ATTENTION DEFICIT HYPERACTIVITY DISORDER:

THEORY OF MIND AND SOCIAL FUNCTIONING.

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ABSTRACT

ADHD: Theory Of Mind And Social Functioning

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There is scant research into the social deficits of children with ADHD. Research suggests that the social disability of children with autism results from a specific impairment in theory of mind (ToM). The present study investigates ToM and social functioning in children with ADHD using a group comparison design. Thirty-seven boys aged 7-12 years and their parents participated in the study. Seventeen of the boys were recruited from a child development centre where they had received a diagnosis of ADHD. A further twenty boys, recruited from a local primary school, constituted a 'typically developing' control group. Each child participant was administered a battery of ToM measures including first and second order false belief paradigms, and the Strange Stories measure. Additionally, children's verbal and nonverbal ability was assessed. Each parent underwent a semi structured interview to assess their child's level of socialization and communication skills using the Vineland Adaptive Behavior Scales. Parents also completed the Social Behaviour Questionnaire, a specially developed measure to investigate frequency of observed social behaviours that require a well functioning ToM. Results suggested that children with ADHD were as likely to pass simple first and second order false belief tasks, as control children. However, on a more complex and ecologically valid measures of ToM, ADHD children demonstrated impairments in contrast to the control children. Furthermore, parents rated ADHD children as being less able in their everyday socialization and communication skills and exhibiting fewer instances of social behaviour indicative of a well functioning ToM, than did parents of control children. Results were discussed in relation to ToM deficits in other clinical samples. The findings offer diverse applications to theoretical and clinical perspectives. Methodological limitations were reviewed with suggestions for improvements and further research.

CONTENTS

Appendices

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The title of this thesis refers to Attention Deficit Hyperactivity Disorder (ADHD), and theory of mind (ToM). Both of these constructs are associated with large bodies of research. It would be impossible to review fully all of the associated literature within this introduction. Therefore issues pertinent to the research design are reviewed. Where there are large bodies of research not fully discussed a reference to further reading is given.

1.1 Diagnosis

1.1.1 Diagnostic criteria

ADHD is-a relatively new childhood psychiatric diagnosis derived from North America, although descriptions of children with similar behavioural symptoms can be found early in the 20th Century (Still, 1902). The diagnostic criteria used most often by clinicians and academics derive from the American Psychiatric Association diagnostic manuals, (DSM-IV, 1994). The three core behavioural symptoms of ADHD are hyperactivity, impulsivity, and inattention.

DSM-IV clusters hyperactivity and impulsivity into one dimension and inattention into another. Listed below are the three subtypes of ADHD described in DSM-IV.

- *Predominantly inattentive* (ADHD-IA)
- *Predominantly hyperactive/impulsive* (ADHD-HI)
- *Combined type* (ADHD-C)

When inattention is the major characteristic, the Attention Deficit Disorder primarily involves difficulty with selection and focused attention. The individual has difficulty knowing what to pay attention to, or sustaining attention without losing focus. However, when hyperactivity and impulsivity are the major problems, the Attention Deficit Disorder is primarily one of disinhibition. Thus the individual will have difficulty controlling impulses and applying skills.

The DSM-IV (1994) criteria for ADHD incorporate the necessity for symptoms to be "more frequent and severe than is typically observed in individuals at a comparable level of

1

development" (Criterion A). Some symptoms need to have been present before age 7 years (Criterion B), although many individuals are diagnosed after the symptoms have been present for a number of years. Furthermore, some impairments from the symptom list must be present in at least two settings, for example at home and school or work (Criterion C).

1.1.2 Methodological issues

Historically, the criteria for identification and classification of these children have been subject to numerous changes in nomenclature. For example, ADHD has been labeled as *minimal brain dysfunction* (Clements & Peter, 1962), *hyperkinesis* (ICD-9: WHO, 1965), and *attention deficit disorder* (DSM-III: APA, 1980). In so wide a literature, the review by Cherkes-Julkowski et al. (1997) is particularly thorough and provides a detailed account of the development of the ADHD diagnosis over time.

The most recent ICD-10 (WHO, 1990) diagnostic guidelines, published in Europe, contain the diagnosis of *hyperkinetic disorders*. Compared with the DSM guidelines they tend to result in the identification of fewer children with a more severe form of ADHD diagnosis. This is accounted for by the insistence that associated symptoms are shown in all situations.

Several revisions of nomenclature and associated symptoms within the evolving DSM guidelines reflect disagreement regarding the diagnostic necessity of the three core characteristics of impulsivity, inattention, and motor excess. These changes create obvious difficulty for evaluating research literature. It is unclear to what extent the different versions of DSM and ICD are measuring the same disorder and therefore the generalizability of findings from one study to another are limited.

Some recent research aims to validate the sub types of ADHD, and investigate the degree of correspondence of these sub classifications with those from earlier editions of the DSM manual (e.g. Gaub & Carlson, 1997; McBurnett et al., 1995).

2

1.1.3 Summary

In summary, the concept of ADHD was initially identified 100 years ago. Terminology used in the literature has changed over the years. This reflects shifts in professional's attitudes about the aetiology and principle underlying concepts of the disorder. Confusion and misperception of the nature of ADHD by parents, the media, and some professionals may in part be accounted for by this rapidly changing nomenclature.

Evaluating research regarding ADHD is problematic due to the different diagnostic guidelines used. In particular the diagnostic categories outlined in ICD-10 (WHO, 1990) and DSM-IV (APA, 1994) refer to children with different severity of problems. Earlier versions of the DSM (DSM-II, 1968; DSM-III, 1980; DSM-III-R, 1987) provide different guidelines on diagnosis and sub classifications of ADHD. These methodological issues must be evaluated when reviewing research on ADHD.

1.2 Prevalence

Estimations of the prevalence of ADHD vary according to the sampling procedure used and the diagnostic criteria employed by the study. Early studies in the United Kingdom found that 1 in 1,000 children demonstrated evidence of hyperkinetic reaction of childhood (Rutter et al., 1970). A more recent study using the ICD-10 guidelines (WHO, 1990) reports prevalence rates of 1.5% in 7 year old boys living in inner cities (Taylor et al., 1991).

American prevalence rates using DSM guidelines tend to be higher. Again rates depend on multiple factors such as, age, type of sample, sex ratio, socio-economic class, and method of diagnosis. Szatmari, Offord, and Boyle (1989) conducted a prevalence study with a large sample of 4-16 year olds. ADHD was diagnosed according to DSM-III criteria (APA, 1980) using multiple information sources. The study reported peak prevalence rates of 8% among children aged between 6 and 9 years. Boys were more likely to obtain a diagnosis of ADHD (9%) compared with girls (3.3%). Forty percent of children with ADHD also had a diagnosis of Conduct Disorder. Finally, The study reported higher rates of ADHD in urban compared with rural communities.

1.2.1 Summary

While there are numerous methodological problems associated with measuring and interpreting epidemiological data, evidence suggests that ADHD is of a sufficiently high prevalence to warrant further investigation. ADHD is the most commonly diagnosed behavioural disorder among children (Cooper, 1997). Children with ADHD are at high risk of psychosocial, educational, and adaptive problems in adolescence and adulthood (Wilson & Marcotte, 1996).

1.3 Aetiology

The aetiology of the disorder is unknown, however it is unlikely that there is one single cause of ADHD. The syndrome may represent the final common pathway for a biological vulnerability and interacting antecedent variables (Weiss, 1991).

The report of the working party of The British Psychological Society (ADHD: A psychological response to an evolving concept, 1996) reviews literature on different factors that may influence the diagnosis of ADHD. These include the role of environmental factors such as life events, home environment, and school environment, as well as cultural issues, neuro-biological factors, individual differences, and diet and toxins.

It is beyond the scope of this introduction to review the substantial body of literature in all of these areas. However it is important to note that ADHD is a controversial diagnosis that is not universally accepted amongst clinicians and academics. Cooper (1997) reviews the different orientations towards the nature and causes of ADHD represented in the professional, academic, and popular literature on ADHD.

1.3.1 Summary

Research into ADHD has not isolated a single causal factor implicated in the disorder. Therefore it is likely that ADHD may be affected by a number of factors. The present research focuses on social and cognitive functions underpinning a diagnosis of ADHD as these are

most pertinent to the research design. However a plethora of literature can be found regarding other mediating mechanisms (e.g. BPS, 1996; Cooper, 1997).

1.4 Intervention

Ritalin (or methylphenidate) is a stimulant medication most commonly used to treat children with ADHD. Other medications such as antidepressants and serotonin enhancers are also used. Precise mechanisms of change associated with these drugs are unestablished. However ADHD medications are known to increase levels of dopamine and norepinephrine at the synaptic cleft, thereby stimulating nerve receptors (Cherkes-Julowski et al., 1997). Richters et al. (1995) provide estimates that between 2 and 2.5% of all elementary school aged children in North America receive pharmacological intervention for hyperactivity. Its use is more limited in the UK. .

1.4.1. Medication effects on core symptoms

Ritalin has short term positive effects on the core symptoms of ADHD (Richter et al., 1995). Much research has investigated the efficacy of Ritalin at improving attention, and increasing task oriented behaviour and reflectivity (e.g. Gittleman & Kanner, 1986). Murphy, Pelham, and Lang (1992) found that Ritalin had a significant positive effect on recall of clues during an encoding tasks.

1.4.2. Medication effects on social behaviour

Less emphasis is placed on assessing pharmacological effects on learning, conduct problems, development of personality traits, and sociability (Alston & Romney, 1992). Research investigating stimulant medication and social behaviour of children with ADHD has provided equivocal results.

Some research suggests that Ritalin does not significantly improve social behaviour. Alston and Romney (1992) investigated the effect of Ritalin on mood, self esteem, attributional style, and social behaviour in prepubescent and pubescent boys with ADHD.

Results indicated significant differences only on self esteem between medicated and non-medicated children. Pubescent children taking medication reported lower self esteem than those not taking medication. However, prepubescent children taking medication demonstrated higher levels of self esteem than those not taking medication.

When improvements in social behaviour are reported, they do not always generalize to peer ratings of acceptance for children with ADHD (e.g. Whalen et al., 1987; Pelham & Bender, 1982). Barkley and Cunningham (1979) postulate that medication alone is ineffective in improving social relations of children with ADHD as they have acquired social skills deficits due to their inattentiveness to social processes.

Hubbard and Newcomb (1991) found that children taking Ritalin had difficulties in progressing in play hierarchies, sustaining associative play, and avoiding withdrawal after rough and tumble play whilst interacting with non ADHD children. Medicated ADHD/non ADHD dyads were characterized by lower levels of verbal reciprocity and affective expression than non medicated ADHD/ non ADHD dyads.

Effects of medication status on judgments of the social intent of children have also been studied (Whalen, Henker, & Granger, 1990). Children with ADHD taking placebo or Ritalin medication, and non ADHD children, rated the social behaviour of other ADHD children taking placebo or Ritalin medication, and non ADHD children, during a taped social interaction game. The children with ADHD were found to be as socially discerning as their same age non ADHD peers. However there was no evidence of medication related enhancement of social cognition. This supports the notion that ADHD children carry their problems of attention, impulsivity, and overactivity from one domain to another and that it is general regulatory deficits that are enhanced by Ritalin medication rather than specific competencies.

Other research suggests that Ritalin has positive ameliorating effects on negative social behaviour. Murphy, Pelham, and Lang (1992) found that Ritalin, in contrast to a placebo, reduced incidents of aggression in children with ADHD interacting in naturalistic settings. This finding was so for both high aggressive and low aggressive children with ADHD.

However during experimental conditions of direct provocation these findings were not generalized. High aggressive children showed no reduction of aggression when taking Ritalin compared to placebo. Low aggressive children taking Ritalin actually demonstrated increased levels of aggression during provocation compared to those on placebo.

Thus the effect of Ritalin on social behaviour is unclear. Individual and subgroup differences may be apparent but this requires further investigation. In the present study the majority of children diagnosed with ADHD were receiving pharmacological treatment. Since the study measures ToM abilities (a social-cognitive process discussed in greater detail later in the introduction) the impact of medication is unknown. However from the evidence reviewed it is hypothesized that medication will not have a specific effect on social-cognition. If medication does effect ToM abilities it is expected that it will have positive effects, and therefore will act to prevent the research hypotheses being accepted on false grounds.

1.4.3. Psycho-social interventions

Social skills interventions designed to ameliorate social relation difficulties of children with ADHD have failed to provide conclusive evidence of positive changes in peer interactions (Pelham & Bender 1982). Richter et al. (1995) review research of psycho-social interventions, some of which combine pharmacological treatments. Treatment packages include class room based behaviour modification programs, social skills and cognitive training, parent training, home based interventions, and intensive summer camps. Richters et al. (1995) emphasize that a tailored multimodal approach combining medication and psychosocial interventions may be the best intervention. However further research is required to clarify how to tailor interventions to individuals for optimum outcome.

1.4.4 Summary

Stimulant medications induce positive effects on core symptoms of ADHD (Richter et al., 1995). These positive effects have not been shown to generalize unequivocally to mood, attributional style, social behaviour, and self esteem (Alston & Romney, 1992), or play

behaviour (Hubbard & Newcomb, 1991), peer acceptance (Pelham & Bender, 1982), and aggression (Murphy, Pelham, & Lang, 1992).

In general it is recommended that medication combined with psycho-social interventions is the most appropriate treatment for children with ADHD. There is however scant evidence to demonstrate which psycho-social interventions are most effective with which children (Richter et al., 1995).

1.5 Social behaviour of children with ADHD

1.5.1 Methodological issues

Studies of social deficits in ADHD are prone to methodological limitations. For example research has utilized various operational definitions of social behaviour ranging from naturalistic to structured paradigms. Some studies examine children in free play activities (Murphy, Pelham & Lang, 1992), and others set work or problem solving tasks (Whalen, Henker & Granger, 1990; Willemsen-Swinkels & Buitelaar, 1996; Diener & Milich, 1997). Furthermore, some studies set up dyadic interactions (Hubbard & Newcomb, 1991) while others initiate group interactions (Diener & Milich, 1997). Children with ADHD are extremely sensitive to environmental contexts and therefore the type of task employed greatly influences the behaviour rated. Methods of measuring social behaviour also differ between research studies. These include the use of teacher or parent rating scales (Roizen et al., 1994), peer rating scales (Hinshaw & Melnick, 1995), and direct observation methods (Hubbard & Newcomb, 1991).

Methods of selecting children with ADHD for research also varies considerably. Children are sometimes recruited from clinical samples or they may be screened from teacher or parent rating scales. Children in contact with professional services may consist of a group with more severe symptoms of ADHD than community based samples.

1.5.2 Summary

Comparison and generalizability of research findings are limited by the diversity of measures used, the test situations, and the selection and recruitment process utilized. These methodological limitations must be evaluated with respect to the literature on social performance of children with ADHD.

1.5.3. Difficulties with social interaction

Parents frequently report concerns about poor social functioning of their children with ADHD. Barkley (1981b) reported that 81% of parents rated children with ADHD as having serious problems with social situations involving play with other children. Despite this, problems with social functioning are not recognized as a core deficit of ADHD in diagnostic manuals (APA: DSM-IV, 1994; WHO: ICD-10, 1990).

Whalen and Henker (1985) review evidence suggesting that children with ADHD act as *negative social catalysts*. That is, the presence of children with ADHD in social situations has a negative impact on the social interactions of peers, siblings, teachers and parents. Thus ADHD not only effects the behaviour of children with the diagnosis, but also the behaviour of those in contact with them.

There are several excellent reviews of the literature relating to social functioning in children with ADHD (Whalen & Henker, 1985; Guevremont & Dumas, 1994; Saunders & Chambers, 1996). The conclusions are summarized below.

In comparison with typically developing children, children with ADHD tend to engage in higher frequencies of socially undesirable behaviour. In the classroom they are often off task, non compliant, and disruptive. At home and in the play ground they may engage in negative social interchanges. Children with ADHD are often in trouble with parents and teachers, but the problematic behaviours do not always appear to be intentional. Their social exchanges are pro-social in intent but are clumsy and miscalculated, as expected of a much younger child (Whalen & Henker, 1985).

Interestingly, children with ADHD appear to interact at the same rate as other children. In fact some studies report higher than usual rates of initiated interaction for ADHD children compared with their peers. However, whilst these children are socially busy, the style, content, and situational appropriateness of these interactions are deviant. Children with ADHD tend to engage in excessive talking, interruptions, noisy interactions and other intrusive behaviour (Whalen & Henker, 1985).

ADHD is frequently associated with antisocial and aggressive behaviour patterns (Hinshaw & Melnick, 1995). This is a worrying finding as childhood aggression is a predictor of later antisocial behaviour and adult psychopathology (Hinshaw & Melnick, 1995). However aggression is not consistently associated with peer ratings of unpopularity and rejection. Hinshaw and Melnick (1995) compared children with ADHD, with and without co-morbid aggression. They found that aggression and noncompliance predominated reported reasons for rejecting age mates by the ADHD and comparison group, but social isolation was also a predictor of peer rejection for children with ADHD without co-morbid aggression.

Similarly, Wheeler and Carlson (1994) found that children with ADHD-Inattentive type were disliked more by their peers than children with ADHD-hyperactive type. They concluded that these children tended to be anxious, shy, and socially withdrawn. Thus aggression is not the sole indicator of poor social interaction and peer rejection in ADHD children.

The actions of children with ADHD often demand attention. They tend to be louder, speedier, and more forceful than their peers (Whalen & Henker, 1985). This high level of intensity is often out of synchrony with situational contexts and social expectations. However this behaviour is not impervious to environmental stimuli. Hyperactive children may get into trouble because of the unmodulated intensity of their interactions rather than because of willful acts of aggression, disruption, or opposition (Whalen & Henker, 1985).

Table 1 summarizes social behaviours that contribute to poor peer relations for children with ADHD (from Guevremont & Dumas, 1994).

Table 1: Social behaviour relating to poor peer interaction for children with ADHD

Social behaviours contributing to poor peer relationships
High rate intrusive behaviours: Excessive talking Interruptions Noisy interaction Dominating activities Monopolizing discussions Obnoxious behaviour
Deficient communication skills: Limited turn taking Less responsive to others' initiations Likely to ignore peer questions Problem's shifting roles between giving and receiving information Inappropriate or disagreeable verbal exchanges Difficulty remaining on topic Poor eye contact and motor regulation
Biased and deficient social cognitive skills: Decreased self awareness Less knowledgeable about appropriate behaviour Deficient social problem-solving skills Biased attributions of others intentions Inattentive to social cues
Poor emotional regulation: Aggressive behaviour Temper outbursts Over reaction to minor events Excitability Poor transition from one activity to another

From the previous literature review it is apparent that children with ADHD have widespread difficulties in social situations that impact on their daily lives. In the following pages theories regarding possible mediating factors of this social disability are discussed in the following order;

1. Socio-cognitive factors

- Social information processing bias
- Motivational deficits
- Social skills deficits
- Neuro-cognitive deficits

2. Theory of mind issues

1.6 Socio-cognitive mediating factors

1.6.1. Social information processing bias

A model of social information processing mechanisms that affect social adjustment of typically developing children has been postulated (Crick & Dodge, 1994; Shapiro et al., 1993). The model is summarized below.

1. *Stimulus Perception*

Social stimuli are perceived by the child and encoded via the perceptual system. Visual or auditory deficits would result from a failure at this level.

2. *Stimulus Decoding*

Meaning is attributed to the social stimuli. This might include the attribution of threat or non threat to the stimuli. A failure at this stage would result in socially inappropriate or immature behaviour, interpersonal insensitivity, naiveté, or inappropriate hostility.

3. *Behaviour Selection*

A certain set of stimuli results in a matching process for an appropriate behavioural response. For example, given a friendly greeting, an appropriate reply is searched for. Problems with this

stage of the process would result in situation inappropriate behaviour or a limited range of responding behaviours.

4. *Performance*

The behaviour selected must be understood and correctly performed. This requires verbal and nonverbal communication abilities. A failure at this stage is proposed to cause a reduced, limited, or poor performance of expressive behaviour.

5. *Feedback Evaluation/Behavioural Regulation*

The appropriateness of a selected behaviour and the effectiveness of its execution are evaluated. In effect the child attempts to work out whether the right behavior was selected and whether it was executed well enough to achieve its intended goal. This analysis requires the ability to utilize feedback from others and a capacity to accurately perceive the self. This ability requires the other four stages to be intact. The process of perceiving, decoding, selecting behaviours, and acting them out, is proposed to be a continuous cycle.

Hoza et al. (1993) found supporting evidence for the notion of cognitive processing deficits in children with ADHD. ADHD and typically developing children were not rated as significantly different on measures of self competence and self worth. However, children with ADHD were more likely to take responsibility for social successes and less likely to take responsibility for social failures than the comparison children. Despite academic failure and social rejection, children with ADHD maintained a positive illusory bias. With respect to the model of social information processing, these findings are consistent with a deficit in the feedback/evaluation stage. However the results can also be explained in terms of an adaptive self protection function. This study used the DSM-III-R diagnostic guidelines. The findings are limited by the inclusion of children with comorbid *Oppositional* or *Conduct Disorders*. Confidence that these findings are caused by ADHD and not other developmental disorders is therefore reduced.

The effect of positive feedback on boys with ADHD has also been investigated (Diener & Milich, 1997). Children with ADHD reported inflated views' of themselves and their performance in social interactions, which was inconsistent with their interacting partners

13

perception. Given positive feedback the ADHD group showed a significant decrease in their self perception, whereas comparison children showed an increase. Again these findings are consistent with deficits in social information processing at the feedback evaluation stage. Alternatively, children with ADHD may offer inflated self perceptions to counter feelings of inadequacy, but when presented with positive feedback they relax this position and offer more realistic self assessments. Thus given the right conditions a child with ADHD can accurately reflect on their own performance.

Individuals with ADHD may differ in their social judgment abilities. Whalen, Henker, and Granger (1990) asked children to rate a videotape of four boys playing a game. The participants had to press a button each time they considered that the children on the videotape had done something good or bad.

The authors concluded that judges with the most serious behaviour problems tended to identify the greatest number of negative behaviours in peers. The authors proposed that these children with ADHD found it difficult to stop themselves from giving out negative criticism due to a mechanism of disinhibition. Alternatively, the results may indicate that children with the most severe behavioural difficulties, are most prone to interpreting ambiguous events negatively. This view is consistent with a deficit in the stimulus decoding phase of the social information processing model (Crick & Dodge, 1994; Shapiro et al., 1993).

Further research has identified an attributional bias towards inferring *hostile intent* by children with ADHD (Milich & Dodge, 1984). Children were asked to explain a hypothetical peer's behaviour in a given scenario. Boys with ADHD tended to explain their peers behaviour as being more hostile than those without ADHD. Again this is consistent with a deficit in stimulus decoding.

1.6.2 Summary

A model of social information processing (Crick & Dodge, 1994; Shapiro et al., 1993) may account for the observation that children with ADHD sometimes display inappropriate or a limited repertoire of behaviour in social situations (Guevremont & Dumas, 1994). Research

indicating that children with ADHD have distorted self perception and attributional bias' can be accounted for by deficits in the stimulus decoding, behaviour selection, performance, and evaluation of feedback stages of the model (Hoza et al. 1993; Whalen, Henker & Granger, 1990).

However the model is simplistic, and these findings can be explained in other ways. For example, a self protection theory hypothesizes that children create distorted perceptions of themselves and their social performances in order to compensate for their failures.

1.6.3 Motivational deficits

Another hypothesis accounting for deficits in social performance is that children with ADHD have atypical social agendas. That is, children with ADHD are motivated by different factors when interacting socially, compared with typically developing children.

Melnick and Hinshaw (1996) studied social goals of boys with ADHD compared to typically developing children in naturalistic play settings. Small group interaction tasks designed to illicit competing goals of competition, cooperation, and having fun were instigated. Social goals were identified via observer ratings and child self reports using forced choice procedures. Social acceptance was measured using peer sociometric nominations. Results indicated that ADHD-high aggressive boys tended to seek domination, disruption, and trouble making to a greater extent than ADHD-low aggressive boys. Furthermore, children's assessment of goals prior to the play situation was predictive of their overall rating of social acceptance by peers, even when the effects of their aggressive behaviour were controlled for.

This study provides evidence that children's goals are implicated in their social standing. Goals therefore may mediate a pathway to social acceptance that is partially independent of children's actual behaviour. However, the study was limited by the relatively small sample sizes of 27 ADHD children and 18 control children. The data collected was correlational, which prohibits the inference of causality.

Children with ADHD may be less successful at generating social scripts, and as a result are hindered in their social exchanges (Whalen & Henker, 1985). This problem is magnified in unfamiliar social situations where children with ADHD experience greater difficulties mastering role and task requirements and regulating their social communication (Hubbard & Newcomb, 1991).

1.6.4 Summary

Children with ADHD may have social goals that differ from typically developing children (Hubbard & Newcomb, 1991; Melnick & Hinshaw, 1996). This has led to the hypothesis that their difficulties with social interactions in part derive from deviant motivations in social situations. However a causal pathway has not been established. It is equally likely that children with ADHD cope with the associated symptoms of hyperactivity, impulsivity, and inattention by creating alternative goals in social interaction that they are more able to attain and therefore find more rewarding.

1.6.5 Social skills deficits; knowledge versus performance

Social skills are defined as situationally specific behaviours that determine valued social outcomes (Frederick & Olmi, 1994). Such outcomes may include peer acceptance; teacher, peer, or parent judgments of social skills; academic achievement; and other behaviours correlating with these outcomes.

A plethora of literature indicates that children with ADHD exhibit deficits in social skills, however there is debate regarding the nature of this deficit. Some researchers assert that the deficit involves lack of knowledge (Grennell, Glass & Katz, 1987; Hubbard & Newcomb, 1991) while others argue for a primary deficit in performance (Shapiro et al., 1993).

Hubbard and Newcomb (1991) found that non ADHD dyads progressed from solitary or rough and tumble play to more constructive play, but that ADHD/non ADHD dyads tended not to progress from these lower to higher levels of play. The ADHD/non ADHD dyads were also characterized by greater levels of social withdrawal following an aggressive incident. The

authors argue that this finding is accounted for by the ADHD child's lack of knowledge about how to deal with conflict. Alternatively it may be due to the non ADHD child's reaction to aggressive episodes, the ADHD child's attributional bias of hostile intent, or it may serve a function of self control and protective retreat.

Other studies report that children know what to do in social situations, but seem unable to perform the correct behaviour. For example, children with ADHD process emotional information adequately, but could not apply this information to new situations or in similar situations across time in a study by Shapiro et al. (1993).

Children with ADHD may have difficulty in learning task and role requirements in unfamiliar social situations (Whalen & Henker, 1985). There is some empirical support for this hypothesis in vicarious social learning situations. Whalen et al. (1979) found that children with ADHD did not seem to benefit as much as their peers from the opportunity to observe another youngster in a difficult role before playing this role themselves. Participants with ADHD perseverated in using similar verbal messages across two separate roles compared with typically developing children. Whalen et al. (1979) concluded that children with ADHD have difficulty learning and adapting to new role requirement particularly when vicarious learning and subtle acquisition processes are involved.

1.6.6 Summary

There is a plethora of evidence to suggest that children with ADHD have deficits in social skills. The research literature continues to debate whether this deficit results from a lack of knowledge or a difficulty with performing the necessary skills. However, the proposition that children with ADHD show deficits in either social skills performance or knowledge need not be mutually exclusive. Also considering the heterogeneity of the group of children under the umbrella term ADHD, it is possible that individuals differ with respect to whether this deficit is present and at what level.

1.6.7 Neuro-cognitive deficits

Behavioural symptoms of ADHD and the associated social difficulties have not been adequately explained in a model. Barkley (1997) developed a more comprehensive theory encompassing neurological, developmental, and evolutionary perspectives. Attention deficits occur in many childhood disorders (e.g. autism and learning disabilities) therefore any theory needs to explain the uniqueness of the attention problems in ADHD.

Barkley posits that the fundamental deficit in ADHD is one of self regulation over time. He believes that behavioural inhibition is a foundation stone for the cognitive processes required to develop more complex executive functions. Executive functions include planning, organizing, goal oriented, and self directed behaviour. The theory asserts that poor self inhibitory functioning of children with ADHD is causally related to poor executive functioning. Barkley outlines four executive functions that have a role in the development of self regulatory behaviour.

1. *Non-verbal working memory*: This cognitive process allows information to be held in mind and used to guide subsequent responses to events. As working memory develops, children become adept at manipulating information. However, children with ADHD are often reported to have problems with computation and mental calculation; Parents frequently report that children with ADHD are forgetful; children with ADHD seem to know what to do in situations, but are forgetful of what to do (Barkley, 1997).

2. Internalizing of speech, or *verbal working memory*: Barkley argues that the process of internalization of speech is a source of human self regulation and the basis for human thought. Reading comprehension requires a person to talk to themselves and hold meaning in mind. Thus it utilizes both verbal and non verbal working memory. This theory predicts that children with ADHD will have problems with reading comprehension and moral reasoning.

3. *Self-regulation of affect, motivation, and arousal*: This allows the generation of an internal drive state that can propel future directed behaviour. Barkley posits that motivation is synonymous with emotional states.

4. *Reconstitution*: Reconstitution is a process subdivided into two constituents. First analysis, in which old behaviour is examined and then broken apart into units of behaviour. The second is synthesis, a process of recombining fragments of old behaviour into novel behaviour not previously reinforced. Deficits in this ability may explain why some children with ADHD have problems with creativity and verbal fluency (Barkley, 1997).

Finally, Barkley (1997) distinguishes between two forms of persistence shown by all humans. *Contingency shaped behaviour* is behaviour predominantly influenced by the environment and is task dependent. This responding is intact for children with ADHD. *Goal directed persistence* is a more advanced process, biologically and developmentally, by which humans become influenced and motivated by internal persistence. Children with ADHD are predicted to be poor at *goal directed persistence* .

This is an important distinction in Barkley's theory. It accounts for observations that children with ADHD are able to concentrate for hours in some situations, such as in front of a computer game, but are unable to sustain this level of concentration at other times, such as when undertaking homework assignments. This phenomenon often leads children with ADHD to be labeled as willfully absent minded, with the implication that they choose when and when not to attend. This theory accounts for situational variability in the behaviour of children with ADHD without this detrimental label.

Evidence that supports Barkley's theory is reviewed in detail in Barkley (1997). However the studies described earlier provide some supporting evidence. For example the tendency of children with ADHD to perseverate in their verbal communications in different roles (Whalen & Henker, 1993) is consistent with Barkley's proposal of deficits in reconstitution abilities.

Furthermore, the observation that children with ADHD tend to display poor emotional regulation in the form of aggressive behaviour, temper outbursts, excitability, and over reactions to minor events (Guevremont & Dumas, 1994) is consistent with the proposition that the internalization of affect to produce internal drive states is delayed or deficient.

However the theory is limited in a number of ways. First, the precise developmental process of the executive functions is not well established. Second, the neurological and psychological mechanisms associated with the internalization of public behaviour have not been studied. Third, it is unclear whether there exists any cultural or gender differences in the development of these executive functions.

1.6.8 Summary

Barkley (1997) has produced a comprehensive model to account for social and cognitive deficits found in children with ADHD. It represents a huge leap forward from the descriptive and atheoretical diagnostic manuals (DSM-IV, 1994; ICD-10, 1990). The theory produces testable hypotheses, and already there is some evidence to support various aspects of the theory (Barkley, 1997). However the theory has several limitations and requires further experimental investigation.

1.7 Theory of mind

Not one of the mediating factors reviewed previously adequately accounts for all social difficulties observed in children with ADHD. It is possible that a socio-cognitive process not studied in these children may be implicated in their problematic social interactions.

The concept of theory of mind (ToM) was developed by researchers studying *autistic spectrum disorder*. Autism is defined as a biologically based disorder with its site of damage in the brain. The disorder is apparent from early childhood and affects sociability, verbal language, nonverbal communication, and symbolic play (DSM-IV, APA 1994).

Theory of mind is defined as the ability of individuals to attribute mental states such as beliefs, desires, thoughts, and intentions to oneself or other's in order to make sense of and predict behaviour and thoughts. Mitchell (1997) has written a thorough review of the research relating to ToM and discusses the concept in terms of an evolutionary perspective. The ability to guess what others are thinking from knowledge of what they have observed would confer obvious advantages for individuals in biological terms. The social context of human evolution

puts great emphasis on the capacity for individuals within social groups to communicate in order to increase survival chances. Communication is greatly facilitated by the ability to be sensitive to contextual issues. In everyday communication we question why a speaker tells us what they do, and interpret what they say accordingly.

The development of the ToM concept led to an explosion of research into social impairments of autism, mind reading capacities of non-human primates, and the development of social understanding of 'normal' children (Frith & Happé, 1994; Mitchell, 1997).

1.7.1 Theory of mind and autism

The concept of ToM was first applied to the study of autism by Baron-Cohen, Leslie, and Frith (1985). They predicted that autistic children should not be able to understand that a person can have a mistaken belief. This prediction was tested out using the Sally-Ann paradigm (a first order theory of mind task) in which two puppets act out a scene. The scene develops so that one puppet becomes aware that the other puppet holds a false belief about the location of a marble. The experimenter asks the child about the puppets beliefs at the end of the procedure, if their answer indicates awareness of the puppets false belief, the child is said to have a theory of mind, and vice versa.

The original study reported that 80% of autistic children, with a verbal age of 4 years and a non verbal mental age of 9, could not answer the ToM question. However, approximately 80% of 'normal' 4 year olds and Down syndrome children with a lower mental age than the autistic children answered the ToM question correctly. It was concluded that autistic children, over and above any general intellectual disability, fail to attribute mental states such as false beliefs.

This seminal study attracted two major criticisms regarding methodological rigor. First, since children with autism illustrate deficits in imagination and make believe play, it was suggested that the results of Baron-Cohen, Leslie, and Frith (1985) were due to the need for the child to become immersed in a story that required them to suspend disbelief. Second, a related criticism was that since Sally-Anne is merely a puppet she has no mind and therefore the

question concerning the content of her beliefs makes no sense to a child with autism (De Gelder, 1987).

Leslie and Frith (1988) overcame these methodological problems by creating a real life test involving a similar procedure of unexpected transfer of false belief. This involved two researchers being in the company of a child. All three participants cooperate in depositing a penny under an upturned cup. One researcher then leaves the room, and while gone the other researcher, observed by the child, transfers the penny to another upturned cup. When the researcher returns the child is asked to predict where the researcher would look for the penny. The majority of children with autism predicted wrongly that the researcher would look under the cup where the penny was currently hiding (Leslie & Frith, 1988).

Another commonly used first order ToM task is called the Smarties test (Perner et al., 1987). This is an example of a deceptive box paradigm. A child is shown a Smarties tube and asked what is in it. They usually reply "Smarties" or "sweets". The experimenter then opens the lid and reveals to the child that the tube contains a pencil. The tube is then closed with the pencil inside. The child is asked to predict what another person, who has not seen the tube, would think it contained. Perner et al. (1989) presented this task to children with autism and found that the majority of children wrongly judged what another child would think was in the tube. They also failed to acknowledge their own prior false belief. 'Normal' children age 5 years however were able to answer this question correctly.

The ToM hypothesis has been translated into many different experimental paradigms and researched thoroughly. Happé (1995) has produced a thorough review of this literature. Research paradigms are conceptualized in terms of first and second order ToM tasks. Baron-Cohen (1989c) conducted a second order ToM test with autistic children. This test was designed to assess whether children understand that people hold beliefs not just about reality, as with first order ToM tasks, but also about other people's beliefs. The scenario is presented as a story known as the Ice-cream Van test. Baron-Cohen (1989c) found that most children over 7 years of age correctly answer second order false belief questions. However, children with autism, even those who are able to answer first order false belief questions correctly, were unable to pass second order ToM tasks.

22

Happé (1994) has developed an advanced test of ToM with a set of stories which require a child to answer questions regarding story characters' thoughts and feelings. The stories consist of vignettes of everyday situations where people say things that they do not mean literally. This was an attempt to create a more naturalistic test of ToM. When presented to autistic children their scores on the stories differentiated between control and autistic children. Furthermore the stories also differentiated between children with autism who failed ToM tests, passed first order ToM tests, or passed first and second order ToM tests.

Although there have been some contrary findings regarding the status of children with autism on ToM tasks (Dahlgren & Trillingsgaard, 1996; Yirmiya et al., 1996) the majority of experimental evidence since Baron-Cohen, Lesie, and Frith's (1985) original Sally-Ann test has strongly confirmed the deficit in ToM account for autistic children (Frith, 1996).

1.7.2 Summary

Experimental paradigms designed to investigate ToM are split into first order, second order and advanced test of ToM. The Smarties test (Perner et al., 1987) is frequently used as a first order ToM measure and the Ice-cream Van test (Baron-Cohen, 1989c) has been extensively utilized as a second order ToM test. Happé (1994) has recently designed a complex test of ToM that is more ecologically valid than other experimental paradigms. Previous research of typically developing children indicates that they are able to easily pass first order tests at the age of 5 years (Perner et al., 1989) and second order tests at the age of 7 years (Baron-Cohen, 1989c). 'Normal' children of 6.6 years and over were also able to complete Happé's advanced test of ToM.

1.7.3 Autism and theory of mind in everyday life

Much of the research reviewed in the previous section has utilized experimental paradigms to study ToM functioning of autistic children. Evidence of how this translates into everyday life is scarce. However Frith, Happé, and Siddons (1994) have investigated this area with the

Vineland Adaptive Behavior Scales (VABS) to measure real life social adaptation via caregiver reports.

The study compared 24 autistic children (aged 7.10-19 years), 15 'normal' children (aged 4.0-5.1 years), and 11 learning disabled children (aged 7.2-10.1 years). The measures used included the British Picture Vocabulary Scales (BPVS), two first order ToM tasks, and the VABS with supplementary social and maladaptive items. Social behaviours were categorized as interactive if they required a child to have a ToM capacity, and active if the social behaviour could be adequately accounted for in terms of a learned behaviour.

Overall, autistic children who passed false belief tasks showed more everyday social insight, but not more simple learned sociability, than those who failed. Children with autism who passed ToM tasks also demonstrated higher levels of interactive social behaviour as well as antisocial behaviour than those who failed.

The authors distinguished three sub-groups within the autistic group. First, 16 children who did not pass the ToM tests and who showed little interactive social behaviour in real life. Second, 5 autistic children who passed the ToM tests, but showed limited interactive social behaviour in everyday life. It was suggested that this group had used a strategy of passing the ToM tasks which did not require an understanding of minds, and thus they were still impaired in everyday functioning. Third, a group of 3 autistic children passed the ToM tasks; they showed evidence of being able to represent mental states in the laboratory and in real life situations. Nevertheless this third group were still characterized by poor social adaptation compared to the learning disabled and 'normal' children.

1.7.4 Summary

Autistic children's ToM abilities have been investigated in a limited number of studies with respect to everyday social functioning. Frith, Happé, and Siddons (1994) developed a methodology that was sensitive enough to discriminate between three groups of children with autism. First, those who failed ToM tests and showed little evidence of social behaviours requiring a ToM in everyday life. Second, those who passed first order ToM tests but showed

a limited repertoire of social behaviour's requiring a ToM. Third, a small number of individuals who passed the ToM tests and demonstrated social behaviour consistent with ToM abilities, although they were still rated as socially impaired in comparison with control children.

This research was well designed but limited by small sample sizes and absence of second order ToM tasks. The relationship between laboratory studies of ToM functioning and social behaviours in everyday life is an area of research that requires further investigation.

<u>1.7.5 Criticisms of the theory of mind hypothesis</u>

The major criticism of the ToM account of autism is that it does not account entirely for all deficits found in the disorder. Frith and Happé (1994) acknowledge that the theory is silent on functioning in non-social areas. Many children with autism appear to show restricted repertoire of interests, obsessive desire for sameness, islets of abilities, good rote memories, or preoccupation with parts of objects. These characteristics are not accounted for by a lack of ToM.

Furthermore, some researchers question why a small percentage of children with autism consistently pass ToM tasks in experimental conditions (Holroyd & Baron-Cohen, 1993). This seemingly disputes the hypothesis that a deficit in ToM abilities is a core feature of having autism.

Happé (1995) investigated the role of age and verbal ability in autistic children's performance of ToM tasks. The analysis suggested that children with autism who passed false belief tasks had far higher verbal mental age scores than comparison children. She proposed that children with autism who pass ToM tasks have developed compensatory verbally mediated strategies which do not require an appreciation of minds.

Klin et al. (1992) conducted a study to examine the extent to which the ToM hypothesis could account for social disabilities in autism. They utilized the Vineland Adaptive Behavior Scales,

a measure of adaptive functioning assessed from parent or teacher report. The authors concluded that children with autism show impairments of very basic social functioning prior to the emergence of the earliest precursors of a ToM.

Most research of ToM concepts in children with autism has relied on laboratory or experimental paradigms. The majority of ToM tests ignore the concept of ecological validity, although Frith, Happé, and Siddon's (1994) study attempted to increase the understanding of how ToM is related to social difficulties in everyday life. This research limitation is addressed in the present research design.

1.7.6 Summary

The concept of ToM as the core deficit that accounts for all idiosyncratic behaviours exhibited by children with autism is criticized. It is likely that autism, in a similar way to ADHD, is caused by different aetiological pathways in individuals (Happé, 1994). However ToM is a concept that is useful in understanding the role of mentalizing in social behaviour, although further investigation is required.

1.8 Relevance of theory of mind to ADHD

Why should the concept of ToM be applied to children with ADHD? There is some evidence of an overlap between different childhood developmental disorders, and a need for clearer diagnostic guidelines. Furthermore, ToM has been investigated in other clinical groups apart from autism to a limited degree. Thus the concept is not exclusive to the autism literature. These points are expanded in the following sections.

1.8.1 Disorders of empathy

Within the literature there is debate over the classification of autism as a separate disorder from other childhood syndromes. For example, Gillberg (1992) reviews evidence disputing the conceptualization of autism as a discrete disease entity with one aetiology and favours the

view that it is one of several syndromes on a spectrum of autism and autistic-like conditions. He proposes that a new class of disorders of empathy be recognized.

Gillberg (1992) discusses the evidence for an overlap between Aspergers syndrome (sometimes known as high functioning autism) and semantic pragmatic disorder. Semantic pragmatic disorders are common in children with deficits in attention, motor control and perception (DAMP). Some children with DAMP also meet the criteria of hyperkinesis which is the ICD-10 version of ADHD. Hyperkinetic children therefore may or may not display autistic features.

Gillberg (1992) defines empathy as the ability to conceptualize other people's inner worlds and to reflect on their thoughts and feelings. Good empathic skills therefore require a well developed ToM. In fact Gillberg (1992) suggests that autism and Aspergers syndrome could overlap with other disorders of empathy such as obsessive compulsive disorder, some cases of anorexia nervosa, Tourettes syndrome, and paranoid disorders. He suggests that autism is perhaps the most severe form of empathy disorder.

1.8.2 Diagnostic issues

The dilemma facing clinicians involved in diagnosing childhood disorders is reflected in published case studies. For example, Porter et al. (1992) present the case of an 8 year old child who's initial diagnosis was a learning disability with associated attention disorders and hyperactivity. Later development of abnormalities in social interaction and play lead to a reassessment and subsequent diagnosis of autistic spectrum disorder.

Attwood (1998) in his recent book about Asperger's syndrome concludes that recent research suggests one in six children with Asperger's Syndrome also have clear signs of ADHD. The two conditions may have specific differences, but there are some similarities and a child can have a dual diagnosis and require treatment for both.

1.9 Theory of mind in other clinical disorders

Studies which examine ToM functioning in clinical groups other than autism are increasing. Corcoran (in press) focuses on schizophrenia, which she has studied with respect to first and second order ToM abilities. She found that schizophrenics with negative symptoms did as badly as autistic individuals on ToM tasks. Furthermore, individuals exhibiting paranoid delusions did not show ToM deficits as great as for those with negative symptoms, and the problem tended to be specific with no other cognitive difficulties with memory or social semantics. Remission of paranoid delusions was associated with a return to average performance on ToM tasks.

Corcoran concluded that the ToM deficit associated with schizophrenia was different in origin to that of autistic individuals. The core deficit in schizophrenia may lie in the use of previously acquired information and/or reasoning abilities. In contrast the deficit in ToM functioning of autistic individuals is characterized as highly selective and independent of other cognitive skills.

Corcoran also reviews evidence of ToM deficits in people with personality disorders and neurological problems, particularly frontal lobe epilepsy. Furthermore, support of poor ToM functioning in children with developmental disorders comes from Happé and Frith's (1996) study of children with conduct disorders. Since many children diagnosed with Conduct Disorder often have co-morbid diagnoses of ADHD, this investigation is of particular relevance to the present study and requires further discussion.

1.9.1 Theory of Mind in children with conduct disorder

Children with conduct disorder (CD) are characterized by a repetitive and persistent pattern of behaviour in which the basic rights of others, or major age appropriate societal norms, are violated (APA; DSM-IV, 1984). Happé and Frith (1996) investigated 18 CD children (16 boys and 2 girls) aged 6 to 12 years. They compared children's performance on standard false belief

first order ToM tests and questionnaire measures of social behaviour, with the performance of 8 control children.

The questionnaire measures used included the Vineland Adaptive Behavior Scales, which assesses a child's strength and weaknesses on communication, daily living skills, socialization, and maladaptive behaviour. Happé and Frith also devised supplementary items to this scale which they categorized as *active sociability* and *interactive sociability* (See also Frith, Happé & Siddons, 1994).

Active sociability is defined as social behaviour performed without the necessity of mentalizing skills. An example of a behaviour rated as active sociability was 'shows a desire to please'. It was deemed that this behaviour could be learned based on behavioural contingencies. *Interactive sociability* is defined as social behaviour requiring the attribution of independent mental states. For example, 'Chooses appropriate present'; this requires a child to consider the recipient's feelings and thoughts. Other measures included were the British Picture Vocabulary Scale (BPVS) which assesses verbal abilities, and the Smarties test of first order ToM.

Results confirmed that all participants passed first order ToM tasks. Interestingly, analysis of the data from the VABS and supplementary items revealed significant differences between the two groups. The comparison children scored significantly higher on the communication and socialization domains of the VABS, but not on the daily living skills domain. The communication domain can be further deconstructed into expressive, receptive and written communication. Children with CD were not impaired in expressive communication, but obtained lower scores for receptive communication compared with non CD children. Also CD children were significantly impaired in written communication skills compared with control children. Further still, the CD children attained significantly worse scores on all of the socialization domains compared with control children.

Analysis of the supplementary items revealed that over half of the CD children scored poorly on interactive sociability items compared with only one of the control children. However,

there were no between group differences on active sociability items. CD children who were impaired on interactive sociability were not significantly different from the control children on verbal ability or chronological age. Finally, the CD group demonstrated significantly more reports of antisocial behaviour but not bizarre behaviour, compared with control children.

The authors concluded that children with Conduct Disorder have marked and widespread deficits in real life social behaviours. These deficits are particularly striking in behaviours that presuppose a well functioning ToM. The results were compared to those of children with autism who passed ToM tasks. Though the results are not indicative of an absolute lack of mentalizing ability, this poor functioning in everyday life requires further explanation.

Research indicates that some children with ADHD develop hostile attributions about social interactions (Hubbard & Newcomb, 1991). It is possible that children with CD have intact ToM abilities but are skewed towards a theory of 'nasty' minds. This is perhaps in part reflective of the child's reality. However, Happé and Frith (1996) point out that this theory is not sufficient to account for some items which children were rated poorly on such as "lacks imaginative play". Maybe children with CD, and this perhaps can also apply to children with ADHD, have a delay in their understanding of other's minds.

This theory is not sufficient to explain why individuals develop CD's. The interaction between environment and cognitive factors has not been evaluated. Frith and Happé make links between the poor executive functioning apparent in ADHD, CD, and autism as a possible mediating factor. This is consistent with Barkley's (1997) theory of executive impairments in children with ADHD.

Many children with CD's also have difficulty with attention and impulsivity. In fact ADHD and CD's frequently co-exist and there is debate regarding the distinction between the two diagnostic groups (Foley et al., 1996; Taylor et al., 1986). Therefore these results may in part be explained by the presence of hyperactivity, impulsivity, and inattention. As yet ToM functioning in children with ADHD has not been studied.

Frith and Happé's (1996) study was limited by the small sample size of the comparison group. The study failed to include second order ToM tasks and more naturalistic assessments of children's ToM functioning in everyday life. The present study attempts to address some of these methodological limitations when investigating ToM abilities of children with ADHD.

1.9.2 Summary

Gillberg (1992) disputes the conceptualization of autism as a discrete disease entity with a single aetiology. He argues that autism is one of several syndromes on a spectrum of autism and autistic-like conditions. He proposes a new class of disorders of empathy. The co-morbidity of empathy disorders including Asperger's syndrome and semantic pragmatic disorder suggest that ADHD might be placed within this spectrum of empathy disorders.

ToM abilities have been investigated in a number of clinical groups including, schizophrenia, personality disorders, epilepsy, and conduct disorders. However ToM abilities in children with ADHD has not been explored.

1.10 Rationale for study

A study of the ToM abilities in children with ADHD is of research and clinical interest for a number of reasons. First, the study will provide further evidence of ToM functioning in a clinical population thus far not studied. A review of the literature on ToM has revealed that it has been inadequately investigated in clinical populations other than autism. Studying ToM functioning in children with developmental disorders, in particular with ADHD, may enable further explanations regarding how children mentalize, and what happens when this process fails, is delayed, or deviant. At present, theory of mind ability is conceptualized as a single selective cognitive process of meta-representation. Evidence rejecting this notion may lead to plausible alternative models of theory of mind functioning.

Second, with respect to children with ADHD, understanding the nature of their ToM functioning may promote a fuller appreciation of the condition. Of particular interest is the relationship between ToM and social functioning. The problems children with ADHD have in

their social worlds is very much demoted to a secondary by product of their core symptoms within the literature, despite concerns of parents and teachers. If it is found that these children have problems understanding other people's thoughts and beliefs, it is probable that this has a major impact on their social interactions. This finding would have two major secondary implications. First it could aid diagnostic precision, and second it could help to inform subsequent individualized intervention plans.

A third implication of this study is that the methodology may be adapted as an outcome measure as well as a diagnostic instrument, to assess the effectiveness of interventions designed to ameliorate ToM deficits. The methodology is designed to assess a graded spectrum of increasingly complex levels of ToM abilities, including experimental and more ecologically valid paradigms. This is an objective sorely lacking in most of the research reviewed.

1.11 Hypotheses

1.11.1 Hypothesis one

Previous research of children with CD's (Happé & Frith, 1996) found that they could easily pass first order ToM test. Since there is an overlap between diagnosis of CD and ADHD it was hypothesized that the children in the present study too would pass a first order ToM task.

Second order ToM tasks have not been administered before to children with ADHD or CD in a published study. However there is some evidence which suggests that children with ADHD share similarities with individuals with autism in their difficulty with empathy and understanding others' motives in social situations. It has been proposed that children with ADHD have a mild form of empathy disorder (Gillberg, 1992). Thus in the present study it was hypothesized that children with ADHD would fail a second order ToM task.

1. Children with ADHD will pass a first order theory of mind tasks (the Smarties test), but will show impaired ability on a second order theory of mind task (the Ice-cream Van test) compared with control children.

The evidence reviewed also suggests that children with autism, who have problems with ToM tasks, have associated difficulties in their everyday social functioning (Frith, Happé, & Siddons, 1994). Furthermore, some evidence from children with Conduct Disorder (some of whom may have had co-morbid diagnoses of ADHD) suggests that they too have specific difficulties in social functioning consistent with a deficit in their ToM functioning (Frith & Happé, 1996).

2. Children with ADHD will demonstrate impairments in social reasoning consistent with deficits in theory of mind abilities (measured by the Strange Stories; Happé, 1994) compared with control children.

3. Parents of children with ADHD will report evidence of impaired social behaviour in their child, consistent with difficulties in theory of mind functioning, compared with control children (measured by domains of the VABS and the Social Behaviour Questionnaire).

1.11.3 Hypothesis four

With respect to the literature on autism and ToM, it has been found that individuals who pass ToM tasks have higher verbal abilities than those who fail (Happé, 1995). Within the present study the relationship between ToM research variables and verbal abilities will be investigated.

4. Verbal ability of children with ADHD will be positively associated with their performance on theory of mind tasks and their everyday social functioning.

2.0 METHOD

2.1 Design

The research was a two group comparison design. The ADHD group consisted of 17 children, and the control group consisted of 20 typically developing children. Child participants were all male, of normal range intelligence, between the age of 7 and 12 years old. Presence or absence of an ADHD diagnosis constituted the independent research variable. The dependent variables included children's ability to pass ToM tests and measures of their social functioning in everyday life. In order to control for possible confounding variables' data were collected regarding family socio-economic status, children's verbal and non verbal abilities, and their treatment status.

Previous research into ToM concepts in other clinical disorders, such as autism and schizophrenia, have utilized similar research designs (Happé & Frith, 1996; Corcoran, in press). These studies successfully identified differences between clinical and control groups using ToM measures.

Figure 1: Summary of research design.

Dependent variables

Independent Variables → Control Group → ADHD Group →

| 1st order ToM task. |
| 2nd order ToM task. |
| Advanced test of ToM. |
| Social functioning in everyday life requiring a ToM. |
| Communication skills. |
| Socialization skills. |
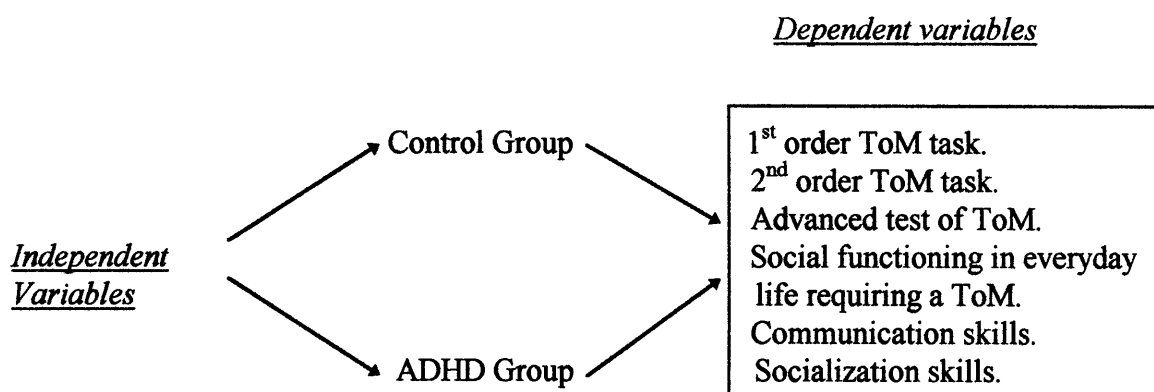
2.2 Participants

2.2.1 ADHD group

Seventeen boys, aged 7.11 - 12.3 years (Mean age = 10.10 years; SD = 1.51 years) with a diagnosis of ADHD took part in the study. Only boys were included in the study to eliminate possible sex differences. Children were selected in consultation with the Clinical Psychologist at a Child Development Centre. The following inclusion and exclusion criteria applied;

1. Only boys between the age of 7 and 12 years were considered.

2. The children had undergone full developmental assessments including psychometric assessments by a Psychologist, medical assessments by a Paediatrician, and assessments by a speech and language therapist.

3. The child's case had been discussed at a multidisciplinary case conference with the conclusion that they displayed symptoms of ADHD consistent with the DSM-IV guidelines. The ADHD rating scale-IV (Home version; Dupaul et al., 1998) was also administered to parents as a 'double' check on the presence of symptoms of ADHD.

4. Eleven of the children had specific learning difficulties and seven had behavioural problems. These children were not excluded from the study as ADHD often co-exist with these difficulties. It would have been problematic to obtain a 'pure' sample of children with ADHD in sufficient numbers for the study.

5. Children were selected only if they had intellectual abilities within the normal range, as assessed by the Consultant Clinical Psychologists psychometric assessment.

6. All but two of the children were being treated with stimulant medication. Again the use of medication was not used as an exclusion criteria because this would have dramatically reduced the sample size available to the study. The fact that children were using stimulant medication if anything should act against the hypotheses. Therefore the use of medication may reduce the risk that the hypotheses will be accepted on false grounds.

2.2.2 ADHD group recruitment

Parents of children identified as possible participants were sent a letter and information regarding the study (Appendix 1 & 2). They were subsequently contacted by telephone and asked if they agreed to participate. From the originally identified sample of 20 children, 3 did not agree to take part. One child had undergone multiple assessments and did not want further contact with services. Another parent and child initially agreed, but the appointment was cancelled due to unforeseen personal circumstances. In the third case, the parent and child were not contactable by telephone and they did not respond to a written invitation to participate.

The majority of parents and children contacted (85%) were agreeable to participating in the research. This high rate of selection may have been due to two factors. First, parents of children with ADHD were enthusiastic about research into the disorder. They recognized that in the long term this may help others coping with ADHD. Second, the selection process involved direct telephone contact with the researcher. This may have allayed participants concerns about the study, as they were able to ask questions before agreeing to take part.

2.2.3 Control group

The control group consisted of 20 boys. Their parents reported that they did not have developmental, emotional, or behavioural problems. Control children's age ranged from 7.10 - 11.4 years (Mean age = 9.2 years; SD = 1.17 years). The following inclusion and exclusion criteria were used with this group;

1. The children were all boys between the ages of 7 and 12 years.
2. Children were excluded from the study if their parents reported that they had learning, emotional, behavioural, medical, or psychiatric problems.

2.2.4 Control group recruitment

The researcher contacted a local primary school. The headmaster agreed to children from the school participating in the study subject to parental consent. A letter of introduction and information about the study were sent to the homes of 153 boys aged 7-12 (Appendix 3 & 4). Parents and children who agreed to further contact from the researcher returned a reply slip to school. The school then provided names and telephone numbers of parents who could be contacted.

Out of the 153 letters sent out, 24 replies were returned confirming that the researcher could contact the family. This reply rate (15.7%) was disappointing compared with that of the ADHD group. Informal feedback from parents of children who did participate indicated that they tended to have experience of ADHD or other childhood developmental disorders. For example one parent was a youth worker interested in ADHD, one was a member of the parents committee at the school, another had a younger child with Autism, and others had relatives or friend with a child diagnosed with ADHD.

Following the receipt of a list of possible participants, the researcher contacted individuals to explain more about the study. Parents were asked whether their child had any learning, behavioural, or developmental problems. Of the 24 families contacted, 2 were excluded from the study because the child was receiving input from health professionals. One child had Asperger's syndrome and the other moderate learning difficulties.

The researcher arranged appointments with the remaining 22 families. On meeting the participants a further 2 were excluded from the study. In these cases parents divulged that one child suffered emotional problems, and the other displayed behavioural and learning difficulties. The parents had not offered this information at an earlier stage because they wanted advice from a psychologist about their child. The researcher gave these parents information about agencies that could provide them with assessment and advice regarding their concerns.

2.2.5 Socioeconomic status (SES)

All children were recruited from the same town in the Midlands, which is a predominantly working and middle class area. Socioeconomic status was measured using parent's occupations, as recommended by the Governmental statistic's service (HMSO, 1991). A one sample chi-square test revealed no significant differences between the number of cases in each SES category ($\chi^2 = 9.9$, df = 4, ns).

2.2.6 Ethnicity

All of the participants were of white British origin. This is typical of the population living in the area from which participants were recruited. Whilst the limited range of ethnic diversity within the groups may reduce the generalizability of findings to other populations, the lack of difference ˙between the groups ensures that ethnicity is not a confounding variable for subsequent acceptance or rejection of the hypotheses.

2.3 Measures

2.3.1 Background questionnaire (Appendix 5)

The researcher developed a background questionnaire. Information about the child's date of birth, medical history, and the family's circumstances were thus obtained. A rating of families SES was based on the standard occupational classification scales from the office of population census and surveys (HMSO, 1991). Fathers' occupations were used to compute SES. However, where the father was absent or the mother was employed in a job representing a higher SES, mothers' occupations were classified. Social class based on occupation were categorized as follows;

I   Professional occupation

II   Managerial and Technical occupation

III   Skilled occupations (including manual and non manual)

IV   Partly skilled occupations

2.3.2 Vineland Adaptive Behavior Scales - Survey Form (Sparrow, Balla & Ciccetti, 1984)

Aim of measure

This measure provides norm referenced information about the strengths and weaknesses of an individual's adaptive behaviour. Extensive use of the VABS in previous research provides wide ranging information about its validity with children who have developmental disorders (Frith, Happé & Siddons, 1994; Happé & Frith, 1996). The questionnaire is administered as a semi structured interview to someone who knows the child well. The survey form consists of five sub-domains, but the present study includes only the Communication and Socialization domains. These two subscales took approximately 20 minutes to administer.

The Communication domain measures what an individual understands (receptive), what they say (expressive), and what they can read and write (written). The Socialization domain measures how an individual interacts with others (interpersonal relationships), plays and uses leisure time (play and leisure time), and how they demonstrate responsibility and sensitivity to others (coping skills).

Scoring

Item's scores on the measure reflect the frequency with which an individual exhibits certain behaviour. A score of 2 indicates "yes, usually", a score of 1 "sometimes or partially", and a score of 0 "no, never". If a respondent has not observed the individual performing an activity, N is scored. Similarly if the respondent does not know whether the individual performs the activity DK is scored. Each domain produces a standard score which relates to the mean scores for individuals of the same age range (mean = 100, SD = 15).

Standard scores are normally distributed. Therefore, 68% of 'normal' individuals obtain scores between 70 and 130. Many psychometric tests utilize standard scores because, unlike

percentile scores, they have the advantage of being equal units across the full range of scores. This property makes them easy to manipulate statistically.

Psychometric properties

The VABS has been standardized extensively on a representative sample from the USA of 3,000 individuals from birth to 18 years 11 months. The scale has well established reliability and validity. Sparrow et al. (1984) review studies of the internal, test retest, and inter-rater reliability for the VABS. Reliability coefficients range from 0.62 to 0.86. Evidence of adequate construct, content, and criterion related validity for the Vineland is reported in the survey form manual (Sparrow, Balla & Cicchetti, 1984).

2.3.3 The social behavior questionnaire (Appendix 6)

Aim of measure

The researcher developed a Social Behaviour Questionnaire to measure the presence of social behaviours in children's everyday life which require a well functioning ToM. Whilst there are a number of well standardized measures of social behaviour in the academic literature, none of them specifically aim to distinguish between behaviour requiring a ToM and behaviour not requiring a ToM.

Items on the questionnaire were generated from various sources. These included the supplementary items of active and interactive sociability from Frith, Happé, and Siddons (1994) study, and Baron-Cohen's examples of the ToM deficit in autism developed from clinical experience (Baron-Cohen & Howlin, 1993).

Originally this questionnaire incorporated items under the following headings.
1) Behaviour requiring knowledge of other's mental states
2) Behaviour not requiring knowledge of other's mental states
3) Behaviour that is antisocial or indicates a lack of social conformity
4) Behaviour that is bizarre or idiosyncratic.

40

Scoring

Parents were asked to rate the frequency of a child's behaviour in each item on a likert scale. A respondent indicated whether a behaviour occurs never, rarely, occasionally, often, or very often. Each questionnaire item scores between 0 and 4, a high score indicated that the behaviour occurs frequently and a low score that it occurs infrequently.

Content Validity

The questionnaires content validity was subsequently assessed to show that, given the criteria for each sub scale, other professionals would categorize the items in a similar way to the researcher. This process involved contacting four Clinical Psychologists with an interest and considerable knowledge about child psychology and autism. These Psychologists were asked to rate each item according to the four criteria.

Feedback revealed that the main problem with the questionnaire lay in the apparent lack of mutually exclusive categories. For example one item described as "Does your child tease or bully other children" was rated as indicative of behaviour that does not require a ToM, and of behaviour that is antisocial and lacking in social conformity. Similarly items designed to assess whether a child exhibited behaviour requiring a ToM were multidimensional. A high score for these items indicated that the child does perform behaviours requiring a ToM. A low score on the same item therefore indicated that the child does not exhibit the behaviour that requires a ToM.

Revised Social Behaviour Questionnaire

Taking these important points into consideration, the questionnaire was re-designed. It was simplified to include only items indicative of a presence or absence of behaviour requiring a well functioning ToM. Items retained from the original questionnaire had been rated as indicative of the presence or absence of a ToM by at least 3 of the 4 raters. The original 36 items thus reduced to 19 items in the final questionnaire.

The researcher produced a scoring key based on a bi-dimensional category of presence or absence of a ToM (Appendix 7). A low score represents a high frequency of rated behaviour indicative of a well functioning ToM, and a high score corresponds to a low frequency of behaviour requiring a well functioning ToM. Items were weighted equally for positive and negative phrasing.

2.3.4 ADHD rating scale-IV; Home version (Dupaul et al., 1998)

Aim of measures

The ADHD rating scale measures the frequency of ADHD symptoms in children based on the DSM-IV criteria. Few other currently available instruments include items directly adapted from the DSM-IV criteria for ADHD. The scale is easy to administer, taking only a few minutes to complete independently by a parent. Numerous other screening questionnaires were considered and subsequently rejected. Many are not confined to hyperactivity disorders, and scales tend to be lengthy and time consuming to complete (*Child Behaviour Checklist*: Achenbach & Edelbrock, 1991a; *The Connors Rating Scale*: Connors, 1973; *SNAP Rating Scale*: Swanson, 1995; *Brown Attention Deficit Disorder Scale*: Brown, 1996).

Scoring

The scale consists of 18 items. Respondents are asked to indicate the frequency of each item on a 4 point Likert scale (never or rarely, sometimes, often, very often,). Inattention items comprise the odd numbered items, and Hyperactive-Impulsive symptoms are represented by the even numbered items. The total raw scores is computed by adding the Inattention and Hyperactive-Impulsive subscale raw scores. Raw scores translate into percentile scores based on the child's age and gender.

Dupaul et al. (1998) describe the factor analysis used to derive the subscales of the ADHD Rating Scale-IV. They have also produced data regarding normative samples, reliability and validity of the questionnaire.

The internal consistency of the home version of the scale was high (Total score = .92, Inattention = .86, and Hyperactivity-Impulsivity = .86). Test-retest reliability was adequate (Total score r = .41, Inattention r = .45, and Hyperactivity-Impulsivity r = .40). The validity of the items on the parent version of the scale ranged from .10 to .81, with 15 out of the 18 items reaching statistical significance. The scale was demonstrated to discriminate between children representing different ADHD subtypes, as well as between children with ADHD and clinic referred children who did not have ADHD (Dupaul et al., 1998).

2.3.5 The Smarties test (Perner et al., 1987: Appendix 8)

Aim of test

The Smarties test is an example of a first order ToM deceptive box paradigm. The test assesses a child's understanding that other people can hold false beliefs about the world.

Procedure

A child is presented with a Smarties tube and is asked what is inside. They usually reply "Smarties" or "sweets". The experimenter then opens the lid to reveal that the tube contains a pencil. The tube is then closed with the pencil inside. The child is asked to predict what someone who has not seen the tube would think it contained. The child's response is noted by the researcher on a response sheet This procedure takes a few minutes.

Scoring

The test is scored as either pass or fail. A child passes the test if they indicate that someone else, not privileged with the same information as themselves, would believe that the tube contained Smarties or sweets. If the child says that someone else would think that it contained a pencil, they would fail the test.

2.3.5 The Ice-cream van test (Baron-Cohen, 1989c: Appendix 9)

Aim of test

This is a second order ToM test designed to assess whether children understand that people hold beliefs about other people's beliefs.

Procedure

The researcher reads a story to the child about an ice-cream van, Mary, and John. The story is demonstrated simultaneously on a 3D prop of a village. The story involves John and Mary at the park with the ice-cream man. The ice-cream man says he will be in the park all afternoon. John returns home to get some money to buy an ice-cream. When he has gone the ice-cream man tells Mary that he is going to sell ice-creams outside the library. Mary stays in the park and the ice-cream man goes to the library. On the way to the library the ice-cream man passes John and tells him where he is going. Later in the afternoon Mary goes to call for John at his house, but his mother answers and tells Mary that John has gone to buy an ice-cream.

Throughout the story the child is asked questions to ensure that they have correctly understood the information presented to them. The researcher records the child's responses to these questions on a response sheet. A child passes or fails the test depending on their response to the final test question. This test takes approximately 5 minutes to administer.

Scoring

At the end of the story the child is asked "Where does Mary think that John has gone to buy his ice-cream?". The correct answer, and one that indicates that the child has passed the second order test, is that Mary thinks John has gone to the park because she is unaware that the ice-cream man told John he would be outside the library. Any other location is scored as incorrect and the child fails the test.

2.3.7 Strange Stories (Happé, 1994: Appendix 10)

Aim of measure

This is an advanced test of ToM, requiring a child to answer questions regarding story characters' thoughts and feelings. The stories consist of vignettes of everyday situations where people say things that they do not mean literally. Happé (1994) found a high degree of concordance (ranging from 92 to 100 %) between two raters on this measure. She also reported that the measure discriminated between children and adults with high functioning autism, who pass first and even second order ToM tests. This measure was included because of its relevance to real life experiences as well as its sensitivity in discriminating between individuals with abilities to pass ToM test at differing levels of complexity.

Procedure

The stories were introduced as follows: "I'm going to read you some stories and I'd like you to listen carefully. I will ask you two questions at the end of the story. There are no right or wrong answers, just tell me what you think".

The researcher then reads out 12 stories to each child. The typed stories were presented to the child to follow if they wanted. One story from each of the 12 categories developed by Happé (1994) was presented in the same order each time. In each story a character says something which is not literally true, and the child is asked to explain why the character said what he or she did.

After reading the scenarios the child is asked "Was it true what X said?". This question is a test of the child's comprehension of the story. If the child answered this incorrectly, the story was repeated to them until they answered it correctly. The second test question was "Why did he/she say that?". The researcher noted down verbatim the child's answer on a response sheet. The stories took about 10 minutes to administer.

Scoring

The second test question was scored by the experimenter for each story on the following criteria. A score of 0 indicated that the child's response was incorrect because they were unable to understand the story characters' thoughts and feelings, or they completely missed the point. A score of 1 represented a partial or incomplete answer. The child may have given an answer concerning physical states or attempted to discuss psychological states in an incomplete way. A score of 3 represented a full and appropriate answer incorporating evidence that the child understood the psychological states involved in the story. Thus one score between 0 and 3 was allocated for each story. If a child gave more than one answer to the test question their 'best' answer was scored.

The total score for all 12 stories was computed for each child. Possible scores ranged from 0 to 36. A high score indicated evidence of a well functioning ToM. A low score indicated absence of evidence of a well functioning ToM.

Inter-rater reliability

Cohen's Kappa was conducted on the results of the ratings of all participants responses to the Strange Stories measure. The Kappa coefficient measures degree of agreement between the evaluation of two raters both rating the same object. A value of 1 indicates perfect agreement, and a value of 0 indicates that agreement is no better than chance.

Inter-rater reliability for the strange stories was assessed in the following way. The researcher and her supervisor, a Consultant Clinical Psychologist, independently scored the strange

stories response sheets for each participant. The supervisor was blind to group membership. Inter-rater agreement was calculated using Kappa coefficients.

Table 2: Interrater reliability coefficients for the Strange Stories

Story	Kappa Values
1. Banana	.730**
2. Crystal vase	.229
3. Hairdresser	.494
4. Aunt Jane	.620**
5. William's bedroom	.422
6. Burglar	.684**
7. Red army, blue army	.618**
8. Fish and chips	.629**
9. Sausage and beans	*
10. Painting competition.	.511**
11. Halloween	.168
12. Ben's class mate	.542**

* Kappa could not be calculated because the full range of scores were not available.

** Results indicating an acceptable inter-rater agreement

The table demonstrates that 7 of the 12 stories used had acceptable inter rater reliability.

2.3.8 Raven's Coloured Progressive Matrices (Sets A, Ab, B; Raven, 1965: Appendix 11)

Aim of measure

The Coloured Progressive Matrices were designed for use with young children. It is a test of nonverbal perceptual reasoning abilities and involves observation and clear thinking. Scores on the RCPM have been found to correlate highly with intelligence scores from the Weschler Scales (Spreen & Strauss, 1991). The test is quick to administer, taking approximately 10 minutes. The test was included in the study to investigate whether children's nonverbal abilities differed significantly between the two groups, and also to explore whether children's ability to pass ToM tests was associated with their nonverbal ability.

Procedure

The test is presented as a booklet with 3 sets of 12 problems. The child is instructed to pick out a small pattern from a number of options, to complete a larger abstract picture. The test is un-timed and is given with the least possible amount of verbal explanation.

Scoring

A raw score is obtained by recording the total number of correct choices a child makes. The total possible score is 36. Raw scores are converted to percentile scores based on age related normative data.

Psychometric properties

Test-retest reliability data for the matrices are acceptable (above 0.8) and concurrent validity studies show modest correlation's of 0.7 between the RCPM and conventional tests of intelligence such as the Weschler and Stanford-Binet scales (Spreen & Strauss, 1991).

2.3.9 British Picture Vocabulary Scale - Short Form (Dunn et al., 1982: Appendix 12)

Aim of measure

The BPVS measures a child's receptive vocabulary for standard English. It does not require the child to read and verbal interaction with the researcher is minimal, therefore it is useful for children with social impairments. This measure was included in the research to control for the possible confounding variable of receptive vocabulary.

Procedure

The child is presented with a page of 4 drawings. The researcher says a word and asks the child to point to the drawing that best describes that word. The researcher notes the child's

response and continues to the next page. The words get progressively harder and termination of the test occurs when the child makes 4 errors on 6 consecutive pages. The test takes approximately 10 minutes to administer.

Scoring

Raw scores are computed by adding up the number of correct pictures the child pointed to. Raw scores translate into standardized norm referenced scores (M = 100; SD = 15). Percentile and age equivalent scores are also available, but standard scores are the most meaningful for research purposes because their numerical properties make them easy to manipulate statistically.

Psychometric properties

The BPVS is based on the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981) which is a revision of an earlier test known as the Peabody Picture Vocabulary Test (PPVT; Dunn, 1959). The PPVT is well established and accepted for educational, clinical and research purposes. Over a hundred published studies accumulate to demonstrate its reliability with many different groups. Validity studies show that it also correlates well with other vocabulary tests and individual intelligence tests (Robertson & Eisenberg, 1981).

2.4 Procedure

2.4.1 Ethical approval (Appendix 13)

Prior to the study ethical approval was gained from the local NHS trust ethics board. This involved outlining a protocol of the study and attending a meeting of the board to answer questions regarding ethical issues. The study design ensured provision of adequate information concerning the study, participants consented prior to participating, and the maintenance of confidentiality. Because children with ADHD and their parents are a vulnerable group, particular care was taken to not mislead them regarding the possible

outcome of the study. The information leaflet included a clear statement that the findings from the study would not provide immediate new treatment options.

2.4.2 Pilot study

Before the study commenced, three children and their parents piloted the procedure. The aims of the pilot were to test that the procedure ran smoothly. The pilot study focused on applicability of the measures with the client group, the timing of the procedure, and the researcher's knowledge and skill in coherently administering the measures. Pilot participants included one boy with ADHD and two control children. The children's ages ranged from 8 years 6 months to 11 years 10 months.

The pilot study resulted in amendments to phrasing of items on the social behaviour questionnaire, and the introduction of a visual prop during the ice-cream van test. The pilot study also influenced the researcher's selection of 12 of the possible 24 Strange Stories. Selection of the stories was based on ease of comprehension for participants.

2.4.3 Procedure

The researcher telephoned participants and arranged to meet them. It seemed important that the children felt at ease when participating in the assessment. For this reason most of the interviews were in the child's home. One participant attended the child development centre for their convenience, as they already had an appointment with another clinician.

The measures used were administered to all children and their parents in the same order by the researcher. During the meeting the researcher introduced herself. The child and parent were given an outline of the procedure. The researcher encouraged participants to ask questions throughout the study. Parents then completed a consent form for themselves and on behalf of their child, to indicate that they agreed to participate in the study (Appendix 14).

Parents began by answering questions about the child and family's circumstances. Information regarding the families socio-economic status, the child's age, diagnostic and medical history,

and whether the parent would like feedback regarding findings from the study was obtained at this point.

The researcher then administered the communication and socialization sub-domains of the Vineland Adaptive Behavior Scales (Survey form) in a semi structured interview with the parent. Finally the researcher explained the ADHD rating scale-IV, and the Social Behaviour Questionnaire to the parents with a request that they complete these during the child's assessment period.

The researcher interviewed the child sitting at a table to ease administration of the measures. Initially the researcher presented the Smarties task to the child followed by the Ice-cream van test. The researcher then administered the 12 strange stories. Each child completed the Raven's Coloured Progressive and then the British Picture Vocabulary Scale.

When the child completed all of the tasks they were reunited with their parent. The researcher obtained the completed ADHD rating scale-IV and Social Behaviour Questionnaire from parents and answered queries regarding the completion of these measures.

Finally, the researcher debriefed participants and answered questions about the research. Subsequently they were thanked for their assistance. All of the participants requested feedback regarding the findings of the study. Following the analysis and write up of the study participants received a summary letter about the findings (Appendix 15). The procedure took between an hour and an hour and a half for each participant.

3.0 RESULTS

3.1 Method of analysis

Appendix 16 contains a summary of the raw data from the study. The data were analysed with parametric and non-parametric statistical tests. Tests were selected depending on whether the data fulfilled three criteria for parametric tests (Bryman & Cramer, 1997).

1. The level or scale of measurement should be of equal interval or ratio scaling.
2. The distribution of the population scores should be normal.
3. The variances of both variables should be equal or homogeneous.

Each research variable was examined on these three criteria and the results are summarized in table 3.

Table 3: Research variable, type of data, distribution, and homogeneity of variance

Variable	Data Type	Kolomogorov -Smirnov Z	Levene's Statistic
Age of Child	Ordinal	-	-
Socioeconomic Status	Nominal	-	-
ADHD Rating Scale-IV	Interval	1.25 (ns)	20.54 (p < .0001)
Social Behaviour Questionnaire	Interval	1.07 (ns)	9.20 (p < .005)
Vineland Socialization domain	Interval	1.43 (p < .05)	13.94 (p < .001)
Vineland Communication domain	Interval	0.64 (ns)	7.07 (p < .05)
Smarties 1st order ToM test	Ordinal	-	-
Ice Cream Van 2nd order ToM test	Ordinal	-	-
Ravens Coloured Progressive Matrices	Interval	0.87 (ns)	1.20 (ns)
British Picture Vocabulary Scale	Interval	0.51 (ns)	2.64 (ns)
Strange Stories	Interval	0.20 (ns)	3.57 (ns)

The table illustrates that the research variables consist of a mixture of nominal, ordinal, and interval data. The distributions of the interval data were investigated with a Kolmogorov-Smirnov Z test for one sample. A non significant result indicates that the variable has a normal distribution of data. The table shows that only the Vineland Socialization domain scores are

not of a normal distribution for the study sample used. All other interval data fulfill criteria 2 for parametric statistics.

The data was further analysed for homogeneity of variance using Levene's statistic. Again a non significant result is indicative of data which is homogenous in variance (This test compares the data between the ADHD and Control group). The table indicates that the BPVS, Strange Stories, and RCPM measures provide data that are homogenous in variance, and hence fulfill criteria 3 for parametric tests.

3.1.1 Summary

Parametric statistics are only possible when investigating the RCPM, BPVS, and Strange Stories measures, as these fulfill all three criteria. All other research variables require non-parametric statistical tests.

3.2 Participant characteristics

First the groups were examined for similarities and differences. It was predicted that the ADHD group would gain significantly higher scores than the control group on the ADHD Rating Scale-IV, as the measure was a 'double check' for symptoms of ADHD. Furthermore the two groups were selected to be similar in age, socioeconomic status (SES), nonverbal abilities, and verbal abilities. However, since a formal matching procedure was not implemented differences between the groups were investigated with respect to these variables. Table 4 summarizes the mean, standard deviations, test results, and significance levels for between group comparisons of nominal and interval data.

3.2.1 ADHD Rating Scale-IV

The difference between the two groups on the ADHD Rating Scale-IV was analysed with a Mann-Whitney U test for two unrelated samples. The Mann-Whitney is a non-parametric version of the t-test, and tests whether two independent samples are from the same population by comparing ranks of cases.

Table 4: Statistical tests of difference for non categorical data between groups

Variable	ADHD n = 17 Mean (SE)		CONTROL n = 20 Mean (SD)		T
ADHD Rating Scale-IV	91.18	(11.15)	63.30	(23.12)	U=4
Age	10.10	(1.51)	9.02	(1.18)	U=1(
RCPM	48.53	(29.09)	51.85	(31.42)	t =
BPVS	87.88	(24.00)	105.00	(17.44)	t = ;
Strange Stories	10.00	(6.36)	15.70	(4.44)	t = ;
Vineland Communication domain	63.35	(22.76)	85.15	(12.93)	U=8
Vineland Socialization domain	66.88	(20.36)	101.80	(10.66)	U=1
Social Behaviour Questionnaire	39.76	(9.48)	20.35	(5.65)	U=1

Table 4 shows that the ADHD group obtained a higher mean score on the ADHD Rating Scale-IV than the Control group. A Mann-Whitney U test indicated that this difference was significant (U = 41.50, p < .0001).

3.2.2 Age

Children in the Control group ranged in age from 7 years 10 months to 11 years 4 months (M = 9 years 2 months, SD = 1.18); children in the ADHD group ranged in age between 7 years 11 months and 12 years 3 months (M = 10 years 10 months, SD = 1.51). A Mann-Whitney U test for two unrelated samples indicated that the two groups did not differ significantly in age (U = 107.50, ns).

3.2.3 Socioeconomic status

Figure 2 illustrates the percentage of participants rated in each of the five SES categories and compares the two groups. SES is grouped into the following five categories; I-Professional; II-Managerial/Technical; III-Skilled; IV-Partly Skilled; V-Unskilled.

Figure 2: Bar chart comparing socioeconomic status of participants in the two groups
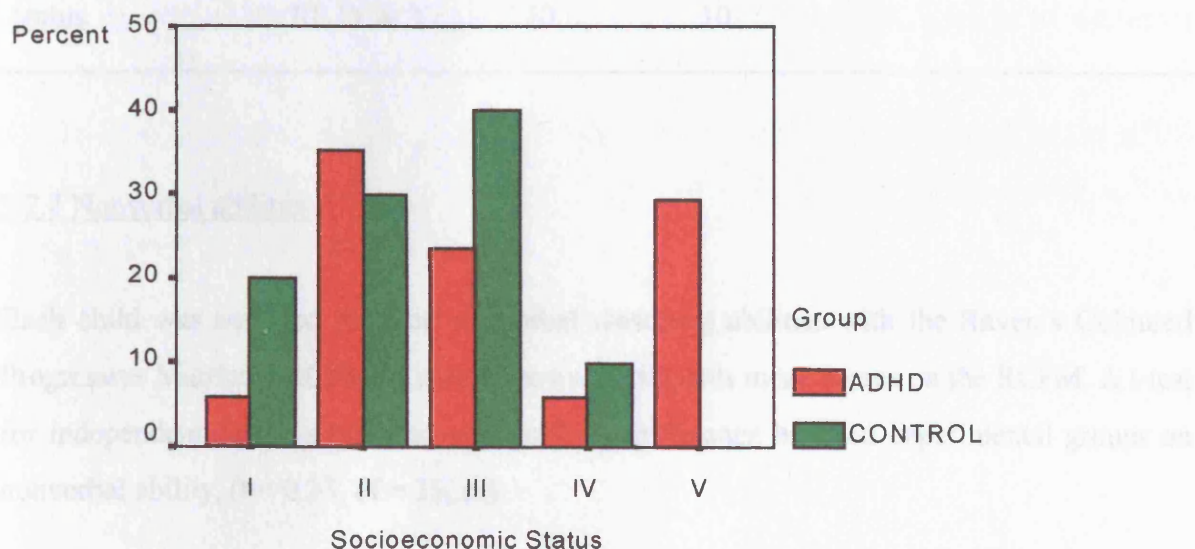
The SES data is categorical, thus to compare frequency's of categories between groups a chi square is necessary. However it was not possible to investigate significant differences between the two groups using the data in all five SES categories, as a Chi square test requires at least five observed responses in each category. Figure 2 shows that none of the control group were rated as category V - Unskilled on the SES ratings.

Therefore the data was split into two larger groups; those attaining an SES category of I and II, and those rated as category III, IV, and V (Table 5). Subsequently a Chi square test was conducted and the results indicated that the groups did not differ significantly on SES (χ^2 = .29, df = 1, ns).

Table 5: Statistical tests of difference for categorical data between groups

Variable		ADHD (n = 17)	Control (n = 20)	Test	df	Significance (1-tailed)
Smarties test	Pass	15	20	-	-	-
	Fail	2	0	-	-	-
Ice-cream van test	Pass	6	13	$\chi^2 = 3.25$	1	ns
	Fail	11	7			
Socioeconomic	I & II	7	10	$\chi^2 = .29$	1	ns
status	III, IV & V	10	10			

3.2.4 Nonverbal abilities

Each child was assessed for their nonverbal reasoning abilities with the Raven's Coloured Progressive Matrices (RCPM). Table 4 shows participants mean scores on the RCPM. A t-test for independent samples revealed no significant difference between experimental groups on nonverbal ability, (t = 0.33, df = 35, ns).

3.2.5 Verbal abilities

Table 4 illustrates group mean scores on the BPVS test of receptive language ability. Both groups obtained mean scores within the average range. However children in the ADHD group in general obtained lower scores for their receptive verbal abilities (M = 87.88, SD = 24.00) than children in the Control group (M = 105.00, SD = 17.44).

The difference between groups on the BPVS were investigated for significance using an independent samples t-test. Results indicated that children from the ADHD group obtained significantly lower scores than those in the Control group for receptive language ability (t = 2.51, df = 35, p < .01).

3.2.6 Summary

- The ADHD group obtained significantly higher scores on the ADHD-IV Rating Scale, than the Control group (U = 41.5, p < .001).

- The experimental groups did not differ significantly in age (U = 107.5, ns).

- The experimental groups did not differ significantly on the SES measure (χ^2= .29, df = 1, ns).

- The experimental groups did not differ significantly on the RCPM measure of nonverbal abilities (t = .33, df = 35, ns).

- The Control group obtained significantly higher scores than the ADHD group on the BPVS measure of receptive language ability (t = 2.51, df = 35, p < .01). This finding will be investigated further in section 3.6.

Each hypothesis is presented in order with a description of the associated analysis and a summary of findings.

3.3 Hypothesis one

Children with ADHD will pass a first order theory of mind tasks (the Smarties test) but will show impaired abilities on the second order theory of mind task (the Ice-cream van test) compared with control children.

3.3.1 First order theory of mind test

Only two participants failed the Smarties test, both of whom were in the ADHD group (Table 5). Because the number of children failing this test is small it was not possible to analyze the results statistically. Figure 3 illustrates the percentage of children who passed and failed the Smarties test from the two groups.

Figure 3: Bar chart comparing group performance on the first order Smarties test
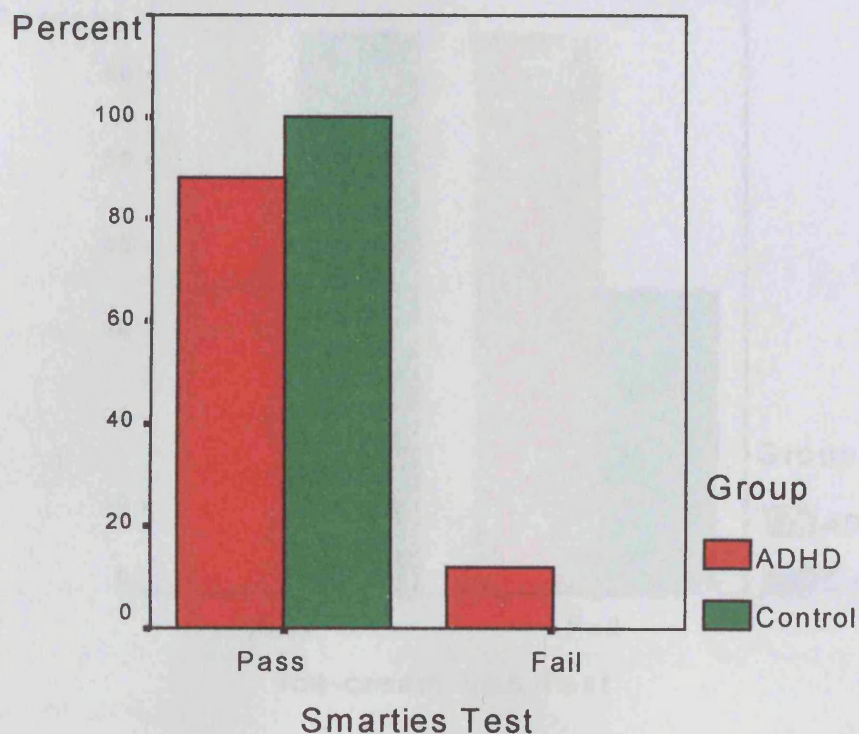
The graph illustrates that it is extremely unlikely that there is a significant difference between the two groups on The Smarties Test.

3.3.2 Second order theory of mind test

Within the Control group thirteen children passed the Ice-cream van test and seven failed. In comparison six children from the ADHD group passed and eleven failed (Table 5). These findings are illustrated in figure 4.

Figure 4 illustrates that a greater percentage of children in the ADHD group failed the second order ToM test (65%) compared with the control children (35%). However a Chi-Square test indicated that this difference in performance between groups was not significant ($\chi^2 = 3.25$, df = 1, ns).

Figure 4: Bar chart comparing group performance on the second order Ice-cream van test

59
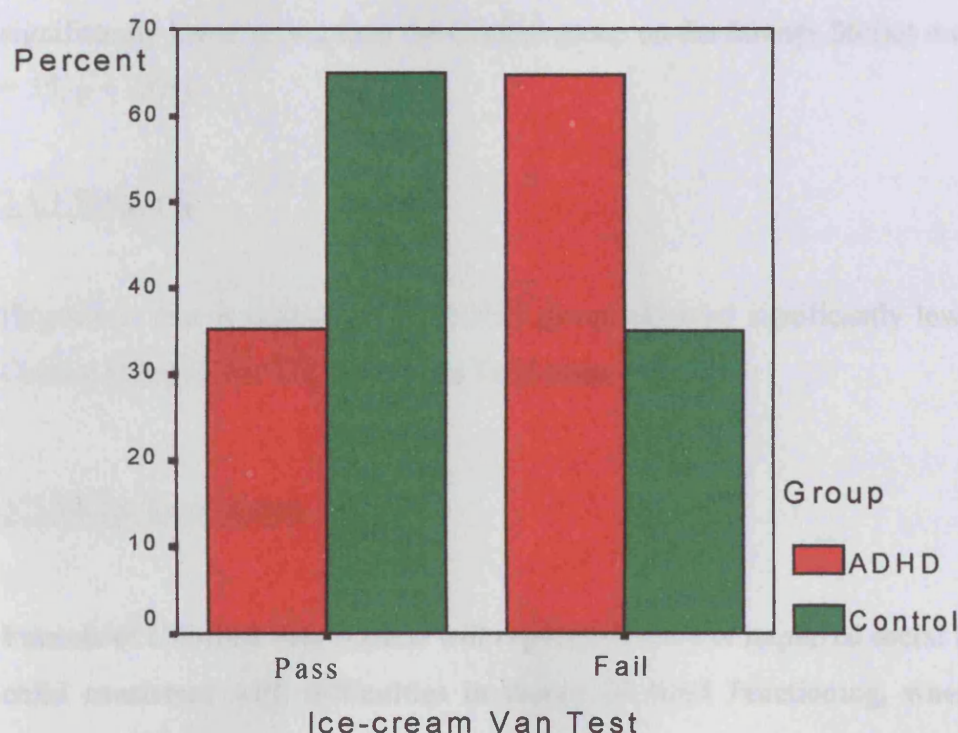
3.3.3 Summary

Hypothesis one is partially accepted. As predicted the groups did not differ significantly on the first order ToM measures. However, the groups also did not differ significantly with regard to performance on the second order ToM test.

3.4 Hypothesis two

Children with ADHD will demonstrate impairments in social reasoning consistent with deficits in theory of mind abilities (as measured by the Strange Stories; Happé, 1994) compared with control children.

Table 4 illustrates mean scores for both groups on the Strange Stories measure. The ADHD group obtained a lower mean score on the Strange Stories (M =10.00, SD = 6.36) than the Control group (M = 15.70, SD = 4.44). To test whether this differences is significant an independent samples t-test was conducted. Results indicate that the ADHD group obtained significantly lower scores than the Control group on the Strange Stories measure (t = 3.20, df = 35, p < .005).

3.4.1 Summary

Hypothesis two is accepted. The ADHD group obtained significantly lower scores than the Control group on the Strange Stories ToM measure.

3.5 Hypothesis three

Parents of children with ADHD will report evidence of impaired social behaviour in their child consistent with difficulties in theory of mind functioning, when compared with control children.

This hypothesis was assessed using three different measures. First, the two domains of the Vineland Adaptive Behavior Scales (VABS) administered to parents in the study were investigated. Then the Social Behaviour Questionnaire also administered to parents was investigated.

3.5.1 Vineland Adaptive Behavior Scales (VABS)

Communication domain

Each participant obtained a standard score for the Communication domain of the VABS (Table 4). The mean score obtained by the Control group is within the low average range (M = 85.15, SD = 12.93). However the children in the ADHD group obtained a below average mean score (M = 63.35, SD = 22.76).

A Mann-Whitney U tests for two unrelated samples was conducted to compare the groups on the Communication domain. Children in the ADHD group obtained significantly lower scores than those in the Control group (U = 80.00, p < .005).

Socialization domain

Each participant also obtained a standard score for the Socialization domain of the VABS (Table 4). The mean score obtained by the Control group again is within the average range (M = 101.80, SD = 10.66). However the children in the ADHD group obtained a below average mean score (M = 66.88, SD = 20.36).

A Mann-Whitney U tests for two unrelated samples was conducted to compare the groups on the Socialization domain. The ADHD group had significantly lower scores than the Control group on socialization (U = 14.00, p < .001).

3.5.2 Social Behaviour Questionnaire

This questionnaire was designed to measure everyday social behaviours that require a well functioning ToM. The higher the score, the less frequently a child was rated as showing social behaviours indicative of a well functioning ToM. Table 4 shows the mean group scores on the Social Behaviour Questionnaire.

As predicted the ADHD group obtained a higher mean score (M = 39.76, SD = 9.48) than the Control group (M = 20.35, SD = 5.65) on the Social Behaviour Questionnaire. This difference was tested for significance with a Mann-Whitney U test for two unrelated samples. Results indicated that this difference was highly significant (U = 11.00, p < .001).

3.5.3 Summary

Hypothesis three is accepted. The ADHD group obtained a significantly lower mean scores than the Control group for the Communication and Socialization domains of the Vineland Adaptive Behavior Scales. Furthermore, the ADHD group obtained a significantly higher mean scores than the Control group on the Social Behaviour Questionnaire.

3.6 Hypothesis four

Verbal abilities of children with ADHD will be positively associated with their performance on theory of mind tasks and their everyday social functioning.

3.6.1 Verbal ability and second order theory of mind performance

First, to investigate whether children who passed the second order ToM task had higher verbal ability than those who failed, independent samples t-tests were conducted on all the data, and on data within the two groups. Results are summarized in table 6.

There were differences in the expected direction between children who passed or failed the Ice-cream van test on verbal ability, but these were not statistically significant (t = 1.88, df = 35, ns). This was true for children within the ADHD group (t = .94, df = 15, ns) and the

Control group (t = .83, df = 18, ns). However caution is required when interpreting this finding due to the limited number of participants in the within group analysis (n ranges from 6 to 13).

Table 6: Tests of difference on verbal ability between those who passed and failed the Ice-cream van test

Ice-cream van test		Mean BPVS score	(SD)	t-test	df	significance (1-tailed)
All Data (N = 37)	Pass (n = 19)	103.58	(20.78)	t = 1.88	35	ns
	Fail (n = 18)	90.33	(22.07)			
ADHD (n = 17)	Pass (n = 6)	95.33	(30.72)	t = .94	15	ns
	Fail (n = 11)	83.82	(19.94)			
Control (n = 20) .	Pass (n = 13)	107.38	(14.30)	t = .83	18	ns
	Fail (n = 7)	100.57	(22.78)			

3.6.2 Verbal ability and Strange Stories theory of mind measure

Next verbal abilities were investigated for all data with regard to the Strange Stories measure of ToM. The results are summarized in Table 7. A Pearson's correlation revealed a positive correlation between the Strange Stories and BPVS (r_P = .65, p < .01). Thus a high score on the Strange Stories is correlated with high verbal ability for all data.

This finding was investigated separately for each group. There was a significant positive relationship between verbal ability and Strange Stories ToM ability for both groups, although the probability level was higher for the ADHD group than the Control group (ADHD group; r_P = .61, p < .01: Control group; r_P = .51, p < .05).

3.6.3 Verbal ability and the Social Behaviour Questionnaire measure of theory of mind

Finally the relationship between verbal ability and the Social Behaviour Questionnaire was investigated. A Spearman's correlation revealed a significant negative correlation between

scores on the Social Behaviour Questionnaire and verbal ability for all data ($r_s = -.46$, $p < .01$). Thus a low score on the Social Behaviour Questionnaire, indicating a well functioning ToM, was correlated with high verbal ability.

Again this result was investigated separately for both groups. A significant negative correlation between verbal ability and scores on the Social Behaviour Questionnaire existed for the ADHD group only (ADHD; $r_s = -.69$, $p < .01$: Control; $r_s = .03$, ns). Thus verbal ability was associated with a well functioning ToM on this measure for the ADHD group, but not for the Control group.

Table 7: Summary of correlation's between verbal ability (BPVS), theory of mind measu

VARIABLE	All Data			ADHD			
	1	2	3	1	2	3	
1. Strange Stories	-	$r_s = -.49$**	$r_p = .65$**	-	$r_s = -.25$	$r_p = .61$**	
2. Social Behaviour Questionnaire	$r_s = -.49$**	-	$r_s = -.46$**	$r_s = -.25$	-	$r_s = -.69$**	$r_:$
3. Verbal Ability (BPVS)	$r_p = .65$**	$r_s = -.46$**	-	$r_p = .61$**	$r_s = -.69$**	-	$r_[$
4. Age	$r_s = .10$	$r_s = .30$	-	$r_s = -.05$	$r_s = .43$	-	$r_:$

* Correlation is significant at the .05 level (2-tailed)
** Correlation is significant at the .0i level (2-tailed)

r_p = Pearson's Correlation coefficient
r_s = Spearman's Correlation coefficient

3.6.4 Summary

Hypothesis four was partially accepted. Verbal ability was correlated with the Strange Stories and the Social Behaviour questionnaire ToM measures for the ADHD group. However, verbal ability was not significantly different between those who passed and those who failed the second order ToM measure for the ADHD group. The results are summarized in greater detail below;

- There were no significant differences between children who passed or failed the Ice-cream Van Test on verbal ability (t = 1.88, df = 35, ns). This was true for both the ADHD group (t = .94, df = 15, ns) and the Control group (t = .83, df = 18, ns).

- Verbal ability positively correlated with ToM abilities on the Strange Stories measure for all data (r_p = .65, p < .01). This was true for both the ADHD group and the Control group (ADHD group; r_p = .61, p < .01: Control group; r_p = .51, p < .05).

- Verbal ability was negatively correlated with Social Behaviour Questionnaire score for all data (r_s = -.46, p < .01) and the ADHD group, but not the Control group (ADHD; r_s = -.69, p < .01: Control; r_s = .03, ns).

3.7 Analysis of possible confounding variables

3.7.1 Verbal ability and theory of mind

Previous results (Section 3.2.5) reported that children in the Control group have significantly higher scores on the BPVS than children in the ADHD group. Since verbal ability is correlated with score on the Strange Stories and the Social Behaviour Questionnaire, there is a possibility that this is a confounding variable for between group differences on those ToM measures.

In order to investigate whether the groups differed in their ToM functioning on the Strange Stories measure, independent of individual's verbal abilities, a single factorial Anova was conducted. The Anova acts to partial out the effect of verbal ability. Results indicated that

when receptive language abilities were partialled out, the ADHD group still attained significantly lower scores on the Strange Stories ToM measure than the Control group (F = 16.29, df = 1, p < .001).

It was not possible to do an anova on the Social Behaviour Questionnaire results because this measure does not fulfill the criteria for parametric tests.

3.7.2 Age and theory of mind

Age was investigated as a possible confounding variable in relation to performance on ToM tests using Spearman's correlation's (Table 7). Results showed that age is not significantly correlated with either the Strange Stories ($r_s = .10$, ns) or the Social Behaviour Questionnaire ($r_s = .30$, ns) for all data.

Similar non significant findings occurred for the ADHD group alone (Strange Stories, $r_s = -.05$, ns: Social Behaviour Questionnaire, $r_s = .438$, ns). However, age was positively correlated with the Strange Stories ($r_s = .50$, p < .05) and negatively correlated with the Social Behaviour Questionnaire ($r_s = -.45$, p < .05) for the Control group. Thus the older the children were in the Control group, the more likely they were of exhibiting well functioning theory of minds on the Strange Stories and Social Behaviour Questionnaire measures.

3.7.3 Summary

• Group differences on verbal ability do not account for the finding that the ADHD group attained significantly lower scores on the Strange Stories ToM measure than the Control group.

• Age was not associated with ToM abilities for the ADHD group as measured by the Strange Stories and the Social Behaviour Questionnaire. However, older children in the Control group were more likely to exhibit well functioning theory of minds on the Strange Stories and Social Behaviour Questionnaire measures.

3.8 Additional analysis

Because the Social Behaviour Questionnaire was devised by the researcher, it was investigated for its psychometric properties including validity and reliability of the measure.

3.8.1 Psychometric properties of the Social Behaviour Questionnaire

Criterion related validity

Criterion related validity refers to the extent a questionnaire measures what it purports to, based on correlation's with other measures assessing the same variable (Lehman, 1991). To test the criterion related validity of the Social Behaviour Questionnaire a correlation with the Strange Stories test of ToM was performed. Table 7 illustrates the results of this analysis.

The Social Behaviour questionnaire was negatively correlated with Strange Stories ($r_s = -.49$, $p < .005$) for all data. Thus a high score on the Social Behaviour Questionnaire, indicating poor ToM functioning, is associated with a low score on the Strange Stories Test. This is evidence that the Social Behaviour Questionnaire correlates well with another ToM test, and has good concurrent validity.

Internal reliability

The reliability of the Social Behaviour Questionnaire was assessed using a model of internal consistency based on average inter-item correlation's. This statistical analysis is known as the Cronbach's alpha test. A score of .8 or over indicates that the scale has good internal consistency (Lehman, 1991). Results of the Cronbachs alpha indicated that the Social Behaviour Questionnaire has good internal consistency ($\alpha = .88$).

3.8.2 Summary

There is evidence that the Social Behaviour Questionnaire has good criterion related validity and internal reliability.

4.0 DISCUSSION

4.1 Summary of findings

The results provide evidence that children with ADHD have performance deficits on some measures of theory of mind and social functioning compared with control children. A group of children with ADHD were found to have significantly impaired ability to understand the thought's and feeling's of story characters compared with a control sample. Additionally, parents of the ADHD group rated them as significantly impaired in their everyday socialization and communication skills. More importantly, parents rated children with ADHD as displaying significantly less social behaviours that require a well functioning theory of mind in their everyday social lives, compared with a control group. Not all the hypotheses were supported. The ADHD group did not differ from the Control group in their performance on standard first and second order theory of mind tests.

This study is the first to investigate theory of mind functioning in children with ADHD. Hence a comparison of the findings with those of other clinical disorders is required and a full discussion of the implications will ensue. The results are discussed in relation to each hypothesis. Theoretical and clinical implications of the research are then described. Finally, methodological limitations are outlined and suggestions are given for improvements and further research.

4.2 Hypothesis one

Children with ADHD will pass a first order theory of mind tasks (the Smarties test) but will show impaired abilities on the second order theory of mind task (the Ice-cream van test) compared with control children.

In the present study, children with ADHD were as likely to pass the first order theory of mind test as control children, therefore this hypothesis was confirmed. This finding is consistent with Happé and Frith's (1996) research results. In their study all 18 Conduct Disordered

69

children passed two first order theory of mind tasks (the Smarties test and a version of the Sally-Anne task). Performance on the second order theory of mind test did not differ significantly between the two groups in the present study. Unfortunately Happé and Frith (1996) did not use a comparable second order tests with their Conduct Disordered children.

Thus on simple experimental paradigms of first and second order theory of mind, children with ADHD were as likely to pass as typically developing children. Previous research into children with autism consistently report that they are less likely to pass these tests than control children. For first order false belief tasks the reported pass rates for children with autism between the age of 4.3 years to adulthood ranges from 15 to 60 percent (Happé, 1995).

Baron-Cohen (1989c) found that all 10 autistic children failed the Ice-cream van second order Theory of mind test, compared with 1 out of 10 typically developing control children. Therefore it is likely that children with ADHD in the present study would show superior performance on both first and second order theory of mind tests compared with children with autism.

4.3 Hypothesis two

Children with ADHD will demonstrate impairments in social reasoning consistent with deficits in theory of mind abilities (measured by the Strange Stories; Happé, 1994) compared with control children.

In the present study the ADHD group obtained significantly lower scores on the Strange Stories measure of theory of mind and social reasoning, than the control group. Therefore the hypothesis was confirmed. The only previously published research using this measure was conducted by Happé (1994). She devised and investigated the measure with typically developing children, able children with autism, children with learning disabilities, and 'normal' adults. It is difficult to compare the results of the present study with those from Happé's, as the scoring procedures and number of vignettes administered differ. She scored 24

vignettes as correct or incorrect, and as representing correct or incorrect mental rather than physical state answers.

Happé (1994) discriminated between individuals with autism who failed theory of mind tasks (no-theory of mind); passed first order theory of mind tasks but failed second order theory of mind tasks (first order theory of mind); and passed first and second order theory of mind tasks (second order theory of mind). Further analysis revealed that the no-theory of mind group obtained significantly poorer scores than the three controls. The first order theory of mind group also obtained significantly poorer scores than the three controls. Finally, the second order theory of mind group had significantly lower correct answer scores than the 'normal' adult controls, and more incorrect mental state answers than the 'normal' adults and learning disabled controls.

It would be interesting to see how the children with ADHD compared to the three autistic subgroups identified in Happé's (1994) study. Most children with ADHD were able to pass both the first and second order theory of mind tests (88 %) in the present study. Thus it might be hypothesized that their performance on the Strange Stories would be similar to those individuals with autism who pass these tests also. This hypothesis requires further investigation.

4.4 Hypothesis three

Parents of children with ADHD will report evidence of impaired social behaviour in their child consistent with difficulties in theory of mind functioning, compared with control children.

This hypothesis was investigated using the Communication and Socialization domains of the Vineland Adaptive Behavior Scales, and the experimenter devised Social Behaviour Questionnaire.

4.4.1 Communication domain

The Control group obtained a mean score within the low average range, and the ADHD group a below average mean score on this measure. Furthermore, the ADHD group had significantly lower scores than the Control group.

Thus, consistent with the previous finding regarding receptive language ability, the ADHD children tended to have lower levels of adaptive communication measured by parent report. The Communication domain measures 3 subdomains of receptive, expressive, and written communication. Westby and Cutler (1994) report that children with ADHD have difficulty using communication patterns appropriate to persons and situations (sometimes referred to as *Pragmatic language*).

The following table compares the findings of the present study with other research using the Communication domain of the Vineland Adaptive Behavior Scales.

Table 8: Comparison of different clinical group scores on the Vineland Adaptive Behavior Communication domain

Study	Clinical Group	Age range (years)	Mean Standard Score	Standard Deviation
Present study	ADHD	7-12	63	13
Roizen et al. (1994)	ADHD, DBD and LD	6-16	70	16
	ADHD	6-16	80	18
Happé and Frith (1996)	CD	6-12	70	18
Frith, Happé and Siddons (1994)	Autism-Passing	7-19	59	21
	Autism-Failing	7-19	36	17

Roizen et al. (1994) used the Vineland Adaptive Behavior Scales with a large sample (104) of average intelligence (Mean IQ = 101, SD = 16) children with ADHD. Participant's scores on the Communication domain were within the borderline to low average range. Children with

ADHD, disruptive behaviour disorder, and learning disorders had the lowest mean scores whilst children with ADHD alone had the highest. The ADHD group in the present study had a somewhat lower mean Communication domain score than both groups in Roizen et al.'s (1994) study.

This difference may be accounted for by sample differences between the two studies. Roizen et al. (1994) studied children from predominantly middle and upper class families living in an urban community in Chicago, USA. In the present study, participants were from upper to lower class SES families in a rural community in the Midlands, UK. Also a small percentage (9 %) of Roizen et al.'s sample were girls in contrast to the present study which was restricted to boys. Despite these differences, one major finding from the present study which is consistent with previous research is that children with ADHD are limited in their adaptive communication skills despite being within the average range of intelligence.

The Vineland Adaptive Behavior Scales have also been researched with other childhood clinical disorders. Happé and Frith (1996) found a mean score of 70 (SD = 18) on the Communication domain for children with Conduct Disorder. Thus it seems that children with ADHD in the present study have poorer adaptive communication skills than children with Conduct Disorders.

Frith, Happé, and Siddons (1994) administered the Vineland Adaptive Behavior scales to teachers of 24 autistic children. Children who passed theory of mind tasks obtained a mean Communication domain score of 59 (SD = 21) whilst those who failed had a mean score of 36 (SD = 17). Thus, children with autism who pass theory of mind tasks are rated as having significant impairments in adaptive communication skills not dissimilar in magnitude to the children with ADHD in the present study.

4.4.2 Socialization domain

The mean Control group Socialization score was within the average range. However, children in the ADHD group obtained a below average mean score. The ADHD group had significantly

lower scores than the Control group on this measure. This is evidence that children with ADHD are severely impaired in their adaptive social functioning.

Again the present findings are contrasted with those from study's with other clinical groups using the same measure of socialization.

Table 9: Comparison of different clinical group scores on the Vineland Adaptive Behavior Socialization domain.

Study	Clinical Group	Age range (years)	Mean Standard Score	Standard Deviation
Present study	ADHD	7-12	67	9
Roizen et al. (1994)	ADHD, DBD and LD	6-16	73	18
	ADHD	6-16	89	19
Happé and Frith (1996)	CD	6-12	67	17
Frith, Happé and Siddons (1994)	Autism-Passing	7-19	44	17
	Autism-Failing	7-19	35	14

The findings from the present study are lower than those obtained by Roizen et al. (1994). In their study children with ADHD, disruptive behaviour disorder, and learning disorders had the lowest mean scores whilst children with ADHD alone had the highest.

The present findings are further evidence that children with ADHD have deficits in their adaptive socialization skills, including items regarding interpersonal relationships, play and leisure time, and coping skills with regards to sensitivity to others. Whilst this is not direct evidence of poor theory of mind functioning some items on the scale would require a well functioning theory of mind (for example "Chooses appropriate present").

Happé and Frith (1996) report mean Socialization domain scores for Conduct Disordered children of a similar magnitude to the ADHD children in the present study.

Children with autism in Frith, Happé, and Siddons' (1994) study obtained much lower mean scores on the Socialization subdomain. Autistic children who passed theory of mind tasks obtained a mean slightly higher mean score than those who failed. However both groups had much poorer adaptive socialization skills than children with ADHD or Conduct Disorder. Since autism is a developmental disorder characterized by poor socialization skills, this is hardly suprising. However, the ADHD children in the present study also show evidence of poor adaptive communication and socialization skills, and this needs further explanation.

4.4.3 Social Behaviour Questionnaire

This questionnaire was designed to distinguish between everyday social behaviours that require the ability to mentalize versus simple learned behaviour. The scoring is slightly misleading as a high score characterizes a child that exhibits few examples of social behaviour indicative of a well functioning theory of mind, i.e. a high score indicates poor theory of mind functioning, and a low score indicates good theory of mind functioning.

The ADHD group obtained significantly higher scores than the Control group on the Social Behaviour Questionnaire. Thus, as hypothesized, children with ADHD were rated by their parents as exhibiting less frequent social behaviours that require a theory of mind ability than Control children.

This measure is new and has not been used in previous research. However, its development was based on Frith, Happé, and Siddons' (1994) distinction between active and interactive behaviour. Active behaviour involves learned behaviour, and interactive behaviour requires intact theory of mind functioning. Autistic children who passed false belief theory of mind tasks showed more everyday social insight, but not more sociability than those who failed.

Similarly, Happé and Frith (1996) applied the concept of active and interactive social behaviour to children with Conduct Disorder. They found widespread impairments in social behaviour compared with control children. This was particularly striking for items of interactive sociability, but there was no significant differences between the two groups on active sociability.

Further investigation of the Social Behaviour Questionnaire with different clinical populations such as autism, conduct disorder, and learning disabilities would provide a more direct quantitative comparison of the similarities and differences between these groups on theory of mind functioning in everyday life.

4.5 Hypothesis four

The role of verbal abilities of children with ADHD will be positively associated with their performance on theory of mind tasks and their everyday social functioning.

Previous research with autistic children has demonstrated a relationship between their verbal ability and performance on theory of mind tasks (Frith, Happé & Siddons, 1994; Happé, 1995). Happé (1995) found for both autistic and control groups, high verbal ability predicted passing of false belief theory of mind tasks. However individuals with autism required far higher verbal mental age scores to pass the tasks than did control participants.

One suggested hypothesis for this finding is that individuals with autism who pass theory of mind tests do so by "hacking out" a solution using a verbally mediated compensatory strategy. Furthermore, Happé tentatively suggests that verbal ability (measured by the British Picture Vocabulary Scale, an assessment of receptive vocabulary) inadvertently measures theory of mind in children with autism. This is because a lack of theory of mind possibly impacts on language acquisition as the failure to "mind read" interrupts processes of joint attention, reference, and ostentation.

Because of these previous findings, the relationship of verbal ability with the different measures of theory of mind in the present study were investigated. Results found no significant differences between children who passed or failed the Ice-cream van test on verbal ability. However, verbal ability was positively correlated with performance on the Strange Stories measure. Verbal ability was negatively correlated with the Social Behaviour Questionnaire for all data. This correlation was replicated for the ADHD group but not the Control Group.

In summary, the relationship between verbal ability and theory of mind functioning in the present study varied according to the measures used. Verbal ability was not associated with performance on the second order theory of mind task. However high verbal ability was a good predictor of a high score on the Strange Stories for both the control and the ADHD group. This may be due to the design of the measure which requires a child to understand the story read out to them, and gives them the opportunity to read back over the story again before giving answers. Children with poor understanding of vocabulary would be at an obvious disadvantage in answering test questions.

Interestingly, the relationship between the Social behaviour Questionnaire and verbal ability differed between the two groups. Verbal ability was not correlated with score on the Social Behaviour Questionnaire within the Control group. However, good verbal ability was correlated with more frequently rated social behaviour indicative of a theory of mind within the ADHD group. This finding is remarkably consistent with Happé's (1995) study of autistic participants, although the measures differ. It could be speculated that children with ADHD who have poor theory of mind ability, have associated poor verbal ability as a consequence of delays in pre verbal skills that require a theory of mind (e.g. joint attention, reference, and ostentation).

4.6 Additional analysis

Part of the analysis involved a further investigation of the psychometric properties of the newly developed Social Behaviour Questionnaire. The Social Behaviour Questionnaire was shown to have good concurrent validity with the Strange Stories measure, and high internal consistency.

This increases the confidence in the results of the present study using the Social Behaviour Questionnaire as a measure of theory of mind functioning in everyday life. However further research is needed with this measure.

4.7 Theoretical implications

The present study has some important implications for theoretical issues within the literature. First, the construct of theory of mind is discussed with reference to the nature of the proposed cognitive processing involved. Second, the nature of theory of mind difficulties between different psychiatric diagnoses are discussed. Third, the specific nature of the social deficit in children with ADHD is discussed with respect to available theories to account for the findings in the present study.

4.7.1 The construct of theory of mind

What exactly is it that we are measuring when we say theory of mind? The theory has been most vigorously tested by researchers of autism. They hypothesize that theory of mind is a cognitive process requiring a person to represent other people's thoughts and beliefs in the form of *meta-representations* (Leslie, 1987). Thus social deficits are considered a secondary function of specific patterns of cognitive impairment.

The process is considered to be specific because only social behaviour requiring a theory of mind will be affected (Klin et al., 1992). Leslie (1987) has speculated that autistic individuals have a specific cognitive incapacity to impute mental states to others and to themselves, and this accounts for deficits in pretend play, empathy, and social cognition.

Later research with individuals with autism has utilized different levels of theory of mind functioning, from first and second order theory of mind paradigms (Baron-Cohen, 1989c) to methods of assessing theory of mind functioning in everyday social life (Frith, Happé, & Siddons, 1994; Happé & Frith, 1996; Ozonoff & Miller, 1995). Indeed, in the present study the focus is less on an all or nothing concept, and more on a graded continuum of theory of mind.

In the present study the first order theory of mind test is designed to assess an individual understanding that other's can hold false beliefs about reality. The second order theory of mind task is more complicated in that it requires an individual to understand that other people

can hold false beliefs about other's beliefs. The strange stories assess an individuals reasoning about people's intentions, desires, beliefs, misunderstandings etc. in a more realistic and ecologically valid way. Finally the Vineland Adaptive Behavior Scales and the Social Behaviour Questionnaire were included to measure the actual level of social and communicative functioning of an individual in everyday life, particularly with respect to social behaviours that require an understanding of other's mental states. Thus the design of the present study was intended to measure different levels of complexity of theory of mind functioning.

Even researchers of autism have found that a small percentage of individuals are able to pass first and second order tests (Frith, Happé & Siddons, 1994). Despite this they continue to have deficits in social functioning in everyday life. This finding can be accounted for by several hypotheses. Autistic children who pass theory of mind test may have social deficits that are not caused by theory of mind difficulties. Alternatively, these children may have theory of mind deficits, but these are not picked up by simple experimental paradigms of theory of mind. These children may have worked out strategies to solve theory of mind problems that do not require an understanding of other's mental states. For example, they may have learned simple rules such as "a person can only know what they see".

Many researchers have hypothesized a strategy of 'hacking out' solutions to theory of mind problems in individuals with autism (Happé, 1995; Ozonoff & Miller, 1995). A further explanation could be that some children with autism who pass simple theory of mind tests do have some degree of understanding of others mental states, but in everyday social situations involving complex and subtle social cues, they are unable to access this meta-representation to inform their subsequent actions.

In the present study it would appear that the ADHD group are functioning at a similar level to those autistic individuals who pass first and second order theory of mind tasks (although this requires further research with a direct comparison group of autistic individuals). Whilst the ADHD group had no problems with the first and second order tasks, they demonstrated significant impairments on the more complex and ecologically valid Strange Stories and on ratings of social behaviours in everyday life, particularly those requiring theory of mind

functioning. This may finding seems to suggest that children with ADHD do not have a specific deficit in theory of mind functioning. However, in everyday life children with ADHD may have difficulty performing social skills requiring a theory of mind.

4.7.2 Theory of mind in other clinical samples

Research evidence suggests that the majority of individuals with autism have a selective and specific deficit in theory of mind functioning, consistent with a model of inability to form meta-representations. Corcoran (in press) reviews evidence of theory of mind deficits in other clinical samples distinct from autism. Her own research focuses on adults with schizophrenia. It has been argued that the symptoms of schizophrenia represent underlying cognitive deficits within a system that enables the recognition and monitoring of ones own willed intentions, and the attribution of intentions, thoughts, and beliefs of other's (Frith, 1992).

In a series of studies Corcoran (reviewed in Corcoran, in press) investigated levels of theory of mind functioning in groups of adults with schizophrenia classified according to their major sign/symptoms. Evidence of theory of mind deficits were found and quantitative and qualitative differences between groups discussed. People with negative feature schizophrenia were found to perform poorly, in a similar way to individuals with autism, on theory of mind tests. However, unlike autistic individuals, they also had impairments in other cognitive skills. For example, they not only failed theory of mind questions, but also had difficulties with memory control questions on second order theory of mind tests. Thus it was concluded that this group of individuals with schizophrenia shared the extent of theory of mind deficits with autistic groups, but not the specificity of the difficulty.

Individuals with thought disorder did not lack mental state terminology, but gave answers that were bizarre misinterpretations of the experimental task. Furthermore, group performance on theory of mind tasks improved as their thought disorder remitted. It was argued that this deficit in theory of mind functioning was less of a failure of development, and more a temporary malfunctioning in which reasoning was confused by psychotic pre-occupations. This theory of mind deficit is unlike that seen in individuals with autism, as mental state

language is used but theory of mind is not intact, and nor probably are other reasoning skills because of the effect of the psychotic condition.

Individuals with paranoid delusions demonstrated deficits in theory of mind functioning to a lesser extent than autistic samples. They tended to fail to recognise hidden intentions or false beliefs and did not use mental state language. There was no evidence of memory problems on the theory of mind stories for these individuals, and no social semantic deficits on a maxims task.

For individuals with schizophrenia whose symptoms remit, their performance on theory of mind tasks improved and did not differ significantly from control 'normal' and non-psychotic groups. Thus, Corcoran suggests that since some of the patients in remission had long histories of paranoid thinking and thought disorder, the problem was state dependent rather than developmentally acquired. In contrast individuals with chronic negative feature schizophrenia, whose condition does not remit, there is a more permanent breakdown in mentalizing ability.

The present study is the first to evaluate theory of mind functioning in children with ADHD. Results suggest that children with ADHD in general are able to pass first and second order theory of mind tasks unlike the majority of individuals with autism. Furthermore, children with ADHD do not share the specificity of theory of mind deficits with autistic individuals. In a similar way to the schizophrenic participants with negative features, some children with ADHD had difficulty remembering the Strange Stories and Ice-cream van tests. This is a qualitative finding, as the memory control and comprehension questions in both tests were not scored, and the researcher repeated the test until the child answered the question correctly. However, this finding is consistent with research indicating that children with ADHD have cognitive impairments associated with executive functioning problems, in particular deficits of working memory (Cherkes-Julkowski et al., 1997).

4.7.3 Social deficit in ADHD

The present study is consistent with previous findings that children with ADHD have measurable deficits in socialisation and communication abilities compared with typically

developing children (Roizen et al., 1994). Though the problems with socialization tend to be less severe than for children with autism (measured by the Vineland Adaptive Behavior Scales; Happé & Frith, 1996).

The present study also suggests that children with ADHD have difficulty interpreting others' motivations, beliefs, and understanding in real life social situations. Roizen et al. (1994) suggests that these deficits in adaptive behaviour are a primary cognitive impairment of ADHD, as secondary cognitive deficits should improve with medication.

It is unclear whether the theory of mind difficulties represent a deficit or a delay in the development of this ability. However the results suggest that unlike most autistic individuals the theory of mind problem is not specific, but involves the integration of information in complex real life situations. Whilst the present study was not designed to specifically test theories of ADHD there is some supportive evidence for both Barkley's (1997) theory of ADHD, and the information processing deficit theory of ADHD (Crick & Dodge, 1994) both of which suggest that these children have difficulty with information processing and executive functioning.

For example, it is interesting to speculate about the poor performance of the ADHD group on the Strange Stories measure. It may be that children with ADHD have poor social reasoning because of deficits in theory of mind ability. Perhaps, in a similar way to the autistic children, they are unable to make mental representation about what others may feel, believe, or think in social situations. Alternatively, children with ADHD may have found it difficult to remember the passages and use the information presented to them to reason out an appropriate answer. This is more like the executive functioning problems described by Barkley (1997).

The finding that children with ADHD do not lack an absolute ability to mentalize but fail to demonstrate this ability to the same extent as the control group in everyday life is similar to the argument about social skills performance deficits. Children seem to know what to do but have difficulty applying this knowledge at the right time.

4.8 Clinical Implications

4.8.1 Assessment/Diagnosis

DSM-IV (APA, 1994) diagnostic criteria for ADHD do not incorporate deficits in social functioning as a core symptom of the disorder. The results from the present study suggest that difficulties in socialisation, communication, and theory of mind abilities are prevalent in the ADHD children. These results indicate that the DSM-IV criteria should be revised to incorporate socialization deficits. Also should this finding be replicated, it may provide additional guidance for the assessment and diagnostic process of children with ADHD.

In particular some of the measures in the present study may usefully be applied to children and their parents in the context of a full diagnostic assessment. The series of first and second order theory of mind tasks and the Strange Stories test, provide a continuum of increasingly complex theory of mind tasks that can identify the level of theory of mind dysfunction for individuals. The Vineland Adaptive Behavior Scales are frequently used in research papers and could provide a useful tool for clinicians in assessing adaptive behaviour in everyday life.

Given further research and validation the Social Behaviour Questionnaire may provide a means of assessing a child's theory of mind functioning in social situations. This could aid the diagnosis of ADHD, autism, and other disorders of empathy. If theory of mind and social deficits are an indicator of a child's level of empathic disorder, this may be helpful in distinguishing between different clinical populations which at present is problematic for clinicians.

4.8.2 Formulation of problems

Results of the present study suggest that in general children with ADHD show impairments in performance on some theory of mind measures. However individual differences were apparent within the ADHD sample. This suggest that theory of mind functioning and social behaviour are important areas to assess when screening for ADHD.

Even more importantly the procedure provides a series of theory of mind measures that increase in complexity, from simple first order experimental tests to a more subtle parent rating scale that measures theory of mind functioning in everyday social life. Thus the study procedure provides a means of assessing individual differences within a group of children with ADHD. This is important clinically when assessing individual cases. For some children with ADHD, it may be that there is very little social difficulty with theory of mind functioning, and the main cause of concern is a lack of attentiveness or impulsivity. This formulation would infer a different means of intervening in a case where a child with ADHD is found to have fundamental difficulties grasping second order theory of mind tasks, and understanding that other people may have different thoughts, beliefs, and perspectives in social situations.

4.8.3 Intervention

All but two of the participants with ADHD were currently being treated with stimulant medication. Even so there were observed deficits on socialization, communication, and theory of mind functioning for these children in general. This would seem to indicate that medication alone is insufficient for treating the social and communication problems of individuals with ADHD. This finding is consistent with research suggesting that psycho-stimulant medication has ameliorating effects on attentiveness, but is ineffectual at changing social cognition's (Whalen, Henker & Granger, 1990) and has little impact on peer ratings of acceptance and rejection (Pelham & Bender, 1982).

The present study has highlighted the difficulties experienced by children with ADHD in respect to socialization, communication, and theory of mind functioning in everyday social life. The next step however would be to devise appropriate interventions designed to ameliorate these difficulties. Devising specific interventions for children with ADHD necessitates a thorough individual assessment and formulation of specific difficulties encountered by the child. For children with ADHD who have difficulties with theory of mind functioning, a sharing of ideas with research into children with autism may present a positive step forward. This does not imply that the two developmental disorders are identical.

Recently, research has began to examine possible interventions focused on teaching theory of mind abilities to children with autism (Ozonoff & Miller, 1995; Howlin, Baron-Cohen & Hadwin, 1999). Ozonoff and Miller (1995) conducted a social skills group focusing on theory of mind skills with nine male autistic adolescents. A battery of theory of mind tests were given before and after the intervention. The intervention package is detailed in Ozonoff and Miller's (1995) research. In brief it involved 14 weekly sessions divided into two major units. The first addressed basic interactional and conversational skills, and the second focused on perspective taking and theory of mind skills.

Results showed substantial improvements on several false belief tasks for the intervention group compared with the no intervention control group. However, although improvement on paper and pencil tests of theory of mind were established, the ability to translate these difficulties into everyday conversation and interactions remained limited. The research was limited by the small sample size. However, results suggest a major disparity between having the ability to think about other's mental states, and performing these skills habitually in the real world.

Since children with ADHD may have less severe impairments in theory of mind functioning, a social skills group designed to help them understand other mind's in social situations may provide more positive results. The importance of individualization of treatment interventions and rigorous experimental investigations of outcome can not be stressed enough.

4.8.4 Evaluation

The battery of tests used in the present study to investigate a continuum of increasingly complex theory of mind skills, may provide a useful protocol for outcome measurements. The Social Behaviour Questionnaire may be particularly helpful, as it represents the first measure designed specifically to investigate theory of mind deficits in everyday social functioning. The measure requires further standardization and validation, but at present it appears to be a promising tool that is sensitive to theory of mind deficits in everyday functioning.

In the intervention study by Ozonoff and Miller (1995) a distinction was made between *specifying measures* (i.e. those designed to determine whether a target behaviour has changed as a result of treatment) and *impact measures* (i.e. those designed to determine whether intervention influenced a socially valid outcome). In the present study the false belief tasks and Strange Stories would constitute good *specifying measures*, and the Vineland Adaptive Behavior Scales and Social Behavior Questionnaire would make excellent *impact measures* for intervention studies designed to ameliorate theory of mind deficits in a number of clinical disorders.

4.9 Limitations of Study

The strength of the present study lies in its use of theory of mind measures with a new clinical group, and the use of a battery of tests. However, the study was not without methodological problems and as such cannot be definitive. First the possibility of confounding variables are discussed and then methodological limitations of each section of the study are reviewed.

4.9.1 Possible confounding variables

Diagnosis

As expected the ADHD group attained significantly higher scores on the ADHD Rating Scale-IV than the Control group. This was a 'double check' and increases confidence in the proposition that children in the ADHD group had more symptoms associated with ADHD than the control. This was particularly important as 88% of the ADHD sample were receiving pharmacological treatment for the disorder.

Age, socioeconomic status, and nonverbal ability

The two groups did not differ significantly with respect to age, socioeconomic background, or nonverbal ability. Thus it is unlikely that diagnostic status is confounded with these other measures within the results. In particular since nonverbal ability is highly correlated with more

general IQ levels (Spreen & Strauss, 1991) it is probable that the results can not be accounted for simply in terms of IQ differences between the two groups.

Verbal ability

The ADHD group had significantly lower levels of receptive language ability than the Control group. This is not surprising since previous research has associated ADHD with difficulties in communication skills (Westby & Cutler, 1994; Roizen et al., 1994). Furthermore, previous research into theory of mind problems in autistic individuals suggests that those who pass theory of mind test have higher verbal ability than those who fail (Happé & Frith, 1996; Happé, 1995; Frith, Happé & Siddons, 1994).

Happé (1995) found that verbal mental ability, measured by the British Picture Vocabulary Scale, was a good predictor of theory of mind performance in young 'normal' and autistic children. However autistic participants appeared to require much higher verbal ability to pass theory of mind tasks than did either young 'normal' or learning disabled participants. Thus if children with ADHD have deficits in theory of mind abilities, it may also follow that they have poor verbal ability.

Verbal ability and theory of mind

The possibility of verbal ability confounding between group differences on the Strange Stories theory of mind measures was investigated. Results indicated that when receptive language abilities were partialled out, the ADHD group still attained significantly lower scores on the Strange Stories theory of mind measure than the Control group.

This is an interesting finding since it implies that performance on the Strange Stories was not simply dictated by children's receptive language ability. It adds credence to the hypothesis that the two groups did differ with respect to their ability to think and talk about other peoples mental state representations in social scenarios.

87

Age and theory of mind

Age was not significantly correlated with either the Strange Stories or the Social Behaviour Questionnaire for the ADHD group. However Control group age was positively correlated with the Strange Stories and negatively correlated with the Social Behaviour Questionnaire.

This finding suggests that as typically developing children get older they become more adept at understanding others in social situations, and this has a positive impact on their social behaviour in everyday life. In contrast the ADHD children did not show better performance on these tasks with increasing age. This is a worrying finding as it implies that even older children with ADHD continue to have difficulties understanding other peoples motives in social situations, and acting accordingly in everyday life.

Unmeasured confounding variables

It is possible that some unmeasured variable could account for the differences in results between the various measures of theory of mind functioning. For example it is possible that the strange stories was demanding for the ADHD children because they had poor verbal auditory and working memory. These cognitive factors were not measured and therefore can not be ruled out as confounding variables between the two groups of children.

Furthermore, by definition the children with ADHD were less attentive and more impulsive than the control group. Again this may interact with the testing situation to cause the children with ADHD to perform less well on theory of mind tasks than the control group.

4.9.2 Methodological limitations

Design

The study was a between groups comparison design. This design does not allow the issue of causality to be explored. Differences can be identified between the two groups, for example with the ADHD group attaining lower Communication and Socialization domain scores than

the Control group, but what causes these differences is difficult to prove. The two groups differed with respect to developmental status, there may however have been other unmeasured confounding variables.

Similarly the design does not distinguish the precursors of an ADHD diagnosis and therefore it is impossible to say whether the theory of mind deficits found are a result of other difficulties associated with ADHD, such as inattentiveness and impulsivity, or whether it is a core feature of the disorder.

Causality can only be investigated with longitudinal data. This would allow for variables, such as theory of mind skills, to be investigated over time. Hence the developmental sequencing of these abilities could be more clearly tracked. In defence of the present research, longitudinal research is time consuming and costly, and it was not appropriate in the context of a doctoral dissertation. Most research in this area has utilized similar group comparison designs.

The researcher of the present study was aware of the participants allocation to the experimental groups. This increases the possibility that experimenter effects could have been implicated in the research findings. The design would have been improved with blind ratings and evaluation of the study.

Participants

Several comments can be made about the participants in the present study. First, the sample of ADHD and Control children all lived in a rural community in the Midlands. There was a lack of cultural and ethnic diversity within the sample. The two groups did not differ in this respect, therefore the results are unlikely to be confounded by cultural and ethnic differences. However this reduces the confidence with which the results might be generalized to other populations of children with ADHD.

Second, as has previously been noted, the children with ADHD were predominantly receiving pharmacological intervention for their disorder, whilst the Control children were not. This is a possible confounding variable between the two groups. However previous research reports

that medication has either positive or no effect on children's social-cognitive processing and peer acceptance (Alston & Romney, 1992; Pelham & Bender, 1982; Hubbard & Newcomb, 1991; Murphy, Pelham & Lang, 1992). Therefore it is unlikely that medication has caused the differences measured between the two groups in the present study.

Third, the children with ADHD in the present study derive from a clinical sample. It is likely that they have more severe problems than a community identified sample would have. It is possible that children with ADHD who have deficits in theory of mind functioning represent the most severely disordered individuals. Alternatively, theory of mind deficits may be a more global feature for most individuals with ADHD no matter how they were identified. This would be an important finding in terms of focusing on intervention plans.

Fourth, no attempt was made to discriminate between subtypes of ADHD children. It may be that children with predominantly inattentive symptoms would differ from those with hyperactive/impulsive symptoms. This requires further research. In a similar way the co existence of specific learning difficulties was not examined in the ADHD group, and this requires further research.

Finally, within the present study the Control children received a low average mean score on the Communication domain, and many failed the second order theory of mind task (54 %). Some also had clinically high scores on the ADHD Rating Scale-IV, although their parents said the children did not have any developmental or behavioural problems. It may be that there is some contamination of children with ADHD or other developmental problems within the Control group. This may have been due to the recruitment process in which parents at a local school were given information about the study in order to recruit participants. It is possible that parents who agreed to participate had some unexpressed concerns about their child that they wanted the researcher to investigate.

Measures

In the present study a suprising finding was that 54% of Control participants failed the Ice-cream van test. Other studies using this test report that 'normal' controls usually pass this test

(Baron-Cohen, 1989 found 9 out of 10 'normal' participants passed this test). Thus it may have been that the control participants in the present study differed from controls in other studies in some way, or more likely that the props or experimenter procedure was difficult for some reason.

Inter rater reliability rates for some of the Strange Stories were inadequate. This requires further investigation, and the selection of stories which have high inter rater reliability should be used in subsequent research.

The Social Behaviour Questionnaire was devised by the researcher, and has not been fully validated, therefore the findings from this measure should be taken with caution until such time as the measure is further evaluated.

Procedure .

The procedure was undertaken at the participant's homes. This had advantages and disadvantages. One advantage was that parents and children were at ease in their home environment. The major disadvantage was that the researcher had very little control over the environment and potential distractions. This is particularly pertinent for the ADHD group who tended to be easily distracted from the experimental tasks. To combat this problem the researcher explained to parents the need for minimal distractions for their children. On occasion however the presence of siblings, other family members, and pets were potential distracters.

This problem could have been overcome if the research had taken place in a more controlled setting such as at the child development centre. However since the research was interested in theory of mind in everyday life the procedure may have produced results which are more ecologically valid.

<u>Analysis</u>

The analysis included parametric and non parametric statistical tests because some of the data did not fulfill the criteria for parametric tests (Bryman & Cramer 1997). It is possible with a larger sample of children from a more heterogeneous population, that the data would have been of normal distribution and heterogeneous variance. However some of the measures (e.g. the first and second order theory of mind tests) did not produce interval data and thus could not have been analysed with parametric statistics.

4.10 Future Research

The present study has provided new findings about theory of mind and social functioning in children with ADHD. However, as with most research the study has highlighted many unanswered questions and ideas for further research.

4.10.1 Generalizability

The generalizeability of the present findings would be improved with further research. This research could focus on applying a similar procedure to children from different age groups, ethnic and cultural backgrounds. Furthermore, the present study utilized children with ADHD from a clinical population. The generalizeability of the findings would be increased by replication with a community sample of children with ADHD.

The present study did not find any differences between the ADHD and Control group on the first and second order theory of mind task. Alternative paradigms of measuring first and second order theory of mind would increase the confidence that this finding is not just a product of the measures used (See Happé, 1995 and Baron-Cohen, 1989, for possible alternative procedures).

4.10.2 Developmental process

The present study focuses on children aged between 7 and 12 years. It has been found that children with autism fail to develop theory of mind abilities at a very young age (Klin et al., 1992). The present study does not give any indication of the developmental sequelae of theory of mind abilities in children with ADHD. Further research with younger children with ADHD would help to determine whether theory of mind difficulties and deficits in social functioning are a primary deficit in these children, or are a consequence of other symptoms of the disorder.

Similarly, research with adolescents and adults with ADHD would provide evidence of the relationship of social difficulties and theory of mind functioning as these children age. It may be that as children get older they find ways of compensating for deficits in social-cognitive processing. Of particular interest clinically would be the prognosis of those children who continue to experience difficulties in social situations in terms of occupation, mental health, and legal systems.

Any research with children of different age groups would need to consider the developmental status of the children when selecting appropriate theory of mind measures. For example Happé's (1994) Strange Stories would not be suitable for children younger than 7 years due to the complexity of the language used.

4.10.3 Medication status

Further research is required to look at the impact of stimulant medication on social-cognitive processing. In the present study most children with ADHD were receiving pharmacological treatment, however they still had measured deficits in theory of mind and social functioning. The present research would have benefited from a third group of children with ADHD who were not being treated with medication. For practical and ethical reasons this was not possible as most children with ADHD in the locality were already receiving pharmacological treatment.

4.10.4 Autism and other 'empathy disorders'

The present study would have benefited from a comparison group of children with autism. Whilst there is a large body of literature looking at theory of mind abilities of children with autism, some measures used in the present study have not been widely used. For example the Strange Stories and the Social Behaviour Questionnaire have not been used widely with children with autism. A comparison of children with ADHD and autism on these measures would provide greater evidence of the impact of different levels of theory of mind deficits, and the relationship with everyday social functioning.

Similarly the role of theory of mind abilities in everyday life needs further investigation in other developmental or clinical disorders, for example with children with Tourette's syndrome, anorexia nervosa, and schizophrenia. This would expand knowledge about the validity of Gillberg's (1992) call for a continuum of 'empathy disorders'.

4.10.5 Social Behaviour Questionnaire

Further investigation to develop and validate the Social Behaviour Questionnaire is required. A number of improvements could help develop the measure. First, the measure could be standardized to take into account the developmental status of children being rated. Second, the measure could be further validated on children with different developmental disorders, such as autism. The present study did not include a large enough sample of children with ADHD or Control children to provide sufficient norm referenced data for these populations. Third, to improve the construct validity of the Social Behaviour Questionnaire the measure needs to be correlated with other theory of mind measures.

4.11 Conclusion

The present study is the first to investigate theory of mind functioning of children with ADHD. The results suggest that compared with a typically developing group, children with ADHD have deficits in communication, socialization, and performance on theory of mind measures in everyday life. The implications of these findings theoretically, and in terms of

clinical assessment and intervention are huge. Further research is required to investigate whether these findings can be replicated.

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APPENDIX 1

Dear ....,

My name is Katy Norman. I am a Clinical Psychologist in training at Leicester University, currently working at The Child Development Centre in Chesterfield. As part of this work, I am conducting a study about children's social behaviour. I am writing to ask you and your child .... to participate in this study.

I enclose an information sheet explaining what the study involves, and two consent forms for you to sign if you wish to take part. One of the consent forms is for you to keep and the other is for my records. Please take some time to consider whether you feel able to participate.

If you have any questions about the study that you would like to be answered before signing the consent form, please contact me at the address above. You can leave a message and I will get back to you if I am not available when you ring.

I will ring you to confirm whether or not you agree to participate, a week or two after you have received this letter. If you decide not to participate, this will not affect the treatment of you or your child in any way, and you will not be contacted again regarding the study. However if you agree to participate we can arrange a meeting at your convenience, to exchange the consent form and undertake the study.

Thank you for your time.

Yours sincerely

Katy Norman
Clinical Psychologist in training.

APPENDIX 2

INFORMATION SHEET

We are contacting parents/guardians of children to ask them and their child to participate in a study about social behaviour. The study will examine the social behaviours of children who have been diagnosed with Attention Deficit Hyperactivity Disorder and compare this with children who are not diagnosed with this condition. We would like your child to participate in the Attention Deficit Hyperactivity Disorder group.

The study would involve parents/guardians filling out three short questionnaires with the researcher about their child's behaviours. This would take approximately fifteen minutes. Then your child would be asked to undertake a short assessment procedure involving five short game like tasks and an assessment of their verbal and non verbal abilities. This will take approximately 45 minutes.

As with all studies like this, we would make sure that any information given by yourself or your child would be completely confidential. No information will be passed to anyone who was directly involved in your child's care. The researcher will not be able to answer questions regarding a child's score on the questionnaires, or their performance on the assessment tasks. However, you will be asked if you would like to receive the overall findings from the study when it is completed.

If you, or your child, decide to stop at any point during the study you can do so. This will not affect any care or treatment that you receive now or at any point in the future.

This study is explorative and whilst it is hoped that it will have beneficial longer term effects on the diagnosis and treatment of children with ADHD, there will not be any immediate benefits from this study for your child.

Katy Norman
Trainee Clinical Psychologist

Dear Parent,

Hello. My name is Katy Norman. I am a post graduate student at Leicester University. As part of my training I am researching boys social behaviour. I need 30 boys aged 8-12 years, to help me with the study.

WHAT IS THE STUDY ABOUT?

The study looks at the social behaviour of boys with Attention Deficit Hyperactivity Disorder (ADHD). This is a serious problem which causes some children to have difficulty sitting still and concentrating on activities. It can affect their learning and how they get on with other children. I need 30 children **without** ADHD, to compare with this group. That is why I need your help.

WHAT WOULD IT INVOLVE?

If you agree to take part, I would arrange to meet with you, and ask you questions about your child and his behaviour. For example I will ask you how he gets on with other children, and what he likes to do in his spare time. This will only take half an hour. I would also like to see your son, and do some game-like activities with him. I would show him pictures, read stories, and ask him questions about what he has seen and heard. This would take another half an hour. The children that I have seen so far, have reported that this was fun!

WHERE WOULD THIS HAPPEN?

I will ring you up on receiving your agreement to take part, and arrange to meet you at a time and place convenient to you. I can arrange to see your son either at school, or at home after school when you could observe what we are doing.

WHY SHOULD YOU PARTICIPATE?

ADHD is a serious problem for children. It can have long term effects in adulthood. Very little is understood about the social difficulties that these children have. You could contribute to important new research which could benefit children less fortunate than yours. The research may help parents and professionals understand the difficulties children with ADHD have in getting along with other people.

I am not looking to recruit children who are perfectly behaved or amazingly clever. I need a cross section of 'ordinary' children to take part.

Mr. Dunbar has given his approval for this study. Please could you fill out the slip below, and return it to school by Friday 5th February 1999. I look forward to your reply.

Thank you for your time.

Yours sincerely

Katy Norman
Clinical Psychologist in Training.

I do / do not agree to participate in a study about children's social behaviour.(Delete as appropriate)

Child's name_____

Parents Signature_____

APPENDIX 4

INFORMATION SHEET

We are contacting parents/guardians of children to ask them and their child to participate in a study about social behaviour. The study will examine the social behaviours of children diagnosed with Attention Deficit Hyperactivity Disorder and compare this with a group of children who do not have a diagnosis. We would like your child to participate in a control group of non disabled children.

The study would involve parents/guardians filling out three short questionnaires with the researcher about their child's behaviours. This would take approximately fifteen minutes. Then your child would be asked to undertake a short assessment procedure involving five short game like tasks and an assessment of their verbal and non verbal abilities. This will take approximately 45 minutes.

As with all studies like this, we would make sure that any information given by yourself or your child would be completely confidential. No information will be passed to anyone who was directly involved in your child's care. The researcher will not be able to answer questions regarding a child's score on the questionnaire, or their performance on the assessment tasks. However, you will be asked if you would like to receive the overall findings from the study when it is completed.

If you, or your child, decide to stop at any point during the study you can do so. This will not affect any care or treatment that you receive now or at any point in the future.

This study is explorative and whilst it is hoped that it will have beneficial longer term effects on the diagnosis and treatment of children with ADHD, there will not be any immediate benefits from this study.

Katy Norman
Trainee Clinical Psychologist

APPENDIX 5

Participant number:_____

Information from this questionnaire is for the purpose of background information. Any information given will remain strictly confidential.

What is your child's D.O.B?_____

What relation are you to the child?_____

Are you a single parent family/married/Living as a couple?_____

What is your occupation?_____

What is your partners occupation (If appropriate)?_____

How many children are in the family?_____

Did you have any pre or post natal problems with X?_____

Is the child on any medication, if so what?_____

Does your child have any medical/developmental problems?_____

What do these problems consist of ? _____

APPENDIX 6

SOCIAL BEHAVIOUR QUESTIONNAIRE

The following questionnaire is designed to find out about your child's social behaviours. Please read each question carefully and tick the box which most applies to the frequency of your child's behaviour in the last two weeks. The options are; Never, Rarely, Occasionally, Often, and Very Often. Please answer all the questions. If you do not understand a question please ask the researcher. Thank you for your cooperation.

		NEVER	RARELY	OCCASIONALLY	OFTEN	VERY OFTEN
1	Does your child unknowingly embarrass you in public?					
2	Does your child respond when you tell him or her to behave?					
3	Can you reason with your child?					
4	Does your child realise when you don't know what they're talking about?					
5	Does your child know the difference between when you are joking and when you are being serious?					
6	Does your child realise when you have done something accidentally or by mistake?					
7	Does your child know when another child is trying to get them into trouble?					
8	Does your child talk at length about things that no one else is interested in?					
9	Is your child too familiar with strangers, for example asking personal questions or showing too much affection?					
10	Does your child upset other children without realising why?					
11	Will your child invent a story to avoid getting into trouble?					
12	Does your child recognise when they have upset you?					
13	If choosing you a present, would your child get something that you would like?					
14	Does your child understand if you give him a hint to do something, for example if you said "Most children go to bed around this time."?					

		NEVER	RARELY	OCCASIONALLY	OFTEN	VERY OFTEN
15	Does your child use words that no one else understands the meaning of?					
16	Does your child express thoughts that do not make sense to you?					
17	Does your child ever deliberately deceive you, for example by telling lies or fibs?					
18	Does your child show a lack of considerations of other peoples feelings, for example by being rude about their appearance?					
19	Does your child recognize when you are sad or happy?					

APPENDIX 7

SCORING KEY FOR THE SOCIAL BEHAVIOUR

QUESTIONNAIRE

		NEVER	RARELY	OCCASIONALLY	OFTEN	VERY OFTEN
1	Does your child unknowingly embarrass you in public?	0	1	2	3	4
2	Does your child respond when you tell him or her to behave?	4	3	2	1	0
3	Can you reason with your child?	4	3	2	1	0
4	Does your child realise when you don't know what they're talking about?	4	3	2	1	0
5	Does your child know the difference between when you are joking and when you are being serious?	4	3	2	1	0
6	Does your child realise when you have done something accidentally or by mistake?	4	3	2	1	0
7	Does your child know when another child is trying to get them into trouble?	4	3	2	1	0
8	Does your child talk at length about things that no one else is interested in?	0	1	2	3	4
9	Is your child too familiar with strangers, for example asking personal questions or showing too much affection?	0	1	2	3	4
10	Does your child upset other children without realising why?	0	1	2	3	4
11	Will your child invent a story to avoid getting into trouble?	4	3	2	1	0
12	Does your child recognise when they have upset you?	4	3	2	1	0
13	If choosing you a present, would your child get something that you would like?	4	3	2	1	0
14	Does your child understand if you give him a hint to do something, for example if you said "Most children go to bed around this time."?	4	3	2	1	0

		NEVER	RARELY	OCCASIONALLY	OFTEN	VERY OFTEN
15	Does your child use words that no one else understands the meaning of?	0	1	2	3	4
16	Does your child express thoughts that do not make sense to you?	0	1	2	3	4
17	Does your child ever deliberately deceive you, for example by telling lies or fibs?	4	3	2	1	0
18	Does your child show a lack of considerations of other peoples feelings, for example by being rude about their appearance?	0	1	2	3	4
19	Does your child recognize when you are sad or happy?	4	3	2	1	0

APPENDIX 8

SMARTIES TASK

Name ....   Date.............................

(P) *(Showing Smarties tube without touching it)*

"What's in here?"

(C) ....(Smarties)

(P) *(Opens box to reveal pencil, or asks child to).*

"X hasn't seen this tube", (insert name of school friend, sibling or parent, as   appropriate),
"When X comes in and I show X this tube and say 'What's in here ?', what   will X say?"

(C) ....(Smarties/Pencil)

(P) " Do you remember at the beginning when I showed you the tube and asked you what was in it?"

(C) ....(Yes/ No)

(P) " What did you say?" *(Memory question)*

(C) ....(Smarties/Pencil)

(P) "And what's really in the tube?" *(Reality question)*

(C) ....(Smarties/Pencil)

PASS/FAIL

APPENDIX 9

Ice Cream Van

name..Date.................................

(P) "This is John, this is Mary. They live in this village (indicate).
"Which is John?, Which is Mary?" (memory question)
(P) " Here they are in the park. Along comes the ice cream man. John would like to buy an ice cream but he doesn't have any money, he's left it at home. "Don't worry" says the ice cream man, "I'll be back here in the park all afternoon. You can go home and get your money and come back.". "oh good" says John, "I'll come back in the afternoon and get an ice cream".
"Where did the ice cream man say he would be all afternoon?"
(C)...(park) (Memory question)
(P) " So John Goes home. He lives in this house. The ice cream man says " I'm going to drive my van to be outside the library to see if I can sell my ice creams there."
"Where did the ice cream man say he was going?"
(C)...(Library) (Memory question)
(P) **" Did John hear him say that?"**
(C)..(No John didn't hear) (Memory question)
(P) "The ice cream man drives over to the library. On he way he passes John and says "I'm going to sell my ice creams outside the library". And he goes off."
"Where did the ice cream man tell John he was going?"
(C)..(Library) (Memory question)
(P) **" Does Mary know that the ice cream man has talked to John?"**
(C)..(No, Mary doesn't know) (memory question)
(P) (Remove the ice cream van and John from the scene)
" In the afternoon, Mary goes over to John's house. She knocks on the door and his mother answers. "Oh" she says, " John's not here, he's gone to buy an ice cream"."
"Where does Mary think John has gone to buy his ice cream?"
(C)..(Park) (Test Question)
(P) **"Why?"**
(C)..
(P) **"Where did John really go?"**
(C)..(Library) (Reality question)
(P) **" Where was the ice cream man at the beginning?"**
(C)..(Park)

PASS/FAIL

APPENDIX 10

The stories can be read out, or the individual can read them silently aloud. It is probably helpful to leave the story visible whilst asking the test questions so that the subject can check back if necessary.

Give the stories in a random shuffled order, or work through from easy to hard. The first question is a comprehension question which checks if the child has understood and remembered the story. The second question is the test question, which gives you an understanding of the child's comprehension difficulties with the various thoughts and emotions involved.

Happé (1994) used the following scoring system. She scored each answer as appropriate or incorrect, and as concerning psychological states or physical states. Of course it is possible to score the stories differently, for example by giving a score between naught and three depending on how complete an answer it is.

"I am going to show you some stories which I will read out to you, or you can read them out loud. Then I will ask you some questions."

One day, while she is playing in the house, Anna accidentally knocks over and breaks her mother's favourite crystal vase. Oh dear, when mother finds out she will be very cross! So when Anna's mother comes home and sees the vase and asks Anna what happened, Anna says, "The dog knocked it over, it wasn't my fault!"

Was it true, what Anna told her mother?

Why did she say this?

Katie and Emma are playing in the house. Emma picks up a banana from the fruit bowl and holds it up to her ear. She says to Katie, "Look! This banana is a telephone!"

Is it true what Emma says?

Why does Emma say this?

Daniel and Ian see Mrs. Thompson coming out of the hairdresser's one day. She looks a bit funny because the hairdresser has cut her hair much too short. Daniel says to Ian, "She must have been in a fight with a lawnmower!"

Is it true, what Daniel says?

Why does he say this?

One day Aunt Jane came to visit Peter. Now Peter loves his aunt very much, but today she is wearing a new hat; a new hat that Peter thinks is very ugly indeed. Peter thinks his aunt looks silly in it, and much nicer in her old hat. But when Aunt Jane asks Peter, "How do you like my new hat?", Peter says, "Oh, it's very nice".

Was it true what Peter said?

Why did he say it?

A burglar who has just robbed a shop is making his getaway. As he is running home, a policeman on his beat sees him drop his glove. He doesn't know the man is a burglar, he just wants to tell him he dropped his glove. But when the policeman shouts out to the burglar, "Hey you! Stop!", the burglar turns round, sees the policeman and gives himself up. He puts his hands up and admits that hid did the break-in at the local shop.

Was the policeman surprised by what the burglar did?

Why did the burglar do this, when the policeman just wanted to give him back his glove?

William is a very untidy boy. One day his mother comes into his bedroom, and it is even more messy than usual! There are clothes, toys and comics everywhere. William's mother says to William, "This room is a pig sty!"

Is it true that William keeps pigs in his room?

Why does William's mother say this?

During the war, the Red army capture a member of the Blue army. They want him to tell them where his army's tanks are; they know they are either by the sea or in the mountains. They know that the prisoner will not want to tell them, he will want to save his army, and so he will certainly lie to them. The prisoner is very brave and very clever, he will not let them find his tanks. The tanks are really in the mountains. Now when the other side ask him where his tanks are, he says, "They are in the mountains".

Is it true what the prisoner said?

Where will the other army look for his tanks?

Why did the prisoner say what he said?

Ann's mother has spent a long time cooking Ann's favourite meal; fish and chips. But when she brings it in to Ann, she is watching TV, and doesn't even look up, or say thank you. Ann's mother is cross and says, "Well that's very nice isn't it! That's what I call politeness!"

Is it true what Ann's mother says?

Why does Ann's mother say this?

Jane and Sarah are best friends. They both entered the same painting competition. Now Jane wanted to win this competition very much indeed, but when the results were announced it was her best friend Sarah who won, not her. Jane was very sad she had not won, but she was happy for her friend, who got the prize. Jane said to Sarah, "Well done, I'm so happy you won!" Jane said to her mother, "I am sad I did not win that competition!"

Is it true what Jane said to Sarah?

Is it true what Jane said to her mother?

Why does Jane say she is happy and sad at the same time?

Brian is always hungry. Today at school it is his favourite meal; sausage and beans. He is a greedy boy, and he would like to have more sausages than anyone else, even though his mother will have made him a lovely tea when he gets home! But everyone is allowed two sausages and no more. When it is Brian's turn to be served, he says, "Oh please can I have four sausages, because I won't be having any tea when I get home!"

Is it true what Brian says?

Why does he say that?

It is Halloween, and Chris is going to a fancy-dress party. He is going as a ghost. He wears a big white sheet with eyes cut out to see through. As he walks to the party in his ghost costume, he bumps into Mr. Brown. It is dark, and Mr. Brown says "Oh! Who is it?" Chris answers, "I'm a ghost Mr. Brown!"

Is it true what Chris says?

Why does Chris say this?

At school today John was not present. He was away ill. All the rest of Ben's class were at school though. When Ben got home after school his mother asked him, "Was everyone in your class at school today?" Ben answers, "Yes Mummy",

Is it true what Ben said?

Why did Ben say that?

APPENDIX 11

RAVENS COLOURED PROGRESSIVE MATRICES ANSWER SHEET

A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
AB1
AB2
AB3
AB4 ·
AB5
AB6
AB7
AB8
AB9
AB10
AB11
AB12
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12

APPENDIX 12

BRITISH PICTURE VOCABULARY SCALE SHORT FORM ANSWERS.

TRAINING PLATE
A DOG
B MAN
C SWING
D SLEEP
E WHEEL
F MOPPING

		ANSWERS	KEY	RESPONSE	ERRORS
2-6YRS	1	BUCKET	1		
	2	BALL	4		
	3	CAR	2		
	4	WOODEN	2		
7-9YRS	5	CAMERA	4		
	6	ENVELOPE	2		
	7	CIRCLE	4		
	8	FURNITURE	3		
	9	NOSTRIL	1		
10-13YRS	10	DANGEROUS	2		
	11	FURIOUS	1		
	12	ATHLETE	3		
	13	ARTIST	3		
14-18YRS	14	WEARY	3		
	15	SOCKET	1		
	16	ANTLER	3		
	17	PULLEY	4		
	18	INFLATED	3		
	19	ASSISTING	1		
	20	COLLISION	2		
	21	FLORAL	1		
	22	GOBLET	3		
	23	UTENSIL	2		
	24	TALON	3		
	25	CONFIDING	3		
	26	INOCULATION	1		
	27	CONSUMING	4		
	28	GABLE	4		
	29	APPARITION	2		
	30	EMISSION	3		
	31	AMBULATION	2		
	32	SALTATION	4		

APPENDIX 13

ETHICS COMMITTEE APPROVAL LETTER

NORTH DERBYSHIRE LOCAL RESEARCH ETHICS COMMITTEE
CHAIRMAN: Rev. David C. Pickering

DCP/AB 516

18th November, 1998

Miss K. Norman,
8 Kenilworth Court,
Kenilworth Road,
South Wigston,
Leicester, LE18 4XT

Dear Miss Norman,

Theory of mind and social impairment: A comparison of children with attention deficit hyperactivity disorder, autism and non-disabled children
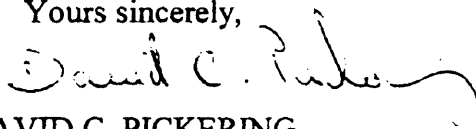
Thank you for forwarding a copy of the letter dated 29th October from Smithson Mason Limited and enclosed copy of your Certificate of Professional Liability Insurance. This was received by the North Derbyshire Local Research Ethics Committee at its meeting on 16th November when the Committee was happy with this cover. As this was the only issue outstanding the Committee agreed ethical approval be given for you to undertake the above study in North Derbyshire.

The Members of the Committee are:

Mrs. A. Ashworth, Nurse
Dr. K. Bennett, Lay Member
Dr. D. Clark, Primary Care Medical Adviser
Mr. J. Harris, Pharmacist
Mrs. M. Harrison, Lay Member
Mr. S. Krishnamurthy, Consultant Obstetrician and Gynaecologist
Mr. D. Marshall, Lay Member
Rev. D. C. Pickering, Lay Member
Dr. J. D. Stevens, Consultant Anaesthetist

Please can you let me know for our records when this study commences and finishes and forward a brief report on completion.

Yours sincerely,

DAVID C. PICKERING
Chairman, North Derbyshire LREC

Copy: Mrs. R. Kempster, Clinical Audit Co-ordinator, North Derbyshire Community Health
Care Service

APPENDIX 14

CONSENT FORM

I have had the nature of the research explained to me. I understand that as the parent/guardian, I can give consent on behalf of........................, to participate in the study. I understand that any information myself or ....give will be anonymised, and can not be traced back to individuals.

I understand that if I give consent for myself and .... to participate at this point in time, I can change my mind and withdraw my consent at any point in the future. My decision to participate or not, will not affect either my current or future treatment, nor that of

....

I give my consent to participate in the study, by filling out questionnaires about ....'s behaviour. Further I also consent on behalf of .... as their legal guardian to undertake assessments tasks.

NAME (Please print).......................................

NAME (Please sign).......................................

DATE..

If you have any further questions I can be contacted at the following address.

Katy Norman
Child Development Centre

APPENDIX 15

<u>ADHD Research Feedback</u>

Thank-you for taking part in the research. I have now had a chance to analyse the data and have written up the research as part of my training in Clinical Psychology. As requested this is a summary of the research and its main findings.

Aim of the study

The study was designed to investigate social behaviours of children with Attention Deficit Hyperactivity Disorder (ADHD). Many parents of children with ADHD voice concern's about their child's social behaviour over and above difficulties of inattention and impulsivity. Despite this little research has investigated this area.

Within the research literature into autism the concept of a "theory of mind" has been used to account for social difficulties. Autism is a rare childhood developmental disorder characterized by problems with socialization, communication and imagination. Theory of mind is defined as the ability to understand that other people have thoughts, beliefs, motivations etc. that differ from one's own in social situations.

Children with autism are thought to lack a theory of mind, thus in social situations they do not take into account that others do not share the same mental states as themselves. This for example may lead them to tell a story but leave out a vital detail; buy a present for someone else that they would like themselves; do exactly what they are told, making them vulnerable to being bullied or ridiculed.

The concept of theory of mind has not been investigated before with children with ADHD.

Who took part in the study?

Seventeen children with ADHD formed the ADHD group. Twenty children without ADHD formed a control group. Each child was administered three tests of increasing complexity to assess their concept of theory of mind. Each child's parent was also interviewed and completed questionnaires to assess their child's theory of mind. The ADHD group and control group did not differ significantly in chronological age or in non verbal ability, but the ADHD group had significantly poorer verbal ability.

What I found

On simple tests of theory of mind, that children with autism often fail, children with ADHD did as well as control children. However on a test that involved understanding stories about social situations that require an understanding of other people's motives, thought's and belief's, the ADHD group performed significantly worse than the control group. In addition parents of children in the ADHD group rated their children as significantly poorer on measures of communication and socialization in everyday life compared with the control group. Also, parent of the ADHD group rated that their children displayed less everyday social

behaviour that require a well functioning theory of mind than did parents of the control children.

What does this mean?

Children with ADHD do not seem to lack the ability to understand that other's have different thoughts and beliefs on simple tests. However there was evidence that in complex situations, similar to those that might occur in everyday life, children with ADHD did not demonstrate this ability. This may be because they have problems with working memory which means that they know what to do but forget to do it in social situations.

Children with ADHD may get into difficulties when socializing with peers and adults, as they fail to take into account that other people do not share the same knowledge and thought's and belief's as themselves.

Further research is needed to replicate these findings. However future work might also involve trying to teach children with ADHD some ways to overcome difficulties in taking other people's perspectives in social situations.

Thank-you once again for your help with this research

Katy Norman
Clinical Psychologist in training

APPENDIX 16

SUMMARY OF RAW DATA

	id	expgrp	age	ethnigrp	ses	medicate	adhdrate
1	1	ADHD	7.11	WHITE	II - Manang	RITALIN	88
2	2	ADHD	9.02	WHITE	III- Skilled,	RITALIN	58
3	3	ADHD	9.04	WHITE	II - Manang	RITALIN	87
4	4	ADHD	10.01	WHITE	III- Skilled,	RITALIN	99
5	5	ADHD	11.04	WHITE	II - Manang	RITALIN	99
6	6	ADHD	12.01	WHITE	II - Manang	MORE THA	99
7	7	ADHD	11.06	WHITE	IV- Partly S	RITALIN	98
8	9	ADHD	9.10	WHITE	III- Skilled,	RITALIN	93
9	9	ADHD	10.09	WHITE	V- Unskille	NONE	99
10	10	ADHD	12.01	WHITE	II - Manang	MORE THA	99
11	11	ADHD	11.04	WHITE	I- Professio	RITALIN	86
12	12	ADHD	10.09	WHITE	V- Unskille	NONE	99
13	13	ADHD	12.03	WHITE	V- Unskille	RITALIN	77
14	14	ADHD	8.00	WHITE	II - Manang	RITALIN	95
15	15	ADHD	8.00	WHITE	V- Unskille	RITALIN	80
16	16	ADHD	11.01	WHITE	III- Skilled,	RITALIN	95
17	40	ADHD	11.09	WHITE	V- Unskille	RITALIN	99
18	18	CONTROL	9.01	WHITE	III- Skilled,	NONE	86
19	19	CONTROL	9.07	WHITE	I- Professio	NONE	93
20	20	CONTROL	8.00	WHITE	III- Skilled,	NONE	93
21	21	CONTROL	9.08	WHITE	II - Manang	NONE	44
22	22	CONTROL	10.11	WHITE	IV- Partly S	NONE	97
23	23	CONTROL	11.01	WHITE	II - Manang	NONE	75
24	24	CONTROL	10.09	WHITE	I- Professio	NONE	58
25	25	CONTROL	11.02	WHITE	III- Skilled,	NONE	65
26	26	CONTROL	8.01	WHITE	III- Skilled,	NONE	32
27	27	CONTROL	9.11	WHITE	II - Manang	NONE	75
28	28	CONTROL	8.11	WHITE	I- Professio	NONE	75
29	29	CONTROL	8.00	WHITE	I- Professio	NONE	86

	socbehq	vinesoc	vinecom	smarties	icecream	rcpm	bpvs
1	27	86	70	PASS	FAIL	75	93.00
2	25	96	99	FAIL	FAIL	50	113.00
3	44	97	46	PASS	FAIL	70	72.00
4	44	52	63	PASS	PASS	50	92.00
5	47	54	59	PASS	PASS	50	73.00
6	50	58	34	PASS	FAIL	5	50.00
7	46	45	48	PASS	FAIL	75	76.00
8	30	96	85	PASS	FAIL	75	118.00
9	50	50	39	PASS	FAIL	10	72.00
10	44	52	45	PASS	FAIL	35	78.00
11	34	70	57	PASS	PASS	10	51.00
12	53	41	34	FAIL	FAIL	10	72.00
13	29	61	103	PASS	PASS	95	138.00
14	42	76	92	PASS	PASS	90	114.00
15	24	93	90	PASS	FAIL	50	98.00
16	44	70	62	PASS	PASS	50	104.00
17	43	40	51	PASS	FAIL	25	80.00
18	23	111	66	PASS	FAIL	64	89.00
19	25	87	78	PASS	FAIL	67	120.00
20	26	96	90	PASS	PASS	45	83.00
21	19	99	85	PASS	PASS	17	104.00
22	36	66	55	PASS	PASS	15	99.00
23	14	106	73	PASS	FAIL	67	70.00
24	19	99	110	PASS	FAIL	75	137.00
25	11	100	84	PASS	PASS	75	115.00
26	22	101	96	PASS	FAIL	30	83.00
27	15	103	83	PASS	PASS	25	116.00
28	25	110	103	PASS	PASS	25	110.00
29	23	102	81	PASS	PASS	0	139.00

	strange
1	7.00
2	6.00
3	13.00
4	10.00
5	17.00
6	1.00
7	12.00
8	15.00
9	2.00
10	2.00
11	5.00
12	5.00
13	21.00
14	16.00
15	6.00
16	20.00
17	12.00
18	10.00
19	18.00
20	12.00
21	21.00
22	10.00
23	16.00
24	18.00
25	22.00
26	9.00
27	19.00
28	19.00
29	17.00

	id	expgrp	age	ethnigrp	ses	medicate	adhdrate
30	30	CONTROL	11.04	WHITE	II - Manang	NONE	44
31	31	CONTROL	8.01	WHITE	IV- Partly S	NONE	44
32	33	CONTROL	10.05	WHITE	III- Skilled,	NONE	44
33	34	CONTROL	10.07	WHITE	II - Manang	NONE	50
34	35	CONTROL	9.03	WHITE	III- Skilled,	NONE	36
35	36	CONTROL	10.03	WHITE	III- Skilled,	NONE	95
36	37	CONTROL	8.08	WHITE	III- Skilled,	NONE	36
37	38	CONTROL	7.10	WHITE	II - Manang	NONE	38

	socbehq	vinesoc	vinecom	smarties	icecream	rcpm	bpvs
30	15	108	99	PASS	FAIL	75	106.00
31	15	114	90	PASS	PASS	92	98.00
32	14	100	98	PASS	FAIL	15	99.00
33	20	108	80	PASS	PASS	95	113.00
34	21	114	78	PASS	PASS	12	87.00
35	22	103	85	PASS	PASS	95	105.00
36	23	100	76	PASS	PASS	69	117.00
37	19	109	93	PASS	PASS	79	110.00

	strange
30	22.00
31	8.00
32	18.00
33	17.00
34	11.00
35	18.00
36	17.00
37	12.00

2-3