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An Investigation of Empathy in Children with Autism

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Abstract

The literature review explored empirical evidence for empathic difficulties in individuals with autism, using a model of the typical development of empathy (Hoffman, 2000). Evidence discussed was taken from studies of deficits in prerequisites to empathic responding (e.g. Downs, & Smith, 2004; Kasari, Sigman, Mundy, & Yirmiya, 1990), and more direct studies of empathy (e.g. Yirmiya, Sigman, Kasari, & Mundy, 1992). The review concluded that, despite the widespread recognition that socio-emotional relating is impaired in children with autism, the research evidence for difficulties in empathic responding is not comprehensive. The empirical study aimed to further investigate whether empathy is impaired in children with autism. Participants were arranged into a group of children with autism (n=20), and two control groups of children with learning disabilities (n=17) and typical development (n=20). A computer based empathy task was used which incorporated emotionally evocative vignettes. The present study extended the previous research findings that children with autism are able to respond empathically, showing the same level of empathic responding as non-autistic children.

Keywords: autism, empathy

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LITERATURE REVIEW

Have Researchers Demonstrated a Deficit in Empathic Ability in Individuals with Autistic Spectrum Disorder?

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(See Appendix 3 for notes for contributors)

Abstract

Empathic ability has been widely believed to be impaired in individuals with autism (e.g. Frith, 1989; Gillberg, 1992; Kanner, 1943). This review used a model of the typical development of empathy as a basis to explore empirical evidence for empathic difficulties in individuals with autism (Hoffman, 2000). Much of the evidence discussed in this review was taken from studies of deficits in prerequisites to empathic responding, such as emotion recognition and attending to others (e.g. Downs, & Smith, 2004; Kasari, Sigman, Mundy, & Yirmiya, 1990). In addition studies which have measured empathy more directly were reviewed (e.g. Yirmiya, Sigman, Kasari, & Mundy, 1992). The limitations of the current evidence base were explored and it was argued that more studies of empathy in children with autism are needed. Directions for future research were considered and a potential tool for exploring empathy in children with autism was described (Howe, Brown, Pitten-Cate, & Hadwin, submitted). This review concluded that, despite the widespread recognition that socio-emotional relating is impaired in children with autism, the research evidence for difficulties in empathic responding, is not comprehensive.

Introduction

Autism is a pervasive developmental disorder in which the severe disruption of social development is one of the most prominent characteristics (Baron-Cohen, Tager-Flusberg, & Cohen, 1993). One aspect of social development that has been widely believed to be impaired in children with autism is empathic responding (e.g. Frith, 1989; Gillberg, 1992; Kanner, 1943). Proposals have been made regarding the relationship that this deficit in empathy has with the wider disorder of autism. It has been hypothesised that empathy deficits in children with autism are a result of a central deficit, such as theory of mind (Baron-Cohen,1995), or that empathy deficits alone are causal in the impairment of many other areas making autism primarily a disorder of empathy (Gillberg, 1992).

The aim of this review is to explore evidence for deficits in empathy in individuals with autistic spectrum disorder (ASD). In order to understand deviations in empathic development the typical development of empathy is discussed. In typical development empathy is an ability that develops in interaction with other social abilities and it plays an important part in the development of social understanding and relatedness (Hoffman, 2000). One prominent framework for empathy has been developed by Hoffman (2000). His model of empathy separates empathic responding into different levels or modes (i.e. affective or cognitive), where each mode requires a more mature level of cognitive development to be elicited.

This review will use Hoffman's model as a basis with which to explore empirical evidence for empathic difficulties in individuals with ASD. The review will highlight that, despite the widespread recognition that socio-emotional relating is impaired in children with autism, the research evidence for difficulties in empathic responding is

not comprehensive. Much of the evidence discussed in this review is taken from studies of deficits in prerequisites to empathic responding, such as emotion recognition and attending to others (e.g. Downs, & Smith, 2004; Kasari, Sigman, Mundy, & Yirmiya, 1990). In addition it will review studies which have measured empathy more directly including those that have observed an individual's response to another's distress (e.g. Bacon, Fein, Morris, Waterhouse, & Allen, 1998), or utilised self-report questionnaires for adults with ASD (e.g. Baron-Cohen, & Wheelwright, 2004), and emotion-inducing vignettes for children with autism (e.g. Yirmiya, Sigman, Kasari, & Mundy, 1992). It will explore the limitations of the current evidence base and will argue that more studies of empathy in children with autism are needed. Specifically it will propose that one major issue in this area of research relates to the difficulty and the diversity in measuring empathy in typical and atypical populations. This review will suggest one potential tool for exploring empathy in children with ASD; a recently developed computerised measure of empathy (Howe, Brown, Pitten-Cate, & Hadwin, submitted). In addition it will outline directions for future research.

The literature in this review is taken from searches using the Psych Info and Web of Knowledge databases, under the search terms: autism/autistic, Aspergers, empathy, emotion, and distress.

Empathy and Development

Empathy is a complex social process that has been a difficult concept to define. It has been described as, "the ability to describe and share in another's emotional state or context," (Cohen, & Strayer, 1996, p 989) and, "the ability to conceptualize other people's inner worlds and to reflect on their thoughts and feelings," (Gillberg, 1992, p

831). Within psychology empathy research has historically been separated into two approaches: theorists who have defined empathy in terms of affect, and those who have understood empathy from a cognitive perspective (Yirmiya et al., 1992). The affective approach emphasises an observer's emotional response to another's presumed affective state (Hobson, 1993). Whereas a cognitive perspective focuses on the understanding of another's feelings using cognitive processes such as perspective taking (Baron-Cohen, 1995). More recent conceptualisations of empathy have accepted that empathy incorporates both approaches and that they cannot easily be separated (Baron-Cohen & Wheelwright, 2004).

The recognition of the complexity of empathy has led to speculation regarding whether it is a singular, definable concept. This is reflected in attempts to break down the experience of empathy into abilities that can be more specifically defined. For example, Feschbach (1982) views empathy as an amalgamation of three abilities: experiencing an emotion; discriminating emotional cues in others; and assuming another's perspective and role. Preston and de Waal (2002) agree that the study of empathy suffers from a, "lack of consensus regarding the nature of the phenomenon." However, they describe how the validity of empathy as a construct is supported by consistent data to show that individuals across many species are distressed by the distress of a conspecific and will act to terminate the object's distress (Preston & de Wall, 2002). Preston and de Wall (2002) propose that empathy is a single concept, which can be viewed as a category that includes all subclass of phenomenon that share the same mechanism, such as emotional contagion, perspective taking and identification. As these phenomena all share aspects of their underlying processes, they cannot be totally disentangled into separate concepts (Preston & de Wall, 2002; Thompson, 1987).

In typical development the experience of empathy reflects the child's emotional and social-cognitive development (Hoffman, 2000), especially the development of a separate sense of self, a sense of others, and a sense of the relationship between self and others. Hoffman (2000) has proposed a model of empathy that aims to capture this development from infancy through childhood. This model of empathic arousal incorporates five distinctly different modes of empathic arousal. Three of these, mimicry, classical conditioning, and direct association, are affective in nature, they are pre-verbal, automatic, and involuntary. The finding that newborn infants cry in response to hearing another infant cry (Martin, & Clark, 1982) is interpreted by Hoffman (2000) to show mimicry and/or classical conditioning. The newborn is responding to a cue of distress in others by feeling distressed himself, which can be considered an early, rudimentary form of empathic distress. This reactive crying contributes to a more advanced form of empathy, conditioning and association; by creating a condition in which a distress cue is paired with an infant's own experience of distress.

The remaining two modes of empathy, mediated association and perspective taking, are higher order cognitive modes (Hoffman, 2000). Mediated association involves language as the mediator between the subject's feelings and an observer's experience. As preschool children develop language they increasingly gain an understanding of causes, consequences, and correlates of emotions, and can empathise with a greater complexity of distressed feelings (Hoffman, 2000). Perspective taking is the most sophisticated empathic response and requires the development of meta-cognitive awareness of empathic distress and the ability to take another's perspective to imagine how they feel. These abilities start in children

as young as 6 years old (Strayer, 1993), but it is not until 12 or 13 years old that children can understand disparities between what a person actually feels in a situation and the feeling that is normally expected in their situation (Rotenberg, & Eisenberg, 1997). It is at this stage that children can be regarded as truly taking another's perspective.

The mode of empathic response experienced is dependent on: a child's level of emotional, social and cognitive development; and on the emotional cues available from a situation (Hoffman, 2000). The most mature empathisers have developed a cognitive sense of themselves and others as separate physical entities with independent internal states and can therefore distinguish what happens to others from what happens to themselves (Hoffman, 2000). They will also have an understanding of how feelings are expressed and the ability to use information about another's situation to understand how they are likely to feel.

The importance of empathy in development is in its facilitation of our interaction in the social world; it allows us to understand others intentions, gives us information with which to predict their behaviour and enables us to relate to others through the experience of an emotion that they are also experiencing (Baron-Cohen, & Wheelwright, 2004). Hoffman (2000, p 3) regards empathy as, "the spark of human concern for others, the glue that makes social life possible." The consequences of atypical development of empathy provide an insight into the role of empathy in typical development. Empathic deficits have been linked to a broad range of childhood problems including attention deficit hyperactivity disorder (Braaten &

Rosén, 2000), aggression (Cohen & Strayer, 1996), mood disorders (Zahn-Waxler, Cole, & Barrett, 1991) and autism (e.g., Charman et al., 1997).

Autistic Spectrum Disorder

ASD is a pervasive developmental disorder that results in poor social understanding and interaction, atypical language development, and a restricted repertoire of activities and interests, (American Psychiatric Association, 1994; Wing & Gould, 1979). Autism appears to be biologically based in aetiology, with a strong genetic component (Bailey et al., 1995; Bolton, & Rutter, 1990), but the diagnosis of the disorder is based on behavioural criteria (American Psychiatric Association, 1994). Some individuals with autism have a learning disability, whereas others have abilities within the normal range of intellectual functioning, (Gillberg, 1992). The associated condition of Asperger's Syndrome (AS) is also characterised by pervasive developmental abnormalities in social interaction and obsessive behaviour, but language development proceeds at a normal rate and intellectual abilities are within the normal or even superior range.

Theories of Central Deficit in Autistic Spectrum Disorder

In seeking to understand autism several theories of a central deficit have been proposed which try to account for the features of autism through developmental links to one core deficit (e.g. Happe, 2000). Ozonoff, Pennington, and Rogers (1990) argued that for a deficit to be 'central' to a disorder it must be universal, specific and unique. A central deficit in autism must therefore be present in all children with autism and should distinguish them from non-autistic children. In addition it must represent a primary feature of autism, and must not be manifested by most individuals with other clinical diagnoses (Ozonoff et al., 1990).

A number of areas of impairment have been considered to represent primary cognitive deficits in autism. One proposed area of central deficit is weak central coherence, which involves the processing of local properties of visual stimuli before global properties in individuals with autism, so that information is not integrated into meaningful representations (Frith, & Happe, 1994; Happe, 2000). This results in the processing of information in a piecemeal way, giving more attention to detail, and consequently interpreting incoming information in a different way to that of a typically developed person with good central coherence. Another cognitive theory, the executive function deficit account, has been proposed to account for the characteristics of autism (Russell, 1997). It has been suggested that deficits in executive function result in the individual being unable to disengage from an object or behaviour, to plan actions or display novel behaviour (Ridley, 1994).

Further theories have focused on the social impairment evident in autism. It has been proposed that social deficits are the most likely central deficit in autism (Ozonoff et al., 1990) and there is some suggestion that social deficits are universal and specific to autism (Rogers, & Pennington, 1991). The most widely discussed of the social deficits is the hypothesis that theory of mind is severely impaired in individuals with autism (Baron-Cohen, 1985). Theory of mind is the ability to assign beliefs and desires to others in order to predict their behaviour; an ability believed to be essential to both self–reflection and coordinated social action. It has been proposed that the social-communication difficulties characteristic of autism are a result of deficits in theory of mind (Baron-Cohen, 1995).

Several studies have found that individuals with autism lack the ability to attribute independent mental states to others in order to explain and predict their behaviour, (e.g. Baron-Cohen, 1995; Baron-Cohen et al., 1985). However, as more subtle aspects of theory of mind have been investigated a more complex picture has emerged. It has been suggested that theory of mind is not entirely lacking in autism, as evidence has found that children with autism can take the perspectives of others, but not as well or as readily as typically developed children, (Kiln, 2000; Yirmiya, Sigman, & Zacks, 1994). For example, Kiln (2000) found that some children with autism can pass theory of mind tests in an experimental context but continue to demonstrate some difficulty applying their understanding to more naturalistic theory of mind demanding social interactions. There have also been suggestions that theory of mind deficit is not specific to autism, a meta-analysis of studies concluded that theory of mind deficits were also shown in children with learning disabilities (Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998).

Rogers and Pennington (1991) have argued that although theory of mind is an important deficit in autism, no singular social impairment should be viewed as 'central' to the development of autistic characteristics. Instead they proposed a cascade model of autism whereby a lack of certain aspects of interpersonal development at every previous stage disrupts specific developments of abilities in the following stages. They hypothesised that the three earliest social capacities that are deficient in autism and have a detrimental effect on later developmental stages are: imitation of others; emotion sharing; and theory of mind. These abilities are all involved in the forming and coordinating of social representations of self and other. Rogers and Pennington (1991) suggest that the basis for autism lies in the deficient

development of representations of self and other which result in, among other deficits, an inability to be aware of or share in another's affective state.

Both theory of mind alone and the wider cascade view of deficits in representing self and other have implications for empathy in children with autism. Both theories emphasise that core social understanding is impaired in autism. The development of representations of self and other, that are fundamental to typical development of empathic responding, are severely disrupted in children with autism.

Development of Empathy in Children with Autistic Spectrum Disorder

Typically developing children learn to socially interact as a natural part of development. However, individuals with autism show widespread impairments in the social-communication skills that are present across varying levels of cognitive and linguistic functioning and persist into adulthood (Frith, 1989). For example, people with autism often show inappropriate behaviours and language and have a limited understanding of social norms and expectations (Frith, 1989; Baron-Cohen, 1995). An area of social-communicative functioning that has been proposed to be specifically impaired is empathic ability (Gillberg, 1992). Furthermore, impairments in empathy have been proposed as casual to the difficulties in social understanding and communication that are characteristic of autism (Rogers & Pennington, 1991).

While there is considerable agreement that social processes are specifically deficient in autism, there is some debate regarding whether these deficits are primary to the disorder or secondary effects of impairments in other areas (e.g. weak central coherence, Happe, 2000). Gillberg (1992 hypothesised that autism may just be one subclass of empathy disorders that could also include obsessive-compulsive

disorder (OCD) and anorexia nervosa. Currently there is some evidence to support this with the finding of: poorer emotion recognition in women with anorexia (Kucharska-Pietura, Nikolaou, Masiak, & Treasure, 2004): lower levels of empathy (Guttman, & Laporte, 2002); and a hypothesised overlap between alexithymia (a common characteristic of anorexia) and Asperger's (Fitzgerald, & Bellgrove, 2006). But the related concept of theory of mind has not been found to be impaired in anorexia nervosa (Tchanturia et al., 2004). There is no current empirical evidence to suggest empathy impairments in OCD.

Implications of Cognitive Deficits in Autism for Empathic Ability

Understanding the implications of cognitive deficits for empathic development in individuals with autism is complex. From central coherence it could be predicted that individuals with autism will have impaired empathy because the information taken from the situation that would induce an empathic response has not been processed into meaningful representations (weak central coherence; Happe, 2000). In contrast (and following Hoffman's model) it is possible that poor empathic skills arise from an inability to infer the mental states of others (theory of mind; Baron-Cohen, 1995).

The extensive research on theory of mind in autism has implications for empathic abilities in individuals with autism, (Baron-Cohen, 1995). It has been argued that theory of mind is a necessary ability for social understanding, (Grice, 1975; cited in Baron-Cohen, Tager-Flusbery & Cohen, 1993) this implies that it would be a necessary ability for empathy. However, theory of mind and empathy are not the same concept. Theory of mind does have some relevance to the cognitive modes of Hoffman's (2000) model that necessitate perspective taking, but not to the more basic, affective modes that do not require the ability to take another's perspective.

Dyck, Feguson, and Shochet (2001) drew a distinction between empathy and theory of mind saying, "there is increasing evidence that autism is characterised by deficits in empathic abilities other than and in addition to Theory of Mind ability." (p107) Therefore, although theory of mind ability is related to some levels of empathy, empathy is a broader ability construct than theory of mind.

Baron-Cohen has extended his theory of mind explanation of autism to understand empathy. Here empathy is conceptualised as a broad based theory and not one that specifically applies to autism (Baron- Cohen, 2002; Baron-Cohen, & Wheelwright, 2004). This theory proposes two overall psychological dimensions: empathising, the drive to identify another person's emotions and thoughts and respond to these with an appropriate emotion; and systemising, the drive to understand and predict a system in terms of its underlying law governed regularities. In typically developing individuals empathising is believed to be stronger in females than males, whereas systemising is believed to be stronger in males than in females, (Baron-Cohen, 2002). It is hypothesised that in autism systemising is over-developed whereas empathising is deficient, (Baron-Cohen, 2002). This difference could account for both the abnormalities in social development and communication that characterise individuals with autism and the obsessional preoccupation with closed, rule-governed systems (e.g. timetables, computers, trains).

Evidence for Poor Empathy in Autism

Despite its importance for understanding social interactions there are relatively few studies that focus directly on empathy in this population. However, there is an abundance of research focusing on social skills that are related to empathic ability such as attention to others emotions, recognition of emotions and taking others

perspective (e.g. Downs, & Smith, 2004). Several studies have found that individuals with autism are impaired in their attention to others emotions (Dawson et al., 2004), and their understanding of others emotions (Downs, & Smith, 2004). Empathic awareness requires an individual to attend to and understand that another is experiencing an emotion. Therefore deficits in either or both of these prerequisites of empathy would have direct implications for the development of empathic ability.

Attention to Others Emotions

A lack of engagement with the social world is a recognised feature of autism (American Psychiatric Association, 1994). Abnormalities in social development are shown at a very early age by infants with autism, these include a preferential interest in the inanimate, as opposed to the social environment (Mundy & Sigman, 1989), and little interest in the human face (Volkmar, 1987). This is particularly striking as it contrasts strongly with typically developed children who show a remarkable sensitivity to social stimuli in early life (Rochat & Striano, 1999). Typically developing Infants as young as 6 weeks old show a particular attraction to the sound, movement and features of the human face, and as children develop they continue to orientate more to social than non-social stimuli (Morton & Johnston, 1991: Trevarthen, 1979). For children with autism it has been argued that this early failure to attend to social stimuli represents one of the most basic social impairments in autism and leads to the later emerging social and communicative impairments (Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998). This argument is very relevant to empathy as a child's voluntary attention to social information makes an essential contribution to the development of empathic skills, which require the child to actively attend to social cues, particularly those expressed facially.

As individuals with autism progress through childhood and adolescence there is a development of some social skills, but evidence suggests that their attention to other people remains relatively impaired (e.g. Dawson et al., 1998). For example, Dawson and colleagues (1998) studied attention to social stimuli in children with autism by measuring their ability to visually orient to two naturalistic social stimuli (name called, hands clapping) and two naturalistic non-social stimuli (rattle, musical jack-in-the-box), and in terms of their ability to share attention (following another's gaze or point). It was found that the children with autism more frequently failed to orient to all stimuli compared with the children with learning disabilities and typically developed children, and that this failure was much more extreme for social stimuli. These results were later replicated with a larger sample, a wider range of social and non-social stimuli, and by controlling for familiarity with the stimuli (Dawson et al., 2004). These findings of a significant impairment in the domains of social orienting, and joint attention, suggest a general social orienting impairment in autism. Although the social stimuli in Dawson et al.'s (1998) study were not particularly emotionally laden, the impairments found in orienting to stimuli and especially social stimuli imply that orientating to others emotional state would also be poor. The finding of impairments in joint attention suggests that a child with autism would be less likely to attend to the situational and facial cues that would be necessary for them to empathise with another's emotional state.

The series of studies by Dawson did not look directly at attention to others emotions, but at a more general category of responding to social stimuli, (Dawson et al., 1998; Dawson et al., 2004). Further research has explored attention to emotional faces in children with autism (Kasari, Sigman, Mundy, & Yirmiya, 1990). For example, Kasari, et al. (1990) investigated the sharing of another's affective state by

measuring whether children with autism reciprocate others positive affect during joint attention. Each participant took part in a structured adult-child interaction involving some toys that the child was presented with and others they would have to request to access. They found that typically developing children were more likely to share positive affect with an adult in a joint attention situation than when requesting assistance with toys. In contrast the children with autism were no more likely to share in positive affect during joint attention acts than when requesting assistance. This lack of affect sharing indicates either a lack of attending to others emotions or a lack of empathic response to their emotions.

Dawson et al. (2004) discussed several explanations for the failure of children with autism to share joint attention and orientate to social stimuli. They hypothesised that it may be due to inability to rapidly shift attention, or difficulty processing the complexity of social stimuli. An explanation that is particularly relevant to empathy is that autism may involve a failure to assign reward value to social stimuli. This suggestion indicates that there is a disturbance in the motivational mechanism that usually gives children the desire to orientate to social stimuli and others emotions.

There is evidence that attention to other people remains impaired in children with autism of different age groups (Dawson, et al., 2004; Kasari, et al., 1990). The impact of poor attention to social stimuli may also have a more indirect effect on empathy by causing impairments in other abilities that affect empathy, such as language development. For example, Dawson et al. (2004) found that poor attention to social stimuli early in life affects later language development, where linguistic cues are needed for the mediated association level of empathy (c.f., Hoffman, 2000). This pathway of deficits in one capacity negatively affecting development in the next

capacity reflects the cascade model of autistic development proposed by Rogers and Pennington (1991). In this way impaired levels of attention to social stimuli can affect empathy through direct and indirect routes.

Recognition and Understanding of Emotions

Several studies have looked specifically at emotion recognition in children with autism (e.g. Hobson, Ouston, & Lee, 1988*a*; Loveland, et al., 1997). Failure to recognise another's emotion would imply a consequential lack of empathic responding, as empathy requires emotion from another to respond to. According to Hoffman's (2000) model some aspects of empathy would require emotion recognition. Mimicry, for example, would require the individual to notice and recognise another's emotional expression. There have been a number of studies of emotion recognition in children with autism, but the findings are equivocal (e.g. Braverman, Fein, Lucci, & Waterhouse, 1989; Downs, & Smith, 2004).

Several studies investigating emotion perception have found evidence of deficits in children with autism. Hobson and colleagues, for example, carried out a series of studies required participants with autism to: classify faces according to emotion (Hobson, et al., 1988*a*); match photographs of facial expressions with vocal and gestural displays of emotion (Hobson, 1986); and carry out a non-emotional comparison task of matching photographs of inanimate objects to their sound effects (Hobson, Ouston, & Lee, 1988*b*). Their participants covered a wide age range from 12 years to 25 years old, with a mean age of 18 years. These studies found that there were no differences between individuals with autism when compared with both the learning disabled and typically developing controls on the non-emotional task. But individuals with autism were less able than controls to match emotional

expressions with corresponding gestures, sounds and contexts. From this Hobson and colleagues (1988*b*) suggested that individuals with autism have specific emotion recognition deficits. This finding has been replicated by further studies (e.g. Braverman, Fein, Lucci, & Waterhouse, 1989; Downs, & Smith, 2004). A study by Downs and Smith (2004) replicated the finding of a deficit in emotion recognition but added extra insight to the limits of this deficit. They compared children with high-functioning autism to groups of children with typical development, attention deficit hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD), on a number of social and emotional measures. On a task of recognition of facial expressions from photographs the children with autism performed significantly worse than the comparison groups. However, they did as well as controls on recognising emotional expressions in schematic drawings. This suggests that children with autism have a specific deficit in visual processing of emotional facial expressions.

A deficit in emotion perception in children with autism has not been supported by all of the research in this area (Ozonoff, Pennington, & Rogers, 1990; Prior, Dahlstrom, & Squires). For example, in an Australian study Prior et al., (1990) pair matched 20 children with autism with 20 children with learning disabilities, and gave them the same test of emotion recognition as Hobson, et al., (1988b) used in their British study. The participants in this study were aged between 5 years and 15 years old, with a mean age of 9 years and 11 months. Prior, et al., (1990) found no differences in emotion recognition between the children with autism and the control group. There was a strong effect of chronological age on the ability to succeed in emotion recognition, suggesting developmental level could contribute to the ability to identify emotional expression in another person. If this is the case, it is surprising that although the participants in Hobson, et al.'s (1988b) study were considerably older

than the Prior et al. (1990) sample, they performed more poorly on emotion recognition tasks than the controls. These results indicate that any deficit in emotion recognition in children with autism may not be as robust as suggested by Hobson, et al., (1988b).

The differences found in emotion perception of children with autism may be explained by studies that have investigated differences between varying different sub-sets of the autistic spectrum. Dyck et al., (2001) investigated the ability of several measures, including emotion recognition, to differentiate children with autistic spectrum disorders from each other and from non-autistic children. They tested 174 children aged 9 to 16 years old, divided into groups of: autistic disorder (20); AS (28); ADHD (35); mild learning disabilities (34); anxiety disorder (14); and no psychological disorder (36). A facial cues test was used which involves attributing an emotion to 32 colour slides depicting faces expressing one of seven basic emotions. Although deficits in emotion recognition were found they were not specific to ASD groups. The children with the lowest performance were the group with learning disabilities and the group with autism, with slightly higher performance were the groups with AS and with ADHD, all of whom had significantly lower performances than the group with no psychological diagnosis. When cognitive ability was co-varied Dyck et al., (2001) found that emotion recognition discriminated the children with autism but not those with AS from all of the other groups. This difference in emotion recognition in children with autism of different functioning was also found by an earlier study (Loveland et al., 1997). These results suggest that emotion recognition deficit is not specific to autism and that it is determined more strongly by developmental level and cognitive ability. It is possible that the mixed results of the

previously discussed studies of deficit in emotion recognition were due to variance in the developmental level and ability of the participants.

There is some evidence that the ability of children with autism to understand others' emotions is variable dependent on the type of information they have about the other individual. A study by Baron Cohen (1991) found that children with autism were able to judge the emotion of a story character when this was caused by a situation, but not when it was caused by the character's belief. This finding implies that simple situational emotions may be within the understanding of individuals with autism but that belief based emotions may pose more difficulty for them. However, further studies have contradicted this finding, showing that children with high-functioning autism do not differ from control children on identifying belief-based emotions (Downs, & Smith, 2004). These two studies suffered from limited numbers of participants (10 participants with autism in Downs, & Smith, 2004, and 17 in Baron-Cohen, 1991). Further investigation of these discrepancies with greater numbers of participants is needed to understand the variations in when children with autism are able to recognise other's emotions.

Another methodology for investigating emotion recognition, that is limited to use with verbal, high-functioning children with autism, is self-report measures. Children with autism have displayed considerable ability to define simple emotional terms and describe their own experience of emotions (Van Lacker, Cornelius, & Needleman, 1991), but have struggled in reporting more complex emotions, such as pride and embarrassment (Capps, Yirmiya, & Sigman, 1992). This provides further evidence that emotion understanding is not a simple construct that is either entirely present or entirely absent in children with autism.

Overall there has been some evidence that emotion recognition is impaired in children with autism, but when the groups have been matched differently these differences have disappeared (Hobson et al., 1988b; Ozonoff et al., 1990). Studies that have looked at a greater range of variables in relation to emotion recognition have found a more complex pattern of emotion recognition in children with autism (e.g. Baron-Cohen, 1991). For example, there are differences between high-functioning and low-functioning children with autism (Dyck et al., 2001; Loveland et al., 1997). This difference follows similar differences in degree of social abnormality and behaviour in high-functioning and low-functioning children with autism (Steven's et al., 2000). It has been proposed that there are two distinct subgroups of children with autism separated by their functioning that should be studied separately (Fein, et al., 1999). There are indications that emotion recognition problems are shown more strongly and consistently in low functioning in comparison with high functioning children with autism (e.g. Loveland et al., 1997). Overall there is some evidence to show that children with autism have deficits in understanding others' emotions, but the nature, extent and specificity of the deficits depend on various factors such as the cognitive ability and language level of the individual, the type of comparison group, and the nature of the emotions examined.

There is evidence to suggest that individuals with autism do not only have difficulties in understanding other people's emotions but also their own emotional state. Hill, Berthoz, and Frith (2004) compared adults with high-functioning autism to a group of normally developing adults and a group of relatives of adults with autism, in order to investigate the cognitive processing of emotions. They found high rates of emotion-processing difficulties in the autism group that were not found in the control groups.

The adults with autism showed difficulties in identifying and processing their own thoughts, they also showed a tendency to focus on external events rather than internal thought patterns. Hill et al., (2004) suggested that these difficulties are caused by a theory of mind deficit, but reflected that the participants were able to have some degree of introspection to enable them to complete the questionnaires. These difficulties have major implications for the experience and measurement of empathy in individuals with autism. If they are not able to recognise their own emotions, their experience of empathy could be of a different nature to the typical experience.

Response to Others' Emotions as a Measure of Empathy

One way in which empathic ability has been examined is through observing an individual's response to another's display of emotion (e.g. Charman et al.,1997). Using this methodology internal empathic feelings have been implied from observations of the individual's external responses. In typical development infants are very interested in affective displays of others, responding differentially to faces showing different emotions by exhibiting more smiling and visual attention toward happy faces compared with neutral or sad faces (Rochat & Striano, 1999). In contrast, there is evidence that children with autism are impaired in their ability to respond to others distress (Bacon, Fein, Waterhouse, & Allen, 1998).

An advantage of this research methodology is that it can be used with very young children, to investigate the most primitive forms of empathy. Dawson, Hill, Spencer, Galpert, and Watson, (1990) focused on Hoffman's (2000) mimicry level of empathy. They compared the interaction between mother and child of children with autism and with typical development aged 30 to 70 months. The two groups of 16 children did

not differ in the frequency or duration of gaze at their mothers face, or the frequency or duration of smiles. However, the group with autism were much less likely to smile in response to their mother's smiles compared with the typically developing children, indicating that infants with autism show less mimicry of others emotions than typically developed infants. This lack of response to positive emotions in others has been also been shown in older children with autism, where they responded less than control children to positive affect when their mothers praised them for successful completion of a puzzle (Kasari, Sigman, Baumgartner, & Stipek, 1993).

In empathy research there has been more interest in response to negative emotions than to positive emotions, perhaps because a stronger empathic response is expected for negative emotions. Charman, et al. (1997) aimed to investigate empathy in a younger age group than autism is typically diagnosed in as part of an epidemiological study of 16,000 children, which used a prospective screening tool for childhood autism (Checklist for Autism in Toddlers, CHAT). A group of 12 20-month old infants with autism were compared to 18 infants with developmental delay and 18 typically developing infants on their response to feigned distress by an experimenter. The results showed that fewer infants with autism looked at the distressed experimenters face compared to the control infants, and none of the infants with autism expressed facial concern. The authors concluded from these results that the infants with autism were impaired in their empathic response.

Sigman, Kasari, Kwon, and Yirmiya (1992) compared three groups with 30 children in each, one group with autism (mean age 42 months), one with a developmental delay (mean age 42 months), and a group with typical development (mean age 20 months). A demonstration of distress was set up for both the experimenter and the

participant's parent, by pretending to hurt themselves with a toy hammer during a play session. It was found that children with autism failed to look very much at an adult showing negative emotion regardless of whether this was the parent or experimenter. Sigman et al. (1992) suggested that children with autism ignore others' distress because they lack the cognitive and affective underpinnings for interpreting the emotions shown by others.

In a replication of the Sigman et al. (1992) study with the same participants Dissanayake, Sigman, and Kasari (1996) explored whether the impaired responses to others emotions extended over later developmental periods. They re-tested the participants at 17 months and 5 years after the original testing sessions, with the addition of an extra comparison situation which discriminated between affective and non-affective cues. Their results demonstrated stability over time in the response of children with autism to the emotions of others, replicating the earlier findings of reduced response to others emotions in the autistic group. It was also found that the children with autism did respond differently within affective contexts, they attended to the adult more and showed a greater degree of concern during the affectively cued situation. Dissanayke et al. (1996) results suggest that although children with autism show impaired responsiveness to others negative emotions that are stable over time, they do not totally fail to perceive affect laden events.

Bacon and colleagues (1998) were interested in the idea that high-functioning and low-functioning autism may represent sub-types that are distinguishable not only by cognitive ability but also by social behaviour. They investigated response to distress and social referencing by comparing five pre-school age groups of: 32 high-functioning children with autism (HFA); 51 low-functioning children with autism (LFA);

42 developmentally language disordered children; 39 children with learning disabilities; and 29 typically developing children. The experimenter simulated distress during a 25 minute semi-structured play session to give as naturalistic setting as possible. They found that the LFA children did not look at the distressed adult as much as the other groups, and were also comparatively impaired on pro-social initiation. The children with HFA responded either at the same level as the typically developing and language disordered groups or intermediate between them and the LFA and learning disabled groups on all measures except for social referencing. Children in both of the groups with autism showed the lowest level of responding on social referencing. Bacon et al. (1998) propose that their findings support the idea that high-functioning and low-functioning autism are behaviourally separate entities. They view the comparable poor performance on social referencing as more directly linked to the core deficit of autism, thereby bridging the proposed gap between the groups. There was significant within–group variability for the HFA group, for example, although the social referencing deficit was striking across the autistic groups a third of the children in both groups did exhibit this behaviour.

The evidence discussed so far indicates that children with autism show less response to others' distress than non-autistic children. Other research has however, found that a response is not entirely lacking. Corona, Dissanayake, Arbelle, Wellington, and Sigman (1998), for example, found that children with autism aged 3 to 5 years were able to distinguish between negative affect displays and neutral displays, as evidenced by their tendency to look more at an examiner's face and show more concern when the examiner showed distress than when he or she showed a neutral expression. But they looked for shorter durations and showed less interest and concern in both conditions than did children with learning disabilities.

This finding supports the finding of Bacon et al. (1998) to highlight that children with autism can discriminate other's distress from other's neutral affect.

One disadvantage of inferring empathic ability from measuring responses to others' distress is that it assumes that children with autism display emotions externally in the same way as non-autistic children. There is evidence to suggest that children with autism have difficulties in sharing affect, and that others experience difficulties in reading their affective signals as they show incongruous blends of positive and negative emotions not shown in non-autistic children (Yirmiya, Kasari, Sigman, & Mundy, 1989). This finding implies that the children with autism may be experiencing empathic emotions, but that they do not display them in the same way or to the same extent as non-autistic children. A methodology that provides more information on this issue is the use of physiological measures to indicate emotional arousal in response to others distress. Blair (1999), for example, used skin conductance as a measure of response to facial displays of sadness in children with autism. He found that a group of 20 children with autism (mean age 11.95 years) showed appropriate responses to the displays of sadness comparable with the two control groups responses. This suggests that children with autism possess at least the physiological element of the affective component of empathy, but cannot tell us anything abut the cognitive component of empathy.

The observation of responses to others' emotions has provided evidence that children with autism are impaired in their response to both positive emotions (e.g. Kasari et al., 1993) and negative emotions (e.g. Sigman et al., 1992) and that this impairment is stable over time (Dissanayake, et al., 1996). However, there are indications of individual differences, and a relationship between ability levels in

responding to emotions (Bacon et al., 1998). It also seems that response to emotion is not totally lacking, rather it is less consistent due to individual differences or possibly less of an obvious observable reaction across individuals (Corona, et al., 1998). Research that has shown differences in the expression of emotion in children with autism questions the validity of using observation of reactions to other's emotions to measure empathy (Yirmiya et al., 1989). The methodology of observing reactions to others emotions is more suited to either young infants, or older individuals with poor communication skills. For participants with communication skills more information can be gained by directly asking how they feel, rather than just observing them.

Direct Measures of Empathy

There are only a few studies that attempt to directly investigate empathy in individuals with autism. The design of these studies for adults and adolescents with autism has involved self-report measures with questions linked to different features of empathy (Baron-Cohen, & Wheelwright, 2004; Shamay-Tsoory, Tomer, Yaniv, & Aharon-Peretz, 2002). For children the research designs have involved an explicit indication from the participant of their emotional state in response to vignette characters emotional state (Travis, Sigman, & Ruskin, 2001; Yirmiya, et al. 1992).

Baron-Cohen and Wheelwright (2004) developed a new self-report measure of empathy, the Empathy Quotient, and used it to determine whether adults with AS or high functioning autism (HFA) showed a deficit in empathy. They compared two groups of 90 adults with HFA or AS and 90 adults with typical development, who were matched with the AS/HFA group on gender and age. The questionnaires contained 40 empathy items (e.g. seeing people cry doesn't really upset me, I tend

to get emotionally involved with a friend's problems) and 20 control items (e.g. I am at my best first thing in the morning). As a test of the external validity the items were rated against a definition of empathy by an independent panel of experimental psychologists, with the finding that all of the empathy items but no control items were judged to relate to empathy. The participants with AS/HFA scored significantly lower on the Empathy Quotient than the matched controls. This finding suggests an empathy deficit in adults with AS/HFA.

Shamay-Tsoory, et al. (2002) also employed self-report questionnaires to measure empathy, but in adolescents with autism rather than adults. They had observed that the empathic abilities of children or adolescents with AS had not been much investigated despite empathy deficits being considered a central characteristic of AS. Shamay-Tsoory et al. (2002) attempted to evaluate the exact nature of empathic deficits in adolescents by comparing 2 young men with AS aged 17 and 18 years old and 6 age-matched non-autistic men. In measuring empathy Shamay-Tsoory et al. (2002) distinguished between two levels: 'affective empathy' is the emotional reaction to observing others experiences; 'cognitive empathy' is the ability to adopt another psychological point of view. (This distinction is similar to Hoffman's (2000) categories, with 'affective empathy' matching mimicry, classical conditioning and direct association, and 'cognitive empathy' matching perspective taking). Two self-report questionnaires were used, one designed to measure affective empathy and the other to measure cognitive empathy. In addition to this they also measured: theory of mind by testing recognition of faux pas's with 20 stories; understanding of ironic meaning; cognitive flexibility; and recognition of facial expression and affective prosody.

Shamay-Tsoory et al. (2002) found that both participants exhibited a profound deficit in empathy, and were impaired to a similar extent in both affective and cognitive empathic abilities. They were able to identify faux pas's and irony, indicating that the empathy impairment cannot be attributed to an inability to make inferences about others mental states. It also cannot be attributed to an inability to recognise emotions, as neither participant showed a global impairment on the emotion recognition tasks. However, in the faux pas task the participants made errors in integrating their cognitive knowledge and emotional knowledge. They detected the difference between the speakers and listeners knowledge, but they did not appreciate the affect that the speakers words would have on the listener's emotional state. Shamay-Tsoory et al. (2002) argue that this provides evidence for their hypothesis that the empathy deficit of individuals with AS is due to an impaired integration of cognitive and emotional facets of a mental state. They feel that the focus of central deficit theories of autism and AS, such as theory of mind, purely on cognitive processes is insufficient as a constant integration of cognitive and emotional inputs are needed in social responding.

Empathy in children with autism has been studied using vignettes to simulate emotion-inducing situations with the aim of inducing an empathic response in the observer. In response to a lack of studies investigating empathy in children with autism Yirmiya, et al. (1992) conducted a study which compared a group of 18 children with high functioning autism aged between 9 and 16 years, to a matched group of 14 typically developed children aged between 9 and 14 years old. Empathy was measured using 5 of the videotaped stories from the Feshbach and Powell Audiovisual Test for Empathy, (Feshbach, 1982), of children experiencing different events and emotions (happy, angry, proud, sad, and afraid). Before testing the

participant were asked to read aloud the emotion labels and tell the experimenter about a time when they had felt each emotion, to ensure they were all familiar with the emotion in the task. After viewing the segments the children were asked to identify the characters feelings and their own feelings in response to the video. These two questions were asked at least a week apart to reduce the possibility of perseveration of response. The empathy score reflected the level of agreement between the child's emotional label for the character and their own emotion, rather than agreement between the emotion that the video's were intended to show and the child's own emotion.

The performance of the children with autism was poorer than the control group across all the measures. However, empathy was not totally absent in the autism group with many of the participants able to label others emotions, respond empathically and to take the perspective of others. These results support the idea that there are empathy deficits in autism, but also suggest that at least some children with autism have some empathic ability. Yirmiya at el. (1992) also found that more intelligent children with autism performed better on the empathy task, a pattern shown in other social responding studies (Bacon et al. 1998) and that is not shown in children with typical development. This suggests that children with autism may use cognitive strategies in dealing with social situations more than is usual in non-autistic children.

In a follow-up study to the Yirmiya et al., (1992) research Capps, Kasari, Yirmiya and Sigman (1993) repeated the procedure but included an analysis of participant's facial expression during the vignettes. They found that the children with autisms' facial expressions were consistent with the affective content of the vignette. This suggests

that although their verbal responses were less accurate than the control group (Yirmiya et al., 1992) they were responding emotionally to the characters emotion. In terms of empathy development this finding would indicate that children with autism display affective empathy, which is automatic and unconscious, but are deficient in cognitive mode of empathy (Hoffman, 2000).

Travis et al., (2001) also used vignettes to measure empathic responding in children with autism, but in a wider age range to that of the Yirmiya et al. (1992) study. They compared 20 children with autism (age range of 8 to 18 years old) to 20 children with a developmental delay (age range of 7 to 18 years old). Travis et al. (2001) measured empathy with a vignette-based test that involved a puppet that had four detachable faces depicting the emotions of happiness, sadness, fear and anger. The participants were asked how the puppet felt and how it made them feel. For this empathy task scores were based on the correspondence between the childs' responses for the puppet and for themselves, regardless of whether their responses for the puppet matched the experimenters intended emotion for the vignette. Travis et al. (2001) found that the autistic group performed more poorly than the developmentally delayed control group on response to others distress and the empathy task, but both of these differences were not significant ($p=0.6$). Providing some weak evidence that empathy is impaired in children with autism.

All of these studies of empathy in individuals with autism have found some deficits in empathic responding. The adolescent self-report questionnaire study (Shamay-Tsoory et al. 2002) added an interesting insight into the interpretation of the larger-sampled adults study (Baron-Cohen, & Wheelwright, 2004). By including other measures of empathy related skills, Shamay-Tsoory et al. (2002) were able to show

that some of the skills usually implicated as precursors to empathy, such as the ability to infer another's mental state, can be intact whilst empathy is still impaired, possibly due to failures in the integration of cognitive and affective aspects of empathy. An interesting feature of Yirmiya et al.'s (1992) results was that some of the children with autism were able to demonstrate empathy, although overall they were significantly worse than the comparison group. The study by Travis et al. (2001) could be interpreted as showing similarly that, although the children with autism did not perform quite as well as the comparison, they were able to demonstrate some level of empathy. This was further supported by the finding that children with autism can display the affective signs of empathy without being able to accurately verbalise their emotional reaction (Capps, et al., 1993).

There are suggestions from the research that aspects of empathy are present in children with autism. There is evidence for variability between children with autism with some of them able to respond empathically (Yirmiya et al., 1991), suggesting individual differences and/or qualitative differences in the type of empathy experienced in individuals with autism. There is also a suggestion that the affective levels of empathy are present without the more complex cognitive levels of empathy (Capps, et al., 1993). We can conclude from this that empathy in children with autism is not an all-or-nothing concept; some ability is present with the level varying between individuals. This heterogeneity of empathy reflects the more general heterogeneity in the population of individuals diagnosed with autism.

Alongside individual differences these findings also reflect qualitative differences in the levels and robustness of empathic responding in children with autism. This replicates findings for other social understanding abilities in children with autism

such as theory of mind and understanding false belief (Leslie & Roth, 1993). Some children appear to have a certain form of competence in these social understanding tasks but it has been argued that their ability is not as robust as typically developed children and that it has been arrived at through a different developmental route (Bowler, 1992).

A criticism of the current research base is the lack of comparisons available across the developmental stages of children with autism. Rogers and Pennington (1991) emphasise the importance of remembering that as autism is a developmental disorder we do not expect to find specific deficits that are maintained through life. Instead we expect to see, during a specific developmental stage, signs of a deficit specific to autism that with further development and experience may change. The amount of improvement over time will show individual variance (Sigman, 2005). The empathy studies in children with autism have very large age ranges covered mid childhood to the beginning of adulthood in typical development, with no sub-range analysis (Yirmiya et al. 1992; Travis et al. 2001). It is therefore difficult to know whether the results were affected by some participants having become accomplished in areas of ability where previously they had deficits.

Despite empathy being considered a central characteristic of autism (Gillberg, 1992) the evidence for empathy deficits in children with autism is not comprehensive. The limited research into empathy in children with autism has not investigated the more subtle individual differences in empathic responding or differences in responding to varying levels of empathy. The small number of studies examining empathy in children with autism suffer from limitations such as small sample sizes, and restrictions to certain age groups. It is especially disappointing that of all the

participants in the four empathy studies discussed in this section, only one is female (Yirmiya et al. 1992; Travis et al. 2001; Baron-Cohen, & Wheelwright, 2004; Shamay-Tsoory et al., 2002). As Baron-Cohen (1995) has hypothesised that a fundamental feature of autism is under-developed 'empathising' a pattern found more weakly in normally developed males, and gender differences have been found in this direction in children with autism's pro-social behaviour (Bacon et al. 1998), gender comparisons of empathy in children with autism are an important missing piece of information in understanding the relationship between autism and empathy.

Methodological Difficulties of Measuring Empathy

Research into empathy in children has used methods such as semi-structured interviews (Lofcraft, & Teglasi, 1997; Strayer,1993), self report questionnaires (Davis, 1980), measures of physiological change (Blair, 1999), and eye gaze (Ruffman, Garnham, & Paul, 2001). It has been acknowledged that these measures are not fully adequate and that empathy is a difficult factor to measure, especially in children (Strayer & Roberts, 2004b).

Baron-Cohen and Wheelwright (2004) argue strongly that there is a lack of adequate measures of empathy. They feel that of the methods available many do not actually measure empathy. For example, the Empathy Scale (Hogan, 1969: cited in Baron-Cohen, & Wheelwright, 2004) has been found to have four factors: social self-confidence; even-temperedness; sensitivity; and non-conformity. These factors indicate it is not a pure measure of empathy and may be more accurately thought of as a social skills measure, (Davis, 1994). Baron-Cohen and Wheelwright (2004) proposed that their Empathy Quotient questionnaire avoids these validity problems and provides an accurate and reliable measure of empathy. There are however,

limitations to using self report measures: they only reflect an individuals' own beliefs about their empathy, which may be different to how empathic they really are; and they do not differentiate or control for differences between trait and state empathy. The biggest limitation is that they are restricted to populations of participants who are able to read and understand the questions and have the self-reflection capacity and communicative ability to answer them. Different methods need to be used for children and individuals of all ages with communication impairments.

It is also useful to consider whether performance in experimental empathy tasks translates into performance in real life empathy-inducing social situations. It is important that any measure of empathy tries to have good ecological validity. This is a factor that has been questioned in the measurement of other skills in children with autism. Klin (2000) has discussed the apparent discrepancy between children with autism's performance on formal theory of mind tests and their ability to demonstrate a theory of mind in real life social situations. It seems that many higher functioning children with autism can pass the formal theory of mind tasks but cannot transfer this to real life social interactions where they seem to lack a theory of mind. These issues can also apply to empathic ability, in that methodologies need to reduce as much as possible any discrepancies between the experimental task and the naturalistic situation.

Empathy researchers have tried to increase the ecological validity of their stimuli by using vignettes reflecting real life situations estimated to be familiar to the participants (Yirmiya et al.,1992; Travis et al., 2001). One problem with the use of vignettes is the risk of perseverative responding when scoring empathic responding as the participant choosing the same emotion for themselves as they chose for the

character (Travis et al., 2001). This could be alleviated by using a scoring technique in which scores are only gained if the participant chooses their emotion to be the same as the intended emotion of the vignette. Although this method also has its disadvantage, as the child may choose a different emotion to the author of the vignettes intended emotion, and then indicate they feel the same emotion as the character. This would be scored as a lack of empathy, when arguably they are displaying empathy by feeling the same emotion as the character.

In response to the inadequate tools available for measuring empathy in children a computer based empathy measure has recently been developed (Howe et al., submitted). It uses videos of children acting out vignettes, thereby reducing the representational leap that needs to be made with puppet based vignettes. It attempts to distinguish between the different modes of empathy by providing different empathy cues to the participants within each vignette. The first two cues (facial and situational) are largely affective according to Hoffman's (2000) model, the other two (verbal and desire) require more complex cognitive skills (e.g. memory, attention and perspective-taking). This program also measures emotion recognition and perspective-taking by providing the observer with different sorts of information and asking them to decide the characters emotion. There is a precedent within autism research in testing this idiosyncratic population for using stimuli that are either novel or have not been widely used (e.g. Heavey, Phillips, Baron-Cohen, & Rutter, 2000). This new tool has been used with typically developing children but has not yet been used with children with autism or with learning disabilities. The use of this tool for children with autism is supported by evidence that children with autism respond better to computerised stimuli than to the more traditional test materials (Ozonoff, 1995).

Synthesis and Future Directions

This review has addressed the development of empathy in children with autism and considered the empirical evidence for a deficit in this ability. A lack of empathy remains a critical feature in many conceptualisations of autism (Gillberg, 1992; Baron-Cohen, 1995). The literature has supported the idea that empathy is different in children with autism in comparison to non-autistic children (e.g. Dissanayake et al., 1996). However, it is also clear that empathy is not entirely lacking, and that the nature of empathic ability in children with autism is complex (e.g. Yirmiya et al., 1992).

This review has drawn on the wider literature on emotion recognition and attention to social cues to provide information regarding the skills that may be prerequisites to empathic responding. This review has highlighted that there are differences between typically developing children and children with autism in the integration of affect with attention. In addition children with autism are less likely than non-autistic children to show attentional behaviours in social contexts, and when they do they rarely display positive affect in conjunction with attending (Kasari et al., 1990; Dawson et al., 1990; Dawson et al., 2004). Further evidence has shown that low functioning and, to a lesser extent, high functioning children with autism have difficulties in understanding emotions, especially more complex emotions (Dyck et al., 2001; Baron-Cohen, 1991). Furthermore children with autism show less response than comparison children to both positive and negative emotions of others (Charman et al., 1997; Dissanayake et al., 1996). The review has also discussed evidence to show that there is some awareness that others are displaying emotions and that some children with autism have been shown to respond to other's emotional display (Bacon et al., 1998; Corona et al., 1998).

The research that has aimed to directly measure empathy has found evidence that in comparison to non-autistic controls empathy is impaired in children and adults with autism and AS (Shamay-Tsoory et al., 2002;Baron-Cohen, & Wheelwright, 2004; Yirmiya et al, 1992;Travis, et al., 2001). But surprisingly, given the widely held assumption of an empathy deficit, children with autism have been found to be capable of a level of empathic responding. A continuing theme of the research findings has been the individual differences between children with autism in their general emotion-related skills and their more specific empathic responding. Greater empathic ability is shown by the children with higher cognitive functioning, more developed language, and greater pro-social behaviour (Bacon et al., 1998; Yirmiya et al., 1992; Loveland et al., 1997; Travis et al., 2001).

The finding that children with autism are impaired in their empathic responding needs replication, preferably with greater numbers of participants than those in previous studies (Yirmiya et al., 1992; Travis et al., 2001). In addition to this, future directions for research could be to investigate the individual differences in empathic responding. One potential focus is the changes in empathy across developmental stages, and whether the variance in empathic responding found has been due to some of the participants having reached a higher developmental level than others. As autism is a developmental disorder we would expect deficit's to change with an individual's maturation (Rogers, & Pennington, 1991). Although the course of maturation will be more idiosyncratic in children with autism than in typical development, their developmental stage would still be hypothesised to have an impact on skills such as empathy. Linked to this is the need for a differentiation in empathy testing between the different levels of empathy, to better understand which

are present in whom within the autism population. In typical development children develop more levels of empathy as their wider social-emotional maturation progresses, leaving them with stages where they possess some but not all levels of empathy (Hoffman, 2000). Explicit differentiation between levels of empathic responding in children with autism and its relationship with individual differences in empathy could be investigated.

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UNIVERSITY OF SOUTHAMPTON

An Investigation of Empathy in Children with Autism using a Computer Based Measure of Empathy

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(See Appendix 3 for notes for contributors)

Abstract

This study aimed to further investigate whether empathy is impaired in children with autism. Participants were arranged into a group of children with autism (n=20), and two control groups of children with learning disabilities (n=17) and typical development (n=20). A computer based empathy task was used which required the participant to identify characters and their own emotions during emotionally evocative vignettes. The present study extended the previous research findings that children with autism are able to respond empathically, showing the same level of empathic responding as non-autistic children. The children with autism showed a different pattern in the modes of empathy that they could access in comparison with the non-autistic children, suggesting a difference in autistic development from the step-wise development of empathy proposed in typical development. The children with autism were as able as the control groups in emotion recognition and understanding of others perspectives. For all the groups there was a trend towards finding the empathic responses more difficult than the emotion recognition.

Introduction

Autism is a pervasive developmental disorder in which the severe disruption of social development is one of the most prominent characteristics (Baron-Cohen, Tager-Flusberg, & Cohen, 2000). Consequently there have been investigations of many areas of social functioning in autism, such as recognition and comprehension of emotion in others (e.g. Loveland et al., 1997); and initiation of contact with peers (e.g. Hauck, Fein, Waterhouse, & Feinstein, 1995). An area of social development that has received less direct investigation is empathy. The ability to share another's emotional state has long been considered a central characteristic of autism (e.g. Frith, 1989; Gillberg, 1992; Kanner, 1943), yet comparatively few studies have assessed empathy in individuals with autism (Shamay-Tsoory, Tomer, Yaniv, & Aharon-Peretz, 2002).

Empathy is a complex social process that has been described as, "the ability to describe and share in another's emotional state or context," (Cohen, & Strayer, 1996, p 989) and, "the ability to conceptualize other people's inner worlds and to reflect on their thoughts and feelings," (Gillberg, 1992, p 831). Hoffman (2000) proposed a model of empathy that separates empathic responding into five distinctly different modes of empathic arousal, with each mode requiring a more mature level of development to be elicited. Three of these, mimicry, classical conditioning, and direct association, are affective in nature, they are pre-verbal, automatic, and involuntary. The remaining two modes of empathy, mediated association and perspective taking, are higher order cognitive modes. Mediated association involves language as the mediator between the subject's feelings and an observer's experience. Perspective taking is the most sophisticated empathic response and requires the development of meta-cognitive awareness of empathic distress and the

ability to put oneself into someone else's place to imagine how they feel. The mode of empathic response experienced is dependent on: a child's level of emotional, social and cognitive development; and on the emotional cues available from a situation (Hoffman, 2000).

The importance of empathy in development is in its facilitation of our interaction in the social world. It allows us to understand others intentions, gives us information with which to predict their behaviour and enables us to relate to others through the experience of an emotion that they are also experiencing, (Baron-Cohen, & Wheelwright, 2004). Hoffman (2000, p 3) regards empathy as, "the spark of human concern for others, the glue that makes social life possible." The consequences of atypical development of empathy provide an insight into the role of empathy in typical development. Empathic deficits have been linked to a broad range of childhood problems including attention deficit hyperactivity disorder (Braaten & Rosén, 2000), aggression (Cohen & Strayer, 1996), mood disorders (Zahn-Waxler, Cole, & Barrett, 1991) and autism (e.g., Charman et al., 1997).

The relationship of empathy to development in the disorder of autism is complex. While there is considerable speculation that empathic processes are specifically deficient in autism, there is some debate regarding whether these deficits are primary to the disorder or secondary effects of impairments in other areas (e.g. weak central coherence, Happe, 2000). For example, Gillberg (1992) argued that empathy deficits are causal in the impairment of many other abilities, making autism primarily a disorder of empathy. In contrast a deficit in empathy has been proposed to be secondary to a primary deficit in social abilities such as theory of mind (Baron-Cohen,1995), or emotion recognition (Hobson, 1993). Theory of mind, the ability to

ascribe beliefs and desires to others in order to predict their behaviour (Baron-Cohen, 1995), has particularly strong links with empathic ability. It has been suggested that without a theory of mind, it is not possible to experience empathy, and clearly a theory of mind does have some relevance to the cognitive modes of Hoffman's (2000) model that necessitate perspective taking. But it is not required for the more basic, affective modes that do not require the ability to take another's perspective. Consequently empathy is a broader construct than theory of mind, and deficits in empathy do not necessarily involve theory of mind deficits (Dyck, Ferguson, & Schochet, 2001).

Despite the importance of empathy for understanding social interactions in individuals with autism, the research base for a deficit in empathy is not comprehensive. However, there is an abundance of research focusing on social skills that are related to empathic ability, deemed prerequisites to empathic responding, such as emotion recognition and attending to others (e.g. Downs, & Smith, 2004; Kasari, Sigman, Mundy, & Yirmiya, 1990). For example, there is evidence to suggest that children with autism are impaired in their attention to other's emotions (e.g. Dawson et al., 2004). Abnormalities in engagement with the social world are shown at a very early age by infants with autism (Mundy & Sigman, 1989; Volkmar, 1987). As individuals with autism progress through childhood and adolescence there is a development of some social skills, but evidence suggests that their attention to other people remains relatively impaired (e.g. Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998).

In addition to attending to another's emotions, a child would need to recognise their emotional state in order to experience an affective level of empathic response, and

understand their emotional state to experience a cognitive level of empathic response (Hoffman, 2000). A number of studies have specifically investigated emotion recognition in children with autism, but the findings have been equivocal (e.g. Braverman, Fein, Lucci, & Waterhouse, 1989; Downs, & Smith, 2004; Hobson, Ouston, & Lee, 1988*a*). Hobson and colleagues carried out a series of studies to show that the children with autism were less able than controls to match emotional expressions with corresponding gestures, sounds and contexts, whereas on a non-emotional task they performed at the same level as the control children (Hobson, 1986; Hobson, et al., 1988*a*; Hobson, Ouston, & Lee, 1988*b*; see also Braverman, Fein, Lucci, & Waterhouse, 1989). These findings suggest that children with autism have a specific deficit in visual processing of emotional facial expressions (but see Ozonoff, Pennington, & Rogers; Prior, Dahlstrom, & Squires, 1990 for counter evidence).

Further studies have compared emotion recognition on stimuli that have differed in their complexity. They have provided evidence that even though high-functioning children with autism do not show the gross emotion recognition deficits that have been found by some studies for low-functioning children with autism, they still struggle with the more complex emotions, such as pride and embarrassment (Capps, Yirmiya, & Sigman, 1992), and with more complex belief based emotions in comparison to simple situational emotions (Baron-Cohen, 1991). Overall there is some evidence to show that children with autism have deficits in understanding others emotions, but the nature, extent and specificity of the deficits depend on various factors such as the cognitive ability and language level of the individual, the type of comparison group, and the nature of the emotions examined.

An area of research with more direct links to empathy is the observation of an individual's response to another's display of emotion (e.g. Charman, et al., 1997). Differences have been found in the response of children with autism to the most basic level of empathy, mimicry, where infants aged 30 to 70 months with autism were much less likely to smile in response to their mother's smiles compared with typically developing children (Dawson, Hill, Spencer, Galpert, & Watson, 1990). Similarly in response to negative emotions of others' very young children with autism children show less response and less facial concern in comparison with typically developing infants (Charman et al., 1997). This relative lack of response to others distress has been replicated in children with autism across a wide age range, and found to be stable over time (Sigman et al., 1992; Dissanayake et al., 1996; Dawson et al., 2004). There are also indications that more cognitively able children are less impaired in their responses to others distress (Bacon et al., 1998; Dissanayake et al., 1996).

There has been evidence of some ability to discriminate between others distress and a more neutral emotional state. Corona, Dissanayake, Arbelle, Wellington, and Sigman (1998) compared attention, behavioural reactions, and facial affect when an experimenter pretended to hurt himself compared with when he showed neutral affect. They found that the children with autism aged 3 to 5 years were more likely to look at the experimenters face and show more concern when he showed distress. This supports the finding of Bacon et al. (1998) that children with autism can discriminate other's distress from other's neutral affect, and although they are impaired in comparison to non-autistic children, some children with autism do respond to negative affect. Overall the evidence suggests that children with autism are less responsive to the negative and positive emotions of others than non-autistic

children (e.g. Charman et al., 1997; Dawson et al., 2004; Kasari et al., 1993). However, there are indications of individual differences, and a relationship between ability levels in responding to emotions (Bacon et al., 1998). It also seems that response to emotion is not totally lacking, rather it is less consistent due to individual differences or possibly less of an obvious observable reaction across individuals.

There are only a few studies that attempt to directly investigate empathy in individuals with autism. The design of these studies for adults and adolescents with autism has involved self-report measures with questions linked to different features of empathy (Baron-Cohen, & Wheelwright, 2004; Shamay-Tsoory et al., 2002). For children the research designs have involved an explicit indication from the participant of their emotional state in response to vignette characters emotional state (Travis, Sigman, & Ruskin, 2001; Yirmiya, et al. 1992).

Baron-Cohen and Wheelwright (2004) used a newly developed self-report measure of empathy, the Empathy Quotient, to determine whether adults with Aspergers syndrome (AS) or high functioning autism (HFA) showed a deficit in empathy. In comparing two groups of 90 adults, one group with AS/HFA, and the other with typical development, the adults with AS/HFA scored significantly lower on the Empathy Quotient than the matched controls, suggesting an empathy deficit in adults with AS/HFA. Shamay-Tsoory, et al. (2002) also employed self-report questionnaires to measure empathy in 2 young men with AS against a comparison group of 6 age-matched non-autistic men. In measuring empathy Shamay-Tsoory et al. (2002) distinguished between two levels: 'affective empathy' is the emotional reaction to observing others experiences; 'cognitive empathy' is the ability to adopt another psychological point of view. (This distinction is similar to Hoffman's (2000)

categories, with 'affective empathy' matching mimicry, classical conditioning and direct association, and 'cognitive empathy' matching perspective taking). Shamay-Tsoory et al. (2002) found that both participants exhibited a profound deficit in empathy, and were impaired to a similar extent in both affective and cognitive empathic abilities. They were able to identify faux pas's and irony, and recognise emotions, indicating that the empathy impairment cannot be attributed to an inability to recognise emotions or make inferences about others mental states. However, in the faux pas task the participants detected the difference between the speakers and listeners knowledge, but they did not appreciate the affect that the speaker's words would have on the listener's emotional state. Shamay-Tsoory et al. (2002) argued that this provides evidence for their hypothesis that the empathy deficit of individuals with AS is due to an impaired integration of cognitive and emotional facets of a mental state.

Empathy in children with autism has been studied using vignettes to simulate emotion-inducing situations with the aim of inducing an empathic response in the observer. In response to a lack of studies investigating empathy in autistic children Yirmiya, et al. (1992) conducted a study which compared a group of 18 children with high functioning autism aged between 9 and 16 years, to a matched group of 14 typically developed children aged between 9 and 14 years old. Empathy was measured using videotaped stories of children experiencing different events and emotions (happy, angry, proud, sad, and afraid). After viewing the segments the children were asked to identify the characters feelings and their own feelings in response to the video. The empathy score reflected the level of agreement between the child's emotional label for the character and their own emotion, rather than agreement between the emotion that the video's were intended to show and the

child's own emotion. The children with autism performed significantly worse than the control group across all the measures. However, empathy was not totally absent in the autism group with many of the participants able to label others emotions, respond empathically and to take the perspective of others. These results support the idea that there are empathy deficits in autism, but also suggest that at least some children with autism have some empathic ability. Yirmiya at el. (1992) also found that more intelligent children with autism performed better on the empathy task, a pattern shown in other social responding studies (Bacon et al. 1998) and that is not shown in children with typical development. This suggests that children with autism may use cognitive strategies in dealing with social situations more than is usual in non-autistic children.

In a follow-up study to the Yirmiya et al., (1992) research Capps, Kasari, Yirmiya and Sigman (1993) repeated the procedure but included an analysis of participant's facial expression during the vignettes. They found that the children with autism's facial expressions were consistent with the affective content of the vignette. This suggests that although their verbal responses were less accurate than the control group (Yirmiya et al., 1992) they were responding emotionally to the characters emotion. In terms of empathy development this finding would indicate that children with autism display affective empathy, which is automatic and unconscious, but are deficient in cognitive mode of empathy (Hoffman, 2000).

Travis et al., (2001) also used vignettes to measure empathic responding in a group of 20 children with autism, but in a wider age range to that of the Yirmiya et al. (1992) study (8 to 18 years old). Travis et al. (2001) employed a vignette-based measure of empathy that involved the enactment of 8 vignettes by a puppet that had

four detachable faces depicting the emotions of happiness, sadness, fear, and anger. The participants were asked how the puppet felt and how it made them feel. The empathy scores were based on the correspondence between the child's responses for the puppet and for themselves, regardless of whether they responses for the puppet matched the experimenters intended emotion for the vignette. Interestingly for the research methodology with this population, 2 of the autistic group and 3 of the control group had to have their data excluded from the empathy task as they were obtaining high scores due to perseverative responding. Travis et al. (2001) found that the autistic group performed more poorly than the developmentally delayed control group on response to others distress and the empathy task, but both of these differences were not significant ($p=0.6$). Travis et al. (2001) found some evidence that empathy is impaired in autistic children, but the statistical difference was weak.

The research that has aimed to directly measure empathy has found evidence that in comparison to non-autistic controls empathy is impaired in children and adults with autism and AS (Shamay-Tsoory et al., 2002;Baron-Cohen, & Wheelwright, 2004; Yirmiya et al, 1992;Travis, et al., 2001). But surprisingly, given the widely held assumption of an empathy deficit, children with autism have been found to be capable of a level of empathic responding. A continuing theme of the research findings has been the individual differences between children with autism. Greater empathic ability is shown by the children with higher cognitive functioning, more developed language, and greater pro-social behaviour (Bacon et al., 1998; Loveland et al., 1997; Travis et al., 2001; Yirmiya et al., 1992).

Despite empathy being considered a central characteristic of autism (Gillberg, 1992) the evidence for empathy deficits in children with autism is not comprehensive. The small number of studies examining empathy in children with autism suffer from a lack of replication, and from limitations such as small sample sizes, and restrictions to certain age groups. The limited research into empathy in children with autism has not investigated the more subtle individual differences in empathic responding or differences in responding to varying levels of empathy. In the area of empathy in autism there are clear gaps in the research base that need to be explored.

This investigation of children with autisms' empathic ability aimed to investigate whether the finding of an empathy deficit in children with autism will be replicated. It also aimed to investigate differences between the different modes of empathy described by Hoffman (2000), and individual variation in empathy.

This study used a newly developed measure of empathy for children. The sparseness of research into empathy in children with autism may be partly due to the difficulties in measuring empathic responding. This difficulty is reflected in the lack of consistency of the measurement tools used in empathy studies, which in turn limits the usefulness of comparisons across studies. Research into empathy in children has used methods such as semi-structured interviews (Lofcraft, & Teglasi, 1997; Strayer,1993), self report-questionnaires (Davis, 1980), measures of physiological change (Blair, 1999), and eye gaze (Ruffman, Garnham, & Paul, 2001). It has been acknowledged that these measures are not fully adequate and that empathy is a difficult factor to measure, especially in children, (Baron-Cohen, & Wheelwright, 2004; Strayer & Roberts, 2004b).

In response to the inadequate tools available for measuring empathy in children a computer based empathy measure has recently been developed (Howe, Brown, Pitten-Cate, & Hadwin, submitted). It uses videos of children acting out vignettes, thereby reducing the representational leap that needs to be made with puppet based vignettes. It distinguishes between the different modes of empathy proposed by Hoffman (2000) by providing different information to the participants within each vignette. This structure permits an investigation of empathy as a broad construct, but also has the potential to provide a more detailed analysis of each of the construct's components (i.e. cognitive versus affective). In addition, embedding the test within a computerised-game format reduces bias by providing social and emotional distance between the interviewer and the child. Computers are being increasingly integrated into the preschool curriculum (see Freeman & Somerindyke, 2001) and provide an interactive, responsive and fun test medium for this age group. This new tool has been used with typically developing children but has not yet been used with children with autism or with learning disabilities. However, there is a precedent within autism research in testing this idiosyncratic population for using stimuli that are either novel or have not been widely used, (e.g. Heavey, Phillips, Baron-Cohen, & Rutter, 2000). The use of this tool with autism children is supported by evidence that children with autism respond better to computerised stimuli than to the more traditional test materials, (Ozonoff, 1995), and that they are better at recognising emotions from schematic drawings than from photos of human faces (Downs, & Smith, 2004).

This study will investigate the issue of perseveration identified with this vignette-based methodology (Travies et al., 2004; Yirmiya et al., 1992). The scoring of responses to the vignettes will be analysed in both possible ways, and frequency of

emotion chosen will be compared between groups to investigate any group differences in perseveration.

Ethical approval for this study was obtained from the School of Psychology ethics committee at the University of Southampton (see Appendix 1).

The research questions addressed by this study were:

- Do children with autism show poorer empathy and emotion recognition than children without autism?
- Is there a variance in the mode/level of empathy shown by children with autism?
- Are children with autism more impaired in empathic responding than in emotion recognition and perspective taking?

The hypotheses generated were:

- The ASD group will achieve significantly lower scores for the empathy measure and emotion recognition measure than the typically developed control group and the learning disability control group.
- The ASD groups scores will be significantly higher for the facial and situational cued vignette questions, than for the verbal and desire cued vignette questions.
- The ASD group will show a significantly lower empathy score than their emotion recognition score.

Method

Design

This study used a combination of between-groups and within-groups comparisons. There were three groups, one with autism and two control groups (a group of typically developed children and a group of children with learning disabilities); a design recommended in comparisons of developmental deficit in autism (Shaked, & Yirmiya, 2004). The between-groups comparison compared empathy measure and emotion recognition between the three groups. The within-groups comparison compared separately, for all three groups, responses to the type of cues (facial, situational, verbal, desire), and the empathy measure compared with emotion recognition.

Participants Characteristics.

Twenty children with autistic spectrum disorder (ASD), twenty children with typical development (TD), and seventeen children with learning disabilities (LD) participated in this study. They were all males aged between 6 and 11 years old, (mean age 9 years and 6 months; age range 6 years 6 months to 11 years and 10 months; standard deviation = 1.29).

The ASD group all had a formal diagnosis of autism according to ICD-10 (World Health Organisation, 1992) carried out by a trained clinician not affiliated with the present research. The typically developed control group all attended mainstream schools and had no clinical diagnoses. The learning disabilities (LD) control group only included those attending schools for children with mild to moderate learning disabilities, or significant learning difficulties.

To be included in the study all children were required to have receptive language age-equivalent of three years or above, as this is the minimum age that the experimental measure was designed for, (see below). There was no expressive language requirement for the experimental measure and therefore level of expressive language was not an inclusion requirement (however, screening measures of verbal intelligence quotient (VIQ) a measure that incorporates expressive and receptive language indicate that all participants had some expressive language, see Table 1 below for VIQ ranges). Children who had head injuries, motor deficits, epilepsy or significant dual diagnosis such as attention deficit hyperactivity disorder were excluded from the study. Females were not included in this study as the male-female ratio (3:1) would mean that greater overall numbers of participants would be would be needed to make meaningful gender comparisons, (Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995).

The children were recruited from two mainstream schools, three learning disability schools, and two autistic schools in Hampshire and Surrey. In the first instance recruitment involve writing to the head teacher of the school, informing them about the study, and asking for their agreement to use their school. The schools were then informed of the inclusion and exclusion criteria for the study, and asked to identify which children met these criteria, in order to minimise inappropriate recruitment and unsuccessful screening. The parents of the identified children were given recruitment packs by the school, with an enclosed response envelopes that was returned to the school (Appendix 2). This mass mailing maintained confidentiality, as the researchers only knew the identities of those children whose parents returned consent forms. Included in the recruitment packs was a form for parents to indicate whether their child had a diagnoses of ASD (Appendix 2). This confirmed the

diagnostic information given to the researchers by the school for the ASD group, and confirmed that none of the TD or LD groups had diagnoses of ASD.

For the purposes of screening and descriptions of the groups the participants were administered the British Picture Vocabulary Scale (BPVS) (Dunn, Dunn, Whetton, & Pintilie, 1982) and the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). The WASI is a brief standardised test of cognitive ability that includes a non-verbal measure of ability, recommended for matching in autism studies (Mottrom, 2004). The BPVS is a standardised test of receptive language that has been widely employed in studies of children with autism (Happe, 1996; Moore, Hobson, & Lee, 1997). The characteristics of the sample are presented in Table 1.

Analysis of variance (ANOVA) revealed significant differences between the groups on: chronological age ($F(2,54)=19.77$, $p<.001$); VIQ ($F(2,54)=50.16$, $p<.001$); PIQ ($F(2,54)=22.85$, $p<.001$); and on BPVS standard scores ($F(2,54)=24.28$, $p<.001$). Further analysis showed that between the ASD and LD groups there were no differences on receptive language ($t(35)=-1.24$, $p=.223$), but the ASD group scored significantly higher than the LD group on non-verbal ability ($t(35)=-4.68$, $p<.001$) and on expressive language ($t(35)=-2.05$, $p=.047$). The ASD group were significantly younger than the LD group ($t(35)=2.31$, $p=.027$).

Further analysis of the differences between the ASD and TD groups showed that the ASD group scored significantly lower on non-verbal ability ($t(38) =-2.85$, $p=.007$), expressive language ($t(38) =-7.46$, $p<.001$), and receptive language ($t(38) =-5.48$, $p<.001$). The ASD group were significantly older than the TD group ($t(38) =3.77$, $p=.001$).

Table 1. Participants Characteristics of the Three Groups showing Age, British Picture Vocabulary Scale scores and Wechsler Abbreviated Scale of Intelligence scores

		Chronological Age (years, months)	BPVS Age Equivalent (years, months)	Performance IQ	Verbal IQ
Autistic Spectrum Disorder (n = 20)	Mean	9,3	7,2	89	83
	SD	1.14	2.05	13.80	12.34
	Range	7,4 - 11,1	3,1 – 10,2	62 - 117	58 - 104
Typically Developed (n = 20)	Mean	8,0	8,11	104	112
	SD	0.94	1.64	19.35	12.95
	Range	6,6 – 9,3	6,7 – 12,10	65 - 135	79 - 128
Learning Disabilities (n=17)	Mean	10,0	6,10	71	74
	SD	0.86	1.99	7.22	11.54
	Range	7,10 – 10,11	3,7 – 10,7	60 - 80	58 - 95

Six participants from the group with autism were excluded from the study after giving consent due to not having the required receptive language ability at screening. Another child from the group with autism was excluded from the study, post written parental consent, as he indicated verbally during testing that he did not consent to the computerised experimental task. One further child, also from the group with

autism, (aged 9 years, 9 months, with a FSIQ of 85) was excluded due to performance on the experimental task (see results section).

Experimental Measure

Southampton Test of Empathy in Preschoolers (STEP), (Howe et al., submitted) is a computerised measure of empathic ability. It is consists of nine vignettes, which are videotaped episodes of children acting out short stories. These stories are incorporated into a cartoon style animated background, and the program is guided by a voice telling the participants what to do at each stage and verbally rewarding completion of the stages. STEP is based upon Hoffman's (2000) normative framework of empathic development (see Appendix 7) and incorporates four types of empathy cues: facial and situational (affective cues); and verbal and desire (cognitive cues). Each of these four types of cues are presented in different sections of each vignette (see Appendices 6 & 7). STEP includes nine (one practice and eight experimental) emotionally evocative vignettes that each portray a primary emotion (happy, sad, angry, scared) and have been compiled into stories about a principal character. For example, one story involves a boy having a bad dream, see Table 2.

The children are able to choose the order of stories by clicking the pictures of the characters on a menu board, after completing the same first example story. During the stories the children are required to identify the character's feelings as well as their own emotional reaction to each vignette using a series of schematic emotional faces provided at the bottom of the screen (neutral, happy, sad, angry, scared). At the beginning of the program, before the stories are shown, the children's ability to discriminate between the schematic faces is tested. Each story also incorporates two

check items. The first, the attention check, requires the child to answer a simple question relating to these vignettes (e.g. "What is Chloe reading? A comic or a

Table 2. Example STEP story: James

Narration	**Empathy cue**	**Characters Emotion & Related Score**	**Observer Emotion & Related Score**
This is a story about James. Here is James. How does James feel? How did you feel when you saw James?	Facial.	Happy = 2 All other emotions = 0	Happy = 2 All other emotions = 0
James's daddy reads him a story. Then it's time for bed. James has a bad dream about a green cabbage monster (picture in thought bubble). How did James feel when he had a dream about a green cabbage monster? How did you feel when James had a dream about a green cabbage monster?	Situational (face cannot be seen)	Scared = 2 Angry = 1 Sad = 1 All other emotions = 0	Scared = 2 Angry = 1 Sad = 1 All other emotions = 0
Did James have a dream about a green cabbage monster or a green cabbage dragon?	N/a – attention check		
James goes to tell daddy about his bad dream. Daddy cuddles him. James says 'No! I won't go to bed daddy, the green cabbage monster is going to get me?' How did James feel when he told his daddy he wouldn't go to bed? How did you feel when James told his daddy he wouldn't go to bed?	Verbal (face cannot be seen)	Angry = 2 Sacred = 1 Sad = 1 All other emotions = 0	Angry = 2 Sacred = 1 Sad = 1 All other emotions = 0
James wants his blankie (picture in thought bubble). What does James want, his blankie or his teddy?	N/a – desire check.		

Daddy gives James his teddy. How did James feel when he got his teddy? How did you feel when James got his teddy?	Desire	Sad = 2 Sacred = 1 Angry = 1 All other emotions = 0	Sad = 2 Sacred = 1 Angry = 1 All other emotions = 0

book?"). This prevents the continuous repetition of feeling questions as well as providing a useful method for determining whether or not the child remains focused on the task, independent of their responses to the stimulus vignettes. The second non-emotional item, the desire check, relates specifically to the child's ability to take the character's perspective (e.g. What does Chloe want?). The empathy measure incorporates picture cues to give sticker rewards to the child after each vignette; these are always the same and are not linked to performance on the test.

The STEP scoring system gives two separate scores, one for empathy and the other for emotion recognition. The score for emotion recognition is derived from the participant identifying the characters feelings within the stories context (*how did the character feel when .....?*). The empathy score is derived from the participant's emotional response to the character in the context of the story (*how did you feel when the character .....?*). Both of these responses to STEP are scored as two points for a correctly identified emotion, one point for incorrect emotion but correct valence of emotion, and zero for incorrect emotion and incorrect valence. As there are four empathy questions and four emotion recognition questions (one for each of the four empathy modes/cues) for each story, the maximum possible score for each story is eight for empathy and eight for emotion recognition. The first example story completed is not included, which leaves eight stories in the scoring to give maximum scores per participant of sixty four for empathy and sixty four for emotion recognition.

Further to this the scores can also be divided into responses to each of four empathy cues (facial, situational, verbal, desire).

The measure has been piloted in cartoon format (non-computerised) on 21 children, and in its finished computerised form on 39 children, (Howe et al., submitted). This pilot has found the composite score data to be normally distributed within a typical sample. Good internal consistency is reported (α = 0.85). Validity is still being established, scores on the test are correlated with parental reports of empathy on My Child (a 100-item parent-report measure of conscious behaviour in children which incorporates 13 items assessing a general disposition of emotional responsiveness to affective events; Kochanska, De Vet, Goldman, Murray, & Putnam, 1994), an independent index of empathic ability, ($r = .33$, $p<0.05$) and measures of pro-social behaviour ($r = .75$, $p<0.01$).

At the time of this study the STEP had only been used with typically developed children within the average ability range, aged between two years, six months and five years old (Howe et al., submitted). For the present study an initial pilot study was conducted which aimed to evaluate whether the STEP could be used for older children up to the age of eleven years, and for children with autism and LD. This specifically aimed to establish whether in the older, typically developed children ceiling scores would be produced and whether it was motivating enough for these older children to attend. Although the typically developed children in the previous study were anecdotally reported to find the stories interesting, children with ASD were less likely to find these social stimuli intrinsically interesting or rewarding and may have shown poor attention and/or poor motivation to attend to the computer program. Therefore the pilot also aimed to establish whether children with ASD and

children with LD's: find the task sufficiently motivating to attend; are able to use the computer mouse in the way that the task requires; achieve scores that fall within a range rather than displaying ceiling or floor effects.

Pilot study. The pilot sample consisted of two typically developed children (aged 7 years and 8 months, and 10 years and 3 months) and one child with ASD (aged 8 years and 11 months). These children did not participate in the experimental study. The STEP program was administered and the children were asked questions about their enjoyment and interest level, and how difficult or easy they thought it was.

The child with ASD had no difficulties with using the computer mouse appropriately, or attending to the program. The 'attention' and 'desire' check questions for all three showed good attending (out of a maximum score of 8 they scored 7,8,8 for attention, and 8,8,8 for desire). All three children reported finding STEP interesting and were observed to enjoy choosing the stories and receiving the stickers. They reported that some questions had seemed quite easy, whereas others had been quite difficult. The scores for all three children did not show ceiling or floor effects (out of a maximum score of 128 for Total Empathy the typically developed children scored 71, & 102, and the child with autism scored 89).

Procedure

STEP administration. .STEP took approximately 25 minutes to administer. A laptop computer was used to run the program, with the same laptop being used for all participants. Immediately prior to testing, verbal assent was sought from each child for his participation (in addition to the written consent already obtained from parents). At the start of testing the experimenter opened the program and entered the

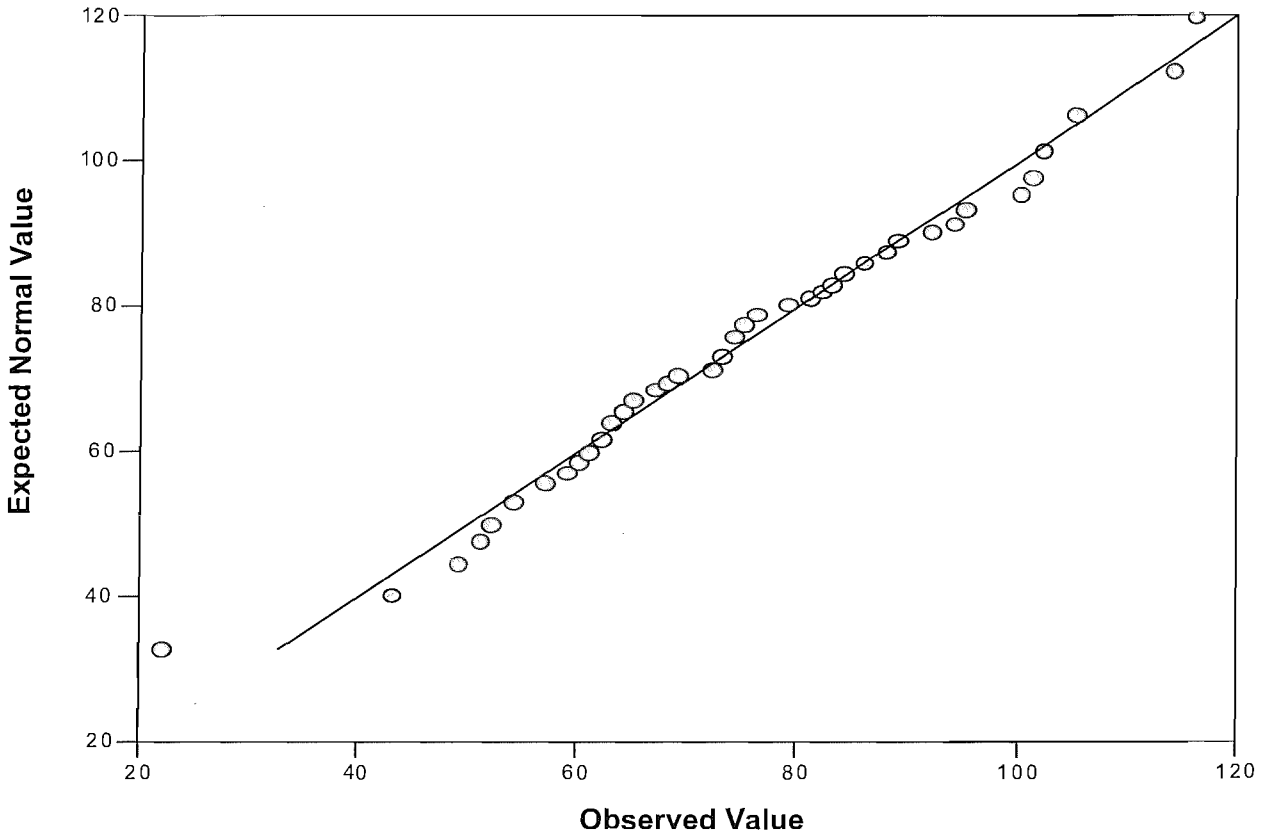
participants details onto the 'profile' page. The experimenter then asked each participant if they were able to use the mouse or if they would like to point to the screen and have the experimenter click on their answer with the mouse. All of the children choose to use the mouse. During the stories the experimenter sat next to and slightly behind the participant in an effort not to distract them. The experimenter talked only in response to the children's questions and answered neutrally to any program related questions. At the end of each story stickers were given to participants as cued by the program, giving them nine stickers each by the end of testing. The STEP program automatically stored each participant's responses in an Excel spreadsheet, as they entered each response.

Experimental study. Each child was tested in either one or two sessions, if two were required they were spaced no more than one week apart. The number of testing sessions was determined by school timetable constraints and the child's level of concentration and motivation towards the testing. The testing was conducted at a desk within a private, familiar room in the participant's school. The BPVS and the WASI were completed first, and then the empathy measure was administered. This allowed screening of the participants before the computer task, avoiding unnecessary completion of the computer task by participants who weren't suitable for the study. At the end of testing each participant was given a standard goodie bag of non-edible toys as a reward.

Results

An analysis of non-normal distribution using Shapiro-Wilks was non-significant, $W(57) = 0.98$, $p > 0.05$. This indicated that the STEP data was normally distributed enabling the use of parametric tests for analysis, see Figure 1.

Figure 1. Q-Q Plot to show distribution of Total STEP Scores



The range and variance for each sub-scale of the STEP measure indicated that there were no consistent floor or ceiling effects, although for the empathy measure sub-scale two of the TD group scored the lowest possible score. There were no participants who dropped below the cut-off score of 6 out of 8 on the attention and desire check questions, suggesting good attention to the program. One participant's data was removed from analysis, as his STEP understanding score was more than 3 standard deviations away from the mean.

STEP performance correlations

In studies that compare a group with autism to control group(s) Jarrold and Brock (2004) recommend controlling for the effect of background measures on the experimental measure, rather than just matching groups. Pearson's correlations

were used to investigate whether PIQ, VIQ, and BPVS scores were significantly correlated with the emotion recognition and empathy measure scores. As correlations on small samples such as ours may be distorted by the presence of outliers, scatter plots were first examined for all correlations.

Table 3. Correlations Between Test Variables Analysed with Pearson's Correlation Coefficient, one-tailed.

	Scale	1	2	3	4	5	6	7
1.	Chronological Age	-						
2.	Full Scale IQ	♠	-					
3.	Verbal IQ	♠	.936**	-				
4.	Performance IQ	♠	.872**	.677**	-			
5.	BPVS Raw Scores	-.081	.723**	.586**	.586**	-		
6.	STEP Emotion Recognition	-.205	.472**	.478**	.418**	.451**	-	-
7.	STEP Empathy	.078	-.029	-.090	.058	-.030	.176	

* = $p<0.05$ ** = $p<0.01$ ♠ = measures already based on age normative data

Table 3 shows that the STEP empathy scores are not correlated with any of the other test variables. However, STEP emotion recognition scores are positively correlated with FSIQ, VIQ, PIQ and BPVS scores. This indicates that as receptive and expressive language, and non-verbal ability increase, the correct identification of the characters emotion in the STEP vignettes increases. This is displayed in Figures 2, 3, 4 and 5.

Figure 2. Scatter Plot to show correlation between Emotion Recognition scores from the Southampton Test of Empathy in Preschoolers and Wechsler Abbreviated Scale of Intelligence Full Scale Intelligence Quotient scores

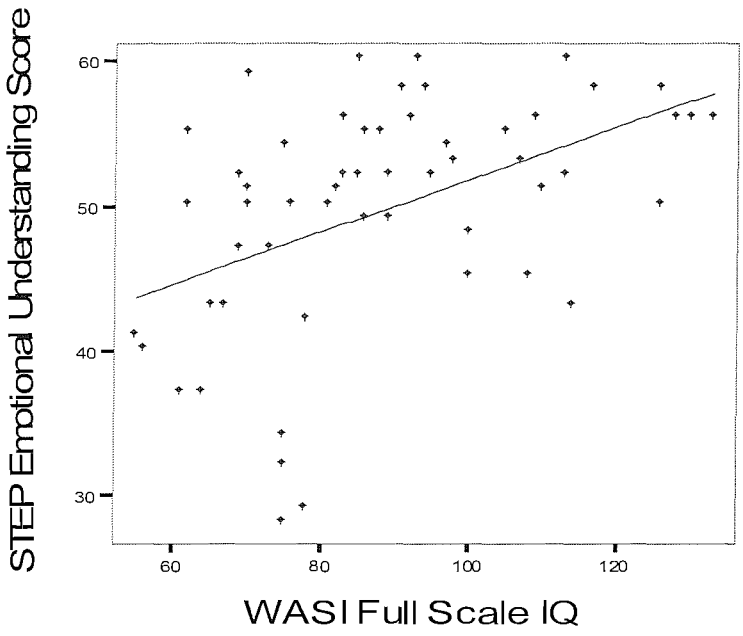


Figure 3. Scatter Plot to show correlation between Emotion Recognition scores from the Southampton Test of Empathy in Preschoolers and Wechsler Abbreviated Scale of Intelligence Performance Intelligence Quotient scores

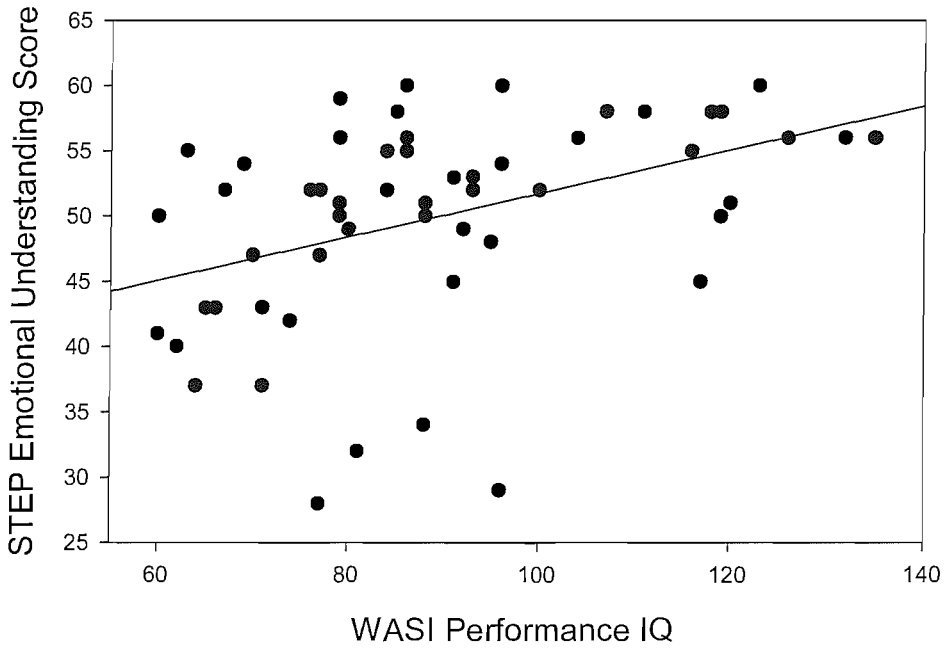


Figure 4. Scatter Plot to show correlation between Emotion recognition scores from the Southampton Test of Empathy in Preschoolers and Wechsler Abbreviated Scale of Intelligence Verbal Intelligence Quotient scores

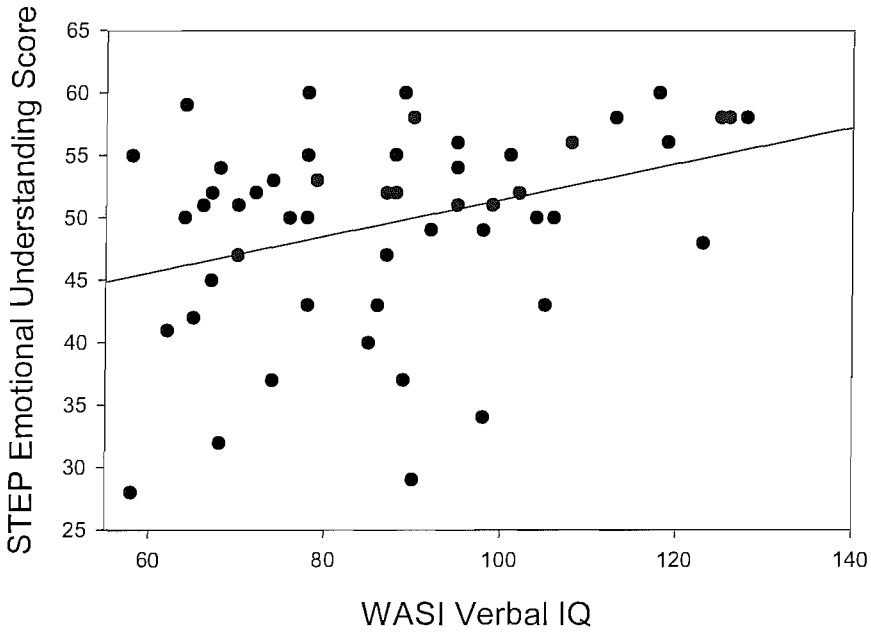
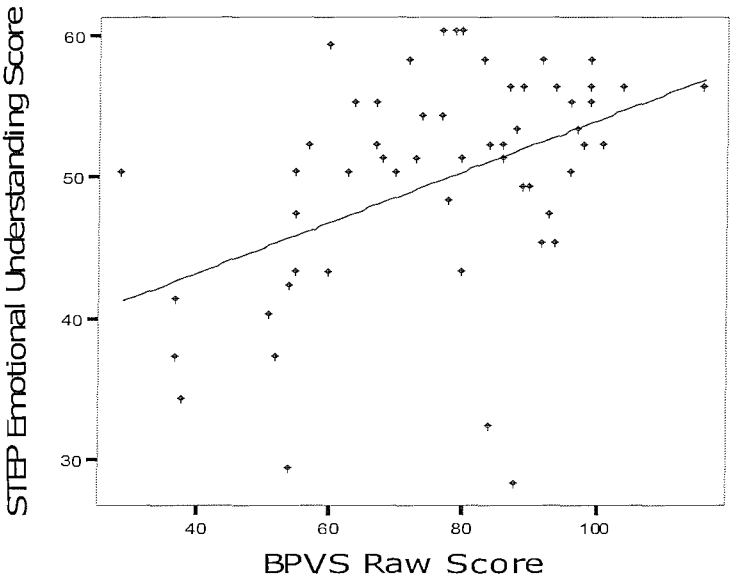


Figure 5. Scatter Plot to show correlation between Emotion Recognition scores from the Southampton Test of Empathy in Preschoolers and British Picture Vocabulary Scale Raw Scores



As there was a significant age difference between the ASD and TD group the correlations within groups between age and the two STEP measures were also investigated. These were analysed using non-parametric Spearman's Rho due to the small numbers per group.

Table 4. Correlations Within Groups, Between Chronological Age and STEP measures analysed with Spearman's Rho, one-tailed.

	ASD	TD	LD
Chronological Age & STEP Emotion Recognition	-.239	.256	.168
Chronological Age & STEP Empathy	-.304	.356	-.257

Table 4 shows that chronological age was not correlated with either of the STEP measures within any of the groups.

STEP Empathy and Emotion Recognition, Between Groups Comparison

In comparing differences in emotion recognition between the groups it was necessary to control for the significant relationship between STEP emotion recognition scores and the FSIQ and BPVS scores. Although the VIQ and PIQ also correlated with STEP emotion recognition scores, due to the risk of co-linearity affecting the analysis the number of variables was reduced by using the FSIQ rather than using the VIQ and PIQ. Two separate analysis of co-variance (ANCOVA) were conducted using a 3 group (ASD, LD, TD) by emotion recognition score design. This was first carried out with FSIQ as the covariates. FSIQ significantly predicts emotion recognition scores, $F(1, 55) = 10.38$, $p < 0.01$. After controlling for the effect of FSIQ there was no significant difference between groups in emotion recognition, $F(2, 55) = 1.799$, $p > 0.05$.

An ANCOVA was then conducted with BPVS scores as the covariate which found that BPVS scores significantly predict emotion recognition, $F(1, 55) = 7.63$, $p < 0.01$. After controlling for the effect of BPVS scores, there were no significant differences between groups in emotion recognition, $F(2, 55) = 1.23$, $p > 0.05$.

As the empathy scores did not correlate with any of the background measures a one-way independent analysis of variance (ANOVA) was used to explore differences between groups. There was no significant difference between the groups in empathy scores, $F(2, 55), = 1.31$, $p > 0.05$.

Table 4 gives descriptive statistics for the STEP scores, with the emotion recognition scores adjusted for the effect of covariates.

Table 5. Descriptive Statistics for Southampton Test of Empathy in Pre-schoolers Scores across the three Experimental Groups

STEP sub-scale	Group		
	ASD (n=20)	LD (n=17)	TD (n=20)
Emotion Recognition measure (0-64[a])			
M	47.25	48.65	53.60
SD	9.99	6.44	4.58
Empathy measure (0-64[a])			
M	30. 20	28.47	23.20
SD	16.41	11.88	13.56

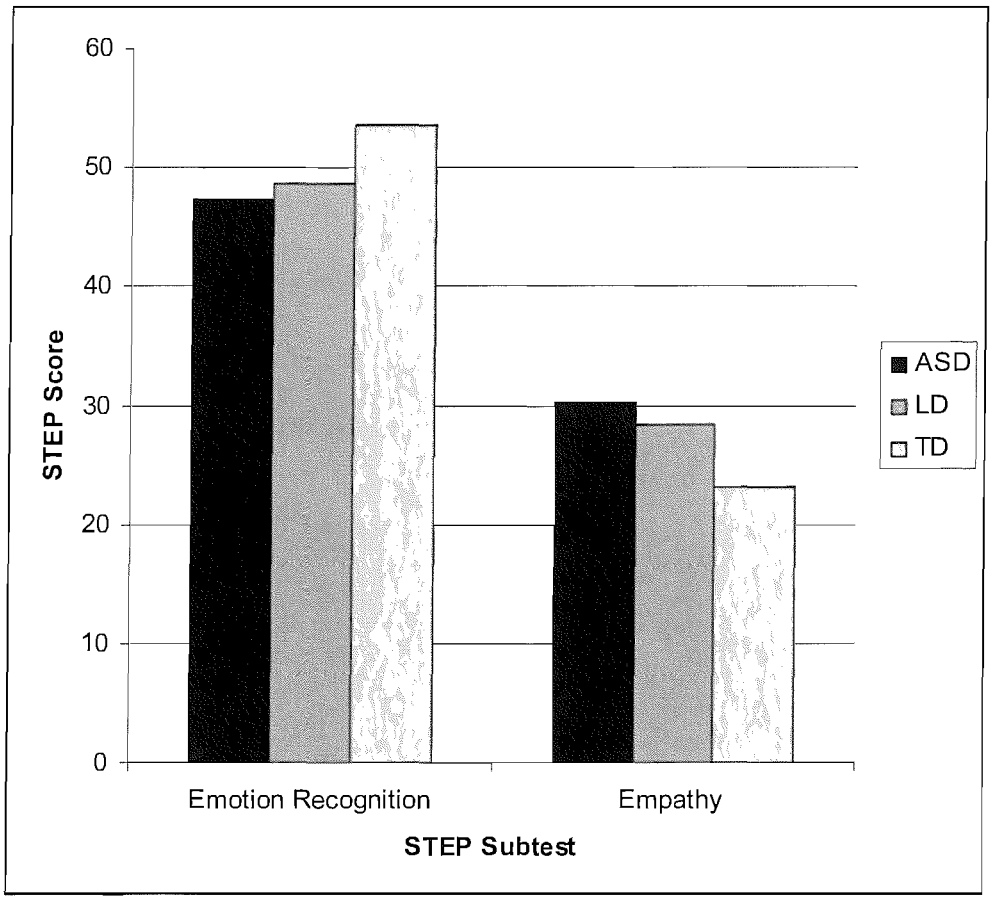
M = mean, *SD* = standard deviation
[a] indicates possible scoring range

Table 4 and Figure 5 show that the mean emotion recognition scores were very similar across the ASD and LD groups, but were higher for the TD group. For empathy the TD group had a much lower mean score than the LD and ASD group, and the LD group had a slightly lower score than the ASD group. For all three groups the variance of scores was higher for the empathy measure than the emotion recognition measure. The variance in the ASD group across both measures was higher than for the two control groups.

STEP Empathy and Emotion Recognition, Within Group Comparisons

The means for all three groups were higher for the emotion recognition measure than for the empathy measure, as shown in figure 6. Comparison of within group's difference between the emotion recognition and empathy found that in the ASD group emotion recognition scores were significantly higher than empathy scores, (t (19) = 5.1, $p < 0.01$). In the LD group emotion recognition scores were also significantly higher than the scores for empathy (t (16) = 6.25, $p < 0.01$), and this significant difference was found in the TD group (t (19) = 9.86, $p < 0.01$).

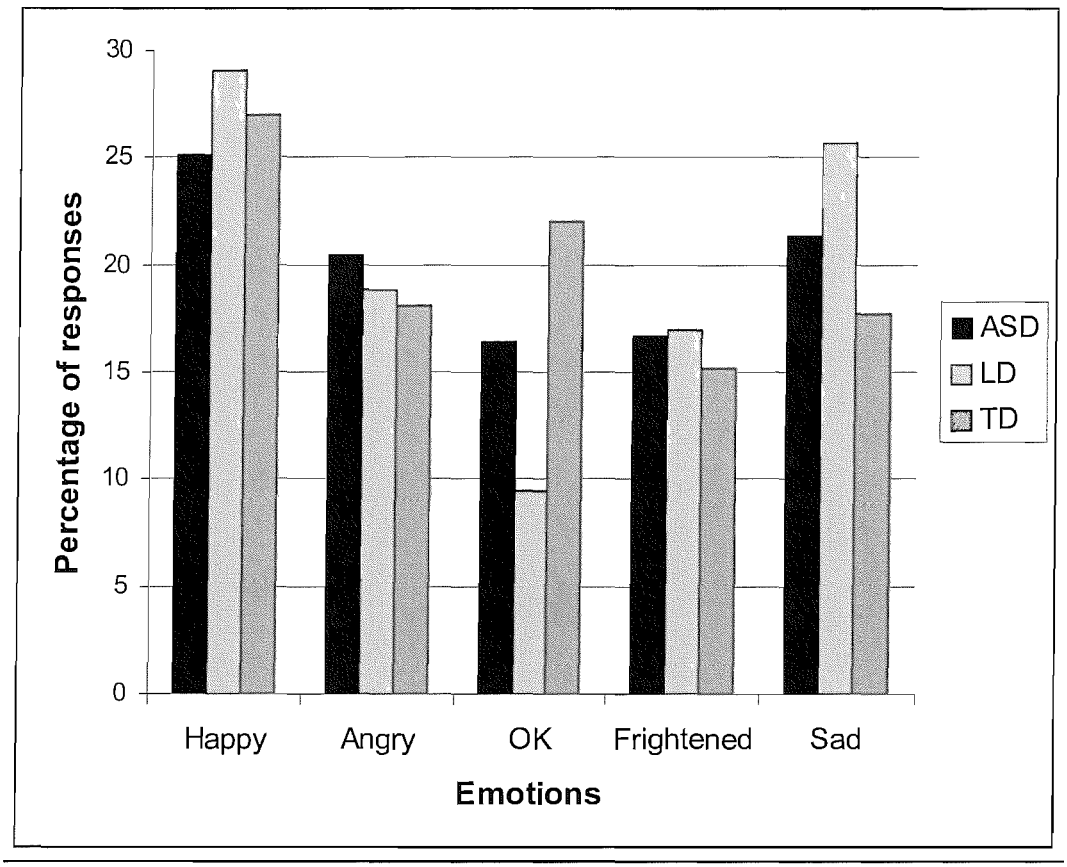
Figure 6. Mean Empathy Scores Across Experimental Groups with Adjusted Means for the Emotion Recognition Measure.



Between Groups comparison – Frequency of Emotions Chosen

To examine perseveration effects on responses to STEP, the frequency of the emotions chosen in STEP was compared for all three groups. As shown in figures 7 all of the groups showed responses spread across all of the available emotions. There are no strong trends in between-group differences, apart from the LD group having fewer 'OK' responses and more 'sad' responses than the other two groups.

Figure 7. Frequency of Emotions chosen in response to STEP, shown by percentage for each group



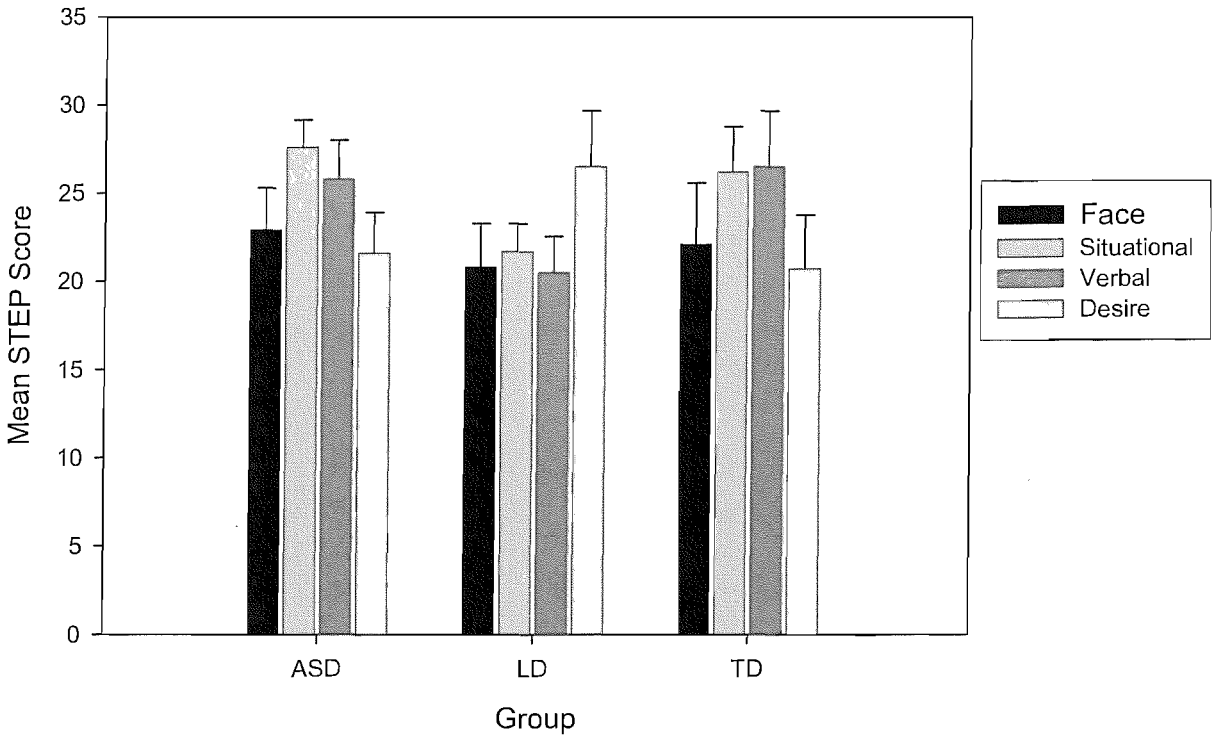
To test for differences between the experimental groups in the frequency of emotions chosen crosstabulation analysis using Chi Squared was performed. There was a

significant association between group and type of emotion chosen, X^2 (8) = 79.73, p<.001.

Within and Between Groups Comparison - Mode of empathy

The STEP scores were separated into sub-categories, based on the empathy cue (related to mode of empathy, see Appendix 6), as shown in Figure 8.

Figure 8. Mean Southampton Test of Empathy in Pre-schoolers score for each type of story cue, shown per group



To answer the research question regarding within-group differences in empathy scores between these cues, a 1 group by 4 cues (facial, situational, verbal, and desire) repeated measures ANOVA was carried out, for each of the three groups. As repeated measures ANOVA's require that the assumption of sphericity is met (the equality of variances of the differences between empathy cue scores), each group

was first tested for sphericity using Mauchly's test, recommended for testing the severity of departures from sphericity (Field, 2005). Due to the assumption of sphericity not being met by the ASD group data (X^2 (5)=0.325, $p < 0.05$), ANOVA analyses were rejected in favour of MANOVA analyses, as MANOVA are not dependent upon the assumption of sphericity (Field, 2005). The MANOVA found a significant main effect of type of cue on empathy score (F (3,12) = 5.49, $p < 0.05$). The contrasts showed that for the ASD group the empathy score for situational was significantly higher than for facial (F (1,14) = 7.76, $p < .05$), and the empathy score for desire was significantly lower than for verbal (F (1,14) = 5.01, $p < .05$).

The LD group and the TD also did not meet the assumption of sphericity (LD: X^2 (5)=0.413, $p < 0.05$, TD: X^2 (5)=0.393, $p < 0.05$), so MANOVA's were used to determine any significant differences within each group in scores between the different empathy cues. Analyses of the LD group found no main effects cue on empathy score (F (3,13) = 2.22, $p > 0.05$). Similarly for the TD group there was no main effect of cue on empathy score (F (3,13) =1.30, $p > 0.05$). This indicates that there was no differences in empathy performance between the various modes of empathy within the LD and TD groups.

To investigate between group differences in the scores for each type of empathy cue a 3 group (ASD, LD, TD) by 4 cues (facial, situational, verbal, and desire) ANOVA was carried out. There was no significant main effect of group, F (2,45)=1.27, $p>0.05$. Indicating no differences between groups in scores on the different types of empathy cue.

Discussion

This study examined empathic ability in children with autism and compared their performance to children with LD and to children with typical development. The results highlighted that for the for both the emotion recognition measure and empathy measure there was no difference between the ASD and the TD or the children with LD. For the empathy task the children with ASD actually performed better than the typical control group against the predicted direction of difference, although this difference was not significant. Overall the children with ASD did not show the empathy deficits that some previous studies have found (Baron-Cohen, & Wheelwright, 2004;Travis, et al., 2001).

In addition the ASD group were found to have differences in their empathy response between the four types of cues that were not found in the two control groups. Contrary to Hoffman's (2000) model of step-wise development, the children with ASD were significantly worse at the more basic level of facially cued questions than the more complex situational cued questions. This trend was reversed for the two cognitive types of cue, back to the direction predicted by Hoffman's (2000) empathy model of step-wise development of the different levels of empathy. The children with ASD were significantly less empathic for the more complex desire based cues and more empathic for the less complex verbally based cues. A further finding was that emotion recognition was related to full scale IQ, with more intelligent children showing greater empathy, replicating the findings of Yirmiya et al. (1992).

The children with ASD achieved significantly lower scores on the empathy measure than they did on the emotion recognition task, as predicted by the research hypothesis. Similarly the two control groups scored significantly more poorly on the

empathy measure than emotion recognition. This result suggests that empathic responding ability is generally more difficult than understanding of another's perspective and emotions. This therefore does not necessarily support a specific ASD impairment in empathic responding. But it does support the idea that the ability to recognise another's emotions is necessary but not sufficient for empathic responding.

These results have partly replicated and extended the findings of Yirmiya et al. (1992) that children with ASD are able to respond empathically to the feelings of others. In contrast to Yirmiya et al. (1992) we found that that empathic responding in children with ASD is no worse than typically developing children and children with LD. In view of the younger overall age group in this study than in Yirmiya et al.'s (1992) it is surprising that we found less difference between groups. Models of empathy suggest that it develops as an individual's sense of self and others develop. It would be expected therefore that if a difference exists between typically developed and developmentally delayed individuals, this difference would decrease with age rather than increase. This implies that other factors in our studies influenced the results.

The lack of difference between the children with ASD and the control groups on emotion recognition and empathy is surprising as several studies have found this to be impaired in children with autism (e.g. Hobson et al., 1988a; Downs, & Smith, 2004). However, this does follow the findings that only low-functioning children with autism have gross emotion perception problems for the most basic emotions (Dyck et al., 2001), as our sample were more weighted towards the high-functioning end of the autistic spectrum and were able to recognise emotions.

Although there were no significant differences between the groups in levels of empathic responding, the non-significant trend was in the opposite direction to that predicted with the typically developing group showing lower scores than the ASD group. This trend could be explained in terms of the differing chronological ages of the children in groups. As the children in the TD group were significantly younger than in the ASD group, this could have partially accounted for the lack of difference in empathy. If this were the case a possible empathy deficit in the ASD group could have been missed due to the TD group being less mature in their development of empathy.

Evidence to the contrary is that in some ways the typical group's development was more mature than the ASD groups, with higher IQ and language scores. This would suggest that it was certainly not a comparison of an ASD group more mature in all aspects with a TD group less mature in all aspects. However, empathy does not necessarily develop on the same developmental trajectory as language and IQ, especially in children with autism whose development is atypical. It has been hypothesised that when comparing children with autism to typically developed children it is not enough to take into account their differing level of cognitive ability, you must also consider their development of specific abilities linked to varying life experience (Mervis, & Klien-Tasman, 2004). In typical development empathic responding increases with chronological age (Hoffman, 2000), and although children with ASD are delayed in many areas it is possible that their empathy development is less delayed, resulting in the older children with autism performing slightly better than the younger typically developed children. To explore this possibility of a type

two error it would be necessary to repeat the study with groups that were closely matched across a narrow chronological age band.

In considering whether the non-impaired empathic responding in the ASD group reflect a generalised lack of deficit in this area we should consider the ecological validity of our results. The children with ASD may have performed at their optimum because of the experimental conditions, (e.g. unrestricted time, quiet environment with only one source of information input). It is also possible that it is easier for children with ASD to respond by clicking a multiple-choice emotion, than it is to respond verbally in a real life, more complex social situation. These types of differences have been found for other social skills in children with ASD (Klin, 2000), and it may be that although children with ASD can demonstrate empathy during testing, it is not as robust to real life situation as the empathic abilities of the control groups.

A possible interpretation of the finding that empathic responding was lower than emotion recognition and perspective taking is that the vignettes were not realistic or extreme enough to evoke strong emotions. The spontaneous comments from the children during the STEP program indicated that some of them were not experiencing empathy because they had rationalised that it was only a story (e.g. the participant chose that the character felt scared, but, "I feel happy because I know it's only fake."). Other comments suggested that the participant was able to have a light heated response to the story in contrast to the response it was aimed to evoke, (e.g. the character feels frightened at the monster, but, "I feel happy because the monster is kinda funny."). The participants were possibly not immersed emotionally in the story as they were not emotionally evocative enough. However, it would have been

ethically unacceptable to test children on stories that would make them experience a range of strong negative feelings. It is possible that this boundary could be pushed more in testing with adults or even older adolescents, with whom it would be more ethically acceptable to evoke strong negative feelings.

The finding that children with autism are better at verbally cued empathy than the more complex desire cued empathy fits well with the idea that empathy in the children with ASD is present, but is developmentally delayed as they have not yet reached the capacity of the other two groups on the most complex stage. However, the finding that they are worse at empathic responding to the most basic cue, facial, than the more complex cue, situational, does not support this idea and instead could suggest that the development of empathy in children with ASD does not follow the same step-wise model as it does in typical development. If it is the case that children with ASD develop modes of empathy in a different pattern to non-autistic children, this could explain the contradictory findings of previous empathy studies. We can hypothesise that some studies have found more empathic responding than others as their stimuli has tested different modes of empathy. This can be further clarified by future studies all differentiating between the emotional information cues necessary for the different modes of empathy.

Alternatively the poor empathy produced by the facial cue in children with ASD may have been due to the ambiguity of the facial expressions. The story with the lowest empathy score for all of the groups was anecdotally reported to have the most ambiguous facial display (see Appendix 5). It aimed to show 'frightened' but was often labelled as 'confused' or 'uncertain,' emotion options not available to choose from in STEP. In contrast the story that consistently scored the highest empathy had

the primary emotion of happy, and was anecdotally observed to show this emotion very clearly. The ambiguity of some of the facial expressions would have the greatest effect on the children with ASD as they had the lower score on understanding of others emotion (emotion recognition). This could therefore explain why the ASD group gave poorer empathic responses from facial cues, whereas the other two groups did not. This also provides an alternative explanation in terms of ambiguity of stimuli for why the most basic level of empathy cue was difficult for the children with ASD.

The method of scoring employed by STEP may have had a differential effect on the ASD group and the control groups. STEP scored an answer as showing empathic responding if the emotion for the observer (participant) matched with the emotion that the story intended to portray for the character. This is the same methodology used by Yirmiya et al., (1992) in their empathy task vignettes, but different from that of Travis et al., (2001). They scored an empathic response as the observer emotion matching the emotion attributed by the participant to the character in the vignette, regardless of whether this emotion matched the emotion that the experimenter intended to convey with the vignette. This difference meant that in the present study children who were feeling the same emotion as the character, did not gain scores for empathy if they picked the 'wrong' emotion for the character. The validity of this method would be improved by a larger scale study than those previously done with STEP being carried out to provide wider normative data on the emotions chosen for the characters.

With regard to the ASD population in this study, they are more likely than typically developing children to have more idiosyncratic interpretations of the information from

the story. This could result in a different interpretation from the experimenter of the characters emotion and therefore an empathic response in line with their choice of character emotion. To explore this potential disadvantage to those participants not following the experimenters view of the emotion being displayed, the raw STEP data was entered into a database the opposite way to STEP, with a response being scored as empathic if it matched the emotion attributed to the character regardless of the stories intended emotion. When the data was analysed in this way the between-groups comparisons had the same results as the original scoring method (see Appendix 4). This suggests that the method of scoring was not a significant problem in this study.

The converse method of scoring, where the observer choosing the same emotion as they attributed to the character is scored as empathic, introduces a different kind of scoring problem. It would mean that perseverative responding would be rewarded with high empathy scores. This is particularly relevant to the autistic population and to a lesser extent learning disabilities, where perseveration is a recognised behaviour. It is important to consider whether the scores for empathic responding shown by the ASD group as comparable to the control groups, is attributable to perseveration rather than greater empathy. In examining the differences in frequency of the emotions chosen across the groups, they all appear to chose a varied selection of all the emotions offered in STEP, suggesting that perseveration did not occur. The re-analysis of the data with the converse method of scoring detailed above further confirms that perseveration did not affect these results.

There are difficulties with both methods of scoring. Yirmiya et al. (1992) tried to minimise problems of perseveration by conducting their two types of test questions

(character emotion & observer emotion) one week apart. This is a methodology that could easily be used for future research with the STEP. But as the re-analysis of the data in this study did not support evidence of a perseveration effect, the original method of scoring appears to be sufficient.

The repetitive nature of the STEP program introduces the possibility of a strategy being adopted for responding that is followed to the detriment of an individual actually indicating their true emotional state. Two of the typically developed children scored zero on the Empathy measure sub-scale as they choose 'OK' as the answer to every observer emotion question. This could be interpreted as them having adopted a strategy to press 'OK' because they were unsure of their emotion. As already discussed all groups scored more poorly on their own emotion than on the character emotion. In addition anecdotally experimenters reported that the children found it more difficult to choose how they felt than how the character felt, and more queries were directed at the experimenter for observer emotions. Alternatively it could have been that these two children were not particularly moved emotionally by the stories and that 'OK' was the best descriptor of their emotions. These two interpretations have different implications. For the latter interpretation the study needs to be done with more emotionally evocative stimuli.

The finding that more intelligent children showed greater empathy follows the pattern recurring across all of the emotion ability research (e.g. Dissanayake et al.,1996; Loveland et al., 1997). From this we can hypothesise that children with ASD may use other cognitive abilities to support their emotional information processing. This idea has been widely used in intervention and self-help approaches

for children and adults with ASD, which aim to develop abilities that are usually impaired in ASD using cognitive strategies (e.g. Attwood, 2005).

Limitations

Some weaknesses of this study have been identified. This study had small sample sizes, a problem that most studies of empathy in individuals with autism have suffered from (Kasari, et al., 1990; Travis et al., 2001; Yirmiya et al., 1992). It would have been beneficial for generalising the findings to have had greater numbers of participants in this study. This would improve the validity of interpretations of patterns such as the differences in modes of empathy. This is especially important in autistic sample as the group are recognised as relatively heterogeneous in their development, so greater numbers are of benefit to ensure that findings are attributable to the wider population and not idiosyncratic to the experimental sample.

A further potential weakness of this study was the wide range of ability within the autistic group of children. Differences have been found in the social-emotional ability between children with high and low functioning autism (e.g. Loveland et al., 1997). It has been proposed that these two groups should be studied separately so that the results of one do not confound the results of the other (Fein et al., 1999; Steven's et al., 2000). The present study attempted to control for these differences in the analyses used. We would not have been validly able to separate the groups into high and low functioning in this study, or have excluded those outside average functioning due to the small numbers of participants. However, alongside the disadvantages there are also advantages to keeping the whole sample of ability levels together. When only a sub-group of children with autism are included in research the problem of representiveness is raised. Recent estimates suggest that between 26% and 40%

of individuals with ASD also have learning disabilities (Chakrabarti, & Fombonne, 2001: Baird et al., 2000), with the remaining non-learning disabled individuals still being heterogeneous in ability. If we had only included children with autism with IQ's within the average range this would have excluded a substantial section of the autistic population.

Conclusion

This study supports the use of STEP as a suitable measure for this age group and for children with learning disabilities and children with autism. This is confirmed by the normal distribution of the scores and the general lack of ceiling and floor effects. All of the children maintained motivation and concentration towards the program and anecdotally they all reported enjoying the program. This was probably aided by the novelty of the stimuli and the use of a computer, with computer-time being used as a reward in several of the schools. The children appeared to particularly enjoy choosing the order of the stories from the menu and receiving the sticker rewards. STEP therefore improves on the limitations of previous empathy research tools to provide a useful multi-dimensional measure for studying the development of empathy in these populations of children.

Clinically this research suggests that children with autism have a foundation of empathic ability upon which to build interventions to improve real life empathy. It is clinically that the possible differences identified between empathy performance on experimental tasks and empathy in real life will be identified and targeted. There are already several programs that aim to improve various emotional skills in children with autism such as emotion recognition and understanding (e.g. Emotional Literacy teaching – Social Emotional Aspects of Learning, Department for Education and

Skills, 2005), and theory of mind (Mind reading, Baron-Cohen, 2003). This research indicates that children with autism need individual assessments, using programs such as STEP, of their empathy level/ability, as there is variation in the type and amount of empathic ability. These assessments will be crucial before any interventions to teach empathy or emotion recognition. For example, an 'Emotional-Social Intelligence Prosthesis' has recently been developed which uses a small video camera worn on the head and attached to a computer to tell the wearer how to interpret the emotional responses of the person they are talking to (El Kaliouby, 2005). In order to aim this teaching at an appropriate level it would be useful to know the individual's baseline level of empathic ability. If sufficient norms were obtained for STEP it could potentially be used clinically to evaluate a child's empathy skills in order to develop an intervention to aid with deficits in empathy. STEP could also be used as a pre/post measure for any empathy interventions being conducted.

In summary, the present study extends the previous research findings that children with autism are able to respond empathically, showing the same level of empathic responding as non-autistic children. The children with autism showed a different pattern in the modes of empathy that they could access in comparison with the non-autistic children, suggesting a difference in autism from the step-wise development of empathy proposed in typical development (Hoffman, 2000). The children with autism were as able as the control groups in emotion recognition and understanding of others perspectives. For all the groups there was a trend towards finding the empathic responses more difficult than the emotion recognition.

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APPENDICES

Appendix 1

University of Southampton

School of Psychology

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Tel +44 (0)23 8059 3995
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17 June 2005

Vicki Glossop
Department of Clinical Psychology
University of Southampton
Southampton
SO17 1BJ

Dear Vicki,

Re: **An investigation of empathy in autistic children using a computer based measure of empathy**

I am writing to confirm that the above titled ethics application was approved by the School of Psychology Ethics Committee on 17 June 2005.

Should you require any further information, please do not hesitate in contacting me on 023 8059 3995.

Please quote approval reference number CLIN/03/79.

Yours sincerely,

KNSmith

Kathryn Smith
Secretary to the Ethics Committee

Appendix 2

ON HEADED PAPER

INFORMATION SHEET

Version 2 Dated 12/10/05

Title of research study: An Investigation of empathy in autistic children using a computer based measure of empathy

You are being asked for your child to take part in a research study. Before you decide whether you would like them to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. If anything is not clear or you would like more information, please contact us using the contact details at the end of this information sheet.

- **What is the purpose of the study?**

This study is trying to find out about empathy in children with autism. Empathy is the ability to describe or share another person's emotional state. Some previous research has found that individuals with autism have poor empathy. But most of the research has used adults with autism, not children. So we do not know very much about the ability of children with autism to feel empathy.

- **Why has my child been chosen?**

The schools that agreed to take part in this study were asked to send the parents of all children at the school in the required age range a letter, consent form, and an information sheet.

The types of children chosen for this study are boys aged 6 to 10 years old. This study is going to find out about empathy in children with autism by comparing their task results to the results of children who **do not** have autism. This means that some of the children chosen for this study will have autism and some of them will not have autism.

- **Do I have to agree to my child taking part?**

It is up to you to decide whether or not you want your child to take part. Your child's participation is voluntary and they are free to withdraw at any time, without giving any reason.

If you want to withdraw your agreement for your child's results to be used in the study after they have taken part, you can contact the researcher and their results will be removed from the study.

- **What will happen to my child if they take part?**

Each child will meet with the researcher, Vicki Glossop, for two sessions where they will be asked to complete three tasks. The sessions will take place at the child's school in a separate room from the main classroom. The sessions will happen at a time of the school day agreed by their teacher as being suitable. The sessions will be a maximum of half an hour long.

Immediately before the sessions each child will be asked if they would like to do the tasks. If the child refuses or avoids the testing area, testing materials or researcher they will return to their class and will not have to take part in the study. Some of the children taking part may not be able to say that they don't want to carry on with the tasks, so they will be carefully monitored throughout the session. Any signs of distress, or agitation will be seen as a withdrawal of agreement to take part and the session will be stopped.

The children will be asked to complete one task at a laptop computer. This is a computer program developed for children that shows eight short video sequences of children acting out different stories. Each story is about one main character who shows a specific emotion at the end of the story, for example Peter loses his pet dog, then he finds his dog. The children will be asked to guess the character in the video story's feelings by choosing from a set of cartoon faces shown at the bottom of the screen. The cartoon faces show the emotions of happy, sad, angry, scared and neutral. The computer program also has picture prompts for the researcher to give sticker rewards to the child after each story.

The children in the study will also be asked to complete two short tasks that involve identifying the names of pictures and matching pictures of shapes.

At the end of second session the children will be provided with a small goodie bag containing either a pot of bubbles, or stickers.

- **What are the possible disadvantages or risks of my child taking part?**

The computer program may cause some children to feel mild anger, sadness or fear in sympathy for the characters in the story. To make this less likely the program has been designed to give potentially distressing stories (e.g. Thomas loses his pet dog) a happy ending (e.g. Thomas finds his dog). In addition, the final story shown is designed to make those watching it feel happy.

The researcher had agreed with each school a plan of how to respond if watching the videoed stories distresses any children. If parents have any concerns about their child following participation in the study, they can contact the researcher.

- **What are the possible benefits of my child taking part?**

Your child may or may not receive any direct benefit from taking part in this study. However, children should enjoy doing the tasks, and receiving the stickers and goodie bag.

This study will help us to better understand the social difficulties that children with autism have.

- **Will my child's taking part in this study be kept confidential?**

All children taking part in this study will be assigned a participant number. This number will be used in place of their name on the database of results collected for this study. The researcher and supervisors are the only individuals who will have access to the database on which the information is stored. Any documentation linking the child's name with their participant number will be kept in a locked filing cabinet and will be destroyed following the collection of all the data.

The written results of this research study will be anonymous, preventing the identity of the participants.

- **Who is organising the research?**

I am a clinical psychologist in training at the University of Southampton, Doctoral Program in Clinical Psychology. This research is being conducted as part of my training.

- **What will happen to the results of the research study?**

A report of the study will be written up and submitted as a thesis. A summary sheet of the findings of the study will be available to you upon request from the researcher. If you are interested in your own child's individual scores, a request can be made in writing to the researcher.

- **Who has reviewed the research?**

The University of Southampton Ethics committee has reviewed the study.

If you have any questions about your children's rights as a participant in this research, or if you feel that they have been placed at risk, you can contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: (023) 8059 3995.

- **Who can I contact for further information?**

If you have any questions or you wish to request a summary of the findings please contact:

Vicki Glossop by email at vjg103@soton.ac.uk

or Julie Hadwin by phone on (023) 80592590

Thank you for reading this information sheet.

ON HEADED PAPER

ADDITIONAL INFORMATION

Please complete the questions below.

1. Has your child received a diagnosis of autism or autistic spectrum disorder?
(please tick the relevant box)

Yes ☐
No ☐

If you answered 'no' to question 1 and your child has not received a diagnosis of autism, you do **not** need to answer the rest of the questions.

2. What was your child's diagnosis?

Autism ☐
Autistic spectrum disorder ☐
Aspergers ☐
Other *(please specify)* .....
.....

3. What was the profession of the person(s) who diagnosed your child?

.....
.....

4. Where did your child receive a diagnosis from?
(e.g. a paediatric department at a general hospital, or a child and adolescent community mental health team)
.....
.....

5. If we need more information about your child's diagnosis would you be happy for us to phone you to ask for this information?
(please tick the relevant box)

I agree to receive a phone call to give further information, my phone number is ..... ☐

I do not want to receive a phone call to give further information ☐

Thank you for completing these questions.

ON HEADED PAPER

CONSENT FORM FOR RESEARCH PARTICIPANTS

Title of research study: An Investigation of empathy in autistic children using a computer based measure of empathy

Name of researcher: Vicki Glossop, Trainee Clinical Psychologist

Please initial each box:

I confirm that I have read and understood the information sheet dated..... (version ...) for the above study.	☐
I understand that my child's participation is voluntary and that they are free to withdraw at any time, without giving any reason.	☐
I understand that data collected as part of this research project will be treated confidentially, and that the written results of this research study will maintain my child's confidentially.	☐
I agree for my child to take part in the above study.	☐

_____	_____
name of participant (child)	date of birth

_____	_____	_____
name of parent/guardian	date	signature

_____	_____	_____
name of researcher	date	signature

1 copy for researcher; 1 copy for parent/guardian

Appendix 3

Autism

The International Journal of Research and Practice

NOTES FOR CONTRIBUTORS

1. The aim of the journal is to publish original research or original contributions to the existing literature on autism. Papers should not previously have been published or be under consideration elsewhere.

2. Each paper submitted will be refereed by at least two anonymous referees.

3. Length of papers. The number of high quality submissions to the Journal has increased significantly over the last few years and in order to facilitate more rapid publication of important papers it has become necessary to limit the size of manuscripts accepted. The maximum text length, therefore, should be 5000 words and the total number of end references should not exceed 30 entries. In execeptional circumstances we may be able to accept manuscripts that exceed this length, but this should be discussed with one of the editors before submission.

4. When submitting papers for consideration, please supply four paper copies. If the paper is accepted for publication, then a copy of the final version will be required on disk. The author is responsible for guaranteeing that the final hard copy and diskette versions of the manuscript are identical. Please attach to every submission a letter confirming that all authors have agreed to the submission and that the article is not currently being considered for publication by any other journal.

5. In order to protect the identity of clients or participants, authors should use pseudonyms and remove any information leading to identification of any of the individuals described in the study.

6. The Editors welcome contributions to the Letters to the editors section of the journal. In the interests of saving space, or to protect confidentiality, for example, the Editors may edit letters for publication.

7. Unsolicited manuscripts will not be returned to authors if rejected.

8. Blind peer review. Authors should provide two title pages, one containing names, affiliations, full mailing address plus telephone, fax, email address, and one containing the title only.

9. Please number all pages except the title pages, in the following order: abstract (100-150 words), keywords (up to five), address for correspondence; main text; appendices; acknowledgements; notes; references; tables; figure captions; figures. Each of the above sections should start on a fresh page.

10. Articles submitted for publication must be typed (or word processed) in double spacing throughout (especially all notes and references), on one side only of white A4 or US standard paper, with generous left- and right-hand margins but without justification. Pages should not be stapled. Titles and section headings should be clear and brief with a maximum of three orders of heading.

11. Quotations. Lengthy quotations (exceeding 40 words) should be displayed and indented in the text.

12. American or UK spelling may be used, to the author's preference. Indicate italics by underlining and use single quotation marks. Dates

should be in the form '9 May 1995'. Delete points from 'USA' and other such abbreviations.

Appendix 4

Analysis of co-variance of the Southampton Test of Empathy in Preschoolers scores when opposite scoring methods were applied to the data.

Tests of Between-Subjects Effects

Dependent Variable: Total STEP score with opposite scoring

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	434.915(a)	3	144.972	1.589	.203
Intercept	26.512	1	26.512	.291	.592
WASI_PIQ	184.965	1	184.965	2.027	.160
Group	430.289	2	215.144	2.358	.104
Error	4836.068	53	91.247		
Total	18703.000	57			
Corrected Total	5270.982	56			

a R Squared = .083 (Adjusted R Squared = .031)

Pairwise Comparisons

Dependent Variable: Total STEP score with opposite scoring

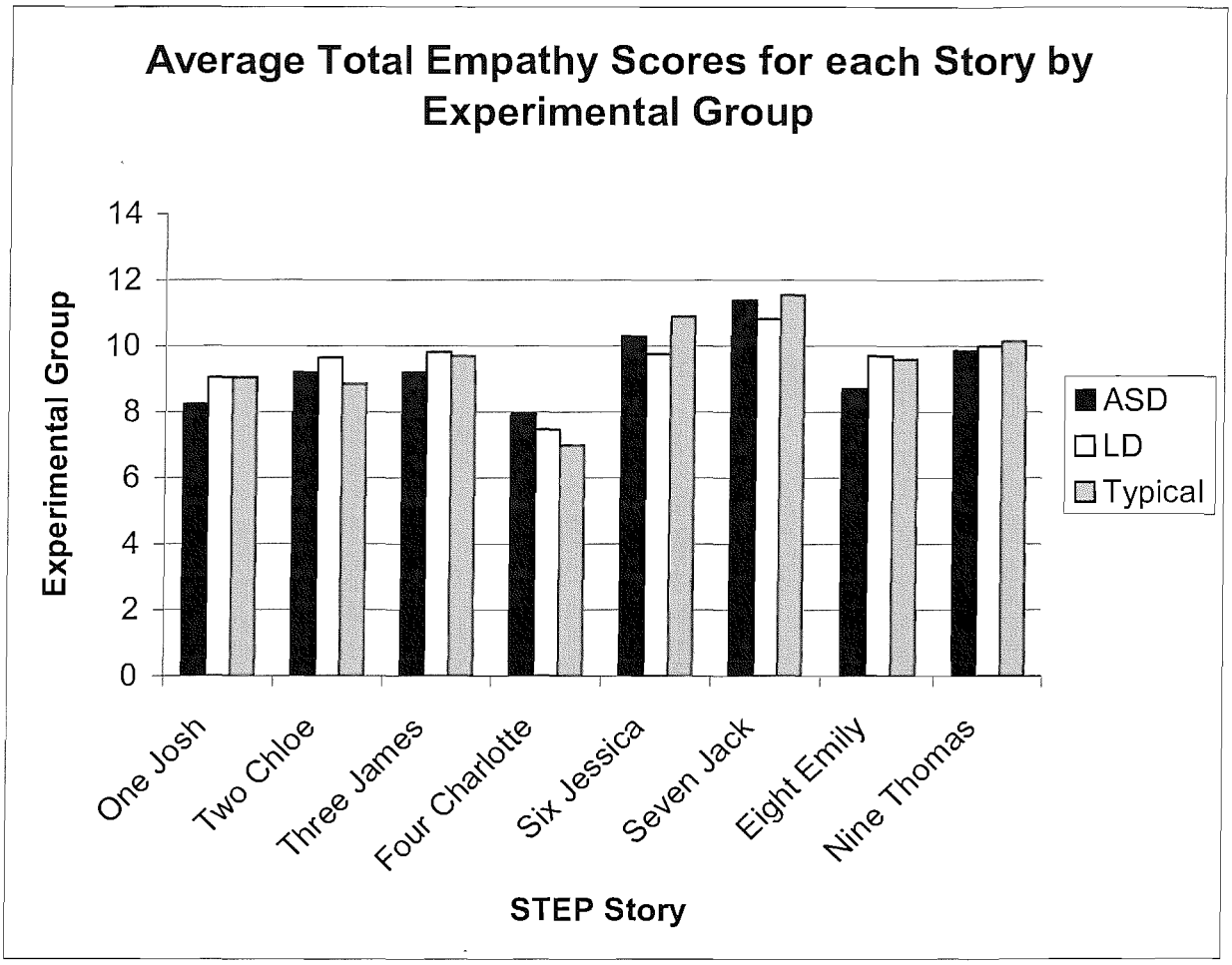
(I) Experimental group	(J) Experimental group	Mean Difference (I-J)	Std. Error	Sig.(a)	95% Confidence Interval for Difference(a)	
					Lower Bound	Upper Bound
ASD	LD control	-1.259	3.511	1.000	-9.940	7.423
	Typical control	6.672	3.309	.146	-1.508	14.851
LD control	ASD	1.259	3.511	1.000	-7.423	9.940
	Typical control	7.930	4.282	.209	-2.656	18.516
Typical control	ASD	-6.672	3.309	.146	-14.851	1.508
	LD control	-7.930	4.282	.209	-18.516	2.656

Based on estimated marginal means

a Adjustment for multiple comparisons: Bonferroni.

Appendix 5

Graph to show between story mean composite STEP scores for each experimental group



Appendix 6

Brief Description of the Four Types of Stimuli used in STEP

Empathy Cue	*Description*
Facial (F)	*Child judges and shares in the protagonist's emotion from their dynamic facial expressions*
Situational (S)	*Child judges and shares in the protagonist's emotion from the situational cues. The protagonist's face cannot be seen.*
Verbal (V)	*Child judges and shares in the protagonist's emotion from their verbal comments. The protagonist's face cannot be seen. The protagonist's emotional response is not evident from the situational cues alone.*
Desire (D)	*Child judges and shares in the protagonist's emotion from the protagonist's desires. The protagonist's face cannot be seen. The protagonist's emotional response is not evident from the situational cues alone. The protagonist's desires are nonverbal and explicit (e.g. pictures in thought bubbles).*

Appendix 7

	5-STAGE MODEL OF EMPATHIC AROUSAL HOFFMAN (2000)	STEP MEASURE	SAMPLE VIGNETTES	SAMPLE QUESTIONS (COGNITIVE/AFFECTIVE)
AFFECTIVE	**MIMICRY** Unconsciously imitating the subject's facial expression, which triggers afferent feedback and produces feelings in the observer that match the feelings of the subject.	Determine emotion from **facial cues.** Protagonist faces camera.	Child smiling (*happy*) Child downcast (*sad*) Child frowning (*angry*) Child cowering (*scared*)	"How does X feel?" (happy, neutral, sad, angry, scared). "How did you feel when you saw X?" (happy, neutral, sad, angry, scared)
	CLASSICAL CONDITIONING Empathic feelings are conditioned responses obtained from observing someone in distress at the same time the observer has had their own independent experience of distress.			
	DIRECT ASSOCIATION Cues in the subject's situation remind the observer of similar experiences in their own past and evoke feelings in them that fit the subject's situation.	Determine emotion from **situational cues**. Protagonist faces away from the camera.	Going to the park (*happy*) Being read story (*happy*) Child looking for lost dog (*sad*) Child falls and breaks toy (*sad*) Peer pushes over (*angry*) Peer snatches food (*angry*) Nightmare (*scared*) Toy goes BANG! (*scared*)	"How did X feel when he/she was at the park?" (happy, neutral, sad, angry, scared). "How did you feel when you saw X at the park?" (happy, neutral, sad, angry, scared)

COGNITIVE	MEDIATED ASSOCIATION The subject's emotional state is communicated through language. Language is the mediator between the subject's feelings and the observer's experience.	Determine emotion from **verbal content.** Protagonist faces away from the camera. The protagonist's emotional response conflicts with the situational cues (i.e. negative reaction to ordinarily happy event).	Hungry (*sad*): "Yummy pudding time!" (*happy*). Playing with toys (*happy*): "My toy is broken!" (*sad*). Playing in paddling pool (*happy*): "Help me! There's a big bug!" (*scared*). Cuddling daddy (*happy*): "No I won't go to bed!" (*angry*).	"How did X feel when he/she cried out?" (happy, neutral, sad, angry, scared). "How did you feel when X cried out?" (happy, neutral, sad, angry, scared).
	PERSPECTIVE-TAKING Requires the observer to put themselves in the subject's place and imagine how he or she feels.	Determine emotion from protagonist's **desires.** Protagonist faces away from the camera. The protagonist's emotional response conflicts with the situational cues. The protagonist's desires are nonverbal and explicit (e.g. pictures in thought bubbles).	Given the grey crayon instead of the yellow crayon (*sad*) but wanted the grey crayon (*happy*). Given a teddy to cuddle (*happy*) but wanted his rag (*sad*). Given frog jelly (*happy*) but doesn't like frogs (*scared*). Given toy sword (*happy*) but wanted kite (*angry*).	"How did X feel when she was given the grey crayon?" (happy, neutral, sad, angry, scared). "How did you feel when X was given the grey crayon?" (happy, neutral, sad, angry, scared).