Theory of mind, executive function

and social relationships

in children with ADHD

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Abstract

Children with ADHD have documented problems with social interaction and executive function. In a different group with social problems - individuals with autism - executive function and theory of mind impairment have been suggested as primary deficits. The present study investigated the relationship between social impairment, theory of mind and executive function in children with ADHD. Clinically referred boys (mean age 8 years) (n = 22) were compared with a group of normally developing boys (n = 22) of the same age and were significantly more impaired on parent rated measures of social functioning (the Vineland Adaptive Behaviour Scales). The groups did not differ on laboratory measures of second order and higher order theory of mind. After age and IQ were taken into account, the ADHD group were less efficient on one of the executive function tasks (the Go No Go task of motor response inhibition) but were just as efficient as the controls on the other (the Tower of Hanoi planning task). The findings are discussed with reference to theories of social functioning and implications clinically.

Introduction

Overview

The purpose of this study is to explore the relationship between impaired social functioning, theory of mind and executive function in a group of boys with Attention Deficit-Hyperactivity Disorder (ADHD). The introduction will aim to set the present study in context by describing the phenomenology of the disorder, by presenting a model of normal social functioning, and by reviewing previous research on the social difficulties experienced by children with ADHD. Two possible explanations (a deficit in executive functioning and an impaired theory of mind) will then be discussed in order to clarify the rationale for the hypotheses.

Phenomenology and epidemiology of ADHD

The group of children categorised as having Attention Deficit-Hyperactivity Disorder (ADHD) tend to be disruptive at home, at school and at play. They perform poorly academically and are frequently failures socially. As such they represent a significant problem of great concern to psychologists.

Although when strictly diagnosed these children represent only around 3% of school aged children, they comprise between 30% and 40 % of total referrals to child guidance clinics in the US (Szatmari, Offord and Boyle,

1989). Because of the stricter diagnostic criteria required by ICD-10 (World Health Orgnaisation, 1990) the prevalence in England is about 1% of the child population (Taylor and Hemsley, 1995). These referrals are understandable because the typical ADHD child demands an excessive amount of attention at home, at school and on the playground. Yet despite this attention they continue to be disruptive, impulsive, domineering and socially inept.

Children with ADHD are likely to have co-existing behavioural, emotional and academic difficulties (Teeter, 1991). Unfortunately their symptoms as well as their difficulties socially and at work follow them into adulthood with interpersonal problems, depression and low self-esteem continuing to be apparent in up to 60% of those who have been diagnosed (Weiss and Hechtman, 1993).

For all these reasons a more accurate diagnosis is needed. The most widely accepted criteria for diagnosis at the present time require that there be significant deficits in sustained attention, impulse control and the regulation of activity levels in response to situational demands (Barkley, 1989). These must be present before the age of seven years and be apparent in at least two settings. To be considered a disorder, social, academic and

occupational functioning must be also affected. (DSM IV; American

Psychiatric Association, 1994).

Even with this consensus on criteria, many issues remain to be

clarified, all of which make it difficult to compare samples studied in the past

with recent ones. The majority of the research has occurred in the US where

most of the referred children are males (9:I). However, epidemiological

studies have reported sex ratios of only 3:1 (Szatmari et al, 1989). This

suggests that some of the findings from clinical populations might result from

'maleness' rather than the disorder per se. It also means that we are less

knowledgeable about girls.

There has also been poor stability in diagnosis. Over the years the

diagnostic criteria have changed (e.g. from DSM II to DSM III to DSM IIIR and

DSM IV) and much of the early research on social difficulties in particular is

based on children who are 'aggressive', 'rejected' or 'hyperactive',

Therefore, it is not clear how many of these children would actually meet the

same criteria used to diagnose ADHD today. Furthermore, in England

professionals have preferred to use the diagnostic system of the International

Classification of Diseases (ICD) which is more exclusive (e.g. behaviours

must manifest in more than one situation and must include both hyperactivity

and inattentiveness) than DSM IV which specifies the presence of either hyperactivity or inattentiveness.

Neither can we be convinced that those children who most clearly fit the diagnostic criteria are a homogenous group as among those referred a number of distinguishable patterns are described. Although the referral system itself may be selecting a subgroup of particularly troublesome children, there is a group of children who can be highly aggressive. However, in some of these aggressive children their actions appear planned and hostile whilst in others the aggressiveness appears to be more explosive and is linked with their emotional lability (Hinshaw, 1987).

There are also indications that there is an atypical group of ADHD children who are neither aggressive or impulsive but are more withdrawn, aloof and disinterested in social involvement. Recently it has been argued that there are two distinct disorders: Attention Deficit Disorder with hyperactivity (ADHD) and Attention Deficit Disorder without hyperactivity (ADD-H) with the observed styles of social interaction differing in both form and intensity between the two groups (Wheeler and Carlson, 1994). These observed differences have given rise to the 'ignored' versus 'rejected' distinction with children with ADHD more likely to be rejected and those with ADD-H more likely to be ignored (Coie, Douglas and Coppotelli, 1982).

In a review of behavioural and neuropsychological studies addressing ADHD and ADD-H, Woodyear and Hynd (1992) also found support for a differential diagnosis. The ADHD group had more behavioural problems, were less popular and were more likely to have a co-existing conduct disorder whilst children with ADD-H were more socially withdrawn with a lower cognitive tempo and a higher incidence of developmental learning disorders. Unfortunately much of the early research did not consider these differences so caution must be used in comparing studies and in generalising results.

Also the boundaries of the diagnostic group remain hazy. By definition, ADHD comprises a complex group of behaviours but more than half of children with ADHD qualify for a comorbid diagnosis of reading/learning disability, conduct disorder, depression or Tourette Syndrome (Biederman et al, 1992). However, as much of the earlier research does not consider these co-existing problems, conclusions about the social, educational and emotional functioning of children diagnosed as 'ADHD' may not be accurate.

The criteria currently used are based on the clinical presentation of these children and say nothing about the neurological and psychological

pathology which causes the symptoms. There is therefore a great need to make the diagnosis more useful in guiding the medical treatment and psychosocial interventions for these children. This need has produced a great deal of research into the underlying psychopathology.

Why study social relationships?

In attempting to bring this research more closely onto the central pathology of ADHD, it is reasonable to follow Barkley (1990) who argues that the social difficulties experienced by children with ADHD are central to the psychopathology of ADHD and may figure predominantly in the generally poor long term outcomes experienced by these children. Difficulties with social interaction have been shown by many authors to be discriminative. These children have significant difficulties in social relationships with other children (Henker and Whalen, 1989; Milich and Landau, 1982), with their teachers (Pelham and Bender, 1982) and within their family (Mash and Johnston, 1983). These differences also reliably distinguish children with ADHD from their peers, (Milich and Landau, 1982; Pelham and Bender, 1982; Whalen and Henker, 1985). Children with ADHD also frequently serve as negative social catalysts by eliciting maladaptive social responses from others (Whalen and Henker, 1985).

Rejected children are characterised by higher rates of inappropriate and disruptive actions, physical aggression, off task and rule violating behaviour, argumentativeness and hostile verbal interactions and solitary play (Gottman, 1977). Popular children, on the other hand, show higher rates of co-operative play, norm-setting behaviours and accepting/offering positive reinforcement with lower levels of disruptiveness, aggression and solitary play (Coie, Dodge and Kupersmidt, 1990). Hartup (1989) found that popular children were more socially responsive, exhibited more positive affect, were more likely to be involved in joint activities and demonstrated prosocial competence.

Hyperactivity clearly predisposes children to problematic relationships with peers simply because the defining characteristics of the disorder (inattention, distractibility and hyperactivity) are the same characteristics which correlate with peer rejection. ADHD are more likely to be rejected than attention disordered children without hyperactivity and simply aggressive children (Walker, Lahey, Hynd and Frame, 1987). It is social behaviour (rather than non-behavioural variables such as physical attractiveness, motor competence, intelligence and academic achievement) which is primarily responsible for peer status (Erhardt and Hinshaw, 1994). Because the behaviours (e.g. aggression, domination, disruptive and off task behaviour) which cause a child to be rejected by his peers are likely to be part of the

ADHD child's social repertoire, it is not surprising that these children are at increased risk of being rejected. Unfortunately social rejection of these children seems to develop quickly after only a short period of peer exposure which means that the ADHD child also experiences less opportunities for social learning (Pelham and Bender, 1982).

Moreover, poor peer relationships and social deficits are also of concern because there is a strong correlation between poor peer relationships in childhood and social maladjustment and mental health problems in later life (see Parker and Asher, 1987 for a review). For example, retrospective studies of school drop outs (using both teacher and peer based assessments) suggest that children who do not finish school have more problematic peer acceptance histories than those who do finish high school. Whilst appreciating the difficulty in operationalising 'delinquency', the relationship between early peer relationship problems and later criminality is significant with retrospective studies of criminals showing a history of aggressiveness and poor peer relationships in childhood (Parker and Asher, 1987).

Another strand of research has studied the relationship between early peer adjustment and later psychological disorders. Although most of the retrospective studies included only male subjects, they consistently show that

adults with psychological problems have histories of poor peer acceptance.

Follow up studies show more mixed results: clinically referred boys

(incidence amongst girls was not reported) who are unable to get along with

their peers have significantly poorer mental health ratings and higher

psychiatric hospitalisation than their socially well-adjusted peers (Janes,

Hesselbrock, Myers and Penniman, 1979). It is understandable that children

without peer support would be at risk of feeling isolated and lonely and would

also lack the important social support during periods of stress and transition.

Social skills and effective social learning play a conspicuous role in the

development of self-esteem, morality and a feeling of acceptance and

belonging as well as stress resistance (Berndt, 1986). Unfortunately, poor

peer relationships mean less opportunities for positive social learning

experiences.

Social interactions are complex and require the same cognitive,

perceptual, evaluative and behavioural functions which are needed for a

child to function effectively in the home, in the classroom and in the

workplace. Therefore it would be helpful not only to clarify the diagnosis but

also to identify the factors which determine a child's relationship with his

peers and to discriminate those influences which may be amenable to

interventions from those which are more stable and resistant to change.

A model of normal social functioning

The process of responding to environmental stimuli effectively within a social situation is described by Dodge (1986) and colleagues who propose a comprehensive model of social competence based on work of Flavell (1974). Information processing theories of social behaviour have evolved from experimental and cognitive psychology and include both the cognitive aspects (e.g. perception, problem solving) and the emotional aspects (e.g. motivation and arousal) involved in social behaviour (Dodge, Pettit, McClaskey and Brown, 1986; Rubin and Krasnor,1986).

According to social information processing theories, the child's behavioural response to a social situation involves a series of steps. Dodge (1993) describes the five steps involved in processing social information as follows: (1) *encoding, (2) mental representation, (3) response accessing, (4) response evaluation*, and (5) *enactment*. This frame work can be expanded to encompass all aspects of social behaviour.

In the first instance a child must perceive and interpret both the stimulus and the context. This involves sensing the stimuli then *encoding* as many pertinent features as possible. The child then must selectively attend to certain aspects (such as facial expression, threats, others' intent and social rules or norms) in an impartial manner. Difficulties could arise if a

child has perceptual difficulties (e.g. involving sight or hearing), attends to fewer cues (thus resulting in less accurate interpretations) or if a child is biased more towards some cues than others.

Once encoding has occurred, the child must begin processing (the capacity to combine the perceived event with previous experiences and to predict the results of action). Processing involves memory (to recall other situations) and judgement (the capacity to attach meaning to these cues through the use of *mental representations* which have been stored in memory (Schneider, 1991). Thus the meaning or interpretation of an event is more important that the actual event itself.

Dodge (1993) argues that representations of encoded cues include "a broad array of features such as attributions of causality, interpretations of intent, social perspective-taking, moral reasoning, inferences about self worth, and generation of expectations about future events" (p.564). Difficulties could arise for the child if there are deficiencies or inaccuracies in any of these features. For example, if a child has difficulty attaching meaning to an event then socially immature or inappropriate behaviour might be observed. Difficulty in social perspective taking could result in self-centredness.

Processing also involves making decisions (*response accessing*) about the behavioural and affective responses which are elicited by these mental representations. These representations have become associated through conditioning with a variety of possible responses which may include affect and arousal, verbalisations and motor actions (Schneider, 1991). *Response accessing* assumes that the child is able either to access a choice of responses from long term memory or to construct a novel response. Deviant behaviour could arise if a child were unable to access a variety of responses or if the type of response accessed was atypical to those of their socially adjusted peers (e.g. a limited range of behaviours and situation inappropriate behaviours).

Timing is also a crucial part of processing because accessed responses can be withheld if they have been evaluated, via *response evaluation*, as being unacceptable, 'bad' or as having potentially unacceptable consequences. The process of feeding back an unacceptable response in order to access an acceptable response is 'problem solving' (Crick and Ladd, 1991) and requires the ability for accurate self observation and monitoring. Problems in timing or response inhibition could result in reckless and inappropriate behaviours.

It also appears that not all responses are presented to the evaluation process (for example, physiological changes and affective responses) and that responses can also be triggered without either evaluation or inhibiting restraints (Guerra and Slaby, 1989). The failure to evaluate can result from developmental immaturity, emotional distress, heightened arousal, and 'physiological intemperance' (resulting from fatigue and/or alcohol) (Dodge and Somberg, 1987). So "failing to evaluate accessed responses sufficiently can be termed a problem of impulse control, delay of gratification, or over-emotionality (as in a passionate rather than a reasoned response), whereas evaluating outcomes fully but in deviant ways can be termed a problem of inappropriate values, inaccurate beliefs or poor decision-making" (Dodge, 1993, p. 562). So the behaviours of children who are highly aroused or emotionally distressed may appear to be thoughtless.

Enactment occurs when the favoured response changes into a specified behaviour. This requires the child to concentrate available physical and cognitive resources into an effective action and to modify the behavioural plan in process as the situation changes. Ongoing appraisal (e.g. evaluation of the action within the social context) involves assessment of the effectiveness of the action, attending to feedback and learning from the experience.

Although the steps above follow a sequential linear path, the information processing system itself is demanding for the child because social encounters involve encoding, processing and acting on several different cues simultaneously (Rumelhart and McClelland, 1986). Clearly the demands of a real life interaction will be enormous on a child who may have difficulties attending to and encoding the relevant aspects of the social encounter, generating or accessing appropriate responses, evaluating (via problem solving) the appropriateness of a response, activating a response or, more importantly, inhibiting responses whilst considering the most effective course of action.

In summary, certain basic capacities are necessary for a child to function well socially: cognitive processes (sensation, attention, memory and reasoning), time (to attend, deliberate, assess and evaluate), emotional calm (as discussed above, anxiety, oversensitivity and pervasive fears affect social functioning as can uncontrollable impulses, phobias or compulsions) and motivation. However, effective social functioning also involves knowledge and understanding of social rules, norms and roles as well as understanding and consideration of the mental states of others.

Social functioning in children with ADHD - the research

ADHD is the single most researched childhood disorder but there has

been comparatively little research on social relationships (Barkley, 1990).

Although there is a broad consensus that children with ADHD have impaired

social relationships, it has been difficult to gain any consensus which either

effectively characterises or analyses their deficits. However, Dumas (1994)

has been helpful in identifying four areas of difficulty: (1) *High rates of*

intrusive overt behaviours, (2) *Deficient communication and reciprocity,* (3)

Biased social-cognitive performance and (4) *Poor emotional regulation.*

High rates of intrusive overt behaviours. These are the problems which

usually bring the child into a clinical setting and are also the ones which most

obviously impair their acceptance by other children. Parent, teacher and peer

evaluations and ratings, behavioural observations and anecdotal reports all

confirm these pervasive overt behaviours in children with ADHD (Whalen and

Henker, 1985).

ADHD children characteristically behave inappropriately. That is, they

appear to lack the normal childhood desire and ability to confirm to the group.

They tend to be intrusive, irritating, domineering, aggressive, socially

awkward, loud and excessively talkative (Pope, Bierman and Mumma, 1989).

Clinical and school based observations of hyperactive children note this

tendency to talk excessively seemingly without reference to their listener's responses. For ADHD children with 'cognitive inattention' (e.g. those who were only able to concentrate only for a short time, who performed work carelessly without thinking and who did not plan or organise before beginning a task) poor performance on tests of verbal fluency (category naming and sentence composition) were the most predictive of poor personal relationships (Sandler, Hooper, Watson, Coleman, Footo and Levine, 1993). The authors argue that these children probably have intact lexical skills but have deficits in frontal lobe functions of planning, editing and self-monitoring which resulted in excessively talking out of turn.

ADHD children are also disruptive. They can be non-compliant, troublesome, rule violating and unpredictable (Campbell, Endman and Bernfield, 1977). They tend to wander off task and to follow their own course rather than going with the social flow. However, there are few signs of wilful or intentional misconduct (when wilfulness is present, a co-existing oppositional defiant or conduct disorder is often diagnosed).

Deficient communication and reciprocity. Research investigating the communication deficits in children has moved away from listing problematic behaviours towards the more productive approach of observing pairs comprised of an ADHD child and a normal peer and of observing stimulant medicated/non-medicated ADHD children in social situations. ADHD children

typically lack the capacity to work together in a team, even when working with

only one other child. When engaged on joint puzzle tasks (either as a worker

or helper) with normal controls, no difference was found between the

behaviour of the ADHD children and controls when acting as worker but a

highly significant difference was reported when acting as helper: the

hyperactive boys showed more cheating and more noncommunicative

speech and were rated as less desirable as a schoolwork partner (Grenell

Glass and Katz, 1987). This suggests that they are more comfortable being

in control and that they are more competent when leading than following.

Mixed ADHD/comparative dyads are also less mature in their play

patterns and have higher social withdrawal than normal pairs (Hubbard and

Newcomb, 1991). They are also more likely than normal pairs to initiate

social interaction when asked to work independently without talking, are more

talkative generally but give fewer verbal responses than their partners

(Cunningham, Seigel and Offord, 1985).

This difficulty in co-operating is also apparent on the playing field.

Pelham and colleagues point out that children are likely to overlook

behaviours in their peers which are the results of deficits or incompetence

but are less likely to forgive team-mates for behaviours which are assumed to

be under a child's control (e.g. being attentive to the rules and order of play)

(Pelham, McBurnett, Harper, Milich, Murphy, Clinton and Thiele, 1990).

In approaching a social situation, they are less likely than their peers to analyse what is happening and to wait for the right moment to join in (Clark, Cheyne, Cunningham and Siegel, 1988). They often jump into a situation and start issuing commands before they are sure what the activity is. Neither are they capable of fine-tuning their interventions when the situation changes. They are less likely to request feedback about their performance, to adjust their behaviour, to accept help or directions from their partner and are more likely to control and direct the interaction by issuing commands in collaborative situations (Whalen, Henker, Collins, McAuliffe and Vaux, 1979).

Although ADHD boys appear to have knowledge of appropriate strategies for *initiating* social behaviour, they appear to have difficulty generating appropriate strategies for *maintaining* relationships and resolving interpersonal conflict. When presented by researchers with a set of 16 hypothetical social situations and asked what they *should* (not would) do, the hyperactive group's responses were less effective, less friendly and less likely to improve the relationship (Grenell et al, 1987).

Although they have a high level of social interest, they seem to have a profound deficit in empathy as they appear insensitive to the needs of others and to the cues and feedback of the interaction (Clark et al, 1988; Cunningham and Siegel, 1987). They display a lack of concern for others

and are deficient in their awareness of the short and longer term

consequences of their behaviour (Barkely, 1981). They have particular

difficulty in adopting another's perspective and in evaluating the intention of

others (Dodge, 1986). Although they have the tendency to elicit maladaptive

social responses from others, they are often surprised at the negative

responses of other children and adults (Moore, Hughes, Robinson, 1992).

Biased Social-cognitive Performance. Children with ADHD show

biases in social knowledge, attention to pertinent social cues and are less

able in interpreting social information (Dodge and Newman, 1981). Research

with aggressive children with social difficulties has revealed that they are

competent at generating an acceptable response when provoked in a

hypothetical situation but are less likely than their peers to generate

alternative responses when asked (Guerra and Slaby, 1989). However, they

are just as accurate as their normal peers in identifying unacceptable

behaviours (Whalen, Henker and Granger, 1990).

Milich and Dodge (1984) reported similar biases in a group of

hyperactive/ aggressive boys referred to a child psychiatric clinic. They also

tended to attribute hostility to the actions of their peers in a neutral

interaction and were more likely to respond aggressively with minimal

provocation. Further support for these biases is offered by Moore et al,

(1992) who compared normal controls with hyperactive-rejected, hyperactive-accepted and non-hyperactive-rejected children (recruited using standardised teacher ratings, not clinical samples). They found that nonhyperactive-rejected children exhibited attributional and response decision biases. The hyperactive-rejected children displayed a unique constellation of social information processing deficits: they had more difficulty attending to and encoding social cues and recalling socially relevant information; they could be described as 'benevolently inept' (p.129). They argue that these results could be explained by the documented problems children with ADHD experience with short term auditory memory, problem solving and selective attention (Landau and Milich (1988).

There also seems to be a distinct self-centred bias in ADHD children. They underestimate their own aggressiveness and assume less responsibility for aggressive encounters than their peers who are more likely to assume responsibility in the early stages of conflict (Lockman, 1987). These inaccurate appraisals and misattributions clearly influence the outcome of ongoing encounters.

They are also incompetent in social problem solving . Problem solving skills are important in social cognition and when ADHD children must apply executive strategies in approaching a task their strategies are impulsive,

poorly organised and inefficient (Zentall, 1988). ADHD boys seem to select a particular strategy and continue to apply it even when task requirements change. This difficulty with social problem solving skills suggests that it is important to distinguish between a child's knowledge of how to act in neutral conditions compared with this ability to appropriately respond in emotional real-life situations.

Poor emotional regulation. Hyperactive children are considered highly emotional and particularly sensitive to both social and physical stimulation. They are impulsive, unpredictable, easily over-aroused and find it difficult both to change set (in response to the demands of the situation) and to inhibit their emotional responses. They display frequent, explosive, over-reactive outbursts and have poor control over these behaviours (Barkley, 1990).

Impact of stimulant medication on social behaviour

Between 60 and 90% of children in America diagnosed with ADHD receive stimulant medication for long periods during their school lives (Safer and Krager, 1988) and the vast majority show improvements in academic functioning (Rapport and Kelly, 1991). There is also well documented evidence (using carefully controlled, double blind protocols) that stimulant

medication has positive, though short-lived, effects on the negative social behaviours of these children (Whalen and Henker, 1991).

When taking medication, children with ADHD become less controlling and domineering with their peers (Cunningham et al, 1985). They show a decrease in the intensity and adversity of interpersonal encounters and an increase in communication (Whalen et al, 1979). Although these improvements in social behaviours emerge more reliably in task related than free play settings (Cunningham et al, 1985), decreases in negative social interactions have also been noted during times (e.g. during lunch, break and playground activities) when children are not in highly supervised structured situations (Hinshaw, Henker, Whalen, Erhard and Dunnington, 1989).

However, not all reports are consistent. Buhrmeister, Whalen, Henker, Macdonald and Hinshaw (1992) reported that medication did not significantly reduce levels of aversive behaviour compared to placebo but they argued that this may have been the result of the task which required their clinical group to act in a leadership capacity with younger boys. Their keenness to be good leaders may have left little space for the significant decreases in negative behaviours which are usually observed.

Stimulant medication also positively affects the relationships between children and their teachers and parents. It seems that the resulting behaviour change in the child is accompanied by reciprocal positive changes in the attitudes and behaviours of their adult caretakers. Adults show decreased levels of control (Barkley and Cunningham, 1980), increased levels of responsiveness and affect (Whalen, Henker and Demoto (1981) and more positive evaluations towards medicated children when contrasted to placebos under double-blind conditions (Whalen et al, 1989).

Unfortunately it appears that stimulant medication does not necessarily bring about the same attitude changes in their peers (Pelham and Bender, 1982). However, in their unreplicated study of a summer school programme attended by hyperactive and normal boys, Whalen and her colleagues reported dose related improvements in peer appraisals (Whalen et al, 1989). Hyperactive boys on a higher dosage were more likely than those on placebo to be nominated as 'fun to be with'. Although the status of boys with ADHD improved, they were still less likely than the non-labelled boys to be so designated (Whalen et al, 1989). It is possible that these results could be the result of the diagnostic mix as there were twice as many hyperactive boys as comparison boys in each group which meant that the majority of boys selecting were hyperactive. Obviously this does not reflect the well documented normal: hyperactive ratio of approximately 15:1.

There have been relatively few studies evaluating the effect of stimulant medication on the modification of affective responses. Whalen and Henker (1991) reported medication related effects in a randomly assigned cross over design: ADHD boys on placebo reported a higher tendency to become angry than when on medication. Another study reported a mild flattening of affect in ADHD boys when on methylphenidate (compared with those on placebo) (Whalen Henker and Granger, 1989).

The effects of medication on social cognition deficits have not been evaluated. As the study of the role of social information processing in relation to ADHD is still very much in its infancy, only one study has investigated one aspect of social cognition: response evaluation.   Whalen and her colleagues reported that both boys with ADHD and the normal controls identified significantly more 'bad' behaviours in unknown hyperactive boys on placebo than in those on methylphenidate. However, the response rates for the ADHD boys were elevated suggesting a difference in the rate of response (due to behavioural impulsivity or lack of inhibition) rather than in the accuracy of their evaluative skills (Whalen et al, 1989).

In another study, no medication effects were observed for socially appropriate behaviours and rule following, but behaviours which required

reasonably advanced skills in social organisation and cue utilisation (e.g. leading, organising and planning the group) were better when the boys were medicated than when on placebos Granger, Whalen and Henker, 1993). However, the observers were comparing medicated ADHD boys with their non-medicated ADHD peers, not with a normal control group and this may have resulted in a contrast effect which distorted the judges' (university undergraduates) views of 'normal' behaviour.

Although stimulant medication appears to decrease the level of disruptive and domineering social behaviours, there is no indication that it can enhance or improve prosocial behaviour or skills or that it improves a child's sensitivity to others. Although it is difficult to measure prosocial behaviour because it is more subtle and less salient than negative behaviour (and also because of the tendency of adults to attend to negative behaviours) perhaps it is also unreasonable to expect medication to produce sensitivity and social competence.

In summary, it appears that the main effect of stimulant medication is a decrease in aversive or disruptive behaviours (with its corresponding increase in the positive attitudes and behaviours of the surrounding adults). These changes could be attributed to the 'window of opportunity' afforded by the medication which allows the child to inhibit his behaviour. As there is

little evidence that medication improves social information processing, increases sensitivity to others or increases prosocial activities or skills, it is possible that the social information processing deficits do not respond to stimulant medication. The child's ability to process social information does not, therefore, appear to be enhanced by his or her ability to inhibit their behaviour - to wait.

However, there are positive social attributes in ADHD children who are often received at least ambivalently by other children. However disruptive they may be, their high energy can provide a source of excitement to their peers and their often divergent ideas can inject creativity into group activities (Whalen and Henker, 1985).

Positive or pro-social behaviours

The majority of research has primarily focused on the skills correlated with rejection (e.g. disruptive/inappropriate behaviour, poor communication skills, aggression, inappropriate levels of attention and impulsivity) and there has been very little on the prosocial behaviours and appropriate social skills displayed by these children. There does not appear to be a clearly defined category of prosocial behaviours and a number of different behaviours are thought to increase social approval and liking (Hartrup, 1989). However,

because of both the paucity of research and the variety of measures of 'prosocial' behaviour, the findings have been inconsistent and not very informative.

When compared with their classmates, 'hyperactive' children engage in higher frequencies of negative interactions but show no differences in frequencies of positive interactions (Klein and Young 1979; Pelham and Bender, 1982). Although significant differences are observed between hyperactive and controls in free play, in responses generated to hypothetical social situations, in knowledge of skills involved in relationship maintenance and in conflict resolution, the groups do not differ in terms of the skills involved in initiating the relationship (e.g. greeting, inviting partner to join in or share information) (Grenell et al, 1987). When given a multiple choice of appropriate responses, boys with ADHD are just as able as their peers to make the appropriate choices (Hecktman, Weiss and Perlman, 1980; Milich and Dodge, 1984). These studies suggest that children with ADHD may know the right answers but do not know how to apply this information when they are required to generate appropriate responses during the course of an interaction which requires complex processing skills.

Clearly it would be helpful to focus on the appropriate social skills displayed by ADHD children and to identify which behaviours are causally

related to social status and which are simply mediating processes. A recent study of learning disabled children who showed impairments in social functioning reported co-existing impairments in emotional cue processing (Lai and Shapiro, 1993). However, ADHD children do not differ from normal children in their ability to process emotional cues (Shapiro, Hughes, August and Bloomquist, 1993) although post hoc analysis suggested that processing of emotional cues may be deficient in children with ADHD at a young age. The authors argued that it was possible that deficits in emotional perception do exist but that over time the child develops compensatory strategies.

How might these difficulties in social interaction be explained?

How can this poor judgement, this apparent disossociation between knowing and acting be explained? One proposal is that their objectives might be different from those of other children. Research investigating the social thinking of children with ADHD using peer nominations reported there was a strong negative correlation between liking and causing trouble in the normal controls but these domains were not correlated for the ADHD boys - so being a troublemaker did not decrease liking (Whalen, Henker and Dotemoto, 1981). This suggests that children with ADHD may have divergent objectives and social goals. Rather than displaying deficient social judgement, it is possible that they may value and enjoy deviant behaviour

rather than conformity perhaps because such excitement is pleasant. Macdonald (1988) identified a sensation and stimulation seeking characteristic which may have the same motivation.

Social learning difficulties may also make it difficult for these children to learn the subtle decoding and self monitoring required in an adaptive social interaction. Although they appear to have many opportunities for social learning (even from the negative responses of other children), it is possible that their ability to appraise and benefit from feedback could be blocked so that the accumulation of experience does not occur.

Whalen and Henker (1992) have questioned whether ADHD children might be simply inappropriate in their timing, or in the force or target of their interventions. Barkely (1990) has proposed that these errors in judgement might be attributable to their haste or excessive emotional arousal at the moment of decision. Children who are unable to wait and to deliberate will be at a major disadvantage in a complex social interaction.

These difficulties could also be explained by social reasoning deficits. The "inability to adopt another's perspective, to evaluate accurately the intentions of others, to predict the consequences of social actions and to identify appropriate social responses" is thought by many researchers to

explain the ineffectual and inappropriate social behaviours displayed by children who are rejected (Moore, Hughes and Robinson, 1992, p.123). Although hyperactive children's behaviour suggests that they lack these skills, the two studies which investigated social reasoning in hyperactive children reported conflicting results. Bernfeld and Peters (1986) found that impulsive (vs. reflective) children do have adequate social-reasoning skills and argued that they display maladaptive behaviour because of impulsivity and low motivation. Grenell et al. (1987), in contrast, found that hyperactive children had limited knowledge about how to maintain social relationships and that they exhibited deficits in both social knowledge and social skills.

Research then, thus far, has helped to elaborate the symptoms which plague these children without establishing any specific neurological or psychological malfunction which can explain their social behaviour. It is still not clear if these children misinterpret or fail to identify necessary social cues, if they have inadequate knowledge of social rules, norms and roles, if they are unable to adopt another's perspective, if they have one or more social information processing deficits or if they are unable to inhibit their behaviour. Two proposals will now be considered: (1) Barkley's (1994) theory that much of the symptom complex can be explained by the loss of a normal capacity to inhibit behaviour and (2) the idea that these children have

an underlying deficit in the ability to attribute and represent states; they lack

a theory of mind (Baron-Cohen, 1988; Frith, 1989)

Lack of behavioural inhibition as an explanation for social difficulties in ADHD children

The growing research evidence suggests that it is not inattention but

behavioural disinhibition (difficulties in regulating and inhibiting behaviour)

which reliably distinguishes ADHD children from both normal children and

children with other clinical disorders (Barkley, 1994; Douglas, 1983;

Schacher, Tannock and Logan, 1993). ADHD children display excessive

impulsivity both clinically and experimentally. They are typically risk takers

and neglect to consider consequences which are dangerous or destructive.

Situations with peers which require turn taking, sharing, co-operation and

restraint are problematic and these children also interrupt and badger both

their peers and adults.

Jacob Bronowski (1967) argued that the ability to inhibit our immediate

urges, to respond and to wait for a while allows us (1) to separate emotional

from information in our evaluation of events, (2) to create a sense of the past

and from it a sense of the future, (3) to talk to ourselves and to use speech to

control our behaviour and (4) to break incoming information into parts and

then to recombine these part into new outgoing messages or responses. Although several authors have recently argued that ADHD stems from a fundamental deficit in the ability to inhibit behaviour, Barkley (1994) has expanded this argument to explain all the problems (e.g. academic, social, mental, language and emotional impairments) children with ADHD experience as a result of this inability to inhibit their behaviour.

According to Barkley being able to wait allows us to separate incoming information into (1) the information or content of the event and (2) our emotional response to that event. Although we obviously do not always separate an event from our emotional response to it, the ability to do so gives us the opportunity to evaluate an event rationally, logically and objectively. A child who is unable to inhibit his immediate emotional reaction to an event is likely to react impulsively and emotionally, a response which, not surprisingly, can result in social hostility, rejection, and a bad reputation. However, he argues that as the actual ability to separate emotions from information is not impaired this means that people with ADHD are emotionally passionate and in the right situation these responses can be socially desirable.

If we are able to delay responses we are also able to think about an event and to compare it with our memory of past experiences which will in turn guide our analysis of and response to the new event. If we can wait for

a moment, we are able to make hypotheses about what will happen next and to use our understanding of the past to generate solutions to the current problem. Barkley argues that the tendency to respond to an event without thinking leaves children with ADHD less prepared for the future, creatures of the moment, risk takers with a lack of foresight who seem never learn from their mistakes (or from punishment). All these effects can obviously be socially devastating leaving the child viewed by parents, teachers and peers as unreliable, unpredictable, immature and careless.

Bronowski (1967) points out that although other species are able to communicate with each other, humans are unique in being able to use language to communicate with ourselves and this process can be observed developmentally in children who progress from talking out loud to themselves to using internalised speech. Language is important for rule governed behaviour as it allows us to consider (and/or create) rules, to set goals and to plan (problem solving). The ability to problem solve is also influenced by the fourth mental ability which Bronowski attributes to our ability to inhibit our response: the ability to break down information into small parts and to resynthesise it into new instructions.

The ability to inhibit behaviour is controlled by the orbital-frontal cortex and several authors have illustrated the parallels between behaviour of

ADHD children and the inappropriate levels of inattention, impulsivity and overactivity which are also observed in both human and animals with frontal lobe lesions (Benson, 1991; Fuster, 1989; Stuss and Benson, 1984; Gualtieri and Hicks, 1985; Mattes, 1980). This apparent similarity in the behaviour observed in adults with frontal injuries and in children with ADHD has resulted in a range of studies which have investigated the performance of these children on neuropsychological tests sensitive to frontal lobe injuries in adults (see Barkley, Grodkinsky and DuPaul, 1992 and Shue and Douglas, 1992 for reviews).

Shallice (1982) argues that patients with frontal lobe damage have a deficit in the Supervisory Attentional System (SAS), the action control system which allows for 'willed' or 'deliberate' action control (as opposed to the action control system which is involved in habitual or automatic actions). He believes that SAS deficits can account for impaired performances in tasks which require planning and inhibition of action before planning (skills known as executive functions).

According to Welsh and Pennington (1988), executive function "...is the ability to maintain an appropriate problem-solving set for the attainment of a future goal (Bianchi, 1922; Luria, 1966). This set can involve one or more of the following: (a) an intention to inhibit response or to defer it to a

later more appropriate time (b) a strategic plan of action sequences and (c) a

mental representation of the task, including the relevant stimulus information

encoded into memory and the desired future goal-state. In cognitive

psychology the concept of executive function is closely related to the notion

of a limited capacity central processing system." Welsh and Pennington

(1988, pp. 201-202).

The behaviour changes which result from frontal lesions, although

quite heterogeneous, all require goal-directed behaviour and usually occur

within a novel context which demands a range of simultaneous competing

responses. Although the patient with frontal lesions understands the goal of

the task, they fail to accomplish it either because of perseveration, lack of

motivation, intrusive irrelevant behaviours or the inability to initiate the

appropriate behaviour (Pennington and Ozonoff, 1996). These difficulties

are not because of deficits in global intelligence (IQ), perception, memory or

comprehension.

There are several methodological issues in the research into

executive function in children with ADHD which must be considered: 1) the

use of variable diagnostic criteria of the participants, (2) the frequency of co-

existing learning disabilities and conduct disorder, (3) the use of tests which

were drawn from the literature on adult neuropsychology many of which are

measures of global frontal lobe functions, and (4) the acknowledgement that

it is not only pre-frontal damage which can cause executive function deficits.

Nonetheless, a fairly consistent pattern has emerged. The tests and tasks

which measure complex problem solving skills - believed to be primarily

frontal lobe functions - reliably reveal differences between ADHD and

normally developing children.

In a recent review of 18 studies of executive function tasks (published

in refereed journals and which used commonly accepted executive function

measures with a control group) in ADHD children, Pennington and Ozonoff

(1996) reported that out of a total of 60 executive function measures, the

ADHD children performed significantly worse than age IQ matched controls

on 67% (40) of these measures and in none of the 60 did the ADHD children

perform better than controls. Measures which were identified as being

especially sensitive to the differences between groups were the Stroop,

Tower of Hanoi, Matching Familiar Figures Test and Trailmaker Part B.

Measures of motor inhibition (e.g. Go No Go) revealed consistent differences

between children with ADHD and normally developing children. The ADHD

children were also consistently poorer on measures of perceptual speed

(Coding and Symbol Search) and vigilance (Gordon Diagnostic System) but

there were no significant differences on verbal tasks (subtests from the

Neuropsychological Assessment of Children) and no consistent differences on visuo-spatial tasks (Embedded Figures, Rey Osterreith).

However, a minority of ADHD children do not display differences on cognitive tests. It is possible that selection bias is an influential factor as results reviewed by Pennington and Ozonoff (1996) were found in children referred from clinics and schools. Only one study examined a population sample of children with ADHD; they found no deficits in functioning on these tasks (McGee, Williams, Moffitt and Anderson, 1989). Pennington and Ozonoff (1996) point out that in some cases there may also have been a co-existing conduct disorder. Executive function deficits in conduct disorder without ADHD have not been documented and non-executive function measures (verbal measures and impulsivity measures) seem to be more sensitive to conduct disorder than executive function measures. (Pennington and Ozonoff, 1996).

The frontal lobes are involved at several stages in the performance of complex social behaviour including the processes of response accessing response evaluation, enactment of the behaviour, in evaluating feedback about the behaviour and, if required, in the regulation and change of the behaviour. The complexity of the role of the frontal lobes in social behaviour

suggests that the inability to inhibit behaviour may not be a sufficient explanation for all the social difficulties reported in children with ADHD.

Although these children may have a repertoire of appropriate behaviours and their delivery and timing are contextually inappropriate, they also appear to be less tuned to social agendas (the thoughts and feelings) of their peers. This difficulty in adopting another's perspective together with a heightened sensitivity to their own needs can also explain (1) their tendency to make inaccurate appraisals of a social situation and to be unresponsive to cues and feedback, (2) their tendency to be controlling and directive in collaborative situations, (3) their difficulty in maintaining relationships (which require empathy with another's views/feelings) and in handling interpersonal conflict and (4) their inaccurate evaluation of another child's intention and the subsequent difficulty in predicting the consequences of their own and others' behaviour. This apparent insensitivity to others may be more consistent with a co-existing difficulty in 'mentalising' or an impairment in theory of mind which is defined as the ability to attribute mental states to selves and others in order to explain and predict behaviour (Premack and Woodruff, 1978).

Theory of mind and the literature concerning individuals with autism

The theory of mind hypothesis has for some time been investigated with another group of individuals with severe social impairments - children and adults with autism. These individuals also (1) exhibit lack of impulse control, (2) have difficulty self-reflecting and self monitoring, (3) have difficulty anticipating the long term consequences of their actions and (4) have problems with social communication. Although some of these difficulties could also be accounted for by impulsivity, it has been theorised that these communication and socialisation difficulties are the result of the inability of autistic children to represent and attribute mental states; they have an impaired theory of mind (Baron-Cohen, 1988; Frith, 1989). It has been argued that theory of mind deficits are specific to autism as other groups of children with developmental difficulties have been shown to pass false belief tasks: children with specific language impairments (Perner, Frith, Leslie and Leekam, 1989), with Down's syndrome (Baron-Cohen, Leslie and Frith, 1985) and with William's Syndrome (Karmiloff-Smith, Klima, Bellugi, Grant and Baron-Cohen, 1995).

Until recently investigation of mentalising ability had not been done with other children with social impairment. However, Happe and Frith (1996) investigated the relationship between impaired social functioning and theory

of mind in children with conduct disorder (CD). Although their sample showed marked social impairments (measured on the Vineland Adaptive Behaviour Scale and on supplementary items designed to discriminate between social behaviours which require a theory of mind and those which do not) and an impaired ability to mentalise, all of the children passed simple theory of mind tasks.

The authors acknowledged that the sample was small and that co-existing hyperactivity or impulsivity could have influenced low scores on the supplementary items. However, the conduct disordered children's poor performance on the measures of social interaction which required the ability to mentalise still needs to be explained. The authors suggested that perhaps the conduct disordered group had an intact but skewed theory of mind - the result of a deficit in social cognition - or that deficits in executive function influenced the amount of solutions they could generate in social interactions.

A recent study by Blair and his colleagues also investigated theory of mind in a group of psychopaths and found no difference between the experimental group and a group of incarcerated non-psychopathic controls (Blair, Sellars, Strickland, Clark, Williams, Smith and Jones, 1996). Although psychopaths are described as lacking empathy, remorse and shame, they also have a superficial charm, can be easy to talk with and

appear to be pleasant and agreeable (Cleckley, 1976). In other words they are socially very able.

Autism, theory of mind and executive function deficits

A further development within the research on autism has focused on the relationship between impaired theory of mind and impaired performance on executive function tasks. Recent research into the relationship between executive functioning and theory of mind has revealed deficits in executive functioning within adolescents and adults with autism (Ozonoff et al, 1991; Ozonoff and McEvoy, 1994). In a recent paper, Pennington and Ozonoff (1996) reviewed 14 studies (in refereed journals, using control groups) and significant differences were found between individuals with autism and controls on 25 (78%) of the 32 experimental executive function tasks used. On no task did the individuals with autism do better than controls.

The most reliable tasks for discriminating between individuals with autism and individuals without autism were the Wisconsin Card Sorting Task (WCST) and the Tower of Hanoi. However it is not clear exactly which cognitive and executive functions the WCST measures. Although regarded as a test of cognitive flexibility, it also requires categorisation, response inhibition, selective attention and adequate working memory (Pennington and

Ozonoff, 1996). Participants with autism also displayed impaired working

verbal memory (Sentence Span and Counting Span) but were not impaired

on a task of voluntary motor inhibition (Stopping task). It could be argued

that differences with the ADHD samples (who displayed impaired voluntary

motor inhibition but adequate working verbal memory) suggest a double

dissociation across the two disorders on these two functions.

In considering how executive function deficits and deficits in theory of

mind might be related, Ozonoff et al (1991) argue that their results suggest

widespread pre-frontal impairment as a possible explanation. Damage to

pre-frontal regions is associated with executive function deficits (Damasio,

1985; Stuss and Benson, 1984) and lesions of the orbito-frontal cortex result

in social isolation, decreased affiliative behaviour, and impaired social

communication, shallow affect and lack of appreciation of social rules

(Damasio, 1994). Since the pre-frontal cortex is implicated in the regulation

of both executive function and emotional behaviour, Ozonoff et al (1991)

argue that pre-frontal impairment may be the underlying deficit in autism as it

is capable of explaining both cognitive and social symptoms of the disorder.

However, as it is still not possible to explain how executive function

deficits can account for the deficits in imitation, joint attention and theory of

mind found in children with autism, it is therefore difficult to validate the

argument that executive function deficit is primary in autism. As Pennington

and Ozonoff (1996) point out, it is possible that executive deficits are "...

secondary to growing up autistic; social interaction provides unrelenting

practice in cognitive flexibility and children with autism have much less social

interaction" (p.80).

The relationship between theory of mind and executive function

deficits has only just recently been investigated in a another group of

children: young 'hard to manage' children (Hughes, Dunn and White, 1996).

The purpose of their research was to identify young children at risk for ADHD

by screening 782 children. Forty children met the criteria for Hyperactivity

alone (20%) or Hyperactivity and Conduct Disorder combined (80%). Of

these only 38% were rated by teachers as "quite popular" (compared with

66% of the comparison group). Using a series of both executive function

and theory of mind experimental tasks they found significant differences

between the groups on executive function performance but not on theory of

mind performance. The authors suggest that disturbed peer relations are not

the result of a delayed theory of mind but may result from the lack of

executive skills of planning, flexible attention and impaired inhibitory control.

Unfortunately, the group used in this study appeared to be mostly

conduct disordered with co-morbid ADHD and the measure of social

functioning was limited to teacher report rather than details of real life social interaction. IQ was not measured so it is also possible that the differences in performance on executive function tasks could have been due either to differences in intellectual ability or to developmental differences as the children were between 3 1/2 and 4 1/2. Levin et al (1991) argued that differences between ADHD and normally developing controls at age seven/eight and nine-twelve on the WCST and the FAS suggested that maturation of neural systems influences developmental changes in executive function ability.

The Present Study

The goal of present study is to examine the relationship between performance on experimental theory of mind and executive function tasks and measures of everyday social competence in children with ADHD - another group with documented social problems and executive function deficits. Although the ADHD literature suggests that there may be a core difficulty in social understanding, it is still not clear if these children are *deficient* in their understanding of appropriate social behaviour because of social reasoning deficits (i.e. they lack a theory of mind) or if their poor inhibitory control and motivational deficiencies interfere with their ability to *utilise* social knowledge when interacting with their peers.

The purpose of this study is to test several hypotheses.

1.   Do children with ADHD perform differently than normally developing

      children on measures of everyday social functioning.

2.   Do children with ADHD perform differently than normally developing

      children on experimental measures of theory of mind.

3.   Do children with ADHD perform differently that normally developing

      children on experimental tasks of executive function.

4.   Is it possible to assess the extent to which social functioning might be

      related to theory of mind and executive function deficits.

Method

Subjects

The sample included 22 boys diagnosed as having Attention Deficit Disorder with Hyperactivity (ADHD) (mean age 8 years 6 months; sd = 12.4) and 22 normally developing boys (mean age 8 years 10 months; sd = 8.5) between the ages of 7 and 10. Informed consent was obtained from parents and children prior to their participation.

ADHD participants:

Each ADHD child had been referred for attentional and impulsivity problems to the Child Psychiatry Team at a London teaching hospital. All children in the ADHD group satisfied diagnostic criteria for ADHD (DSM-IV, APA 1994) and for Hyperkinetic disorder (ICD-10), a stricter set of criteria. In addition scores on the Revised edition of the Conners Teachers Rating Scale were above the 1.5 cut-off (out of a possible 3.0) on the Hyperactivity Index. The Revised Conners Teacher Rating Scale (Goyette, Conners and Ulrich, 1978) is a standardised norm-referenced symptom list which has been shown to discriminate between normal and hyperactive samples. It has been widely used as a dependent measure in drug trials as it is sensitive to drug effects. (Barkley, 1977). The scale has adequate psychometric properties with reported test-retest reliability (4 weeks) of .82 (Goyette, Conners and Ulrich, 1978). The 39 item scale was completed by the child's class teacher who

was asked to rate the degree of activity of the child for each item on a four

point scale. Children receiving stimulant medication (n = 20) had not been

medicated for at least 24 hours before testing, a washout period considered

sufficient in previous research (Cunningham & Barkley, 1979).

Normally developing controls:

Normally developing participants were recruited from the same Inner

London Borough as the location of the hospital. None of the children were

taking psychotrophic medication and scores on the Revised edition of the

Conners Teachers Rating Scale were below the 1.5 cut-off (out of 3.0) on

the Hyperactivity Index of the scale.

IQ

Four subtests of the WISC-III (Wechsler Intelligence Scale for

Children - 3rd edition; Wechsler, 1992) were used to provide measures of

Verbal and Performance intelligence quotients. The WISC-III is a well

standardised and widely used test which assesses intelligence in terms of

Verbal and Performance (non-verbal) functioning by measuring a number of

facets of intelligence on a number of subtests which comprise the scale.

Verbal IQ was prorated from the Similarities and Vocabulary subtests and the

Performance IQ was prorated from the Block Design and Object Assembly

subtests.

Behaviour

The Child Behaviour Checklist (CBCL) (Achenbach & Edelbrock, 1983) was completed by the child's parents. The CBCL is extensively used as a research tool and is based on factors identified from principal component analysis of results obtained from 2300 children referred to 42 mental health services in North America. It has been shown to be reliable in both clinical and non-clinical populations (Achenbach and Edelbrock, 1991). The CBCL is a standardised rating scale and provides normative data regarding a child's functioning in diverse areas within internalising (e.g. social withdrawal and anxiety/depression) and externalising (e.g. inattention and social difficulties) domains of behaviour of children aged 4 -16. It also provides a global screening of social adjustment through items on the Social Competence scale which obtains parental reports of the amount and quality of their child's participation in sports, games and friendships; how well the child gets along with others; and school functioning. Each of the 118 behaviour problem items are rated on a 0 - 1 - 2 scale corresponding to *Not true, Somewhat or Sometimes True* and *Very or often true.* The checklist comprises scales dealing with the following specific childhood diagnostic categories: Withdrawn, Somatic, Anxious, Social, Thoughts and Attention.

Measures

1. Executive Function Domain

Tower of Hanoi. This is a disk transfer task which has been used to study the planning capacity of adults and both normal and learning disabled children (Simon, 1975; Borys, Spitz and Dorans, 1982). The Tower of Hanoi evaluates the ability to plan and execute a sequence of moves by changing an initial configuration of disks into a goal state which duplicates the configuration on the experimenter's board. An efficient performance requires both the ability to plan a series of moves and to inhibit irrelevant responses. A deficit in this type of planning has been demonstrated in adults with frontal lobe damage (Shallice, 1982).

Identical apparatuses (boards with three vertical pegs and three disks of different sizes and colours) were set up in front of the subject and the experimenter. The experimenter's disks were arranged on the right hand peg of the experimenter's board to form a tower with the largest disk on the bottom and the smallest on the top. This arrangement represented the goal state which the subject was required to achieve on each problem. Following a pre-arranged sequence, the disks on the subject's board were placed on different pegs and the subject was required to plan and implement a series of moves which created a tower like the experimenter's on their left-hand peg. Subjects were familiarised with the rules: (1) a big disk must not be placed on

a little disk, (2) only one disk could be moved at a time and (3) the pegs had to be used to hold the disks. All subjects confirmed their understanding of these rules by demonstrating legal and illegal moves.

Participants were given a simple practice problem to complete and all were able to solve this problem without assistance. The practise item was not included in the final score. Participants were then administered several problems of decreasing difficulty with the most difficult problem solution requiring seven moves. The child was required to complete the problem correctly for two consecutive trials to receive credit and was given six trials to achieve this criterion for each problem.

The scoring system for the Tower of Hanoi was developed by Borys et al. (1982). If a problem was solved in the first two trials, a score of six was given. The point totals decreased with the number of trials required to achieve the solution so only two points were given for trials five and six. The dependent variable was the sum of the scores received on each of the problems of differing move lengths.

Go-No-Go paradigm. This task requires the rapid discrimination of 'go' (S+) and 'no-go' (S-) signals and has been shown to successfully discriminate between ADHD and normal control groups (Shue and Douglas,

1992). Stimuli included 40 cards with pictures of an apple (S+; 20 cards) or

an ice cream cone (S-; 20 cards). Participants were required to press a

response key as quickly as possible when presented with the S+ but to

refrain from pressing in response to the S-. Based on Shue and Douglas

(1992), very brief (1 sec.) interstimulus intervals were used in order to

increase task demands. Responses to the S- were scored as errors.

2. Theory of Mind Domain

Second-order belief attribution task. This task was first developed by

Perner and Wimmer (1985) and has been used with children with autism by

Baron-Cohen (1989). This task requires the ability to make second-order

attributions (in other words it requires the child to be able to take into account

what people are thinking about other people's thoughts). The test involves a

toy village constructed from models (see Baron-Cohen, 1989 for a depiction

of the town). The participants were asked to name all the toys and were then

told the following story by the experimenter who moved the dolls and van

accordingly.

This is John and this is Mary. They live in this village.

Naming question. Which is John/Mary?

Here they are in the park. Along comes the ice-cream man. John

would like to buy an ice-cream but he has left his money at home. He

is very sad. 'Don't worry', says the ice-cream man 'you can go home

and get your money and buy some ice-cream later. I'll be here in the park all afternoon....' 'Oh good' says John, 'I'll be back in the afternoon to buy an ice-cream'.

Prompt question [1] Where did the ice-cream man say to John he would be all afternoon?

So John goes home. He lives in this house. Now, the ice-cream man says 'I am going to drive my van to the church to see if I can sell my ice-creams outside there'.

Prompt question [2] Where did the ice-cream man say he was going?

Prompt question [3] Did John hear that?

The ice-cream man drives over to the church. On his way he passes John's house. John sees him and says 'Where are you going?' The ice-cream man says 'I'm going to sell some ice-cream outside the church'. So off he drives to the church.

Prompt question [4] Where did the ice-cream man tell John he was going?

Prompt question[5] Does Mary know that the ice-cream man has talked to John?

Now Mary goes home. She lives in this house. Then she goes to

John's house. She knocks on the door and says 'Is John in?'.

'No,' says his mother, 'he has gone to buy an ice-cream'.

Belief question: Where does Mary think John has gone to buy an ice-

cream?

Justification question: Why?

Reality question: Where did John really go to buy his ice-cream?

Memory question: Where was the ice-cream man in the beginning?

The belief question was scored as pass/fail and the justification

question was scored according to the order of mental state attributions made

by the participant. If the child made no mental state attributions, he scored 0;

if mental states were attributed to only one character a score of 1 was

obtained. If the child accounted for the mental states of both John and Mary,

a score of 2 was given.

Ellie the elephant Belief-Desire reasoning task. The materials and

procedures were based on those described by Harris, Johnson, Hutton,

Andrews and Cooke (1989). The child was introduced to Mickey-the-monkey

who is "always playing tricks on the other animals", to Ellie-the-elephant

whose "favourite drink is coke (she does not like milk)" and to Leo-the-Lion whose "favourite food is smarties (he does not like peanuts)".

The child was then told the following two stories and asked to make and justify two predictions about Leo's/Ellie's emotions. The first question required the child to imagine Ellie's/Leo's desire/non-desire given the false belief that the can/packet contains coke/peanuts. The second test question required the child to imagine Ellie's/Leo's state of desire and to check that against the actual contents of the can/packet. The Ellie-the-elephant Belief-Desire reasoning task was passed if the child correctly answered both memory control questions, both test questions and gave appropriate justifications.

Ellie's mummy has just given Ellie a can of coke but Ellie isn't thirsty right now so she goes for a walk. While Ellie is gone, Mickey decides to play a trick on her. He pours all the coke out of the can and replaces it with milk. Then Mickey puts the coke can with milk in it back on Ellie's table, exactly how Ellie left it. Ellie comes home very thirsty. She sees the can of coke on her table.

Memory question 1: What is Ellie's favourite drink?

Test Question 2: How does Ellie the elephant feel when she sees the can of coke? Does she feel happy or sad? Yes, and why does she feel happy/sad?

Memory Question 2: What is in the coke can? Coke or milk?

Test Question 2: How will Ellie feel when she has a drink from the can and finds that there is milk instead of coke? Will she feel happy or sad? Yes, and why will Ellie feel happy/sad.

Leo-the-lion is very hungry for a snack and all his mummy has is a packet of peanuts. Leo goes into the kitchen to get some water and while he is gone Mickey-the-monkey decides to play a trick on him.

Mickey empties out the peanut packet and replaces the peanuts with some smarties. He puts the packet back on Leo's table exactly how he left it. Leo comes back into the room very hungry and sees the peanut packet on the table.

Memory question 1: What is Leo's favourite snack?

Test Question 1 : How does Leo feel when he sees the packet of peanuts? Does he feel happy or sad? Yes, and why does he feel happy/sad?

Memory question 2: What is in the peanut packet? Peanuts or smarties?

Test Question 2: How will Leo feel when he opens the packet and finds that there are smarties instead of peanuts? Will he feel happy or sad? Yes, and why will Leo feel happy/sad.

Strange Stories. These stories were developed by Happe (1994) as measures of higher order Theory of Mind functioning (in other words, the ability of the child to think about what others think about their thoughts). The set used in this study is composed of 12 different naturalistic short vignettes titled Lie, White Lie, Joke, Pretend, Misunderstanding, Persuade, Appearance/Reality, Figure of Speech, Sarcasm, Forget, Double Bluff and Contrary Emotions. Each vignette is accompanied by a picture and two test questions: the comprehension question ("Was it true what X said?") and the justification question ("Why did X say that?").

Each story was read out loud to the child by the experimenter and the story remained in front of the child throughout to minimise memory requirements. At the end of the story the child was asked the two test questions. The answer to the comprehension question was recorded but if the answer was incorrect the story was read out again until the child answered correctly. The justification question was scored as either involving

mental states or physical states. Only one score was given per story as the

child was credited for the 'best' answer.

3. Questionnaires about the child's social competence

Vineland Adaptive Behaviour Scale: The Vineland Adaptive Behaviour

Scales (VABS) provides a standardised, norm-referenced assessment

instrument which measures a wide range of social and non-social behaviours

(Sparrow, Balla & Cichetti, 1984). The child's parent provided information

about each child's actual (e.g. habitual) level of functioning. Ratings on the

VABS ranged from 0 to 2 for each item where 0 indicated the behaviour was

never seen, 1 that it was sometimes or partially performed and 2 that it

occurred regularly.

The Survey Form contains 297 items designed to assess the strengths

and weaknesses of an individual across a wide range of behaviours in the

domains of Communication, Daily Living Skills, Socialisation, Motor Skills

and Maladaptive Behaviour. As this measure was used to gain information

about the participants' social behaviour only the questions covering the

Socialisation domain were administered. The VABS has adequate

psychometric properties with reported test-retest reliability (2 - 4 weeks)

ranging from .80 to .90 and interrater reliability from .62 to .75 (Sattler, 1988).

As the first 13 items of the Socialisation subdomain applied to children below the age of two years, the first item administered was number 14. As instructed in the manual, participants were given full credit for the preceding 13 items.

These items were supplemented by two further sets of 16 items developed by Frith, Happe and Siddons (1994). The 'Active Sociability' items refer to behaviour which can be carried without the ability to mentalise (e.g. initiates social contacts, shares toys when asked) whilst the 'Interactive Sociability' items consist of behaviours which appear to require the ability to attribute mental states (e.g. responds to hints and indirect cues in conversation, initiates conversation of interest to others) (See Appendix for Active/Interactive Sociability items).

The supplementary items were scored in the same way as items were scored on the VABS: 2 was given if the behaviour occurred regularly, 1 if the behaviour was sometimes or partially performed and 0 if never performed.

Procedure

Ethical permission was obtained from the Joint UCL/UCLH Committees on the Ethics of Human Research and from the Harrow Research Ethics Committee.

The primary school Headteacher who had agreed to allow access in order to recruit a group of normally developing boys, forwarded letters, information sheets and consent forms to all the parents of boys between the ages of 7 and 10 requesting their help in a research project being undertaken to investigate the social communication difficulties children with psychological problems experience. (See Appendix for copies of information sheets and consent forms). Parents of 22 boys gave written permission for their sons to take part.

Medical records of all the boys between the ages of 7 and 10 attending the ADHD clinic at the teaching hospital were consulted. Those boys who met the criteria for Hyperkinetic disorder only were identified. The psychiatrist who knew the child best was then consulted to confirm suitability in terms of diagnosis and to get permission to contact the family. Parents were then sent a letter, information sheet and consent form. Parents of 22 boys gave written permission for their sons to take part.

Parents of the children in both groups were asked to complete the CBCL together with the items from the Socialisation domain of the VABS and the Active and Interactive Sociability Scales. The child's class teacher completed the Revised edition of Conners Teacher Rating Scale. Each child was tested individually by the author either at his school (control group) or at the outpatients department of the teaching hospital (ADHD group) in a single

session lasting approximately one hour so the experimenter was not blind to group membership. Theory of mind tasks (Strange Stories, Ellie the Elephant/Leo the Lion Belief-Desire Reasoning Tasks, Perner and Wimmer 2nd order task) were administered first followed by the executive function tasks (Tower of Hanoi and Go-No-Go). The four WISC-III subtests (Object Assembly, Similarities, Block Design and Vocabulary) were administered last.

Results

Characteristics of the sample

A series of one way analyses of variances (ANOVAs) for independent

samples was used to determine differences between the means of the two

groups. Descriptive characteristics of the sample are given in Table 1.

Table 1. Participant characteristics: means and sd's

		ADHD n = 22	Normal n = 22	p
Age	(in months)			
	mean	102.8	108.2	ns
	sd	12.4	8.5	
VIQ				
	mean	101.7	112.4	.03
	sd	15.4	16.4	
PIQ				
	mean	100.2	113.1	.03
	sd	19.0	19.3	
FSIQ				
	mean	101.1	114.2	.01
	sd	15.9	15.9	

The groups did not differ in chronological age $(F(1,42) = 2.75, p = .10)$.

However, the normal participants exceeded the ADHD group in terms of Verbal

IQ (VIQ) $(F (1,42) = 4,94, p = .03)$, Performance IQ (PIQ) $(F (1,42) = 4.94, p =$

$.03)$ and Full Scale IQ (FSIQ) $(F (1,42) = 7.43, p = .01)$.

Behavioural variables

The scales of behaviours and social competencies dealing with

specific childhood diagnostic categories (on the Child Behaviour Checklist)

were then analysed to determine the differences between the two groups in

terms of psychopathology. (Parents of three of the control group children and

one of the ADHD group did not return questionnaire data). Scores shown are

T scores with a mean of 50 and a sd of 10. The results are shown in Table 2.

Table 2: Means and sd's of the Child Behaviour Checklist behaviours

	ADHD n = 21		Controls n = 19		
	mean	sd	mean	sd	
Withdrawn	58.0	5.5	55.1	6.4	ns
Somatic Complaints	62.9	8.9	56.2	8.5	*
Anxious/Depressed	64.9	9.9	58.9	8.4	*
Social Problems	66.4	9.7	54.9	7.1	***
Thought Problems	65.7	10.5	56.7	7.4	**
Attention Problems	74.0	10.2	57.2	9.1	***

*p < .05   ** P < .001   *** p < .0001

With the exception of 'Withdrawn' (F (1,38) = 2.44, p = .12), the

groups differed significantly on 'Somatic complaints' (F (1,38) = 6.02,

p = .02), 'Anxiety/Depression' (F (1,38) = 4.16, p = .05), 'Social problems'

(F (1,38) = 17.77, p < .0001), 'Thought problems' (F (1,38) = 9.66, p = .004)

and 'Attentional problems' (F (1,38) = 30.05, p = .0001)

Measures of everyday Social Competence

Domain scores of the VABS are standardised (using North American

normative groups) with a mean of 100 and sd of 15 which enables

comparison across groups. The VABS socialisation subdomain scores (raw

scores, standardised scores and age-scaled scores) and the supplementary

items (Active and Interactive Sociability) were analysed to determine

differences in social competence. (Parents of three of the control group

children and one of the ADHD group did not return questionnaire data.)

The normally developing control group showed significantly higher raw

scores (F (1,38) = 15.29, p = .0004), standardised scores (F (1,38) = 18.19,

p = .0001) and age scaled scores (F (1,38) = 15.26, p < .0004). They also

showed significantly more Active behaviours (F (1,37) = 17.33, p < .0002)

and Interactive behaviours (F (1,37) = 18.61, p < .0001).

Table 3 shows the socialisation measures: raw scores (measures of

absolute level of social functioning), standardised scores on the socialisation

subdomain of the VABS; the age equivalent scores computed from the

standardised socialisation scores; and the scores of the supplementary items

(Interactive and Active sets).

Table 3: Means and sd's of the Vineland standardised scores, age equivalents and supplementary items

	ADHD n = 21		Controls n = 19		
	Mean	sd	Mean	sd	
VABS: Raw scores	77.0	14.1	94.0	13.5	***
VABS: standardised scores	72.7	15.9	93.6	15.0	***
VABS: Age equivalent (months)	64.5	22.4	98.0	31.5	***
Active (max = 32)	19.1	5.1	25.7	4.6	***
Interactive (max = 32)	14.8	6.1	22.5	4.9	***

*** $p < .001$

In analyses of covariance (ANCOVAs), after controlling for Full Scale IQ and Age, significant differences between the two groups remained for VABS raw scores (used instead of standardised scores in order not to account for age twice) (F (1,36) = 6.42, p = .01), for Active behaviours (F (1,35) = 10.18, p = .003) and for Interactive behaviours (F(1,35) = 8.11, p = .007.

Performance on Executive Function Measures

Correlational analysis of the two executive function tasks (Tower of Hanoi and Go No Go) suggests they are independent (r = -.069, p = .76, two tailed test). The groups differed significantly on both measures of executive function with the ADHD group performing less efficiently than the controls: Tower of Hanoi (TOH) (F (1,42) = 4.72, p = .04) and Go No Go commission errors (F (1,42) = 10.83, p = .002). The results are shown in Table 4.

Table 4: Means and sd's of Executive Function tasks

	ADHD n = 22		Controls n = 22		
	mean	sd	mean	sd	
Tower of Hanoi	22.64	5.46	25.59	3.31	*
Go No Go errors	3.41	1.59	1.95	1.33	*

* $p < .05$

In analyses of covariance (ANCOVAs) after controlling for Age and

FSIQ, group performances did not differ significantly on the Tower

of Hanoi (F (1,39) = 2.74, p = .11). However, the group difference remained

on the Go No Go task (F (1,39) = 4.26, p = .05. There were no significant

covariance effects for Age or FSIQ.

Theory of Mind Competence

All participants passed the Ellie the Elephant Belief-Desire reasoning

task. Chi Square analysis confirmed no differences between the groups on

both the Belief question of the Second-order belief attribution task (X^2 (1) =

0.0) and on the Justification Question (X^2 (2) = 2.28, p = .32). 68% of the

children in each group passed the Belief Question. Results for Justification

Question are shown in Table 5.

Table 5: Percentage of zero, first and second order responses the Second Order Justification Question

	ADHD n = 22	Controls n = 22
Justification Question		
% Zero Order	9%	14%
% lst Order	59%	36%
% 2nd Order	32%	50%

The answer to Justification Question in each of the 12 Strange Stories was scored as either involving mental states or physical states by the author. However, the answers of 11 ADHD children (50%) and 11 of the control group (50%) were randomly selected and were also rated by a trained second rater who was blind to group membership. On the whole, agreement was very high with Cohen's Kappa being unacceptable on only one story (Joke: .47) and marginally acceptable on one other (Sarcasm: .60) (Cohen, 1960). Inter-rater reliability for each story is shown in Table 6.

Table 6: Inter-rater reliability for the Strange Stories

Story	K	Story	K	Story	K
Pretend	.89	Idiom	.89	Persuasion	.79
Lie	1.00	Misunderstanding	.89	Contrary/Emotion	.89
Joke	.47	Double Bluff	.89	Appearance/Reality	.89
White Lie	1.00	Sarcasm	.60	Forget	1.00

Scores for each story were totalled for each group. The maximum possible total score was 12. The mean:sd for the normally developing control group (8.22:1.44) and the ADHD group (7.86:1.70) did not differ significantly (F (1,42) = .58, p = .45).

To determine the relationship between the absolute level of everyday social performance, executive function and theory of mind performance within each group, scores on social measures (VABS raw scores and both the Interactive and Active subsets) were correlated with executive function measures (Go No Go and Tower of Hanoi) and with theory of mind measure (the total score on the 12 Strange Stories). Because performance on both executive function and theory of mind experimental measures and on ratings of social behaviour are likely to be related to a child's age and IQ, partial correlations controlling for age and FSIQ were conducted to investigate the relationship between social behaviour and the experimental measures. None of the Pearson product moment correlation coefficents were significant. Table 7 contains the intercorrelation matrix for the ADHD group.

Table 7: Intercorrelation matrix after controlling for Age and IQ, ADHD Group (n = 21)

	Tower of Hanoi	Go No Go	Strange Stories
VABS raw score	.34	-.18	.09
Active score	.25	-.03	.07
Interactive score	.36	-.14	.29

Within the group of normally developing boys, performance on the Strange Stories was significantly related to all three of the everyday social

functioning measures. Table 8 contains the intercorrelation matrix for the

normally developing controls.

Table 8: Intercorrelation matrix after controlling for Age and FSIQ, normally developing controls (n = 19)

	Tower of Hanoi	Go No Go	Strange Stories
VABS raw scores	.32	-.06	.63 **
Active score	.01	-.10	.56 *
Interactive score	.24	-.09	.62 *

*p < .05   ** p < .01

A discriminant function analysis was performed to evaluate how well

the groups could be empirically distinguished from each other on the basis of

task performance and FSIQ. When the performance on the three main

experimental tasks (Go No Go, Tower of Hanoi and Strange Stories)

together with FSIQ were entered in the analysis, an overall classification

accuracy rate of 70% was achieved. The group membership of 72.7% of the

normally developing control participants and 68.2% of the ADHD participants

was correctly predicted by the discriminant function. The Go No Go task was

the most highly correlated with the function so was best able to discriminate

between the groups (Wilks lambda = .67, p = .003.) Table 9 shows the

correlations with the function of each variable.

Table 9: Correlations of variables with discriminant function

Composite	r
Go No Go Task	-.73
Full Scale IQ	.60
Tower of Hanoi	.48
Strange Stories	.17

Discussion

Summary of results

The purpose of this study was to consider the difficulties a group of ADHD children experience in everyday social behaviour and to explore the role of theory of mind and executive function in influencing this behaviour. Compared with other children of the same age, the children with ADHD were significantly more impaired in their day to day social functioning as measured on the Socialisation domain of the Vineland Adaptive Behaviour Scales (VABS) and on the supplementary Active and Interactive behaviours. However, tests of second order mentalising ability (the Belief-Attribution task and the Belief-Desire reasoning task) and higher order mentalising ability (the Strange Stories) did not differentiate between children with ADHD and their normally developing peers.

Although the performance of the ADHD children on both of the tasks presumed to measure different aspects of executive function (Tower of Hanoi: planning efficiency and Go No Go: response inhibition) was significantly less efficient than their peers, after IQ was taken into account differences in performance on the planning task (Tower of Hanoi) task did not reach significance. However, the difference between the groups on the response inhibition task (Go No Go) remained. The Go No Go task was also the measure which best discriminated between the two groups.

Social functioning

Traditionally the research assessment of social functioning has been

based on sociometric ratings by peers and teachers (Parker and Asher,

1987). However, as the purpose of this study was to investigate the

everyday social functioning of the ADHD group and to consider this

behaviour in terms of a theory of mind, the Vineland Adaptive Behaviour

Scale was chosen as a measure of social functioning because it is a

standardised measure which considers several different aspects of every day

social behaviour. It was used for the purpose of comparing results with those

reported in recent research with individuals with autism (Frith, Happe and

Siddons, 1994), with learning disabled children (Charman and Campbell,

1996) and with conduct disordered children (Happe and Frith, 1996).

Domain scores of the VABS are standardised (using North American

normative groups) with a mean of 100 and a standard deviation of 15. The

children in the ADHD group scored significantly worse than the controls on

the Socialisation domain. The children with ADHD were functioning, on

average, three years below their chronological age which suggests a serious

impairment in terms of social functioning. Although it is not clear to what

extent this impairment is present in all children with ADHD as estimates vary,

80% of the children with ADHD in this study scored below 85 (one standard deviation below the population mean) compared with only 26% of the controls. These results are consistent with studies which suggest that 80% of parents of 'hyperactive' children are seriously concerned about their child's social relationships (Campbell and Paulauskas, 1979; Barkley, 1990) and are in excess of estimates that 50% of these children have significant problems with their social relationships (Pelham and Bender, 1982).

Analysis of the Active and Interactive sociability behaviours confirmed that the ADHD group also showed significantly less of both of these behaviours than their normally developing peers. The construction of these sets was theoretically driven with the Interactive set composed of behaviours which require 'mentalising' and the Active set of behaviours which could be performed without the ability to 'mentalise'. The Interactive set successfully discriminated autistic children from mentally handicapped children of the same Verbal IQ (Frith, Happe and Siddons, 1994), conduct disordered children from their normal peers (Happe and Frith, 1996) and predicted social competence in a group of children and young adults with a mental handicap (Charman and Campbell, 1996). However, the pattern of impaired social functioning impairment in the ADHD group (that is on both the Active and the Interactive behaviours) suggests that they have global difficulties.

Happe and Frith (1996) reported a mean Verbal IQ of 85 (measured on the BPVS) in their conduct disordered group; their normally developing control group had a significantly higher mean IQ of 99.8. This discrepancy in ability between the group being studied and the normally developing controls was also evident in the present study which also reported a difference of 15 IQ points. However, the mean VIQ of the ADHD group in this study was 101.

The conduct disordered and ADHD groups were very similar, however, in terms of their standardised scores on the Socialisation subdomain (67.4 and 72.7 respectively), scores on Active behaviours (22.8 and 19.1 respectively) and Interactive (16.3 and 14.8 respectively). The socialisation scores of both groups were not dissimilar to those reported by Frith et al (1994) in their learning disabled children (chronological age 8:8 years; mental age 4:7 years) but were unlike Frith et al's (1994) group of children with autism (chronological age 14:7; mental age 7:9) whose mean score was 43.6. These data suggest that the VABS is a useful measure of everyday social functioning which successfully discriminates children with social difficulties from their normally developing peers. However, it would be informative to investigate in more detail the difficulties the ADHD group experience by looking at both the VABS and the Active/Interactive behaviours.

Furthermore, if the Interactive sets really do require the ability to mentalise, the results in this study suggest that ADHD children are impaired across the whole range of behaviours and not just those which supposedly require a theory of mind. However, the Happe and Frith's (1996) conduct disordered group were recruited from a special school whilst the ADHD group were a clinically referred sample so comparisons between the two groups may not reflect the complexity and severity of their difficulties.

Theory of mind

All of the children passed the Belief-Desire reasoning task and there were no differences between the ADHD and normally developing children on the second order Belief-Attribution task. These results resemble patterns recently reported in other groups with striking social difficulties: young 'hard to manage' children (Hughes, Dunn and White, 1996) and children with conduct disorder (Happe and Frith, 1996) but contrast with the studies investigating children with autism who show impaired functioning on these tasks (Baron-Cohen, 1993).

Happe and Frith (1996) used first order theory of mind tasks with their conduct disorderd children and acknowledged the need for using higher order tasks as four year old normally developing children pass first order

tasks. Hughes, Dunn and White (1996) reported that 40% and 60% of their young (3 1/2 to 4 1/2 years olds) children passed first order False Belief and Deception tasks.

The children in this study with ADHD performed just as well as their normally developing peers on the higher order reasoning task. Because standard theory of mind tasks can be passed by children as young as age four, the necessity for more complex research tasks has resulted in the development of the Strange Stories which are being widely used for both research purposes and clinically. They were used in this study because they were the only method available for investigating higher order theory of mind but it is possible that the Strange Stories do not actually tap higher order theory of mind ability. In retrospect, it would have been valuable to provide other measures of higher order theory of mind, measures designed to elicit responses about both thoughts and feelings, in both others and self. It would have been useful to gather data about the ability of these children to empathise, a much more sophisticated and sensitive process than mentalising.

The results in this study suggest that there is not a relationship between theory of mind and social functioning in ADHD children and is consistent with the results of Frith et al (1994) who found no relationship

between performance on theory of mind tasks and scores on the VABS or on

the Active and Interactive Sociability Scales in their group of individuals with

a mental handicap without autism. They are also consistent with results from

a study which found that young bullies were quite skilled at understanding

mental states in others (Sutton, Smith and Swettenham, 1996). However,

Charman and Cambell (1996) did find a relationship between some aspects

of poor social functiong and experimental theory of mind tasks in their group

of individuals with a mental handicap.

In this study, it was the performance of the normally developing

children on the higher order measure of theory of mind (the Strange Stories)

which was significantly related to all of the social functioning measures even

when IQ and age were taken into account. These results are consistent with

other studies which have also reported relationships between theory of mind

and peer and teacher rated social abilities in normally developing children

(Astington & Jenkins, 1995; Lalonde and Chandler, 1995). This suggests

that in normally developing children (and in individuals with a mental

handicap who appeared to be functioning socially at their mental age) there

is a relationship between the ability to mentalise and everyday social

functioning. However, the social functioning of children with ADHD appears

to be influenced by some other non specified or more global difficulty. Their

difficulty actually performing behaviours which do (Interactive) and do not

(Active) require mentalising contrast with their unimpaired performance on theory of mind experimental tasks suggests that it is not the <u>ability</u> to mentalise which is their problem.

The Strange Stories have not been fully validated and although this study has shown (1) that raters can agree on scoring at least eleven of the twelve stories and (2) that the social functioning in normally developing children is related to this measure, further research is needed to determine how helpful these stories are in actually measuring higher order theory of mind in other children with social problems and without developmental delay.

Executive functioning

The children with ADHD made significant errors on the response inhibition task (Go No Go) even after age and IQ were taken into account. These results were consistent with those reported by Shue and Douglas (1992) who matched their ADHD and normally developing groups in terms of receptive vocabulary IQ (Peabody Picture Vocabulary Test). Although Trommer et al (1988) used auditory (taped taps) rather than visual stimuli, they also found that boys with ADHD made more commission errors than the normally developing controls. Trommer et al (1988) also mentioned that almost all of the children with ADHD who made commission errors

"spontaneously demonstrated their chagrin immediately thereafter" (p.613).

This same behaviour was observed in this study which suggests that the

boys understood the stimuli but were too late to inhibit their response.

Although significant differences were observed between the groups in

this study on the planning task (the Tower of Hanoi), once age and IQ were

taken into account the groups did not differ statistically. These results

suggest that planning tasks are influenced by IQ. Although all of the three

studies reviewed by Ozonoff and Pennington (1996) which used Tower of

Hanoi also reported better control group performance, only one (Aman,

Roberts and Pennington, 1996) matched for IQ. Although frontal lobe lesions

result in impaired performance on executive function tasks (and in thinking or

controlling their behaviour when placed in a situation which may require

novel patterns of behaviour), paradoxically 'normal' scores on structured

tests of 'intelligence' are reported (McCarthy and Warrington, 1990). The

results in this study suggest, perhaps not surprisingly, that IQ does affect

performance on both the Go No Go and the Tower of Hanoi tasks and that

any future research on executive function in children with ADHD should

match groups on IQ as well as age and gender.

However, not all studies show differences between ADHD and

controls in performance on planning tasks. Only continuous performance

tasks (on which the ADHD subjects make more impulsive errors) have shown

consistent results in the literature (Barkley, 1988). For reviews see Barkley,

Grodzinsky and DuPaul, 1992 and Pennington and Ozonoff, 1996. It is

possible that the performance of all the children on the planning task was

influenced by their developmental stage. Although, as discussed earlier,

there is good evidence that ADHD children do have frontal lobe deficits, the

prefrontal cortex is not unitary in nature (for example, orbital lesions have

been associated with social disinhibition and dorsolateral lesions with

behavioural regulation such as poor planning) (Stuss and Benson, 1986).

Therefore, frontal lobe dysfunction in children could produce several different

behavioural deficits which would vary across individuals and age. Luria

(1980) also suggested that some parts of the frontal lobes do not begin to

mature until about aged seven and Golden (1981) argued that frontal

functions do not completely mature until about twelve to fifteen years of age

- or even later.

These theories seem to be supported by studies which report

significant improvements with age on executive function tasks (Grodzinsky

and Diamond, 1992; Diamond and Taylor, 1996) and with studies reporting

that children with ADHD score about two years behind age matched cohorts

(Chelune, Ferguson, Koon and Dickey, 1986; Shue and Douglas, 1992).

However, as the ADHD group in their study still performed significantly

poorer at all ages on tasks of inhibition/ impulsivity, tasks of cognitive flexibility and tasks of planning and organisation (Grodzinsky and Diamond, 1992) it seems likely that these executive functions remain stable in young hyperactives although longitudinal studies are needed to provide more convincing evidence.

It is possible that the Tower of Hanoi was too simple a task to successfully discriminate between children with planning problems and children without. It is a complex task which involves generating and utilising problem solving strategies, memory, response inhibition, switching sets, and monitoring of progress through feedback. It had proved to reliably distinguish between ADHD and controls in the few studies which have used it as a measure of executive function (See Pennington and Ozonoff, 1996, for a review) and discriminant analysis has also identified it as one of the cognitive tasks which discriminates ADHD children from other groups (Weyandt and Willis, 1994). However, 86% of the children in this study were able to solve the six move problem which suggests that it may have been too simple.

It is also possible that the executive function deficits reported in other studies are an artefact of selection. Although differences have been found in both clinic and school samples, the one study which examined executive function in population samples of children with ADHD did not find executive function deficits (McGee et al, 1989). However, a selection bias is unlikely to explain the results in this study because the ADHD group exhibited high

explain the results in this study because the ADHD group exhibited high rates of psychopathology (on the CBCL) which are likely to distinguish them from non-referred population samples.

Finally, it is also very possible that the ADHD children did perform significantly worse than their peers on the Tower of Hanoi task and that larger groups would have resulted in a statistically significant difference. Although this study did not show statistically significant links between social functioning and performance on the Tower of Hanoi task, it did show a significant impairment on the task of behavioural inhibition and that this task discriminates ADHD children from normally developing children. These results offer support for Barkley's (1994) argument that it is the inability to inhibit responses which is the primary deficit in ADHD.

Linking executive function and everyday social functioning

This study suggests that although children with ADHD are able to mentalise, their ability to mentalise does not relate to their everyday social functioning in the same way as it does for normally developing children. It also suggests that these children find it difficult to inhibit a response - to wait.

As we have seen, studies investigating their social functioning indicate that children with ADHD are motivated and able to initiate social relationships (Grenell et al, 1987); they know what they *should* do in hypothetical social situations (Guerra and Slaby, 1989); they can identify unacceptable behaviours in others (Whalen et al, 1990); they can function efficiently as a 'worker' (as opposed to being the 'helper') on joint tasks (Grenell et al, 1987); they do not differ in terms of prosocial initiation or responsiveness (Buhrmeister et al, 1992); they can select appropriate skills when given a multiple choice (Milich and Dodge, 1984) and they are just as able as their peers in recognising and processing emotional cues (Shapiro et al, 1993).

On the other hand, these children do have difficulties in generating appropriate skills in a freeplay situation (Hechtman et al, 1980); their timing and force of delivery of social skills is inappropriate (Whalen and Henker, 1982); their on-task application of problem solving skills is impulsive and poorly organised (Zentall, 1993); they are talkative, controlling and directive during play (Barkley, 1990); they are less responsive to feedback about their performance and are less able to adjust their behaviour to the changing demands of the social interaction (Whalen et al, 1979).

Shue and Douglas (1992) argue that because of documented difficulties in problem solving, effective use of feedback and the generation

and use of strategies, the hypotheses for ADHD difficulties based on inhibitory control deficits are not sufficient. However, it could also be argued that if a child is unable to inhibit or delay a response, he or she will be unable to monitor a situation, to deliberate, to choose a strategy and to attend to feedback. Barkley (1994) argues that it is 'impaired delayed responding' or the inability to inhibit a response which is the major deficit in ADHD and this study appears to offer support for his theory.

It is the function of the executive system is to inhibit a response, to select the most appropriate strategy in approaching a problem, to monitor the ongoing efficiency and effectiveness of the strategy and to alter the strategy to meet demands of the task (Cavanaugh and Perlmutter, 1982). However, if we return to Dodge's (1993) model of normal social information processing, we can see that if a child is unable to wait and to take time, he or she will also find it difficult to deliberate: to attend to the context, to recall previous experience, to plan appropriate actions and to assess the effectiveness of these actions. Thus it follows that the child will also have difficulty in effectively processing social information.

Response accessing is the capacity of the child to select or plan a course of action (from a variety of familiar and/or novel options) which has a reasonable chance of producing the desired outcome for the child. For a

child who cannot wait, accessing appropriate responses will clearly be difficult. In addition, time is also needed to build a memory bank of both successful and unsuccessful solutions, experiences which are crucial to social skill. *Response evaluation* requires on-line judgement of the effectiveness of the action via feedback. The ability to hold back unaccceptable or 'bad' responses, to switch to a different course of action mid-stream or to continue actions which are having the desired effect clearly requires the ability to hold back and monitor the self and others. However, the inability to wait could explain not only the reckless and inappropriate behaviours but also why these children rarely seem to learn from their mistakes, one of the most frequently voiced concerns by parents..

The evidence suggests that these children do not lack the cognitive skills, abilities, strategies or motivation necessary for engaging in rewarding social behaviour but rather that they are unable to use or maintain the use of their existing behavioural repertoire in 'on line' social engagements. Further support for on-line processing difficulties is offered by evidence that their inhibitory deficits are increased when they are presented with complex tasks; this in turn increases their tendency to respond to stimuli which are more salient, (Dykman, Ackerman and Oglesby, 1979). Furthermore, if the quality of these children's social experience is affected by their inability to wait, to reflect, and to consider, then they are penalised further by the lack of

opportunities to build up a repertoire of practised, competent, <u>appropriate</u> and rewarding social interactions.

Thus, this study appears to offer support to the theory that the failure of these children to respond competently in social interactions can be termed a problem of impulse control (a 'passionate' response) rather than a problem of deficiency in their understanding and knowedge of appropriate social behaviour (a 'reasoned' response; Dodge, 1993) In other words, the difficulties in ADHD are not so much the result of a skills deficit as a performance deficit (Barkely, 1989) with the on-line demands of a social interaction placing great stress on a child who is unable to wait and to take the time to deliberate.

However, defective inhibition of behaviour and emotions will not only result in hyperactivity, impulsivity and explosive emotional outbursts. It may also affect the social process in another more subtle way: self-centredness. The behaviours observed which prompted this study - the apparent inability to adopt another's perspective, the apparent disregard for others, the insensitivity to the needs and wishes of others, the surprise at the negative responses they generate in others (in other words their apparent self-centredness) - could also result from emotional dyscontrol. One could speculate that if a child has great difficulty processing social information and

behaviour, then the demands of interacting socially would place quite a strain on the system. Many of these children also talk about a 'head that never stops' or a 'head that is always thinking' - another form of pressure. Protecting the self from outside injury requires a huge amount of energy and one way of protecting the self from pressure is to pull back within the self - to become self-centred. When a child also has to combat internal pressure from a mind that is running at high speed a great deal of the time, it seems plausible that there will be very little energy or motivation left for consideration of others.

Linking theory of mind, executive function and social functioning

It has been argued that the social and cognitive deficits observed in autism (e.g. in theory of mind, pretend play and joint attention) are the result of primary developmental deficits in executive function and planning (Ozonoff et al, 1991; Ozonoff et al, 1994). Charman (1996) argues that studies investigating theory of mind and executive function in other groups of children with documented social impairments were required to illustrate the relationship between executive function, theory of mind and social functioning. He suggested that if another clinical population with neurodevelopmental disorders was found to have executive function deficits without impairments in theory of mind, then the claims that joint attention,

pretend play and theory of mind development are the result of an impairment in the more basic cognitive processes of executive function or attention could be challenged.

This study offers support to other studies which have found that theory of mind is related to social functioning in normally developing children. However, the results also suggest that a group of children with a neurodevelopmental disorder (children with ADHD) who show poor social functioning globally (and also in behaviours which require the ability to mentalise) and who also have deficits in the executive function ability to inhibit motor behaviour, nonetheless appear to perform as well as their normally developing peers on higher order theory of mind tasks. It is possible, therefore, that this study can act as a challenge to the argument that deficits in executive function (in individuals with autism) underlie impairments in theory of mind which in turn affect social functioning.

However, this study has also provided support for the argument that the underlying executive function deficit in ADHD may be the inability to inhibit behaviour. It has also been hypothesised that this difficulty could underlie (at least in children with ADHD) poor performance on more complex tasks. In contrast, it appears that in individuals with autism, inhibition is a relatively spared component (Ozonoff, Strayer, McMahon and Filoux, 1994)

whilst difficulties on planning and working memory tasks are consistenty

reported (Pennington and Ozonoff, 1996). Furthermore, because 'executive

function' consists of several related but disassociable cognitive functions

(e.g. inhibition, flexibility, planning, working memory, organisation), it seems

more fruitful in future research to consider executive function as a

multidimensional rather than a unitary construct in order to be more precise

about the nature of the specific dysfunctions associated not only with ADHD

and autism but with the other disorders which show executive function

impairment (Ozonoff, 1996).

Limitations

Although the size of the groups in this study is similar to those used in

other studies using clinical groups of ADHD children, further studies are

required to determine if these results are representative and if they can be

generalised to a larger sample. In addition, as the ADHD group in the current

study included only Caucasian male participants, these findings may not

generalise to female and non-white children.

The ADHD group was selected from a clinical sample which may not

be representative of community samples. A study carried out recently in

south London reported significant differences between groups of children

referred to clinic and those identified in the community (Woodward, Dowdney and Taylor, 1997) with much higher rates of comorbid conduct and emotional disorders in the clinic sample. Parents of their clinic sample also exhibited significantly poorer coping skills, more negative affect and insensitivity, higher rates of depression and exhibited less effective control over their child. Therefore it is possible that the children in our sample may be particularly difficult to parent and as the parents were not asked about their own behaviour and attitudes, their views may have reflected these difficulties rather than an accurate picture of their child's actual difficulties.

A further limitation is the reliability and validity of the diagnosis. Although considerable advances have been made, the reliability and validity of diagnosis is an ongoing focus of scientific investigation (Rutter and Tuma, 1988). However, because the clinical sample in this study were referred from the same referral source and because selection criteria were stringent, it is highly likely that these children meet the diagnostic criteria for ADHD although they may also have unidentified co-existing problems which may have affected the results.

Although the children with ADHD who participated in this study did not have a co-existing diagnosis of conduct disorder, it is possible that they had higher rates of emotional disturbance than non-referred children which may

have affected not only their day to day social functioning but their overall psychological well-being. This assumption is borne out by the significant differences between the ADHD group and the controls on the behaviours assessed on the CBCL.

There is also a potential reporting bias. Although teachers provided measures of the child's behaviour at school on the Revised Conners Teachers Rating Scale, the questions concerning social behaviour were not as numerous or as thorough as those on the VABS and the CBCL which were completed by the parents. Therefore, it is possible that parental views were not shared by teachers and that these difficulties were more prevalent at home than at school. However, other research has indicated good agreement between parental and teacher reports of social functioning and also between these reports and peer ratings (Pelham and Bender, 1982).

Although the groups did not differ in age, they did differ significantly in terms of Verbal (VIQ), Performance (PIQ) and Full Scale IQ's. Mean scores of the normally developing group on all three were in the high average range. Although their mean scores were lower, the ADHD group was nonetheless functioning within the average range in terms of VIQ, PIQ and FSIQ. This suggests that the ADHD group was not 'impaired' as such or at a disadvantage in terms of their overall intellectual functioning. However, it is

also possible that this difference reflects a depressed performance on IQ

tests in general within this group as lower levels of performance have been

referred to in the literature on assessment of children with ADHD

(Pennington, 1994). Although it is not clear why this might be, it might be

reasonable to hypothesise that the ADHD child's attention and motivation,

although not visibly apparent to the tester, affects their performance.

This study is not the only one to report a significant difference in IQ

between ADHD children and their normally developing peers. For example,

Greene et al (1997) used only one subtest from the Performance scale (Block

Design) and one from the Verbal scale (Vocabulary) of the WISC-R to

estimate Performance IQ, Verbal IQ and Full Scale IQ. They reported

significantly higher scores in favour of the normally developing group.

Erhardt and Hinshaw (1994) used all five verbal subtests of the WISC-R to

obtain a measure of Verbal IQ and also reported a significant difference of 11

points in favour of the control group.

However, Woodward et al. (1997) used a measure of receptive

vocabulary (BPVS; Dunn et al, 1982) and did not report a difference between

the ADHD children and normally developing children. A search through the

studies investigating social functioning in ADHD has revealed that most

researchers have not obtained measures of verbal functioning or IQ even

though research on the social reasoning abilities in children has highlighted the importance of controlling for the variation which is attributable to different levels of intellectual functioning (Milich and Dodge, 1984).

It is also possible that the control group was particularly able (their mean PIQ was nearly one standard deviation above the mean of the population). Although parents of all boys at the school within the designated age range were approached, there may have been a selection bias as boys who were given consent to participate may not have been representative of the group at large (even though the school has pupils with a wide range of ability)

Clinical implications

Clinically, together with worries about school performance, social functioning is a major concern of parents; however, to date, adaptive social functioning is not formally assessed as part of the diagnostic process. Given the relationship between social problems in childhood and the poor long term prognosis, assessment of a child's social functioning would identify both their strengths and weaknesses. This information could then be used to design appropriate interventions which could develop existing skills and remediate weaknesses.

It would also be useful to investigate those children whose adaptive social functioning is not impaired. Unfortunately as only four of the ADHD children in this study scored within the average range on the VABS, the group size was too small for any further analysis.

As the social difficulties experienced by children with ADHD are a major source of concern they have been identified as important targets for intervention, which is invariably social skills training. If these children do not lack social ability and social skills and if the social problems they experience are the result of on-line processing difficulties, then they are unlikely to be effectively addressed by approaches which emphasise social skill training alone.

There is recent evidence that these children can inhibit their responses in controlled laboratory experiments. The authors suggest that these children are 'delay averse' and that their responses are underpinned by a desire to minimise delay (Sonuga-Barke, Williams, Hall and Saxton, 1996). However, generalising this ability into the child's everyday experience continues to remain a challenge. Unfortunately the clinical benefits of cognitive-behavioural therapies for ADHD children remain unproven (Abikoff and Gittelman, 1985). Some of the more recent interventions which use self

instructional and problem solving training (which includes teaching the child to 'Stop' first) are proving more promising, providing they are also taught to the primary caregivers (e.g. teachers and parents) and used at home and at school. This ensures that as the techniques are used frequently and in natural settings, they are therefore more likely to be generalised and internalised (Hinshaw and Erhardt, 1991).

Finally, as professionals we need to consider better ways of understanding how these children think and what it might be like to have a mind which appears to be going a mile a minute, which is constantly buzzing with information and sensory stimulation, and which does not allow the child to deliberate, to consider, to pause or attend to cues, to choose options or to take advantage of feedback. They are the experts on their own difficulties and we would be advised to talk with them and to listen to how they understand and manage their thoughts, feelings and behaviour. The research into ADHD has focused on identifying a deficit or deficits but in considering this a problem of processing, it is possible that we may begin to help these children and their parents gain a greater understanding of their social difficulties. In so doing we may then be able to begin to develop more effective ways of helping both the children and their parents.

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<u>Appendices</u>

Appendix 1   Ethical approval letters

Appendix 2   Information sheets and letters to parents

Appendix 3   Consent forms

Appendix 4   Active and Interactive sociability behaviours

Appendix 5   Samples of the Strange Stories

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Committee Secretary
Joint UCL/UCLH Committees on the Ethics of
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(External address as above.
Internal address/deliveries by hand - 6th Floor, St.
Martin's House, 140 Tottenham Court Road
(opposite Warren Street Underground Station).

THE QUEEN'S
ANNIVERSARY PRIZES
1994

13 June 1996

Dr Tony Charman
Clinical Health Psychology
UCL

Dear Dr Charman,

Joint UCL/UCLH Committees on the Ethics of Human Research: Committee Alpha

No: 96/3413   *(Please quote in all correspondence)*
**Title: The role of theory of mind and executive function in the social communication problems
experienced by young children with attention deficit disorder with hyperactivity (ADHD)**

I am writing to let you know that I have looked at the above project (including the amendments
requested) and have given it Chairman's Approval. You may therefore go ahead with your study.

Please note that it is important that you notify the Committee of any adverse events or changes (name
of investigator etc) relating to this project. You should also notify the Committee on completion of
the project, or indeed if the project is abandoned. Please remember to quote the above number in
any correspondence.

Yours sincerely,

Professor M Hobsley
Chairman
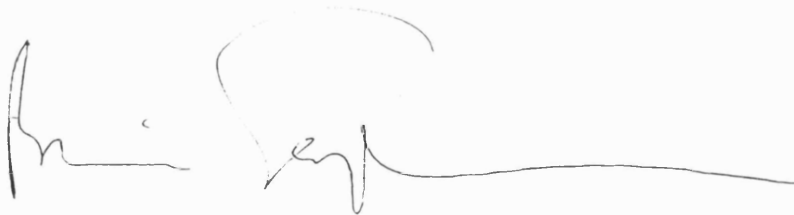
NP

NORTHWICK PARK

0181 869 2688

11 June 1996

Dr C Sturge
Chaucer Unit

Dear Claire

Ethical Submission No 2211: Theory of mind & executive functioning deficits in social communication problems in children with ADHD

I am pleased to inform you that the above study has been approved by Chairman's action. This allows you to proceed with the study, but please note that your application will have to be formally considered at the next meeting of the Committee, after which I will write to you again.

Yours sincerely

Brian Saperia
SECRETARY - HARROW RESEARCH ETHICS COMMITTEE

UNIVERSITY COLLEGE LONDON

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CONTROL GROUP INFORMATION SHEET

May 1996

Mrs. Thomas has given me permission to write asking for your help in a research project I am undertaking as part of my Doctorate in Clinical Psychology at University College London. I may be known to some of you as a governor and/or parent.

I am interested in investigating the social communication difficulties children with psychological problems experience. In order to be able to compare this group with normal children (those without psychological problems) I need a control group of children aged 6 - 10 years old. As your child falls within this age range, I am writing to ask you if you would allow your child to participate in my study as part of the normal control group.

All proposals for research using human participants are reviewed by an ethics committee before they can proceed. This proposal was reviewed by the Ethics Committees at Northwick Park Hospital and at University College London. Please read this form carefully.

If you and your child are kind enough to give permission, the following conditions will apply:

1. I would like to visit your child at school - at a time convenient to the teaching staff - to complete a series of language and social understanding assessments. These are couched in terms of game-playing and puzzle-type tasks and most children enjoy taking part.

2. We would like you and your child's class teacher to complete a questionnaire which assesses aspects of your child's social development.

3. All information collected in these sessions is **anonymous** and **confidential** to the research team and NO details of any individual who takes part in the study will be released.

4. Your child does not have to take part in this study if you do not want him to. If you decide to take part you may withdraw at any time without having to give a reason. Your decision whether to take part or not will not affect his care in any way.

Attached you will find a consent form for your own participation and that of your child. **Please complete and return to your child's class teacher if you are willing for your child to take part in the study.** I will be pleased to clarify any points or queries that you have so do not hesitate to ring my supervisor Dr. Tony Charman, Lecturer in Psychology at UCL, on 0171 380 7897 or me on 0181 968 3900.

Please retain this information sheet for your future reference.

Thank you in anticipation of your co-operation.

Yours sincerely,

Frances Carroll
Clinical Psychologist in Training UCL

Dr. Tony Charman
Lecturer in Psychology, UCL

NORTHWICK PARK

July 1996

Dear Parents,

Dr. Claire Sturge has suggested that I contact you to ask for your help in a research project I am undertaking over the next 12 months to investigate the social problems children with ADHD experience. Dr. Sturge is supporting this project because she believes that the information gained will be useful in the future to both families and professionals in developing ways of helping children with ADHD to improve their social relationships.

I am a Clinical Psychologist in Training at University College London and have been based at Northwick Park Hospital with the Child Psychiatry team for six months. I am asking your child to take part in this research because he has been diagnosed as having ADHD and is between 6 and 10 years of age.

Enclosed you will find an information sheet explaining in more detail what will be involved if you decide to take part. Please read the information sheet carefully. I have also attached a consent form for your own participation and that of your child. If you and your child are willing to take part, **please complete and return to me in the enclosed envelope.**

I am planning to see children during the half term week on Chaucer ward.

I will be happy to clarify any points or answer any queries that you have. Please do not hesitate to ring me on 0181 968 3900. .

Many thanks for your help.

Yours sincerely,

Frances Carroll

CLINICAL GROUP INFORMATION SHEET

You and your child are being asked to take part in a research project investigating the social difficulties children with ADHD experience because your child has been diagnosed as having ADHD and is between 6 and 10 years of age. This research is being carried out by Dr. Claire Sturge, Consultant Child Psychiatrist at Northwick Park Hospital, Frances Carroll, Clinical Psychologist in Training at University College London and Dr. Tony Charman, Lecturer in Psychology at University College London.

All proposals for research using human participants are reviewed by an ethics committee before they can proceed. This proposal was reviewed by the Ethics Committees at both Northwick Park Hospital and University College London.

If you are kind enough to give permission for your child to take part in our study, the following will apply:

1. You will be asked to bring your child to see me, at your convenience, on Chaucer Ward to complete a series of language and social understanding assessments. The assessments are couched in terms of game-playing and puzzle-type tasks and most children enjoy taking part. The session should not last more than 1 1/2 hours.

2. If your child is on Ritalin, it will be necessary for him to refrain from medication for 24 hours prior to assessment.

3. You and your child's class teacher will be asked to complete a questionnaire which assesses aspects of your child's social development.

4. All information collected in these sessions is **anonymous** and **confidential** to the research team and NO details of any individual who takes part in the study will be released.

5. Your child does not have to take part in this study if you do not want him to. If you decide to take part you may withdraw at any time without having to give a reason. Your decision whether to take part or not will not affect his care or management in any way.

I will be pleased to clarify any points or answer any queries that you have. Please do not hesitate to ring me on 0181 968 3900 or my supervisor, Dr. Tony Charman, Lecturer in Psychology at UCL, on 0171 380 7897.

Please retain this information sheet for your future reference.

Frances Carroll
May 1996

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Social Communication Study

Dr. Claire Sturge, Consultant Child Psychiatrist, Northwick Park Hospital
Frances Carroll, Clinical Psychologist in Training, University College London
Dr. Tony Charman, Lecturer in Psychology, University College London

To be completed by parent

Delete as necessary

1.	Have you read the information sheet about this study?	YES/NO
2.	Have you had an opportunity to ask questions and discuss this study?	YES/NO
3.	Have you received satisfactory answers to all your questions?	YES/NO
4.	Have you received enough information about this study?	YES/NO
5.	Who have you spoken to about this study ?	_____

6.   Do you understand that you are free to withdraw your child from this study

        *at any time
        *without giving a reason for withdrawing
        *without affecting his education?   YES/NO

7.   Do you agree for you and your child to take part in this study?   YES/NO

Signed_____Date_____

Child's Name in Block Letters _____

Your Name in Block Letters _____

Researcher _____

CONSENT FORM

Social Communication Study

Dr. Claire Sturge, Consultant Child Psychiatrist, Northwick Park Hospital
Frances Carroll, Clinical Psychologist in Training, University College London
Dr. Tony Charman, Lecturer in Psychology, University College London

To be completed by the patient/volunteer

Delete as necessary

1. Have you read the information sheet about this study? YES/NO

2. Have you had an opportunity to ask questions and discuss
   this study? YES/NO

3. Have you received satisfactory answers to all your questions? YES/NO

4. Have you received enough information about this study? YES/NO

5. Who have you spoken to about this study ? _____

6. Do you understand that you are free to withdraw your child from this study

   *at any time
   *without giving a reason for withdrawing
   *without affecting your future medical care? YES/NO

7. Do you agree for you and your child to take part in this study? YES/NO

8. Do you give permission for your child's teacher to be contacted? YES/NO

Signed_____Date_____

Child's Name in Block Letters _____

Your Name in Block Letters _____

Researcher _____

Headteacher_____School_____

Supplementary Items to the Vineland Adaptive Behaviour Scales

Active Sociability

Shows a desire to please
Takes turns in conversation
Shares toys when asked
Recognises happiness and sadness in others
Initiates social contacts
Uses appropriate table manners
Delivers simples message
Says please when asking for something
Names favourite TV programmes and times
Asks permission to play with a toy
Plays board games
Follow time limits sets by care giver
Responds appropriately when introduced
Apologises for errors
Return borrowed items

Interactive Sociability

Chooses appropriate presents
Responds to hints and indirect cues in conversation
Makes confidences
Recognises surprise and embarrassment in others
Initiates conversation of interest to others
Initiates flexible small talk
Supplies important missing information
Expresses ideas in more than one way
Refrains from statements that might embarrass
Engages in elaborate make-believe activities
Knows behaviour appropriate for different people
Plays hide and seek or cheats appropriately
Has realistic long-range goals and plans
Keeps secrets for as long as appropriate
Apologises for hurting other's feelings
Weighs consequences of actions

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?

Elephant

Today James is going to Claire's house
for the first time. He is going over for
tea, and he is looking forward to seeing
Claire's dog, which she talks about all
the time. James likes dogs very much.
When James arrives at Claire's house
Claire runs to open the door, and her
dog jumps up to greet James. Claire's
dog is huge, it's almost as big as James!
When James sees Claire's huge dog he
says, "Claire, you haven't got a dog at
all. You've got an elephant!"

Is it true, what James says?

Why does James 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 which 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, its very nice".

Was it true what Peter said?

Why did he say it?

Emma has a cough. All through lunch she coughs and coughs and coughs. Father says, "Poor Emma, you must have a frog in your throat!"

Is it true, what Father says to Emma?

Why does he say that?

Late one night old Mrs.Peabody is walking home. She doesn't like walking home alone in the dark because she is always afraid that someone will attack her and rob her. She really is a very nervous person! Suddenly, out of the shadows comes a man. He wants to ask Mrs.Peabody what time it is, so he walks towards her. When Mrs.Peabody sees the man coming towards her, she starts to tremble and says, "Take my purse, just don't hurt me please!"

Was the man surprised at what Mrs.Peabody said?

Why did she say that, when he only wanted to ask her the time?

John hates going to the dentist, because every time he goes to the dentist he needs a filling, and that hurts a lot. But John knows that when he has tooth-ache, his mother always takes him to the dentist. Now John has bad tooth-ache at the moment, but when his mother notices he is looking ill and asks him, "Do you have tooth-ache, John?", John says, "No, Mummy".

Is it true, what John says to his mother?

Why does John say this?