with HFASD performed at a similar level to the control group in both the short and long story versions. A 2 (Group: HFASD and control) x 2 (Story length: short and long) analysis of variance showed no main or interaction effects.

Table 4. Mean (SD) number of responses that included mood corresponding behaviour for control children and children with HFASD in the short and the long story versions (Range 0-4).

		Short story condition	Long story condition
HFASD	(n=29)	2.86 (1.16)	3.09 (.91)
Control	(n=29)	3.21 (1.08)	3.14 (.95)

Mood related explanations. Explanations were analysed for references to mood or mood cause in the two story length conditions. A 2 (Group: HFASD and control) x 2 (Story length: short and long) x 2 (Reference: mood and mood cause) analysis of variance indicated an interaction effect of Group x Story length ($F_{(1, 56)} = 4.83$, $p < .05$), but no other effects. Post hoc t-tests indicated that children from the control group referred more often than children with HFASD to mood and mood causes of the story characters following the long story versions ($t_{(56)} = 2.27$, $p < .03$). This group difference was not found following the short story versions ($t_{(56)} = .61$, *ns.*) (Table 5).

Table 5. Mean (SD) number of responses that included references to mood or cause of mood of children with HFASD and control children following short and long story versions (Range 0-4).

		Short story version		Long story version	
		Mood	Cause	Mood	Cause
HFASD	(n=29)	1.48 (1.53)	1.72 (1.22)	1.21 (1.32)	1.55 (1.15)
Control	(n=29)	1.93 (2.70)	1.55 (1.21)	1.97 (1.42)	1.86 (.95)

Probabilistic impact of mood on behaviour. A significant difference was found in the amount of references to probability terms in the explanations of the causal relation between mood and behaviour of children with HFASD (M = .45, SD = .91, range 0-8) and children from the control group (M = 1.66, SD = 2.47) ($t_{(56)}$ = 2.47, p < .02). Children with HFASD made fewer references to probability terms than children from the control group.

Additional explanations. Story length did not have an effect on the number of responses that included additional information. Therefore, the analysis was conducted over all eight stories. Inspection of Table 6 indicates that children with HFASD provided fewer responses in all categories. This was confirmed by a 2 (Group: HFASD and control) X 3 (Nature of explanation: Mood and consequence, Relevant supplement and Irrelevant supplement) analysis of variance, which revealed a main effect for Group ($F_{(1, 56)}$ = 11.32, p < .001). The interaction effect of Group by Nature of explanation did not reach significance.

Table 6. Mean (SD) number of responses in categories mood and consequence, relevant supplement and irrelevant supplement for control children and children with HFASD (Range 0 - 8).

		Mood and consequence	Relevant supplement	Irrelevant supplement
HFASD	(n=29)	.55 (.91)	.52 (.78)	.90 (.98)
Control	(n=29)	1.55 (1.86)	.97 (1.18)	1.62 (1.78)

Control Measures. The behavioural inferences given in response to the non-mood stories were compared to those given in the mood stories. A 2 (Group: HFASD and control) X 2 (Information: mood and non-mood) analysis of variance confirmed a main effect for Information ($F_{(1, 56)}$ = 16.78, p < .01). All children made more corresponding behavioural inferences following non-mood (M = .93, SD = .13, score range 0-1) than mood (M = .78, SD = .23) stories. No group differences were found in the behavioural inferences based on non-mood information.

Correlation between intelligence and understanding of mood related behaviour within the HFASD group. Similar to the first study, no connection was found between verbal and total IQ scores and task performance in the children with HFASD. The total IQ scores did not correlate with the number of correct responses in the short ($r_{(27)}$ = .28, *ns.*) or long ($r_{(27)}$ = -.04, *ns.*) condition, the number of explanations where children referred ($r_{(27)}$ = .18, *ns.*); and the references to the mood cause ($r_{(27)}$ = .04, *ns.*); the number of references to the probabilistic connection between mood and behaviour ($r_{(27)}$ = .21, *ns.*); the extendedness of the explanations as reflected in the number of references to mood and behaviour ($r_{(32)}$ = .10, *ns.*); the number of relevant additions ($r_{(27)}$ = .17, *ns.*) and the number of irrelevant additions ($r_{(27)}$ = -.10, *ns.*).

Conclusion

The second study indicated that children with HFASD were equally able as normally developing control children to infer the behavioural consequences of mood states, even if these mood states had to be inferred from implicit and distracting context information. Both groups also showed similar responses to the implicit non-mood stories that were administered in order to control for general information processing differences: they inferred story character's behaviour equally often from implicitly described non-mood features. However, some more subtle differences could be identified in the explanation of the mood stories. In the long story versions, where distracting information was added to the story content, children with HFASD explained the mood consequences less often than controls by referring to mood states or causes of mood states. This effect was not found in the short story versions. Furthermore, children with HFASD explained the mood consequences less often by referring to probabilistic terms and provided less additional information than normally developing children. Again, all findings were independent of the intelligence in the HFASD group.

General discussion

High functioning children with ASD did not differ from their normally developing peers in the matching of descriptions of story characters' positive or negative moods with descriptions of positive or negative behaviour, respectively. It made little difference whether these descriptions were presented explicitly, such as in the first study, or implicitly and combined with distracting context information, such as in the second study. Children with HFASD and normally developing children thus seemed equally able to acknowledge the possible impact of mood on behaviour. The main group differences identified in both studies were in the explanations of the mood-behaviour congruence. Children from the HFASD and control groups differed on three accounts: the amount of mood related explanations, the additional information included in these explanations, and their indication of the probabilistic relation between mood and behaviour.

First, children from the HFASD or control groups differed in the number of mood references they included in their explanations. These differences depended on the explicitness and complexity of the mood descriptions. Following the explicit mood descriptions of the first study, the group effect was counter-intuitive: children with HFASD more often mentioned moods of story characters, while children from the control group – besides their references to moods - more often mentioned the cause of story character's mood states. As discussed above, the possibility exists that children from the control group found the – explicitly described - mood states of the story characters so obvious that they would consider it unnecessary to mention these again in their explanations. This explanation is supported by the absence of this effect in the second study. When mood information was no longer explicitly presented, no difference was found in the number of mood references following the short stories. Furthermore, the group effect reversed in the long story condition where children from the control group gave more mood related references than children with HFASD.

The different response patterns of both groups in the first study may address something less trivial than we first suggested. The redundancy explanation implies that children from the control group modify the content of their response based on the understanding they assume in the experimenter. As in other forms of communication, they may aim to adjust the information they provide to the perceived demands for information of the experimenter. Possibly, the control children, more often than children with HFASD, saw no need to inform the experimenter about the fact that they noticed the mood information in the stories. In line with the presumed impaired theory of mind and pragmatic skills of children with HFASD (Tager-Flusberg, 1995), we would expect them to be less attuned to the presumed knowledge of the experimenter and obediently answer the question posed. Based on this assumption, we can also explain the low number of mood related explanations that followed the longer, implicit story versions of the second study. The descriptions employed here included no explicit mood information, but several other, trivial story elements. This would require an explanation of why mood state and not one of the other bits of information was considered to influence the story character's behaviour. Adapting the information they present to the experimenter's understanding of their motives, children from the control group now did provide the extra information. However, children with HFASD did so to a lesser extent.

Second, the above explanation, which is based on empathic skills, may also explain the tendency of normally developing children to provide the experimenter with extra information about the motives behind their choice of story character. Providing extra information does not necessarily imply that children are more empathic with their audience. However, the content of the information generally consisted of relevant explanations of possible links between mood and behaviour (e.g. 'He is angry and usually when I am angry I feel like everybody should just go away and I don't feel like helping someone else at all'). This revealed that these children generally considered the experimenter's

conceptions about their own rationales in their explanations. The combined findings that children with HFASD are aware of mood consequences, but are less inclined to explain the reasons for mood-related consequences they are aware of suggests that the latter findings should be attributed to poor communication and empathic skills rather than to a lack of understanding of social-emotional interactions.

Third, children with HFASD seemed to differ from normally developing children in their indications of the certainty with which a mood state would result in specific behaviour. In both studies, children with HFASD referred to the probabilistic relation between mood and behaviour less often than matched control children. Children from the control group more often acknowledged that someone's mood is nothing more than a heuristic for someone's behaviour. Children with HFASD more often neglected this probabilistic element and seemed to interpret the impact of mood on behaviour in a more deterministic fashion. Possibly, children with HFASD do not possess sufficient linguistic abilities to report on probabilistic relations with respect to emotion and behaviour (Losh & Capps, 2003). However, our findings on the coherent explanations of story character's behaviour are not in congruence with this hypothesis, but suggest instead that these children should be able to use probabilistic terminology. Another explanation is that the low number of references to probabilistic terms indicates a more deterministic impact of mood on behaviour. This would be understandable given the inclination of children with HFASD to cognitively compensate their poor emotional competence by seeking and using rules for social-emotional interactions (Capps et al., 1992). These rules are usually algorithmic, definite in nature and finite in number. However, the influence of mood on behaviour can eminently not be captured in algorithmic rules. Our findings suggest that examining the probabilistic nature of emotional and social insights can contribute to our understanding of the cognitive compensation of impoverished social-emotional competence in high functioning children with HFASD.

The link between mood and behaviour is non-determined in nature. Mood states do not always result in the same behavioural consequences. This makes it possible to create a sound line of reasoning that results in 'mood-behaviour incongruence', where, for instance, somebody is happy but still behaves in a bad way. Since we had no specific hypothesis on differences between responses of children with HFASD and normal development in this respect, and mood-behaviour incongruence was relatively rare in both groups, we have not addressed this topic in the Results section. Nonetheless, post hoc observations suggested certain group differences. For example, children with HFASD relatively often stated that 'bullying can make someone happy' (8 answers versus 3 within the control group). This type of answer makes you wonder about their experiences with other children. More importantly, it suggests weak central coherence with regard to the structure of the story. In the stories, children had to create a connection between a cause, the mood state, and a result, the behaviour. However, children

giving incongruent answers seemed to regard the result (negative bullying) behaviour as causing a (positive) mood state, thereby reversing the causal connection and taking the mood fragment out of its context. A second type of explanation did not violate the task requirements and might even indicate a sophisticated insight in the consequences of mood. In these responses, negative mood was corresponded with positive behaviour, followed by mood improvement explanations (e.g. 'X will help because he is sad and helping will cheer him up'). This response was exclusively found within the control group (5 times). We have avoided sadness as an initial mood state in our scripts, since in contrast to anger, sadness is known to stimulate positive behaviour for various reasons (Meerum Terwogt, 2002). However, even in an angry person, mood improvement can be a reason to do something positive: 'He helps, because it takes of his mind of (the angering incident)' or 'He helps, because it makes him feel better'. The interpretation of these responses is of course preliminary due to their low frequency, but they indicate subtle differences in advanced ways of reasoning about emotions in social interactions that are worthwhile to future studies with both children and adults with HFASD.

Within the HFASD group, no correlations were found between level of intelligence and any of the dependent variables. This suggests that the social and emotional competence that we intended to measure with the present studies may be relatively independent of intelligence. A similar independence was found between intelligence and the recognition of emotional expressions in Children with HFASD (Heerey et al., 2003); see also Chapter three). However, several studies did find correlations between intelligence and performance on tasks measuring social and emotional behaviour (Happé, 1995; Travis et al., 2001). While the limiting effect of low intelligence on the functioning of children with autism has been established repeatedly (see Chapter one), the role of intelligence in the HFASD group is not univocally established. There may be a beneficial effect of high intelligence on the translation of abstract knowledge to specific situations. However, present findings lend little weight for a direct effect of intelligence on social and emotional understanding.

Children with HFASD spontaneously attend less to emotions than normally developing children (Hobson, 2002; see also Chapter three). This study shows that they do seem to have a general understanding of the role of emotions during social interactions. Based on the present findings, we posit that the impact of mood on behaviour is acknowledged by children with HFASD, but that these children communicate their understanding in a different manner than their normally developing peers. Following explicit, orderly arranged descriptions, children with HFASD seem to reason and explain the impact of mood on behaviour in a manner similar to control children. However, following implicit and obscured descriptions, they emphasized mood related information less than normally developing children did. They seemed less aware of the social necessity to clarify their – often adequate – line of reasoning. This connection of the nature, communication and daily use of social-emotional

competence seems to be a very relevant source for future studies with high functioning children with HFASD.

6. Responses of children with autism to situations that elicit conflicting emotions

Introduction

Children with autism are commonly thought to show substantial deficits in social and emotional domains. In contrast to these stereotypical ideas, normally intelligent or 'high functioning' children with autism spectrum disorders (HFASD) often display a relatively adequate understanding of basic emotions and social-emotional interactions. These children are attentive to emotional interactions of other people (Capps et al., 1993), can recognise and label emotions (Davies et al., 1994; Loveland et al., 1997), are able to provide examples of causes or contexts that elicit different emotions (Jaedicke et al., 1994; Baron-Cohen, 1991; Capps et al., 1992; Capps et al., 1996), understand the social consequences of emotions (Chapter five), and even show and understanding of emotional display rules (Chapter four). Children with HFASD seem to be particularly aware of elementary principles and prototypical responses to emotions. However, in some situations, more than one response is applicable. Sometimes, these responses may even be in conflict with each other. Situations that elicit conflicting emotions will give rise to conflicting response patterns. A child who is only aware of prototypical responses will have difficulty deciding which pattern to follow. The present study will investigate responses to situations that elicit conflicting emotions in children with HFASD and normally developing children.

Study 1: Behavioural responses to situations that elicit conflicting emotions

When children start to reason about emotions, their understanding involves the idea that any given situation elicits a single emotion and a single behavioural response (Harris, 1989). For instance, most three- to four-year-olds are able to distinguish between situations that elicit positive emotions and situations that elicit negative emotions (Harris, Olthof, Terwogt, & Hardman, 1988). At first, young children often ignore the emotional impact of past situations. However, they soon start to realise that emotional reactions may persist across situations, and that earlier emotions can influence later ones. Signs of this knowledge can already be observed in three-year-olds (Lagattuta & Wellman, 2001), while most six-year-olds clearly acknowledge that an initial situation can provoke an emotion that persists and becomes concurrent with a later emotion (Harris et al., 1987), and twelve-year-olds generally regard emotions as mental states that are relatively independent of the situation from which they originated (Harris et al., 1987; Harris, 1989). When considering the transfer of emotions from one situation to the next, preschoolers have also been found to rate the impact of earlier negative emotions higher than earlier positive emotions. This can be explained by the more disruptive nature of negative emotion (Dunn & Brown, 1993; Lagattuta et al., 2001).

Despite their elementary insight in the principles of emotions (see also Chapter one), at around 10 years-of-age children with HFASD have been found to explain emotions less often by referring to subjective mental states, in particular to beliefs, than normally developing children. In line with their

Theory of Mind impairments, children with HFASD generally prefer to explain emotions by referring to situational factors (Tager-Flusberg, 1993). This tendency to attribute emotions to situational factors may be problematic when children have to reason about the enduring effect of emotions, as is the case when they are confronted with multiple or conflicting emotional cues.

Furthermore, children with HFASD seem to reason about emotions in a more rigid, scripted manner. For instance, when asked about a time when they felt happy, twelve-year-old children with autism could provide appropriate responses, but these were often very prototypical (e.g. 'when it was my birthday'). Questions about their personal experience with emotions often elicited bare enumerations of details, and seemed to be approached as algorithmic problems. In many cases these children even looked at the interviewer as if to check whether they got the answer right. Normally developing children, in contrast, usually responded in a more personal, inductive and ad hoc manner (Capps et al., 1992; Sigman, Yirmiya, & Capps, 1995; Frith, 2003).

Children with HFASD seem to rely more on explicit knowledge about emotions. In line with this reasoning style, some evidence was found for deviant responses to situations that elicit conflicting emotions in a subgroup of children with HFASD. Normally intelligent children with PDD-NOS, aged ten to twelve years old, compared to controls less often referred to a prior affectively charged experience when explaining their responses to a new experience involving the same event. These deviations were not found in seven-to-nine-year-old children with PDD-NOS, which may suggest that the ability to infer emotions on the basis of preceding emotionally charged events develops at a slower pace in children with PDD-NOS than in normally developing children (Serra et al., 1995). The general problem of children with HFASD to deal with ambiguous emotional situations may become more apparent as they grow older, and normally developing children become more aware of the effects of multiple or successive emotions. However, this issue needs more empirical foundation, preferably based on studies including not only children with PDD-NOS, but also including children with autism.

In the present study, we aimed to focus on the element of integrating conflicting information. Children with HFASD were expected to exhibit problems responding to conflicting emotional cues, due to more rigidity in their reasoning about emotions. In order to test this hypothesis, children were presented descriptions of hypothetical social situations that elicited conflicting positive and negative emotions and asked what they would do in such situations. Responses were categorized for the extent to which they were based on the integration of the confliction emotions. A lack of integration of conflicting emotions would follow from the predominant reliance on a single emotional perspective. Compared to control children, children with HFASD were expected to choose and explain their responses based on integrated perspectives less often, but rather rely exclusively on one of the prototypical responses. It was also explored whether children with HFASD more often preferred responses to the scenarios

presented first over responses to the scenarios presented last, and whether there was a preference for a response to positive or negative scenarios. Furthermore, to investigate the possible group differences in more detail, explanations of responses of children from HFASD and control groups were analysed for the manner in which the conflict between emotions evoked by the two scenarios was resolved. Based on their poor ability to apply mindreading skills on their own account (Tager-Flusberg, 1993; Rieffe et al., 2000), children with HFASD were expected to resolve the conflict less often by reappraising the situation or referring to mental or behavioural solutions (see scoring) than children from the control group.

Method

Participants

Thirty children with HFASD (mean age 9;3, range 6;4 to 12;6) were recruited from a child psychiatric centre. This group included 11 boys and one girl with classic autism (mean age 9;4, range 6;4 to 12;4), and 18 boys with PDD-NOS (mean age 9;2, range 6;5 to 12;6). The children were recruited from a specialised child psychiatric centre providing both inpatient and outpatient care for children with disorders in the autism spectrum. A control group of normally developing children, including one girl and 29 boys (mean age: 9;2, range 6;7 to 12;6), was recruited from two primary schools around Amsterdam, the Netherlands.

The diagnostic classification of the children with HFASD was based on a three months diagnostic assessment by a child psychiatrist, during which multiple informants also observed the children in the group and in school. The children with high-functioning autism showed a history of 'classical' autism and fulfilled established diagnostic criteria according to the DSM-IV. Children were classified as PDD-NOS when they met three or more criteria for autistic disorder according to the DSM-IV, and their impairments had an onset before the age of 36 months, but the full set of criteria of an autistic disorder were not met (American Psychiatric Association, 1994). The verbal (M = 102.3, SD = 18.3, unknown for four participants) and total IQ scores (M = 101.3, SD = 19.4, unknown for three participants) of the children were within 'normal' range, based on the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986) or the RAKIT intelligence test (Bleichrodt, 1988). The subgroups of children with PDD-NOS and autism did not differ in their verbal (M = 96.7, SD = 12.6 and M = 109.8, SD = 22.5, respectively) and total IQ scores (M = 96.1, SD = 11.1 and M = 109.0, SD = 26.1, respectively).

Children from the control group functioned at an adequate level in regular elementary schools, and according to their teacher they showed intelligence within the 'normal' range. Furthermore, at the time of testing, the policy of primary schools in the Netherlands was based on the outplacement of children with mental retardation to special education institutes (Driessen, 2002). It therefore seems reasonable to assume that the children from the control group functioned at a normal intelligence level. In order to

control for group differences in short term memory span, the digit span task, a subtask of the Wechsler Intelligence Scale for Children-III (Wechsler et al., 1986), was administered to all children. In this short-term memory task, children had to remember a small amount of numbers for a relatively short time. No differences were found between the scores on the digit span task of control children (M = 9.73, SD = 3.69), children with autism (M = 9.45, SD = 3.64) and children with PDD-NOS (M = 8.00, SD = 2.40) ($F_{(2, 57)} = 1.64$, *ns*.). This suggests equal short-term memory abilities in children from the clinical and control groups.

Material

Mood scenarios. The material consisted of four scenario pairs, which all included a positive and a negative mood scenario (see *Figure 1*). Care was taken to fit the stories with children's experiences. All interactions were based on everyday social interactions that were observed by teachers and supervisors of children in this age group, with or without a diagnosis in the autism spectrum. The order of the four scenario pairs, as well as the sequence of the two scenarios within a pair, was varied. In order to check whether children would indeed show the prototypical response to the first scenario, the experimenter asked the children what they thought they would do in this situation. Answers requested had a free format. Then, after the second scenario was read, children were asked the same question. This time they could respond by choosing a response from 3 alternatives, referring to one of the single scenarios or to an integration of both scenarios. Stories were read to the children and illustrated with schematic drawings of objects that featured the scenario (e.g., a bike, a birthday cake, etc.). Explanations by the children that accompanied their responses were transcribed and coded in three additional scoring categories.

Scenario 1: Your classmate asks if you can help him on a computer program. You are very good with computers and like to help him. *What would you do?*

Scenario 2: When you want to go and help him, you see that he broke your new markers. You mind very much. *What would you do?*

Would you:

(A) Help him, because he needs it, and you are good at it.

(B) Take away the markers of your classmate because he broke yours.

(C) Show the program very briefly and let him sort the rest out himself.

Figure 1. Example of two mood scenarios and the formulated behavioural responses

Scoring

Understanding of the first scenario. A-typical responses to the first scenario could hypothetically cause flaws in the manipulation of conflicting emotional scenarios. Therefore, children's general

responses to the first scenario were checked and coded for the general compatibility and understanding of the scenario. For instance, in the negative scenario of a friend breaking your markers (see *Figure 1*), examples of compatible responses would be general negative responses such as getting angry, telling your friend to fix it, telling your friend to buy new markers, telling your mother. All responses that were in line with these prototypical descriptions were coded 1, all other responses were coded 0.

Multiple-choice answers. After both scenarios were read, children were asked to choose one of three options, corresponding either with the first-, the second- or an integration of both scenarios. Data were analysed in three ways. We counted how many children chose a behavioural response that corresponded with the integrated or with one of the single scenario options. The single scenario responses were then categorized in two ways, based on the sequence of the scenario they referred to (first or second), and based on the valence of the scenario they referred to (positive or negative).

References in explanations: multiple and single scenarios. Transcribed explanations of multiple choice answers were also categorised in three ways. First, explanations were categorized for their reference to multiple or single scenarios. Second, they were categorized for the reference to the sequence (first or second) of the scenario involved. Thirdly, they were categorized for the valence of the scenario that was referred to (positive or negative). For all three categorizations, children could receive total scores ranging from 0 to 4, reflecting their summed number of references within that category. Explanations that included the rejection of one scenario were coded as referring to the other scenario.

Type of explanations: resolving scenario conflict. We also coded children's explanations for the different ways in which the conflicting information was integrated. Four categories were distinguished. Within each category, scores ranged from 0-4, reflecting the number of references in that category summed over the four stories. The interrater reliability for the four categories mentioned was satisfactory and ranged from .77 to 1.00 (Cohen's kappa).

Reappraise: Reappraising valence of scenario. Answers were included when the affective charge of one scenario was adapted to the other, contrasting scenario, which disregards the conflict between the two scenarios. (e.g. 'it's not so bad that he broke my markers, so I'll just help him, or 'I don't really want to show him the computer anyway, so I will not help and take his markers').

Behavioural: Reflect on both scenarios, and adopt a behavioural middle course between two scenarios (e.g. 'I will help him and say that he has to be careful with my markers and ask for his').

Mental: Reflect on both scenarios, and adopt a mental middle course between two scenarios (e.g. 'I will help him and think that if he does it again he has to pay').

Unresolved: Reflect on both scenarios, but follow one scenario (e.g. 'I want to help, but he broke my markers so I will not help').

Procedure

Participants were tested in a quiet room during one session of approximately 25 minutes. They were assured that there were no right of wrong answers, and the only important thing was that they would indicate which one of the behavioural responses they would chose and explain their choice. When children hesitated or chose for more than one response option, they were asked to indicate the most likely option. Sessions were tape-recorded and transcribed later.

Results

In all analyses, responses from both HFASD subgroups were compared with those of normally developing children. We also compared the separate performances of children with autism and PDD-NOS, but only report scores that distinguished significantly between the HFASD subgroups.

Understanding of first scenario. All responses of children from both the HFASD and the control group to the question what they would do following the first scenario were in agreement with the general procedures that were associated with the scenario in question. This indicated that all children understood the scenario and were able to describe an appropriate behavioural response that corresponded with the scenario.

Multiple-choice answers: Integrated versus single scenarios. Children's choices for responses that corresponded with the integrated or one of the single scenarios are presented in Table 1. As can be seen in this table, a clear majority of children from both clinical and non-clinical groups chose for one of the single scenario options ($Chi^2 = 180.0$, $p < .001$). No group differences were found in the number of children that chose the integrated or the single scenario options (Mann-Whitney $U = 447.0$, *n.s.*).

Table 1. Number and percentage of choices corresponding with the integrated scenarios or single scenarios as function of Group.

		Integrated scenarios	Single scenarios
Control	(N = 30)	26 (22%)	94 (78%)
Autism spectrum	(N = 30)	28 (23%)	92 (77%)

Multiple-choice answers: Sequence. Children's choices for responses that corresponded with the first scenario or the second scenario are presented in Table 2. No group differences were found in the number of children that chose the option corresponding with the first (U = 431.5, *n.s.*), or second (U = 415, *n.s.*) scenario. Note that the majority of children from both groups chose the option that corresponded with the second scenario (Chi^2 = 36.3, $p < .01$).

Table 2. Number and percentage of choices corresponding with the first or second scenarios as function of Group.

		First scenarios	Second scenarios
Control	(N = 30)	35 (29%)	59 (49%)
Autism spectrum	(N = 30)	37 (31%)	55 (46%)

Multiple-choice answers: valence. The valence of scenarios did not seem to differently affect choices of children with HFASD and control groups. The number of children that chose for positive or negative scenarios did not differ in the autism spectrum and control groups (Chi^2 =3.23, p = .52).

References in explanations: multiple versus single scenarios. The mean number of explanations in which children referred to single or multiple scenarios is presented in Table 4. Given the exactly equal means, no group differences were found in the number of children that referred to one of the scenarios (t_{58} = .00, *ns.*), or multiple scenarios (t_{58} = .00, *ns.*).

Table 4. Mean (SD) number of references to single or multiple scenarios as function of Group (Range 0-4).

		Single scenarios	Multiple scenarios
Control	(N = 30)	1.83 (1.42)	2.07 (1.44)
Autism spectrum	(N = 30)	1.83 (1.34)	2.07 (1.39)

References in explanations: scenario sequence. The mean number of children's references to no, first or second scenarios are presented in Table 5. Note that answers referring to both scenarios were assigned to both the 'first scenario' and the 'second scenario' category. A 2 (Group: HFASD and control) x 3 (Scenario: no scenario, first scenario, second scenario) analysis of variance with repeated measures on the last factor indicated a main effect for Scenario ($F_{(2, 116)} = 197.24$, $p < .01$), but no other effects. Children referred to the second scenario more than the first scenario, while hardly any children failed to refer to any of the scenarios.

Table 5. Mean (SD) number of references to no, first or second scenarios as function of Group (Range 0-4).

		No scenario	First scenario	Second scenario
Control	(N = 30)	.10 (.31)	2.63 (1.22)	3.33 (.88)
Autism spectrum	(N = 30)	.10 (.55)	2.77 (1.19)	3.20 (.85)

References in explanations: scenario valence. The explanations of children with HFASD and control groups did not contain different amounts of references to positive ($F_{(2, 57)} = .91$, $p = .41$) or negative ($F_{(2, 57)} = 2.23$, $p = .12$) scenarios. Neither were any differences found between the clinical sub-groups of children with autism and PDD-NOS on references to positive ($F_{(1, 58)} = .42$, $p = .52$) or negative ($F_{(1, 58)} = .63$, $p = .43$) scenarios.

Type of explanations: resolving scenario conflict. Explanations were categorised according to four manners of integrating the two mood scenarios: reappraise, behaviourally, mentally, or unresolved (see Table 6). A 2 (Group: HFASD and control) x 4 (Resolving strategy: Reappraise, Behavioural, Mental, Unresolved) analysis of variance indicated a main effect for Strategy ($F_{(3, 58)} = 7.61$, $p < .01$). Most children from both groups most often used strategies from the reappraise or behavioural categories. However, no group or interaction effects were found.

Table 6. Mean (SD) number of references to resolving strategies as function of Group (Range 0-4).

		Reappraise	Behavioural	Mental	Unresolved
Control	(N = 30)	.90 (1.00)	.57 (.73)	.17 (.38)	.43 (.82)
Autism spectrum	(N = 30)	.77 (1.04)	.73 (.83)	.23 (.57)	.33 (.55)

Discussion

The present findings indicated a surprising similarity in task performances of children with HFASD and normally developing control children. No confirmation was found for our first hypothesis, that children with HFASD would be less inclined to integrate two conflicting social-emotional scenarios. Results from the multiple-choice responses indicated that both children from clinical and non-clinical groups referred to the integrated scenario options in about 20% of their responses. Thus, while most children tended to choose the more general, single scenarios, the merits of integrating emotional scripts seem to be appreciated equally by children with HFASD and their normally developing peers.

A clear majority of both clinical and non-clinical children reacted in accordance with the scenario that was presented last, irrespective of the type of scenario. This may be a result of the procedure, which forced the children to provide their reactions immediately following the first scenario. A second mention of this scenario may have given children the feeling that they were repeating themselves. Alternatively, this finding could indicate an implicit understanding of the fact that emotions decline over time, which may have resulted in a tendency to choose the response option that was in accordance with the second scenario. Still, no group differences appeared in responses to consecutive, conflicting scenarios. Therefore, at least on the current measure of responses to conflicting emotional interactions, children with HFASD did not display the expected rigidity in their reasoning about emotions. However, it seems unlikely that the hypothesis of rigidity in social-emotional reasoning of children with HFASD should be dismissed based on these results. We rather propose that the presumed rigidity may not be apparent in their explicit reflections on hypothetical emotional behaviour. The similarity in the way children from HFASD and control groups resolved the conflict between the scenarios adds weight to the competence of children with HFASD in this respect.

In the first study, we presented children with explicit descriptions of possible response options that were in accordance with single or integrated emotional scenarios. Children with HFASD did not differ in their ability to reasoning about these rather obvious emotional scenarios from normally developing control children. This could be due to the explicitness of the described actions. Children did not have to generate their responses; they only had to choose between responses that were already formulated for them. Furthermore, besides the expressive, behavioural aspects of emotions that were included in

the first study, emotions also involve internal states that are not explicit or observable. The integration of emotional states rather than emotional behaviour will be investigated in a next study. In this second study, we investigated the integration of emotions by asking children to elaborate freely on their emotional state in hypothetical situations, and varying information about the emotional charge of events that preceded these situations.

Study 2: Affective responses to successive situations that elicit conflicting emotions

In the second study, the understanding of emotional states rather than behavioural responses to emotional scenarios was investigated. As was mentioned before, the ability to integrate emotional states develops gradually. Young children tend to regard emotions as situation specific, independent states that have little influence on each other. Older children seem more aware of how past emotional experiences change a person's emotional reaction to a current situation. To our knowledge, the understanding of the mutual impact of emotions has not been studied before in children with HFASD. In the present study we tested the comprehension of conflicting, successively aroused emotions in children with HFASD and normally developing control children.

When reasoning about the impact of a past emotional experience on a current situation, it is important to take the valence of these emotions into account. Most five- to eight-year-olds more accurately predicted the impact of past negative versus past positive experiences on a current response (Gnepp & Gould, 1985). The salience of negative emotional cues can be related to the disruptive nature of negative emotions, which results in a higher demand for regulation compared to positive emotions. Children learn at a young age that they cannot permit themselves to neglect these negative cues (Denham, 1998). Children with ASD often lack appropriate empathical responses to negative emotional expressions in others. They have been shown to be less attentive to negative emotions in others than other children are, and to fail to respond appropriately (Sigman et al., 1992; Bacon et al., 1998). It could be that children with ASD do not possess the relatively high sensitivity for negative emotions, based on a more urgent need to react on these signals, that can be observed in normally developing children and adolescents (Lagattuta & Wellman, 2002).

The question investigated in this study was whether children with HFASD and normally developing controls differ in their ability to rate the impact of a previously aroused emotional state on the emotional reaction to a successive situation. Hypothetically, children with HFASD rely more strongly on situational aspects of emotions, and would be impaired in their understanding of the influence of earlier, conflicting affective situations on later emotional reactions. Furthermore, we expected that performances of children with HFASD would be less dependent on the valence (positive versus negative) of the emotions involved than the performances of normally developing children. Since

normally developing children are more attentive to negative than positive emotions from an early age, and children with HFASD have been found to be relatively less attentive to negative emotions, we expected to observe a higher sensitivity to negative versus positive preceding emotions in the normally developing, but not in the HFASD group.

In order to investigate the hypothesis that children with HFASD, compared to control children, are less able to rate the impact of previous affective situations on later emotional reactions; children were questioned about conflicting, successively aroused emotions. Children were presented scenarios that originated from an earlier study by Olthof, Meerum Terwogt, Van Panthaleon van Eck, and Koops (1987). All scenarios included descriptions of two hypothetical, successive situations. All descriptions included an affectively charged target situation that was preceded either by an affectively neutral initial situation or by an affectively charged initial situation that was opposite in valence to the target situation. Children could monitor their emotional state by pointing to a schematic facial expression from an array of possible expressions, and subsequently explain the reason for their choice. The explanations were coded for the number of references to the initial emotion eliciting situation, and the type of references. We specifically expected children with HFASD, compared to children from the control group, to show a weaker impact of the initial affective situation on their emotional responses to the target situation. In their explanations they were expected to refer to the initial situation less than normally developing children. Furthermore, since these children generally are not inclined to spontaneously refer to subjective states, but rather situational aspects or abstract social rules (Capps et al., 1992; Sigman et al., 1995; Frith, 2003), we also expected children with HFASD to include less terms referring to mental and emotional states, and more references to the situation and social conventions related to the situation.

Method

Participants

Thirty-one children with HFASD were recruited from a child psychiatric centre (one girl, 30 boys, mean age: 9;3, range: 6;6 to 12;6). The diagnostic classification and intelligence assessment of the children were based on similar procedures as in Study 1 (see sample description). The mean IQ scores of the autism spectrum group were: verbal: (M = 102.1, SD = 17.9); total (M = 101.4, SD = 19.0). The autism spectrum subgroups of children with PDD-NOS and autism did not differ in their verbal (respectively M = 96.7, SD = 12.6 and M = 108.9, SD = 21.6, unknown for four children) and total IQ scores (respectively M = 96.1, SD = 11.1 and M = 108.6, SD = 24.9, unknown for three children). A control group of 31 normally developing children was recruited from primary schools around Amsterdam, the Netherlands (one girl, 30 boys, mean age: 9;3, range 6;4 to 12;6). While all but one child of the autism spectrum group also participated in the first study, the children from the control group were an entirely new sample. Again, children from the normally developing control group

functioned at an adequate level in regular elementary schools, and according to their teacher they showed intelligence within the 'normal' range. No differences were found in short term memory span, as indicated by the results of the digit span task, between the control children (M = 9.39, SD = 3.16), children with autism (M = 9.45, SD = 3.64) and children with PDD-NOS (M = 8.00, SD = 2.34) ($F_{(2, 59)}$ = 1.46, *ns*.). This finding suggests equal short-term memory abilities in children from the clinical and non-clinical groups.

Material and procedure

Each child was tested individually in a quiet room at the child's school. The session began with training the child to indicate an emotion by pointing to one of five schematically presented facial expressions: 'very happy', 'a little happy', 'just normal', 'a little sad' and 'very sad'. Each child then received a series of four initial situation – transition - later situation scenarios, listed in Table 7. The initial situation was either affectively charged, (e.g. a quarrel at school) or affectively neutral (e.g. talking at school). The sequence of both types of target scenario (positive/negative) and initial scenario (neutral/affective) were varied following a Latin square design (Cotton, 1993). The hypothetical affective state was described only in the initial situation. When the initial situations were affectively charged, the descriptions were accompanied with the schematic facial expressions 'very happy' for positive and 'very sad' for negative situations. The neutral initial situation was accompanied with the 'just normal' facial expression. The target situation was always affectively charged and was always opposite in valence to the initial situation. Children were asked to indicate how they would feel in the target situation by choosing one of the five schematic facial expressions that were laid out in front of them. After choosing an expression, they were asked to explain their choice.

Table 7. The four scenarios used in the study.

Initial Situation		Transition	Target-situation
Affective: positive (+) or negative (-)	Neutral		Affective: positive (+) or negative (-)
1. Quarrel at school (-)	Talking at school	Going Home	Getting a nice cup of tea and a cake from mother (+)
2. Broken toy (-)	Talking	Going outside	Meeting a friend (+)
3. Showing father good grades (+)	Talking with father	Going to one's room	Meeting angry sister (-)
4. Friend brings a present (+)	Visit by a friend	Going to the shop	Having to wait in the shop (-)

Scoring

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

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

Justification categories. Explanations were coded for the type and frequency. The explanations were attributed to five categories displayed in Table 8. The interrater reliability, based on 10% of the responses, was ranged between .80 and 1.00.

Table 8. Explanation categories.

1	Situation	All responses that included references either to the situation or to the advantage of a certain situation. E.g.: 'because you can play outside'.
2	Emotion	All responses that mentioned emotion as justification. E.g.: 'because I am happy with my grades'
3	Mental	All responses including a mental, non-emotional process. E.g.: 'because you can't forget about it'
4	Social	All responses that included a social convention or an insight in the social consequences of a situation or an emotion. E.g.: 'it is fairly normal that you have to wait in line in a shop'
5	Other	All other answers. E.g.: 'I don't know why' or 'I've also got a remote control car'

Results

Amount of target appropriate affect. Table 9 shows the affective responses of children from control, autism and PDD-NOS groups, reported separately for target situations (positive and negative) and initial situations (neutral and affectively opposite). A 3 (Group: control, autism or PDD-NOS) x 2 (Target situation: positive or negative) x 2 (Initial Situation: neutral or affectively opposite) analysis of variance with repeated measures on the last two factors showed a main effect for Target situation ($F_{(1, 59)} = 18.98$, $p < .001$), indicating that the positive target situations elicited more target appropriate affect than the negative target situations, and a main effect for Initial situation ($F_{(1, 59)} = 6.10$, $p < .02$), indicating that the affectively opposite initial situations, as expected, changed the appropriateness of the affect to the target situations more strongly than the affectively neutral initial situations.

Interaction effects were found for Target situation x Initial situation ($F_{(1, 59)} = 3.14$, $p = .05$), and Group x Initial situation ($F_{(2, 59)} = 3.08$, $p = .05$). Post hoc analyses of the Target x Initial situation interaction indicated that the impact of the initial affective situation was significant in the positive target condition ($t_{(61)} = 3.25$, $p < .01$), but not in the negative target condition. Post hoc analyses of the Group x Initial situation interaction, comparing the responses following neutral versus affective initial situations in children from the three groups, indicated that children with autism acknowledged the impact of the initial situation on their reported affect in a target situation irrespective of the valence of the target situation ($t_{(10)} = 4.22$, $p < .01$). This effect was not found for children from the control or PDD-NOS group.

Indeed, if we analysed children's responses for the positive and negative target situations separately, children from the control group indicated to feel less happy following a negative than a neutral

experience ($t_{(30)} = 2.51$, $p < .02$), but not less sad following a positive than a neutral experience. On the other hand, children with autism showed the impact of an affective versus a neutral initial situation in both conditions, i.e. in the positive target ($t_{(10)} = 2.88$, $p < .02$) and the negative target ($t_{(10)} = 2.39$, $p < .04$) situation. Children with PDD-NOS reported to feel the same, irrespective of the initial situation.

Table 9. Means (SD) of the 'amount of target-appropriate affect' scores as a function of Group (control, autism or PDD-NOS), Target situation (positive and negative) and Initial situation (neutral and affectively opposite). Range 1-5.

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

Note: higher scores indicate more 'target situation appropriate' answers.

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

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

Reference to initial situation. In Table 10, the mean number of references to the initial situations is presented for the neutral and affective initial situation conditions. As can be seen, all children referred more often to the affective than to the neutral initial situation. A 3 (Group: control, autism or PDD-NOS) x 2 (Target situation: positive or negative) x 2 (Initial situation: neutral or affective) analysis of variance indicated main effects for Target situation ($F_{(1, 59)} = 9.24$, $p < .01$), Initial situation ($F_{(1, 59)} = 28.07$, $p < .001$), an interaction effect for Target x Initial situation ($F_{(1, 59)} = 13.04$, $p < .01$), and a near significant three-way interaction effect of Group x Target situation x Initial situation ($F_{(2, 59)} = 2.55$, $p < .09$). Children from the normally developing and the PDD-NOS group referred more often to negative initial situations than neutral initial situations in the positive target condition ($t_{(30)} = 5.04$, $p < .00$ and $t_{(19)} = 4.35$, $p < .01$, respectively), but they did not refer more often to positive initial situations than neutral initial situations in the negative target condition. Children with autism, on the other hand, showed a tendency to refer more to both positive and negative affective initial situations than to neutral initial situations ($t_{(10)} = 1.94$, $p < .08$ and $t_{(10)} = 1.94$, $p < .08$, respectively). In fact, children with autism referred to positive and negative initial situations equally often ($t_{(10)} = .56$, $p = .59$), while children from the normally developing and the PDD-NOS group referred more often to the negative than to the positive initial situations ($t_{(30)} = 4.35$, $p < .001$ and $t_{(19)} = 3.20$, $p < .01$, respectively).

Table 10. Means (SD) of number of references to the initial situation as a function of Group (control, autism or PDD-NOS), Target situation (positive and negative) and Initial situation (neutral and affectively opposite). Range 0-1.

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

Note: higher scores indicate more references to initial situation.

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

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

Explanation categories. Table 11 shows the distribution of children's explanations over five categories. Since the categories were mutually exclusive, we analysed these data by a non-parametric Mann-Whitney test. It has to be noted that most children gave situational explanations. Furthermore, children with autism gave more other category responses than children from the control group (U = 103.5, $p < .02$), while children with PDD-NOS did not differ from control children in this respect. Children with autism generally referred less often to subjective states (emotional or mental) than control children (U = 88.0, $p < .02$). However, references to subjective states of children with PDD-NOS did not differ from control children, due to the relatively high number of references to emotional states in the PDD-NOS group, which in fact exceeded the references of children with autism (U = 64.5, $p < .04$). The distribution of references to justification categories did not differ for the positive and the negative initial situations.

Table 11. Mean (SD) number of explanations in five categories (range 0 – 4).

	Situation	Emotional	Mental	Social	Other
Control (n=31)	1.71 (1.07)	.65 (.88)	.77 (.88)	.61 (.84)	.26 (.58)
Autism (n=11)	1.73 (1.27)	.18 (.40)[a]	.36 (.81)[a]	.63 (.81)	1.09 (1.30)[a]
PDD-NOS (n=20)	2.00 (1.21)	.80 (.83)[b]	.35 (.49)	.50 (.61)	.35 (.59)

[a]Significantly different from control group, [b]Significantly different from autism group.

Discussion

In the second study, a general influence was observed of affectively charged initial situations on later emotional states. This impact was found in children's indications of their emotional state, as well as in their explanations of these emotional states. Compared to neutral situations, affectively charged initial situations had a higher impact on the reported affect in the target situations, and were mentioned more often. The reaction patterns of the children with ASD seemed to resemble the responses of the control groups. However, more specific analysis of the data showed differences between children from the control and HFASD groups. Normally developing children indicated a higher impact of negative than positive initial emotions on a subsequently aroused opposite emotion. In other words, after a negative situation, they indicated to feel less happy in a later positive situation, but after a positive situation, they did not feel less sad in a later negative situation. They also explained their feelings more often by referring to negative than to positive initial situations. This confirmed earlier findings in normally developing children (Gnepp et al., 1985; Harris et al., 1987; Denham, 1998). Some confirmation was found for a lack of differentiation between the impact of positive and negative emotions in children with HFASD. Children with autism equally acknowledged the effect of positive and negative initial situations on how they felt, as well as on their explanations of these feelings. In contrast, children with PDD-NOS reported to feel the same, irrespective of the affective nature of the preceding situation. However, they did refer more often to the negative than to the positive initial situations.

The stronger impact of negative than positive initial situations on the emotions and explanations in a later situation of children from the control group confirms earlier findings (Gnepp et al., 1985; Harris et al., 1987; Denham, 1998). The higher salience that is awarded to negative than positive emotions can be explained by the disruptive nature of negative emotions. The relative urgency to react on these kinds of emotions seems to be acknowledged at an early age in normal development. Children between two and five years of age, compared to positive emotions, talk about negative emotions in more detail, in particular regarding the causes of negative emotions and the connections between mental states and negative emotions. It is therefore unsurprising that preschool-aged children show a

more advanced understanding of negative than positive emotions (Lagattuta et al., 2001; Lagattuta et al., 2002).

Children with autism did show more awareness of affective over neutral initial situations. They indicated to feel differently following affective situations, and acknowledged affective situations more often than neutral situations. However, they did not distinguish between the impact of positive and negative emotions, but inferred the impact of affective situations irrespective of the valence of these situations, as if following a simple rule that 'previous emotions influence subsequent emotions'. We could speculate that children with autism follow an a-typical developmental route, resulting in these response patterns. Compared to normally developing children, autistic preschoolers are less responsive to negative emotions, such as fear and sadness, in others (Sigman et al., 1992; Bacon et al., 1998). These early differences in experiences with (negative) emotions in children with autism could have resulted in a deviant development of the appreciation of emotions, and of the perseverant effect of these emotions. After all, if you do not realize the salience of negative emotions, it would be logical to infer that both positive and negative earlier situations equally affect your feeling state experienced in a later situation, as they seemed to do in our study.

In contrast to children from the autism and control groups, children with PDD-NOS did not show a correspondence between monitoring and justifying their affective state. They mentioned negative initial situations more often than positive situations. This indicates that they acknowledged the higher salience of negative emotions. However, they did not indicate to feel different in situations that were preceded by positive, negative or neutral initial situations. In contrast to children with autism, children with PDD-NOS seem to recognize the salience of negative over positive emotions. In fact, they generally included more references to subjective states in their explanations than children with autism. However, they did not translate this knowledge to their affective responses. These findings are reminiscent of the impaired ability to use Theory of Mind understanding in children with PDD-NOS (Begeer et al., 2003). Still, children with PDD-NOS have also shown restrictions in their ability to transfer emotions to new situations and interpreting emotions from conflicting cues (Serra et al., 1995). In short, the deficits in emotional competence found in the present, very heterogeneous, group of children with PDD-NOS are in need of further empirical confirmation.

Conclusion

The studies reported in this chapter provided some evidence for the algorithmic reasoning style in the reflections of children with HFASD on social-emotional interactions, but not in the way we originally anticipated. The first study indicated that children with HFASD were equally able as normally developing children to choose and explain explicitly formulated scenarios on conflicting emotional actions. The second study indicated that children with autism might integrate successive internal

emotional states in an a-typical manner, due to learned conventions about emotions in combination with a relative inattentiveness to negative emotions. Their failure to acknowledge the salience of negative over positive emotions has no equivalent in normal development, and can be seen as a sign of a-typical emotional development in children with autism. Their ability to apply more abstract rules about emotions may lead them astray, as we saw in the present study, but could hypothetically, if guided in the right direction, be of great help in the compensation for their absent capacities in the emotional domain that seem to come so easily to normally developing children.

7. Conclusions and speculations

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Introduction and research questions

Previous studies already indicated that the social and emotional abilities of children with HFASD can not univocally be characterized as impaired. Under the structured and straightforward conditions of psychological studies, these children often show elementary social and emotional abilities, as outlined in detail in the first chapter. However, when explicitness and structure are lacking, as is the case in many daily life situations, children with HFASD often fail to translate their abilities into appropriate responses. One of the reasons for this discrepancy between skills and understanding could be that these children rely too heavily on theoretical knowledge in their social and emotional functioning. This approach may result in adequate responses in experimental settings, but is often not triggered or otherwise insufficient for affective functioning in the complex daily social reality. The first aim of the present thesis was to investigate social and emotional skills and understanding of children with HFASD on more advanced levels and in applied settings, with a particular focus on the social role of emotions. While impairments may be more apparent on these more advanced levels, an additional possibility is that these children fail to apply their abilities due to conditional factors, such as a failure to observe relevant information or a poor ability to integrate and translate this information into an adequate response. These conditional factors could be fundamental in nature, but could also involve a motivational component. The second aim of this thesis was to investigate factors that influence production deficits of social-emotional skills and understanding in children with HFASD.

Social and emotional skills and understanding of children with HFASD were investigated in five separate studies. As outlined in the first chapter, previous research suggests that children with HFASD fail to acknowledge the social regulatory element of emotions, despite their intact elementary emotional understanding. In our first two studies (Chapters two and three), we investigated the use of social abilities and the detection of emotional information, by testing to what extent children with HFASD apply their mind reading skills during real life interactions, and to what extent they are attentive to emotional expressions, respectively. In Chapter four and five, different aspects of emotions and social knowledge were investigated: the understanding of the link between emotions and social behaviour, and the understanding of the regulation of emotional expressions in social interactions. In Chapter six, a final study is described on responses of children with HFASD to conflicting emotions.

With each of these studies, we especially aimed to investigate factors that are involved in the activation of available skills and understanding. It was assumed that children with HFASD often do not see the need to use their abilities, and that a variety of additional factors play a role in their failure to apply these abilities. In Chapter two, a study is described on the impact of a simple and direct motivational factor on the use of mind reading skills. A reward was offered for correcting a false belief in a conversation partner. Chapter three includes a study on whether the social relevance of emotional expressions influences children's attention to these expressions. Children were asked to sort pictures

of emotional expressions in a neutral and a social context. In Chapter four we looked at the influence of the orientation on own versus other perspectives on children's reports of regulating their emotional expressions. Children were asked about their understanding of emotional display rules in pro-social and self-protective situations. The factor investigated in Chapter five involved the way in which children are presented with information about emotions. Here, we studied the impact of the structure and straightforwardness of information on the detection of relevant emotional cues in stories about emotional interactions. In the last Chapter, we focused on indications of responses to conflicting emotions. Children were asked to respond to stories describing social interactions involving conflicting emotions.

Signs of social and emotional abilities

The first general question of this thesis regarded differences in the advanced and applied social and emotional skills and understanding between children with HFASD and normally developing children, aged between 7 and 13 years. Surprisingly, none of the studies included in the present thesis indicated fundamental impairments in children with HFASD. This was particularly unexpected because children were tested on their responses to relatively complex and adapted social and emotional interactions. Comparisons between multiple samples of children with HFASD and children with normal development indicated no major arrears in the HFASD group. Note that altogether, around 200 children with HFASD participated in our studies. Though it is reasonable to expect elementary social and emotional abilities of autistic children in these ranges of age and intelligence, it is important to stress their signs of competence on these more advanced levels, in particular in the light of the many studies that mainly emphasise their impairments (see Chapter one). Therefore, we argue for a more subtle qualification for the social and emotional functioning of these children.

In Chapter two, we described how children with PDD-NOS were able to respond adequately to false beliefs of their conversation partner. Not only did these children acknowledge that their conversation partner had a false belief, they also acted upon this knowledge and corrected the false belief. This performance would be unlikely if the children were indeed 'mindblind', as they have been denoted before (Baron-Cohen, 1995). In a similar way, children with HFASD, described in Chapter three, showed equal attention to facial expressions as children from the control group when they were asked about the social actions of the depicted persons. Thus, while these children are often described as less attentive to emotions because they fail to develop a concept of another person and the feelings that others experience and express (Hobson, 1993), they are certainly able to appreciate emotional expressions once these are explicitly presented in a social context. Furthermore, children with HFASD showed a similar understanding of emotional display rules as control children (Chapter four). They seemed to be generally aware of social rules for how and when to regulate the of expressions their emotions. These results were found based on accounts of their personal experiences and on their

responses to hypothetical social interactions. In the latter case, children with HFASD mentioned pro-social display rules even more than self-protective display rules. With this unexpected pro-social attitude, they exceeded the performance of normally developing children, who showed equal attention to both types of display rules. In Chapter five, children with HFASD corresponded explicit descriptions of emotions and social behaviour of story characters to a similar extent as control children. When explaining the connection between emotion and behaviour, they referred to information about emotions even more than normally developing control children. Finally, the last empirical study, described in Chapter six, indicated that children with HFASD were equally able as control children to integrate conflicting emotions, and even overgeneralized the impact of previously aroused emotions.

Taken together, these findings indicate that responses of children with HFASD were often similar to, or sometimes even more accurate than responses of control children in the use of social rules. It was a recurring finding that children with HFASD showed impressive signs of general knowledge of social and emotional rules. Therefore, statements about the social and emotional impairments of these children should be qualified by highlighting their relative inability to apply or use the skills and knowledge that are available to them indeed. Their social and emotional problems should not be dismissed, but it should be acknowledged that the bottleneck of their impairment may be that their abilities are dormant rather than absent.

Factors that influence the use of social and emotional abilities

The second general question of this thesis was which factors are involved in the active use of social and emotional abilities by children with HFASD. Based on the present studies, a variety of facilitating, directive and clarifying task elements seem to influence the social and emotional responses of children with HFASD. By manipulating these factors, their impact on children's responses could be isolated. In general, it was found that children with HFASD were in principle able to search for appropriate information or to respond adequately, but only did so provided that certain conditional constraints were met. The content of these constraints focused these children on the relevance and potential usefulness of this information.

Children with PDD-NOS corrected false beliefs in a conversation partner, but only when this correction involved a personal gain. When this personal gain was not triggered, they did not act upon the false belief of their conversation partner (Chapter two). Children with HFASD were able to select human faces based on their emotional expressions, but only when prompted on the social actions of the depicted people, which involved personal consequences. When faces were presented in a neutral setting, children with HFASD were less attentive to emotional expressions than control children (Chapter three). Furthermore, when asked about hypothetical situations, children with HFASD

reported more pro-social than self-protective motives for concealing their emotions. However, on their own account, they hardly mentioned the use of pro-social display rules in their personal experiences (Chapter four). In Chapter five, it was shown that they referred to the emotional states of story characters when these were explicitly formulated, but failed to do so more often than controls when they had to derive the story character's emotional states from context information. And, finally, they were able to take previously aroused emotional states into account when asked about successive conflicting emotional situations described in the second study of Chapter six, but tended to overgeneralize this ability, and indicated that all previous emotions, including positive ones, would influence their current emotional state. In short, while abilities may be available, they were not triggered as automatically or adequately as can be observed in normally developing children. Several explanatory frameworks may be offered for this phenomenon, such as their processing of social and emotional information, the acquisition of Theory of Mind competence and the cognitive compensation for lacking social and emotional abilities. These will be discussed below.

Social and emotional information processing

A shared element of the above described factors seems to be that they focus children with HFASD on relevant social and emotional information that is often overlooked on their own account. In order to explain the nature of this focus and locate its point of impact in the functioning of these children, it may be helpful to perceive the impairments of children with HFASD from an information processing perspective, where deficits may occur on different levels. First of all, in the encoding phase of information processing, children with HFASD focus mainly on the concrete information that is exchanged. This suggests a perceptual problem in these children: they seem to fail to attend to subtle background cues that are relevant in social and emotional interactions. In particular the findings in Chapters two, three and five seem to imply that it takes little effort to focus these children on relevant information. Following relatively minor prompts or clarifications, these children showed an awareness of false beliefs, attended to emotional expressions and acknowledged information about emotional states. However, without these directions to guide their perspective, they performed more poorly, even though they essentially proved to be able to provide an adequate response under slightly more optimal circumstances.

It could also be argued that the deficit is located at a later stage in the process, when information is integrated. Social and emotional problems of children with HFASD are often explained by a presumed weak central coherence in these children. It is argued that these children process information in a piecemeal rather than in a holistic way, and often fail to integrate information on a global, abstract level. Information that is exchanged during social-emotional interactions particularly needs to be processed at this global level (Happé, 1993; Frith, 2003). Therefore, even if all relevant elements of information are perceived, the child may not be able to see the connection between these cues. When

the global coherence of the separate elements is not acknowledged, an adequate response is unlikely, because the separate elements only become sufficiently informative when put in a certain perspective. Focusing children on the coherence between different elements may thus help to trigger adequate responses. Priming social relevance of information or structuring information in an explicit way seem to be promising factors in this respect, as we have seen from the results of Chapters three and five. However, it may be very difficult to 'learn' abilities that seem to come naturally to a normally developing child from its first day of life (Chapter one).

The bottleneck in the autistic social information processing could also be situated at the execution stage. Some of the current studies imply that these children did in fact arrive at a coherent understanding that is comparable to normally developing children, but still did not act upon this understanding. The autistic participants of the study described in Chapter two did acknowledge that the experimenter had a false belief. Still, they had not felt the need to communicate this to him. Similarly, children with HFASD in Chapter three were able to attend to emotional expressions just as well as their normally developing peers, but did not respond according to this ability. These children may simply not see the need to act spontaneously, even though they have the required knowledge available to them. This highlights a motivational aspect of the impairment of these children. Their lack of motivation may be caused by their failure to set prospective goals or anticipate the consequences in social and emotional exchanges. Somehow, normally developing children seem to find social actions rewarding in themselves (see Chapter one). Children with HFASD highly appreciate explicitly defined goals, but the exact goals of social and emotional actions are often fuzzy and less specific. Making prospective goals of social or emotional interactions evident to children with HFASD may help to trigger the appropriate response in these children. Contemporary interventions do already focus on these issues (Rumsey & Vitiello, 2001), but the clinical treatment of these children could still benefit from more detailed explorations of the elements that focus these children on the social functions of emotions.

Based on the present studies it is hard to estimate the effectiveness of such production triggers in the encoding, interpretation or execution phases of social information processing. Motivational factors may be involved in all three levels. It is possible to say something more about the impact of these factors. The shifts in response strategies of children with HFASD following prompts or social priming were substantial and qualitative. Following subtle directions, these children seem to address a new schema regarding stimulus aspects, rather than a small increase in processing similar schemas. In the latter case, we would assume a mediation deficit in these children, and interpret the facilitating factors as enhancing a schema or strategy that was already being produced. However, in particular the size of the shifts in responses that were observed following the reward in Chapter two or the social priming in Chapter three seem to be indicative of a production deficit in these children: they more often failed to

produce abilities because they were simply not considering the option at all. However, it seems that once they realize this, a new set of processing criteria becomes available to them, resulting in equally adequate responses as children from the normally developing control groups. In short, their dormant abilities seem to be sleeping with their clothes on.

Theory of Mind and emotions

Within the Theory of Mind domain, a related discussion of dormant understanding has been carried on. Interestingly, the definition of Theory of Mind itself has evolved during this discussion. When Theory of Mind was first studied in chimpanzees (Premack & Woodruff, 1978) and in young children (Wimmer & Perner, 1983), its original definition referred to the ability to impute mental states to others. This definition focused on formal knowledge of how the mental world works, and emphasized beliefs, to the cost of other mental states such as desires and emotions (see also Leslie, 1994). Note that the same Theory of Mind conception can be used as a means to understand one's own mental functioning (Frith, 2003). In recent years, Theory of Mind knowledge often refers to a more broadly conceived social understanding, which may be based on the ability to form mental representations, but also depends on other factors such as personality, motivation, empathy, intelligence, and environmental and experiential factors (Dunn, 1991). Some of these factors have been studied in the present thesis, and the wider definition of Theory of Mind seems very useful for investigating the abilities of older children with HFASD, who pass simple Theory of Mind tasks, but may fail to respond appropriately in daily life situations. Recently, a range of new studies on so-called advanced Theory of Mind understanding in children with HFASD used a comparable broadened scope, for example by using measures of the ability to discern emotional expressions, or real life social actions as indications of Theory of Mind (Baron-Cohen et al., 1997; Roeyers et al., 2001; Ponnet, Roeyers, Buysse, De Clercq, & Van der Heyden, 2004) See also Chapter one and two). Considering Theory of Mind as part of the explanation of children's emotional functioning seems to provide a more integrated perspective that may be more useful than earlier views where Theory of Mind and emotion recognition were described as rivalling hypotheses with regard to their explanatory power for autism (Buitelaar, van der Wees, Swaab-Barneveld, & van der Gaag, 1999).

It is worthwhile to reminisce how theoretical explanations of Theory of Mind development, such as the theory-theory (Leslie, 1994) and the simulation theory (Gordon, 1992) would fit into the broadened concept of Theory of Mind and the presumed deficits of children with HFASD. One of the main issues in this theoretical debate is how young children develop Theory of Mind understanding. The two main points of view are that children either form an explicit theory about the mental states of others (theory theory), or that they simulate mental states in order to explain behaviour of themselves and others (simulation theory). The recurrent eloquence on social and emotional topics of children with HFASD in the last three studies of this thesis fits well with the theory theory explanation. These

children strongly relied on theoretical ideas about the content of subjective states in others, whether social, emotional or representational. The simulation theory (Gordon, 1992), or even the contamination of both ways to acquire Theory of Mind knowledge, which is suggested to characterize normal development (Harris, 1992) has not been considered much in the scientific literature on social impairments of autistic children. However, the simulation route to Theory of Mind understanding may well be a representative analogy for the missing ingredient in the social-emotional functioning of autistic children.

The differentiation between theory-theory and simulation theory is particularly relevant to the explanation of the results of Chapter six, where we distinguished between explaining and pretending emotional states. Normally developing children were found to acknowledge the hypothetical impact of a previous emotion on a current emotion more when they were explaining why they would feel a certain way than when they were monitoring how they felt. This confirmed earlier findings in normally developing children of similar ages (Harris et al., 1987). However, children with autism showed little difference between explaining and pretending or monitoring their feelings. They seemed to apply the same response strategy to both responses. These findings could be related to the above described Theory of Mind approaches. Both normally developing children and children with HFASD seem to apply a theory-theory approach when explaining their own emotional states, that is, they focused on their knowledge about emotions, and logically deduced the relevant emotional information that they mentioned. However, when they were monitoring how they would feel, normally developing children seem to use a different approach. They ascribed more persistence and transfer to negative emotions than to positive emotions, even though both emotions would in theory have an impact on their affect in successive situations. These responses could be assumed to be the result of a simulation. According to this approach they mentally simulated the hypothetical situation and monitored the feelings they experienced, which could be assumed to be derivative of their feelings in the actual situation. The similarity between responses that explain and monitor emotions in children with autism could be the result of the application of a general rule about successive emotions which is applied irrespective of the type of response that is requested, or the valence of the emotions involved. This would make them the ultimate theory theorists when assessing their own emotional states.

Though the findings of Chapter six may not be powerful enough to etch the above conclusions in stone, they do provide leads for future research. In particular the role of pretence in simulating others' subjective states may be related to autistic children's deficits in Theory of Mind in its broadest sense. The inability to simulate emotions and reciprocally mirror of others' internal states that is presumed in the HFASD group is a likely result of a lack in pretend abilities (Harris, 2000). Investigating the simulating abilities could particularly illuminate the black box of social-emotional functioning of

normally developing children, where a homuncular terminology involving 'automatic', 'natural' or 'intuitive' abilities is always ready to blur our perspective.

Cognitive compensation

It has been suggested on various accounts in the current studies that children with HFASD arrive at their social-emotional understanding via a different route than normally developing children. This route involves a relatively late-acquired, explicit understanding of social interactions and emotions (Capps et al., 1992; Gopnik, Capps, & Meltzoff, 1993). The social and emotional functioning of children with HFASD involves a high dependency on intelligence. Performance on tasks measuring Theory of Mind or social and emotional understanding were found to depend on intelligence scores in children with HFASD, but not in normally developing children (Happé, 1995; Travis et al., 2001). The adequate responses observed in the last three empirical Chapters of the current thesis could thus be attributed to the strong intelligence levels of the children in our autistic sample and might be explained by some form of cognitive compensation.

An illustration of how cognitive skills help autistic individuals to 'survive' in a world inhabited by 'neurotypicals' (people without autism) can be given by Temple Grandin (1995), one of the most outspoken individuals with HFASD. She compares herself to Data, the android robot from the television series 'Star trek'. She continuously tries to gain information about human interactions. This information is then stored into the data base of her brain. In a new situation, she has to search this database and look for comparable, earlier experiences. She also studies rules about the consequences of her actions. Based on these premises, she then deduces how to respond on a purely logical basis. This observation closely resembles the logico-affective hypothesis, which states that children with autism need to actively acquire social-emotional skills, while normally developing children seem to develop these skills without conscious effort (Hermelin et al., 1985). The suggested inference of responses from a knowledge base of 'appropriate' behaviour is in stark contrast to responses of normally developing children, who seem to rely more on their subjective experiences with appropriate responses.

Some empirical foundation for the compensating abilities of children with HFASD can be found in the results of Chapters four and six. In Chapter four we described two studies where children with HFASD showed a general awareness of social rules for how and when to express or conceal their emotions. This awareness is surprising in the light of the social awkwardness that these children often display in their interactions (American Psychiatric Association, 1994). As discussed before, this understanding may not be fully indicative of the social-emotional behaviour of these children. However, irrespective of its use, their understanding also seemed to be organized in a different way. In the interview in Chapter four, children with HFASD illustrated their use of display rules more often by

referring to prototypical situations. In contrast, normally developing children referred more often to their subjective daily life experiences. The tendency of children with HFASD to reason about emotions in terms of abstract, prototypical scripts rather than personal experiences can be related to attempts to cognitively compensate for an impaired introspective awareness of emotions.

A remarkable finding is that children with HFASD mentioned hypothetical pro-social display rules more often than self-protective ones, while normally developing children did not show this preference for pro-social motives. This surprising attitude could be the result of differences in the autistic and non-autistic development of this type of knowledge. Violating display rules often results in feedback from people in their environment. This feedback may be irritated or shortened when it concerns normally developing children, but children with autism will most likely be excused, and provided with a full explanation (e.g. 'It's not nice to make fun of somebody who is feeling sad'). Note that this type of 'learned' response pattern is likely to stay relatively rigid, since there is only a limited number of rules that can be stored in memory. Therefore, future responses to a sad person will most likely be executed in the exact same manner. It could be assumed that violations of pro-social display rules are particularly provided with explicit feedback, since they involve harm to another person. In contrast, children often have to find out the self-protective display rules on their own account, without these explicitly formulated rules. After all, when self-protective display rules are not applied, the child is its own victim. Therefore, the adequate understanding of the principle of pro-social display rules may be in contrast to the assumed Theory of Mind deficits, but seems to fit with an account of social learning. Still, we can doubt whether the adequate understanding of pro-social display rules of children with HFASD is put to practise in their daily life situations, since the inclination to respond pro-socially was not found in the interview findings that reflected children's personal experiences with display rules.

In Chapter six, some more empirical basis is provided for the idea of cognitive compensation. High functioning children with autism were shown to possess the cognitive tools for judging their hypothetical emotional states following previous, contrasting emotions. However, they indicated that positive and negative emotions would have an equal impact on successive emotions. This may indicate the application of a learned principle. The development of this type of understanding seems to differ between children from the HFASD and control groups. Normally developing children expect negative emotions to have a higher impact on successive situations from about three to four years of age (Lagattuta et al., 2001; Lagattuta et al., 2002). The current control group did in fact ascribe a higher impact to negative than positive initial emotions. This judgment may be based on previous experiences with emotions, and indicate a better ability to simulate individual emotional experiences in normally developing children, as discussed before. Children with autism seemed to apply a general rule about the impact of previous emotions, without differentiating between positive and negative emotions.

The results of both studies imply an overgeneralization of prototypical responses in children with HFASD. They seem to be imbued with the rules of social and emotional interactions. Often, these children are very aware of their shortcomings. Many of these children show a great interest and willingness to learn about and adjust themselves to 'neurotypical' social and emotional behaviour. Their inclination to study the human behaviour as 'outsiders' would probably even make them very objective psychological researchers (though they are likely to fail as therapists).

Mature emotional functioning: the backfire of compensation

Despite impressive attempts to 'learn' social and emotional rules, the variety of possible social-emotional encounters in daily life is hard to cover by means of explicit rules. People can interact in an infinite number of ways. This requires a flexible, heuristic and ad-hoc approach. The need for these abilities grows stronger when children mature, and their social and emotional lives become increasingly complex. More mature cognitive emotional complexity is evidenced by a language that is complex and non-stereotypical, that tolerates intra- and interindividual conflict and that appreciates the uniqueness of individual experience. Young children seem to start with an outlook that highlights the physical aspects of emotions, which then transfers into a perspective of emotions as mental constructs in their preadolescent years. However, they seem to revoke this idea when they reach adolescence and acknowledge a dual perspective of emotions as both physical and mental phenomena (Labouvie-Vief, De Voe, & Bulka, 1998; Olthof, 2004). The transition of the early learning of social and emotional rules to a more nuanced view on emotions seems a process that could enhance our understanding of the compensating abilities of children with HFASD, but also is in need of more empirical foundation in normally developing children.

The 'mature' reasoning style that can be observed in high functioning adults with autism is in obvious conflict with the above described requirements for 'mature emotional functioning'. Autistic individuals show little individuality, but mainly seem to gain a general awareness of the socialization aspects of emotional maturation. Their social-emotional understanding is often construed in a deductive, top down architecture. Questions about their experiences are often approached as cognitive problems and responses seem to be calculated algorithmically. Moreover, despite their compensating abilities, children with autism often respond incompletely or inadequately and also take more time to generate their responses. As can also be gathered from the studies in this thesis, social and emotional knowledge alone is insufficient for adequate behaviour. The knowledge component of social and emotional functioning could be considered the 'roof top of a house in which the walls are founded in an evolutionary account of social engagement' (Klin et al., 1993) pp. 382). The additional abilities that are needed to interact successfully in daily life seem to take root very early in development. Normally developing children, before the age of three, fail false belief tasks, but are able to negotiate successfully in everyday life. In brighter individuals with autism, the social and emotional roof seems

to be free standing. Only with additional support, this house can stay upright (Frith et al., 1991; Capps et al., 1992; Yirmiya et al., 1992).

Limitations

We have to be aware of various limitations of the present investigations. The heterogeneity of the PDD-NOS group, but also of the whole HFASD group prevents us from drawing strong conclusions about the meaning of the current results on an individual basis. Although altogether about 200 children with HFASD took part in our studies, each study included only about 30 children, both with autism and PDD-NOS. Larger samples of participants would allow stronger conclusions about the functioning of the children in the subgroups. However, even more importantly than spending effort collecting such samples, it seems necessary to search for better classifications of autism spectrum subgroups, in particular regarding the current diagnosis of PDD-NOS. Unfortunately, early attempts to capture the quality of autistic impairments, for instance by differentiation between aloof, passive, and odd children with autism (Wing et al., 1979; Prior et al., 1998), have not received much following in scientific investigations. These attempts seem more fruitful in gaining an understanding that can be useful for these children on an individual basis, than repeated, detailed investigations of groups of children who may be assembled based on flawed classification criteria. A dimensional approach might be helpful to revive the early attempts to differentiate between diverse typologies within autism spectrum disorders.

Furthermore, most contemporary research only includes officially diagnosed children. Consequently, most children will also be familiar with some form of treatment. The question is whether this interferes with the comparison with normally developing control groups. One response would be to choose clinical control groups for the autistic samples. When mentally retarded children were tested on very basic social knowledge, such as false belief understanding, children with Down syndrome provided a useful comparison group (Baron-Cohen et al., 1985). However, it is hard to find clinical control groups for high functioning children with autism that bring about less problems than the obvious comparison with normally developing controls. Moreover, the behaviour of this latter group determines the norm of social and emotional functioning. Another response to the potential effect of treatment on test performance is that these children, even without receiving treatment, are by nature deviant in social behaviour and communication, and therefore most likely be provided by their direct environment with explicit instructions about how to behave. When these children are normally intelligent, they are often eager to learn about accepted personal interaction. This could then result in similar rigid, top down strategies that may follow from behavioural treatment.

Lastly, all tasks were specifically designed for the studies in the current study. Therefore, we had no information concerning the validity and reliability of the tasks. Performance of the children may result from a range of peripheral task demands, such as attention, pragmatics in the understanding of the task

aims and executive task demands. However, we did repeat several studies (e.g. Chapter four, five and six), and found similar results in different groups of clinical and control children, suggesting at least some internal consistency. In addition, the coding of children's responses proved to be reliable. More studies will be necessary to provide certainty about the validity and generalization of the current results. Furthermore, every study included experimental tasks that consisted of a limited number of trials. This need not be problematic, since most studies in the literature about advanced Theory of Mind studies only involved two to four stories or trails, and still showed strong test-retest reliability (Hughes et al., 2000). Higher numbers of trials would probably not lead to more valid or reliable data.

Practical implications

The present studies call for more direct investigations of how the advanced social and emotional understanding is related to behavioural skills of children with HFASD. In combination with further research on the classification of autism spectrum subgroups, this would make more suitable individual treatment possible. In this respect, it seems very important to strongly differentiate between autism spectrum children with lower and higher cognitive skills. In the lower functioning groups, the poor understanding may be a limiting factor in the behaviour of the children. Therefore, treatment could focus more on the cognitive element of social and emotional functioning. The high functioning group may need less help on the cognitive level, but seems to need more assistance in learning about the application of their insights in daily life.

The present studies have managed to isolate various factors that may be of systematic use in the assistance given to these children. Factors such as the personal gain that is awarded to a certain response, or the clarity of social context of a response, seemed to help putting social action as well as emotional attention on line. Structuring or making explicit information that is presented to the child seems to have a great impact on the detection of relevant information by these children. A further investigation of these factors may enable us to improve the treatment of still younger children. Following the present studies, it seems important to single out subgroups of children with HFASD that are particularly sensitive to the benefits of facilitating factors such as personal gain, social priming, or clarification of context information. Instead of teaching children with HFASD what they may already know, educators could focus on helping children to use the knowledge they possess to guide their own behaviour in their daily life interactions.

Further studies

The factors that were studied within the scope of this thesis seem to have an impact on various different levels of children's performances. They facilitate, direct or clarify different aspects of social and emotional functioning of children with HFASD, and thereby highlight possible underestimations of their true competence. This approach can also be adopted within various other problem domains

that are related to the social and emotional functioning of children with HFASD. In our search for the bottleneck of autistic social-emotional information processing, central coherence and executive functions may become more integrated rather than alternative perspectives on the impairments of children with ASD.

As described in Chapter one, young children develop their elementary emotional and social understanding to a large extent within the first ten years of their lives. As can be seen in Table 1 (Chapter one), children with HFASD seem to acquire these elementary skills as well, albeit somewhat later. Therefore, in future studies of high functioning children with HFASD, we may have to focus on the kind of social and emotional abilities that children develop in preadolescence. Rather than only looking at the methodological heritage of developmental psychology, it seems worthwhile to see what tests from experimental social psychology may be useful to further examine the social and emotional functioning of (pre)adolescents with HFASD.

One of the areas where such new approaches would be very welcome is the study of Theory of Mind functioning in older preadolescents and adults. Developmental studies often seem to suggest that once children reach a certain (mental) age, they are emotionally competent, have acquired social cognition, and 'possess' Theory of Mind knowledge. However, interactions between non-autistic adults show that we usually do not know the content of others' mental states, and we are often poor at attempting to adjust our behaviour at such contents. See for instance the work of Keysar, who convincingly showed the limits of Theory of Mind use in normally functioning adults in various studies (Keysar, Lin, & Barr, 2003; Meerum Terwogt & Rieffe, 2003). Adults in this study were not able to adjust their behaviour the perspective of an interacting person while they were fully 'Theory of Mind competent'. There seems to be a gap between the wealth of Theory of Mind investigations of children between four and six years old, and the few studies that have attempted to address how Theory of Mind skills further develop once the basics have been internalised. We are currently adopting this approach in a study with younger participants with HFASD, and aim to further investigate the development of Theory of Mind related abilities of older participants with HFASD in future studies.

Another aspect of emotional functioning that is currently under investigation is the impact of arousal on emotion perception. Strangely, one rarely finds the issue of over-arousal or sensitive overload among explanations of social-emotional impairments in HFASD. However, stemming from the first descriptions of autism by Kanner (1943), the idea of sensitive overload would fit very well in the current debate on abilities that remain un-used. In fact, over-arousal caused adults with HFASD to fail cognitive tasks that they were able to pass under more quiet conditions (Raymaekers, van der Meere, & Roeyers, 2004). Elaborating on the facial attention study described in Chapter three, we are

currently examining whether the influence of arousal can also be found in the attention of children with HFASD to emotional expressions.

The studies in the present thesis suggest that children with HFASD depend on cognitive compensating abilities for their limited social and emotional skills. However, we know very little about the nature and the development of these compensating abilities. With regard to Theory of Mind reasoning, longitudinal studies have already been executed, suggesting significant improvement in Theory of Mind abilities of children with ASD (Steele, Joseph, & Tager-Flusberg, 2003). A similar longitudinal investigation of advanced and applied social and emotional functioning of children with HFASD could highlight the cumulative development of their impairments and could be particularly informative about the emergence of their cognitive compensatory skills.

Conclusion

This thesis was set out to compare the advanced and applied social and emotional skills and understanding of children with HFASD and normal development and study factors that are related to the active use of these abilities. A general finding concerns the unexpected similarity between abilities of children from HFASD and control groups. However, this similarity may be superficial, because the understanding of children with HFASD seems to be organized in a different way than in normally developing control children. More research is necessary to closely compare the different aspects of this understanding in autistic and non-autistic children. Several factors could be isolated that had an impact on the use, or reported use of these abilities. Children with HFASD were particularly triggered by enhancing motivational aspects, focusing them on the relevance of social-emotional information and clarifying the context of such information. Several factors were also suggested to be involved in the development of social-emotional knowledge. Explicit feedback may play an important role in social learning about emotional interactions, and children with HFASD seem to rely more on theoretical knowledge when reasoning about social-emotional topics, while normally developing children seem to rely more on their subjective experience. These findings may be ascribed to cognitive compensation in these children, which results in a social and emotional functioning that is qualitatively different from normally developing children. Future studies will need to investigate the factors related to the development and the enhancement of the social-emotional functioning of children with HFASD in more detail.

Rather than being blinded by the mindblindness hypothesis or other theories that assume a fundamental absence of social-emotional skills and understanding in children with autism, it seems worthwhile to focus on the many factors that are involved in the activation of adequate social and emotional responses. Many children with HFASD are still subjected to the ‘classic’ Theory of Mind tasks, such as the false belief task, when they have reached preadolescence, while these tasks were

originally designed for three to four-year-olds. This occurs in clinical practice, but also in scientific studies. From 1985 to 2000, 750 studies reported using the false belief task, often involving older children (Hughes et al., 2000). It seems worthwhile to break with this tradition and focus on the complexity of social and emotional problems from the perspective of the diversity of factors that are involved in these typical human, but inscrutable abilities.

Summaries of chapters

Chapter 1

Children with autism spectrum disorders exhibit a variety of cognitive and emotional impairments that are particularly apparent during social interactions. Intelligence and maturation play a role in the manifestation of these impairments. Autism often coincides with mental retardation. However, studying children with autism who are not cognitively impaired provides an opportunity to focus on the 'pure' autism, without the possible confounding effects of the mental retardation. In the first chapter of this thesis, an overview is presented of current findings on the social-emotional development of high functioning children with autism spectrum disorders (HFASD). Using the scope of typical development we will discuss the deviations, as well as the analogies of the development of autistic children. Special attention is given to the discrepancy between relatively well-developed theoretical knowledge of these children of social-emotional interactions and their poor ability to use this knowledge in daily life situations. The chapter results in the two main research questions of the present thesis: to what extent do children with HFASD deviate from normally developing children in their more advanced and applied social and emotional abilities, and what factors are involved in the actual use of these abilities in daily life situations?

Chapter 2

In this study we investigated if task interest facilitated the application of Theory of Mind capacities in children with HFASD. Children were invited to carry out two simple tasks. Sabotage of both tasks by a third party, in the absence of the experimenter, resulted in the experimenter appearing to have a false belief. Children from the control group generally responded directly upon the return of the experimenter and informed him about the sabotage. Children with PDD-NOS tended to correct the experimenter's false belief in the rewarded task condition, but refrained from doing so in the nonrewarded task condition. Children with autism did not respond, or responded very late, and were not influenced by the reward. These results highlight the role played by social and communicative factors in the application of ToM knowledge in the former clinical group.

Chapter 3

Children with HFASD are frequently noted for their impaired attention to facial expressions of emotions. In this study, we wanted to examine whether their attention to emotion cues in others could be enhanced, by varying the social relevance of children's attention to emotion expressions. Children with HFASD and normally developing control children were asked to sort photos depicting smiling or frowning faces of adults. In conformance with earlier findings, under neutral conditions children with HFASD were less attentive to emotion expressions than children from the control group. Yet, this difference disappeared when children were explicitly asked to make a socially relevant decision. These

findings suggest that the attention of children with HFASD to emotion expressions in others is influenced by the social relevance of this information. Theoretical and practical implications of these findings are discussed.

Chapter 4

In two studies, expressive display of emotions was examined in children with HFASD. In a first study, children were interviewed about their personal experiences with masking emotional expressions. Children with HFASD showed adequate abilities to reflect on this topic, and reported similar experiences with concealing emotions as control children. However, they strongly relied on prototypical examples in their responses, while normally developing children more often seemed to report from their personal experience. Furthermore, children with HFASS less often acknowledged the role of audience figures, and reported less pro-social motives for concealing emotions than normally developing children. A second study focused on the theoretical understanding of display rules. Children were presented with hypothetical situations, in which the motives for concealing emotions were varied. A higher overall report was found of display rules for pro-social than for self-protective reasons. Furthermore, motives for concealment were found to interact with the diagnosis of the children: children with HFASD concealed emotions less often than controls for self-protective reasons, but more often for pro-social reasons. Explanations for these contrasting results from both studies are discussed.

Chapter 5

In two studies, children with and without HFASD were tested for their understanding of social consequences of mood states in other persons. Both experiments included stories about hypothetical social interactions. Information about mood states of story characters was described explicitly (Study one) or implicitly and combined with irrelevant information (Study two). Children were asked to predict and explain behaviour of the story characters. Children's predictions and explanations were analysed for the extent to which they relied on the information about the mood states of the story characters. Following direct questions about possible mood consequences, children from the HFASD and normally developing samples peformed similar. However, various group differences were found in the way children referred to mood in the explanations of their responses. Remarkably, children with HFASD referred to explicitly described moodstates even more than normally developing children, but referred to implictly described moodstates less often. Furthermore, children with HFASD less often referred to the uncertainty of the relation between mood and behaviour. Findings are discussed with respect to the relatively strong theoretical understanding of emotions and social interactions of normally intelligent children with more often in structured test situations, and their poor ability to apply and communicate this knowledge in daily life situations.

Chapter 6

In two studies, we examined the responses of children with HFASD and normally developing control children to situations that elicited conflicting emotions. In Study one, children were asked about their behavioural responses to hypothetical situations that elicited conflicting emotions. Children with HFASD showed similar response patterns to normally developing control children. In Study two, children were asked about their emotional responses to successive conflicting emotional situations. In this study, children with autism seemed to calculate their emotional responses, while the responses of normally developing controls or children with PDD-NOS seemed to rely more on their personal experience. These findings may be indicative for an a-typical development of the understanding of emotions in children with HFASD.

Chapter 7

In the final chapter the overall conclusions of the present thesis are discussed. First, children with HFASD showed relatively adequate social and emotional skills and understanding, even at the more advanced and applied levels they were tested on in the present studies. Second, the responses of children with HFASD were found to depend on different factors, which support these children by directing them to relevant information, triggering adequate response patterns, and clarifying the context information. These findings suggest that the social-emotional functioning of children with HFASD rely on various additional factors and should be studied with care. These results are discussed from various explanatory frameworks, such as information processing, theories of Theory of Mind and cognitive compensation. Implications for clinical interventions and future studies are highlighted.

Samenvatting

Kinderen met autisme spectrum stoornissen (ASS) worden gekenmerkt door gebrekkige sociale, communicatieve en verbeeldende vaardigheden. De psychologische problematiek van deze kinderen manifesteert zich op zowel cognitieve als affectieve gebieden. Een belangrijk cognitief probleem van deze kinderen is hun verminderde Theory of Mind (ToM) vermogen. Dit wil zeggen dat zij niet goed in staat zijn om op grond van mentale toestanden (zoals gedachten, wensen, intenties of emoties) betekenis te geven aan gedrag en emotionele reacties van anderen. Daarnaast laten deze kinderen ook problemen zien van emotionele aard. Ze gaan in mindere mate affectieve relaties aan met anderen, hebben moeite met het identificeren en begrijpen van emotionele uitdrukkingen, uiten emoties dikwijls op een atypische manier en hebben minder aandacht voor de emotionele uitingen van anderen. Zowel de theory of mind problematiek als de problemen met het herkennen van emoties worden vaak naar voren geschoven als karakteristiek voor kinderen met een autisme spectrum stoornis.

De mate waarin verminderde kennis van ToM en emoties in testsituaties naar voren komen bij kinderen met ASS blijkt samen te hangen met intelligentie en taalvaardigheid. Mentaal geretardeerde kinderen met ASS presteren vaak slecht op taken die kennis meten over ToM of emoties. Dit in tegenstelling tot de normaal intelligente kinderen met ASS. Deze hoogfunctionerende subgroep is lange tijd relatief onbelicht gebleven. Niettemin varieert de omvang van deze groep volgens recente schattingen van een kwart tot meer dan de helft van de kinderen met ASS. In testsituaties blijken deze kinderen vaak wel de beschikking te hebben over basale kennis van emotionele en mentale toestanden bij anderen. Echter, de aanwezigheid van deze kennis, aangetoond in een testsituatie, betekent ook bij hen niet dat zij deze kennis daadwerkelijk toepassen in het dagelijks leven.

In het eerste hoofdstuk wordt een overzicht geven van nieuwe ontwikkelingen in het onderzoek naar de sociaal emotionele problematiek van hoogfunctionerende kinderen met ASS (HFASS). Hierbij wordt het functioneren van kinderen met HFASS enerzijds vergeleken met de prestaties van mentaal geretardeerde kinderen met ASS en anderzijds met de prestaties van zich normaal ontwikkelende kinderen. Er wordt in het bijzonder aandacht besteed aan de relatief sterk ontwikkelde theoretische kennis over sociale en emotionele interacties van kinderen met HFASS. Deze kennis staat in contrast met hun beperkte vermogens om deze kennis te gebruiken in hun alledaagse functioneren. Verschillende factoren worden besproken die mogelijk een rol spelen in het beschikbaar maken van de sociaal emotionele competentie van kinderen met HFASS. Deze overwegingen monden uit in de algemene onderzoeksvragen van het huidige proefschrift: in welke mate zijn er verschillen tussen de gevorderde en toegepaste sociaal emotionele vaardigheden van kinderen met HFASS en van kinderen met een normale ontwikkeling en welke factoren spelen een rol bij het gebruik van de sociaal-emotionele capaciteiten van kinderen met HFASS?

In het tweede hoofdstuk wordt een onderzoek beschreven naar de vraag of kinderen met HFASS hun Theory of Mind kennis eerder toepassen als zij hier meer belang bij hebben. De kinderen werden gevraagd twee taakjes uit te voeren. Sabotage van beide taken door een medewerker creëerde een 'false belief' bij de tijdelijk afwezige proefleider: bij zijn terugkeer verkeerde deze immers in de veronderstelling dat de taken gewoon konden worden uitgevoerd. Kinderen uit de controle groep corrigeerden deze veronderstelling van de proefleider vrijwel direct bij beide taken, onafhankelijk van de beloning. De proefleider werd door de kinderen met PDD-NOS eerder gecorrigeerd bij de taak waarvan het volbrengen een beloning op zou leveren dan bij de onbeloonde taak. Dit effect bleef uit bij kinderen met autisme. Zij reageerden pas later en vaak helemaal niet op de foute veronderstelling van de proefleider. Opmerkelijk was dat ook de laatste groep na afloop duidelijk aangaf dat zij wel degelijk wisten dat de proefleider niet op de hoogte was van de sabotage van de taken. Deze resultaten wijzen erop dat sociale en communicatieve factoren een rol kunnen spelen bij het toepassen van ToM kennis bij kinderen met autisme.

Hoofdstuk drie bevat een onderzoek naar de aandacht voor emotionele uitdrukkingen. Kinderen met HFASS laten vaak een verminderde aandacht zien voor emotionele uitdrukkingen. In dit onderzoek is onderzocht in hoeverre de aandacht voor emotionele cues bij deze kinderen kan worden gericht door de relevantie van deze cues te benadrukken. Kinderen met HFASS en normaal ontwikkelende controle kinderen werden gevraagd om foto's te sorteren waarop blij of boos kijkende volwassenen waren afgebeeld. In overeenstemming met eerdere bevindingen bleken kinderen met HFASS minder aandacht te hebben dan controle kinderen voor emotionele uitdrukkingen. Dit verschil werd echter alleen gevonden onder neutrale omstandigheden. Als de kinderen de opdracht kregen om een sociaal relevante beslissing te nemen, bleken zij evenveel aandacht aan emotionele uitdrukkingen te besteden als de controle kinderen. Deze bevindingen suggereren dat de aandacht voor emotionele uitdrukkingen van kinderen met HFASS afhankelijk is van de sociale relevantie van deze uitdrukkingen. Theoretische en praktische implicaties van deze resultaten worden besproken.

In het vierde hoofdstuk worden twee studies beschreven naar het inzicht in het maskeren van emotionele uitingen. De sociale regulatie van emotionele uitingen, ook wel 'display rules' genoemd, is uitvoerig onderzocht bij zich normaal ontwikkelende kinderen, terwijl er nagenoeg niets bekend is over de vaardigheden van kinderen met HFASS op dit gebied. Met behulp van een interview werd allereerst gekeken in hoeverre kinderen met HFASS ervaring hadden met het reguleren van hun emotionele expressie. Kinderen met HFASS bleken hier goed toe in staat te zijn en rapporteerden vergelijkbare ervaringen als zich normaal ontwikkelende kinderen met het verhullen van hun emoties. Wel hanteerden kinderen met HFASS in hun antwoorden vaker prototypische en abstracte voorbeelden, terwijl controle kinderen meer vanuit hun persoonlijke ervaring leken te spreken. Ook maakten kinderen met HFASS minder gewag van de rol van een omstanders bij het verhullen van

emoties en noemden zij minder vaak pro-sociale motieven voor hun emotie verhulling. In een tweede onderzoek werden kinderen ondervraagd over hypothetische situaties. Hierbij werd expliciet het motief voor de verhulling gevarieerd. In tegenstelling tot de eerste studie bleek hier dat kinderen met HFASS nu vaker pro-sociale motieven noemden dan controle kinderen. Dit contrast tussen de twee studies wordt in de discussie gerelateerd aan de ontwikkeling van sociaal-emotionele kennis bij kinderen met HFASS.

De twee studies die beschreven worden in hoofdstuk vijf betreffen een onderzoek naar de vraag of kinderen met HFASS begrip tonen van de sociale consequenties van andermans stemmingen. In beide experimenten werd kinderen beschrijvingen voorgelegd van hypothetische sociale interacties. Informatie over de stemming van personages uit deze beschrijvingen werd expliciet beschreven (Studie één) of impliciet en in combinatie met irrelevante informatie (Studie twee). In beide studies werden kinderen gevraagd om het gedrag van de personages te voorspellen en te verklaren. Hierbij kon worden nagegaan in hoeverre de kinderen gewag maakten van de stemming van de personages. Er bleken weinig verschillen te bestaan in de antwoorden op directe vragen over de gevolgen van stemming. Wel verwezen controle kinderen in vergelijking met HFASS kinderen in hun antwoorden vaker naar expliciet genoemde stemmingsbeschrijvingen uit de verhaaltjes. Dit terwijl zij stemmingsinformatie juist minder vaak afleidden op basis van de achtergrond informatie alleen. Ook waren kinderen met HFASD stelliger over de waarschijnlijkheid dat bepaalde gedragingen volgen op bepaalde stemmingen, terwijl kinderen uit de controle groep vaker aangaven dat het niet altijd zeker is tot welke gedragingen een bepaalde stemming leidt. Deze resultaten worden gerelateerd aan het relatief sterke theoretische begrip van emoties en sociale interacties en de beperkingen in het toepassen van deze kennis van kinderen met HFASS.

In Hoofdstuk zes worden twee studies beschreven waarin onderzocht werd hoe kinderen met HFASS reageren op situaties die conflicterende emoties oproepen. In een eerste studie werd kinderen gevraagd hoe zij zich zouden gedragen in reactie op conflicterende emoties. Kinderen met HFASS rapporteerden vergelijkbare reacties als zich normaal ontwikkelende kinderen. In een tweede onderzoek werd kinderen gevraagd naar hypothetische situaties waarin conflicterende emoties elkaar opvolgden. De reacties van kinderen met HFASS weken af van zich normaal ontwikkelende kinderen, voornamelijk met betrekking tot negatieve emoties. Kinderen met autisme leken vaker te redeneren dat een voorafgaande emotie van invloed is op hun emotie in een situatie die hierop volgt, onafhankelijk van de vraag of de voorafgaande emotie positief of negatief was. Kinderen uit controle en PDD-NOS groepen gaven aan dat een voorafgaande negatieve emotie een sterkere invloed zou hebben dan een voorafgaande positieve emotie. Dit komt overeen met eerdere studies waarin werd aangetoond dat zich normaal ontwikkelende kinderen aan negatieve emoties een sterkere impact toedichten dan aan

positieve emoties. De resultaten worden gekoppeld aan een meer theoretisch gestoeld begrip van emoties in kinderen met HFASS.

In het laatste hoofdstuk worden algemene conclusies getrokken uit de onderzoeken van dit proefschrift. Allereerst wordt vastgesteld dat kinderen met HFASS relatief sterk ontwikkelde sociale en emotionele inzichten en vaardigheden lieten zien, zelfs op de meer toegepaste en gevorderde niveaus waarop zij onderzocht werden. Ten tweede bleek het functioneren van kinderen met HFASS afhankelijk te zijn van verschillende factoren. Deze factoren richten hen waarschijnlijk op relevante informatie, activeren adequate responspatronen en verduidelijken de context waarin informatie geïnterpreteerd moet worden. Deze bevindingen suggereren dat het sociaal emotioneel functioneren van kinderen met HFASS afhankelijk kan zijn van additionele factoren waarmee rekening moet worden gehouden in verder onderzoek en in de algemene omgang met deze kinderen. Verschillende theoretische benaderingen komen aan bod bij het verklaren van de resultaten, waaronder informatieverwerkingsprocessen, theorieën over Theory of Mind ontwikkeling en het ontstaan van cognitieve compensatie. Het proefschrift wordt afgesloten met een beschrijving van enkele implicaties van de uitkomsten voor klinische interventies en verder empirisch onderzoek.

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