# IMITATION, PLAY AND THEORY OF MIND IN AUTISM : AN OBSERVATIONAL AND EXPERIMENTAL STUDY

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# Imitation, Play and Theory of Mind in Autism: An Observational and Experimental Study.

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# Abstract

This observational and experimental study takes the Intersubjectivity Theory of Rogers and Pennington (1991), as the guiding line by which to investigate imitation in autism. A deficit in imitation in early childhood is the principal aspect of this theory which distinguishes it from other major theories such as those of Baron-Cohen et al. (1985) and Hobson (1986).

With much debate over the existence of a general deficit in imitation, this study aimed first to test for different types of imitation (including those differentiated by Piaget (1962), such as vocal, immediate and deferred imitation) and second, to examine other deficits linked to imitation in Roger and Pennington's theory - emotion perception, joint attention, theory of mind and play. The effect of age was also investigated. Rogers and Pennington (1991) predicted that young autistic children would show a profile of deficits including impaired imitation, emotion sharing, joint attention and pretend play while older children and adults would show impaired "theory of mind", emotion sharing and language pragmatics, relative to controls.

In an observational study autistic children and adults showed less social interaction with peers, more manipulative play, less symbolic play in some comparisons and less evidence of mental state understanding but few differences in imitation, compared to children with learning disabilities and normal 3-4 year old and 5-6 year old children.

Virtually the same samples were then tested experimentally for the ability to imitate. This was done for (1) elicited imitation (including vocal, simple body movements and symbolic actions, with and without objects), (2) spontaneous, problem-solving imitation and (3) deferred imitation. In addition, spontaneous, elicited and instructed play was tested and visual perspective-taking, joint attention, false-belief and emotion recognition. No general deficit for imitation in school-age autistic children and autistic adults was found, although a younger group (CA 4 - 7 years) of autistic children did significantly worse on all aspects of the task. Scores were lower on deferred imitation and on spontaneous, problem-solving imitation for

the autistic groups and certain categories of actions in the elicited task proved more difficult for the autistic children, namely those requiring symbolic ability.

Previous findings on joint attention, false-belief and emotion perception were, for the most part, confirmed, although no links between any of these behaviours and imitation were evident from examination of individual profiles. In addition, a picture of inconsistency across tasks emerged. However, some evidence was found for Rogers and Pennington's theory at a crude level, in that it was the youngest children who had most problems with imitation, symbolic play, and emotion recognition, relative to controls. It is concluded that although imitation may be lacking in early autistic development, Rogers and Pennington's theory may not be an altogether satisfactory way of explaining its contribution to the autistic disorder and is, in fact, very difficult to test.

I dedicate this thesis to my family
and to Duncan, with appreciation
for all their love and support.

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Some of the autistic children I studied for this thesis. Thank you all.

## Table of Contents

# CHAPTER 1
# INTRODUCTION

Autism, its nature, causes and the theories surrounding it, has seen a resurgence in interest in the past two decades from psychologists of many disciplines. Not only has there been an increase in research on this relatively recent discovery (first described by Kanner, 1943), the focus of the research has seen much expansion. Some of the old ideas have been thrown out and many new ideas introduced. On the other hand, the underlying cause of this extremely variable disorder remains much of an enigma. It is now known that the underlying cause is biological, possibly with a genetic connection, but researchers cannot be much more specific than this. As a result, most research into both the understanding and the remediation of this disorder has remained in the behavioural and cognitive domains and diagnosis is still made by mostly behavioural means.

This thesis reports the results of both an observational study and an experimental investigation of imitation, and its relationships with play and "theory of mind" (used in its broadest developmental sense), in an attempt to provide evidence for one of the current theories surrounding autism - the Intersubjectivity Theory of Rogers and Pennington (1991), which is taken as the guiding line for this thesis. This theory introduced a new element into the theory of autism - a deficit in imitation. However, although a lack of imitation had been included in the diagnosis of autism since 1987 (DSM-III-R), the evidence for such a deficit is by no means conclusive (so much so that it is not one of the DSM-IV (1994) criteria). Clarifying the existence of such a deficit and its possible relationships with other deficits seen in autism as proposed by Rogers and Pennington, is the main focus of this thesis. Rogers and Pennington (1991) predicted that a deficit in imitation, along with deficits in affective mutuality, joint attention and symbolic play, are most important for autistic children in early childhood. This profile changes as the child gets older so this thesis also aims to take some account of the potential development of such abilities by including autistic individuals of a wide age range (4 years to 34 years) and two groups of normal children, one with an average age of 3-4 years and one

with an average age of 5-6 years, since the age of four years has been suggested to be a developmental watershed for many developmental abilities, particularily those related to Theory of Mind, such as understanding false-belief.

This introductory chapter is divided into four distinct parts. Part 1 begins with a section on the nature of autism, from historical, behavioural, biological and theoretical perspectives. Once Rogers and Pennington's theory is presented, along with the preceding theories of Baron-Cohen et al (1985) and Hobson (1986a; b), this chapter will then concern itself in Part 2 with issues of the nature of imitation from the point of view of both the normal developmental pattern and the definition of imitation. Part 3 will present the existing evidence for and against a deficit in imitation in autism before a fuller analysis of Rogers and Pennington's theory is given in Part 4. This final section will present the predictions these authors make with regard to the developmental pattern seen in autism and the relationship between imitation and other deficits, the evidence for which will be presented as concisely as possible. This will include data from both experimental and observational studies, specifically on social interaction, play and understanding mental states. The rationale for the choice of the subjects used in this study will be presented before the predictions, based on Rogers and Pennington's model and the literature review.

Despite the huge bodies of research on autism, very little work has been conducted on what autistic children do in their natural or everyday environment, which typically includes a structured element. A few studies to be reviewed later and in Chapter 2, have examined social interaction and play in autistic children. Most "naturalistic" data has come from reports by parents and care-givers, which inevitably have problems intrinsic to retrospective questionnaires or interviews. Chapter Two, therefore, reports an observational study examining 1) social interaction as a general index of autism 2) play, 3) evidence of "theory of mind" abilities and 4) imitation. This provides a background for the occurance of imitation and other relevant activities in subjects' everyday lives and helped design appropriate batteries of tests presented in later chapters.

This thesis employs a variety of methodological methods and following the observational study of Chapter 2, the methodology changes to experimental investigations of both spontaneous and elicited behaviour. Chapters Three, Four and

Five present the main experiments on the ability to imitate, including an experiment on elicited immediate imitation using a Do-As-I-Do scenario (Custance, 1994; Custance et al., 1995) and immediate spontaneous imitation of problem-solving actions on a novel object (Whiten et al., 1996). Both of these paradigms had been designed and tested for use with non-human primates and normal preschool children. The present study also tests deferred spontaneous imitation of actions on a novel object, something not before attempted with autistic children and adults. Chapter 6 will illustrate the developmental pattern of the ability to imitate, looking at the relationships between age and imitation and between the different types of imitation.

Rogers and Pennington (1991) suggested a relationship between imitation, emotion sharing, pretend play and "theory of mind". Chapter Seven presents an investigation of play, of all types, but concentrating on symbolic play and the relationships between symbolic play and imitation. Chapter Eight presents experiments on mental state understanding using behaviours which have been presented as existing along the continuum of a developing "Theory of Mind" - emotion perception, visual perspective-taking, joint attention and false-belief (Hobson, 1993). This chapter analyses the links between imitation and understanding mental states by using individual profiles for the autistic children and adults used for all stages of this study. The concluding chapter summarises the findings from the perspective of both theoretical implications, implications for future research, and possible important implications for early interventions, both at home and in an educational environment.

## Part 1

## The Nature of Autism

The following long quotation is a series of extracts from the first ever description of an autistic child, by Leo Kanner in 1943. The information presented here came from Kanner's own observations of the child and from observations by the parents. Donald T. was one of eleven children described in this seminal paper and as I go through this thesis I will draw on Kanner's descriptions to illustrate the main diagnostic criteria and thus the deficits in autism, as well as how the disorder develops with age.

> "Donald T. was first seen in October, 1938, at the age of five years.....At the age of 1 year "he could hum and sing many tunes accurately." Before he was 2 years old, he had "an unusual memory for faces and names, knew the names of a great number of houses" in his town...He became interested in pictures "and very soon knew an inordinate number of the pictures in a set of *Compton's Encyclopedia.*" ...It was observed at an early time that he was happiest when left alone, almost never cried to go with his mother, did not seem to notice his father's homecomings, and was indifferent to visiting relatives... "he seems almost to draw into his shell and live within himself".....In his second year, he "developed a mania for spinning blocks and pans and other round objects". At the same time, he had "a dislike for self-propelling vehicles, such as Taylor-tots, tricycles and swings...He was always constantly happy and busy entertaining himself, but resented being urged to play with certain things".
>
> When interfered with, he had temper tantrums, during which he was destructive. He was "dreadfully fearful of being spanked or switched" but "could not associate his conduct with his punishment".....
>
> There was a marked limitation of spontaneous activity. He wandered about smiling, making stereotyped movements with his fingers, crossing them about in the air. He shook his head from side to side, whispering or humming the same three-note tune. he spun with great pleasure anything he could seize upon to spin. He kept throwing things on the floor, seeming to delight in the sounds they made. He arranged beads, sticks or blocks in groups of differing series of colours.....Most of his actions were repetitious.....If he spun a block, he must always start with the same face uppermost. When he threaded buttons, he arranged them in a certain sequence that had no pattern to it but happened to be the order used by the father when he had first shown them to Donald.
>
> He used the person pronouns for the person he was quoting, even imitating the intonation. ...Words to him had a specifically literal, inflexible meaning. He seemed

unable to generalise, to transfer an expression to another similar object or situation. if he did so occasionally, it was a substitution, which then "stood" definitely for the original meaning.....

He paid no attention to the person's around him. When taken into a room, he completely disregarded the people and went for objects, preferably those that could be spun...He was never angry at the interfering *person.* he angrily shoved away the *hand* that was in his way.....If a child took a toy from him, he passively permitted it....

After his return home, the mother sent periodic reports about his development. ..He could spend hours writing on the blackboard. His play became more imaginative and varied, though quite ritualistic....his attention and concentration were improved. He was in better contact with his environment, and there were some direct reactions towards people and situations. He showed disappointment when thwarted, demanded bribes promised to him, gave evidence of pleasure when praised.....

"He is becoming resourceful, builds things with his bricks, dramatises stories, attempts to wash the car, waters the flowers with the hose, plays store with the grocery supply, tries to cut out pictures with the scissors. Numbers still have a great attraction for him. While his play is definitely improving, he has never asked questions about people and shows no interest in our conversation....The first day (at school) was very trying for them but each succeeding day he has improved very much. Don is much more independent, wants to do many things for himself. He marches in line nicely, answers when called upon, and is more bidable and obedient. He never voluntarily relates any of his experiences at school and never objects to going..."

Donald was brought for another check-up in April 1941....Once inside, he did not even glance at the three physicians present but immediately made for the desk and handled the papers and books.....He used pronouns adequately and his sentences were grammatically correct. The major part of his conversation consisted of questions of an obsessive nature.....

He was still extremely autistic. His relation to people had developed only in so far as he addressed them when he needed or wanted to know something. He never looked at the person while talking and did not use communicative gestures. Even this type of contact ceased the moment he was told or received what he had asked for...

A letter from his mother stated in ..1942: "....His literal-mindedness is still very marked, he wants to spell words as the sound and to pronounce letters consistently...He really enjoys the movies now but not with any idea of a connected story. He remembers them in the order in which he sees them." ..."(Kanner, 1943)

Although not described clinically until 1943, autism is thought to have existed throughout history. Frith (1989) and Happé (1994) offer historical accounts that

point to the possible existence of autism for many centuries, such as stories of feral children and wild boys. The cause of this developmental disorder, which is not usually diagnosed until well into childhood, remains much of an enigma. Although Kanner first proposed that the underlying cause was an "innate inability to form the usual, biologically provided affective contact with people", his comment that the parents of these children tended not to be warm-hearted, prompted some researchers to propose that "refrigerator mothers" or bad parenting were the cause of autism (Bettleheim, 1956, 1957). However, recent decades have seen an increase in neuropsychological and genetic research and it is now universally agreed that the cause is biological in nature (Rutter, 1991; Rutter et al., 1994; Morton, 1989; Frith et al., 1991). There are still many suggestions as to the exact nature of these biological causes and how they may be triggered: these suggestions are discussed more later.

There are three levels at which one can consider the disorder of autism (Happé, 1994) - the biological level, the behavioural level and the level that most researchers in the area propose falls between the two - the cognitive level. This thesis will deal with each in turn, and in doing so, introduce the possible causes of autism and the criteria by which this disorder is diagnosed.

*The Biological level.*

> "The organic basis of autism is no longer in dispute and is a matter of common consent" (Rutter et al., 1994)

Although it is widely agreed that the cause of autism is biological, there is still much controversy about what causes autism. It has seemed impossible to track down any one particular cause. One problem is that there is such a high association between autism and learning difficulties that it is difficult to say whether any neurological abnormalities found are the result or cause of autism or of the associated mental retardation. Secondly, autism seems to exist on a continuum (Wing, 1970) with various degrees of severity, as well as various degrees of association with mental retardation, discussed further in the next section. Thirdly, autism is not reliably associated with any known medical disorder, as was once thought (Rutter et al., 1994). Even perinatal problems, once thought to be quite strongly associated with autism, are not involved in many autistic births. Rutter et al.

(1994) conclude that there are definitely brain abnormalities in autism but very few relate to known problems and if they do there is little consistency. Those disorders which on occasion accompany autism, include tuberous sclerosis, congenital rubella, infantile spasms and epilepsy, phenylketonuria and Fragile X syndrome. Cerebral Palsy and Down's Syndrome are very rarely associated with autism, which is why the latter children make such a convenient control group for experiments.

Despite these difficulties researchers have come up with several possibilities for the biological causes of autism.

a) Genetic: Evidence that autism is genetic is reviewed in many of the recent text books and papers on autism (Happé, 1994; Rutter, 1991; Rutter, 1990) so only a few of the most important findings will be presented here. In his original paper (1943), Kanner went to great lengths to describe the background of each of his children, including the anti-social nature or "oddness" of one or both of each child's parents. Although he stated that the parent's nature may contribute to the disorder in the child, he may have been hinting at the genetic nature of a disorder which he proposed was caused by an "*innate*" inability to form normal affective relations with people.

More recently, Rutter (1968) reported that 1 in every 50 siblings of autistic children showed the autistic syndrome. Although this does not seem a very high figure, it is much higher than in the general population and the figure is higher still for monozygotic twins. In a later study, Rutter et al. (1990) discovered that 15-20% of siblings of autistic children tend to have some cognitive and social disabilities, even if not fully autistic. This compares to only 3-10% of children with Downs Syndrome. One interesting point, important for any work on the biological nature of autism, is that there is less concurrence of autism or social/cognitive abnormalities in siblings of autistic children with normal nonverbal IQ, compared to the siblings of those autistic children with lower IQs.

b) Neurochemical abnormalities: Studies on neurochemical causes have pointed to increased levels of 5-HT or seratonin and abnormalities in dopaminergic systems but relatively little work has been carried out in this area (see Volkmar and Anderson, 1989 for a review). Further replication is needed to establish whether

there is any reliable, autism specific association between these abnormalities and the disorder itself.

c) Brain structure abnormalities: It has been suggested that there is a "final common pathway" in autism, and that this pathway arises from different biological causes. Over the past few decades, several sites in the brain have been offered as the origins of autism. These include the cerebellum, basal ganglia and limbic system, the frontal lobes, and the brain stem and central nervous system. (Courchesne et al., 1987, 1988; Rutter, 1990). However, CT, MRI or PET scans, neuropsychological test batteries and autopsy studies have all been hard to replicate and as yet there is no reliable evidence as to the nature of this final pathway (See Happé, 1994; Rutter, 1991).

Although hard evidence for the exact nature of the biological cause of autism is not yet available, it is widely believed that there is one final common pathway. This common pathway may be affected by many different biological causes, including brain damage caused by perinatal problems, neurochemical abnormalities or genetic abnormalities. There may be many other causes of which we are not yet aware. Aitken (1991) suggests that it is the timing of the disruption to neurogenesis which results in autism, whatever underlying pathology is responsible. The point where development stops could dictate the exact nature of the symptoms seen in each autistic child. This common pathway in autism leads to what I shall call a cognitive deficit, for sake of argument, although I stress that this cognitive deficit can be described in may different terms, such as a metarepresentational deficit (e.g. Baron-Cohen, Leslie & Frith, 1985), an executive function deficit (e.g. Ozonoff & McEvoy, 1994) or an intersubjectivity/affective deficit (e.g. Hobson, 1993; Rogers & Pennington, 1991). Not only is the biological disorder still under investigation but the underling cognitive problem, arising from this impaired biological pathway, is still the subject of much debate. Before dealing with the current theories of autism it is necessary to look at the nature of autism in more detail and I now turn to examine autism at the behavioural level.

*The Behavioural level.*

Before going on to the details of the behavioural deficits of autism, on which the disorder is diagnosed, some background statistics provide helpful context. The prevalence of autism as assessed by various studies worldwide, is generally viewed to be between 4 and 5 children per every 10,000 (Frith, 1989). One of the first studies done on this was by Lotter in 1966 and this study put the incidence at between 2 and 4 per 10,000. If milder cases of autism are included (see below, Wing & Gould, 1979) the incidence rises. More boys are diagnosed autistic than girls (approximately 3:1), although once again this difference lessens when milder cases are taken into account (Frith, 1989).

Diagnosis is normally made on the basis of such aids as the Diagnostic and Statistical Manual (American Psychiatric Association), the Childhood Autism Rating Scale (Schopler et al., 1988), or Wing's Triad of Impairments (Wing & Gould, 1979). All of them, however, are based quite closely on Kanner's original descriptions. From his clinical records, Kanner identified the following criteria, which he saw as playing a large part in the cases he described:

a) inability to relate themselves in the ordinary way to people and situations, resulting in autistic aloneness
b) some delay in speech acquisition
c) excellent rote memory
d) delayed echolalia
e) literalness
f) pronoun reversal
g) problems with feeding
h) abnormal reaction to loud noises and moving objects
i) repetitious actions and utterances
j) anxious obsessive desire for the maintenance of sameness
k) limitation in the variety of spontaneous activity
l) good relation to objects
m) poor relations with people
n) good cognitive potential (impression of serious-mindedness)

o) physically normal

p) highly intelligent families, of upper middle class backgrounds.

Although some of these features are no longer associated with autism, what is known as classic autism (See Table 1.1 below) is diagnosed by most of the features described by Kanner. These have been summarised into three categories: 1) an autistic aloneness; 2) an impairment in verbal and non-verbal communication and in imaginative activity and 3) an insistence on sameness. It is now known that autism can affect children from families of all backgrounds and intelligence and that the children themselves are rarely without mental retardation. However, although not a diagnostic criterion, many teachers and parents remark that they are sure their autistic child is much more intelligent than he/she first appears. This is reflected in Kanner's observations that the children observed had good cognitive potential. This in turn reflects two things which we now know about autism - the non-verbal IQ is usually higher than their verbal IQ and some autistic children do have "islets of ability", usually of a spatial or mathematical nature, and involving an abnormally good memory. Although all of Kanner's children seemed to have some sort of islet of ability, it is not a necessary criterion for autism. Finally, his observations on feeding are also coincidental in this group, and this is not now one of the diagnostic criteria of autism.

Table 1.1: Summary of DSM-III-R Criteria for Autism (1987):

| |
|---|
| A) a qualitative impairment in reciprocal interaction as manifested by the following:<br>1) marked lack of awareness of the existence or feelings of others;<br>2) no or abnormal seeking of comfort in times of distress;<br>3) no or impaired imitation;<br>4) no or abnormal social play;<br>5) gross impairment in the ability to make peer friendships.<br><br>B) a qualitative impairment in verbal and non-verbal communication and in imaginative activity as manifested by the following:<br>1) no mode of communication, such as communicative babbling, facial expression, gesture, mime or spoken language;<br>2) markedly abnormal non-verbal communication, as in the use of eye-to-eye gaze, facial expression, body posture, or gestures to initiate or modulate social interaction;<br>3) absence of imaginative activity, such as play-acting of adult roles, fantasy characters, or animals; lack of interest in stories about imaginary events;<br>4) marked abnormalities in the production of speech, including volume, pitch, stress, rate, rhythm, and intonation;<br>5) marked abnormalities in the from or content of speech, including stereotyped and repetitive use of speech;<br>6) marked impairment in the ability to initiate or sustain a conversation with others, despite adequate speech.<br><br>C) Markedly restricted repertoire of activities and interests, as manifested by the following:<br>1) stereotyped body movements;<br>2) persistent preoccupation with parts of objects or attachment to unusual objects;<br>3) marked distress over changes in trivial aspects of environment;<br>4) unreasonable insistence on following routines in precise detail;<br>5) markedly restricted range of interests and a preoccupation with one narrow interest. |

The diagnosis was widened somewhat from the classic autism described above by Wing and Gould (1979) and Wing (1988). These studies introduced what are now called the Triad of Impairments and the autistic continuum. The triad of impairments are basically the same as suggested by Kanner but have been shown to really be a triad, in that they tend to exist together in autism (Wing and Gould, 1979). They are impairments in : 1) socialization, not just in the frequency of social interaction but in the social skills that most of us acquire early in life; 2) communication, both verbal and non-verbal - autistic children show severe pragmatic difficulties with language, including as Kanner reported, echolalia, pronoun reversal, a very literal comprehension, and a lack of mental state terms in speech (Baron-Cohen, 1988;

Tager-Flusberg, 1981; Tager-Fusberg and Sullivan, 1994); and 3) imagination, specifically in pretend play, creativity and other symbolic abilities, with an abnormally high frequency of repetitive, obsessional and stereotypic behaviours. Looking back to Kanner's description of Donald, we can identify examples of most of these impairments, just as for Kanner's three categories. More details of the deficits in each aspect of the triad relevant to this thesis, will be given throughout the remainder of the Introduction. The triad of impairments can occur at differing degrees of severity along a continuum, from the child who might not be diagnosed as autistic on the DSM-III-R below[1], but who still shows problems on each aspect of the triad, to the child with classic autism as described by Kanner, to the very-high functioning child, sometimes referred to as having Asperger's syndrome (See Happé, 1994 for review on Asperger's). If the triad of impairments is used as a diagnostic criterion, so that mild as well as classic types of autism are included, the incidence in the population rises to approximately 20 in every 10,000 (Wing and Gould, 1989).

Parallel to the autistic continuum runs the learning disability[2] continuum and autistic children and adults can be described at different points along both continua. Approximately 70 % of autistic children and adults have an IQ below 70, another 15% have an IQ above 70% but still below the average IQ (Frith, 1989 p54). These figures have varied from study to study, with the highest figure for normal IQ being 33% of the sample. Almost every study has found that autistic children tend to have a higher non-verbal, performance IQ than verbal IQ, which leads to the perception that they might be more intelligent than the tests state, and to their generally good spatial skills and performance on tests such as Block Design on the WISC test.

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[1] This was the current version of the DSM at the beginning of this thesis and it was what was used to design the questionnaire described in Chapter 2. Since then a new version has been published - the DSM-IV (1994). Very little has changed in the new version except for some rewording and the fact that a deficit in imitation is no longer mentioned. This in itself makes this project of additional interest for the diagnosis of autism.

[2] Throughout this thesis I will use the term "learning disability" rather than "mental retardation" as this is now generally accepted practice in the UK. For those readers who are not British, please note that "learning disabilities" does not equate with learning difficulties such as dyslexia or attention deficit disorder.

Finally, in this section it is necessary to consider the timing of the diagnosis of autism, this develomental disorder that changes but never disappears as the child grows up. Although it is generally assumed that autism is present from conception, diagnosis cannot be made reliably before 30 months of age. Until recently, many autistic children were not diagnosed until much later, but onset of the symptoms had been before 30 months of age. A recent study by Baron-Cohen et al. (1992) found that certain developmental markers, such as pointing and pretend play, could be reliably used to diagnose autism at 18 months of age, but this is not yet used in a clinical diagnosis. Researchers are still searching for a way of diagnosing autism earlier, and although this study is not investigating diagnosis per se, it is possible that the use of imitation tasks in infancy may lead to an earlier diagnosis of autism or at least to predict the possibility of autism and allow for closer monitoring of children and earlier intervention.

*The Cognitive level.*

Like the biological level, there is still much debate about the primary cognitive deficit in autism. All the theories I will present below try to offer an explanation for the link between the still unknown biological deficit and the behavioural deficits described above. However, although they concern themselves with each part of Wing's Triad of Impairments, it must be noted that few theories offer satisfactory explanations for some puzzling aspects of autism - why some have islets of ability, while others don't, and why many have such an "insistence on sameness", to use Kanner's term, and an obsession with stereotyped movements.

However, before moving on to consider the various theories, I will review the type of cognitive skills that are absent *and* the ones that remain intact in autism. Sigman, Ungerer, Mundy and Sherman (1989) report that discriminative learning and short-term memory skills are not pathogenic with respect to autism. These skills are only limited by the use of symbolic material. Some studies have found deficits in sequencing and in cross modal transfer, but others have not. On performance IQ tests, autistic children have deficits in cognitive processes and in stored knowledge subtests, but these are mostly problems in the verbal domain. On verbal subtests autistic children score best on digit span and worst on comprehension. But the

problem is not just with language, because dysphasic children do better on three of the verbal scales than autistic children. Autistic children do best on Block Design subtests, better than all other performance scales. There are few specific deficits in terms of spatial performance, perceptual organization and attentional short-term memory. Object permanence is not impaired, relative to mental age (MA) matched controls, nor are most other sensori-motor skills. So these cognitive difficulties are not specific to autism but a result of the mental retardation accompanying the autism.

Other developmental cognitive capacities, such as play, are often impaired in autism. For example, work by Sigman and Ungerer (1984) and Ungerer and Sigman (1981) showed that when autistic children were observed in an unstructured setting they produced a range of behaviours from manipulative through to a few examples of symbolic play. However, while the non-autistic children spent longer in functional and symbolic play than other types, the autistic children spent equal amounts of time in manipulative, relational and functional play and less time in symbolic play. As we saw in the case described by Kanner, autistic children's' play often consists of repetitive, obsessional use of toys but functional play can improve with age. Other studies on the nature of play in autistic children will be described in a later section.

Finally, categorization and classification of objects do not provide many problems for autistic children (Sigman et al., 1989). The authors conclude that the areas of cognitive development in which deficits were observed all involved early forms of symbol use and social involvement. The main problems seen in autism are with knowledge of other people and social communication and language problems. For the most part knowledge of self remains intact.

*Theories of Autism*

There are two main sets of theories which attempt to pin down the primary "cognitive" deficit which links the biological deficit to the behavioural symptoms of autism. These are the intersubjectivity theories such as that of Hobson (1986a) and Rogers and Pennington (1991) and the "cognitive" theories such as the metarepresentational theory of Baron-Cohen, Leslie and Frith (1985). Within these

two sets there are many variations, but within the scope of this thesis it would be impossible to describe them all. For this thesis I shall deal with just three in any detail, although I shall mention other important theories in passing. It must be borne in mind that the theories presented here are not only theories of autism, but also theories which refer to normal development. I shall concentrate on the theory of Rogers and Pennington (1991) as this is the theoretical basis for this thesis. However, it is necessary to first present the two main theories that preceded Rogers and Pennington. In fact, Rogers and Pennington in essence combined the Metarepresentation hypothesis of Baron-Cohen et al. (1985) and the Affective hypothesis of Hobson (1986a) and added the new dimension of a deficit in imitation. Although many theories of autism only attempt to explain certain aspects of autism, all of them have been useful in inspiring continued research into autism and thus increasing our knowledge, if not yet real understanding of this disorder.

a) The Metarepresentational hypothesis:

This theory is perhaps the best known theory of autism and it is usually called the Metarepresentational theory or Theory of Mind theory, first proposed by Baron-Cohen, Leslie and Frith (1985). Many of the theories that followed arose in response to this theory which was based on a relatively newly-studied area of normal development. The term "theory of mind" was first coined by Premack and Woodruff (1978), who were studying the mental life of non-human primates, specifically of a chimpanzee called Sarah. It referred to the ability to impute mental states to others and to predict their behaviour on this basis. The research on animal theory of mind (ToM) is far too extensive to include here but useful overviews can be found in Byrne & Whiten (1988), Whiten (1991, 1993, in press), and Byrne (1995). To return to the child literature, Frith (1989) explained theory of mind as a tool which provides us with the ability to mentalise, that is, to predict relationships between external states of affairs and internal states of mind. Perner and Ogden (1988) suggested that what distinguishes mental states from other internal states was their "intentionality" or "aboutness": when you think, you think *about* something, e.g., you think *that* there is a ball in the box.

Many other terms are used interchangeably with ToM - mindreading, understanding mental states, mentalising, are just a few examples (see Whiten (1991; 1994) for many more examples). I will use the term "mental state understanding" to include Theory of Mind in the conventional sense as defined by Premack and Woodruff (1978) and as referred to by Baron-Cohen et al. (1985) but I will also include in this category some of the abilities seen as precursors to a Theory of Mind in the narrower sense, such as visual perspective-taking, joint attention and recognition of emotional states. Dunn (1990) describes the normal development of a Theory of Mind, and includes behaviours which will be focused on in this study, such as joint attention and pointing, joking (verbally and non-verbally), teasing, pretend play, social pretend play, empathy, talking about mental states, and manipulating others' mental states by lying or deception.

Studies on what can be viewed as one of the most complicated skills of a theory of mind - recognising false-belief, began in 1983 with Wimmer and Perner, who designed false-belief tasks which have been used and adapted ever since. They discovered that normal three year old children could not predict another person's behaviour on the basis of a simple, first-order false-belief but four year olds could.

Baron-Cohen, Leslie and Frith (1985) tested autistic children of a mental age above four years on a false-belief test and found that 80% of children failed (More details of the tasks will be given later). They proposed that autistic children had an impaired meta-representational capacity, that is, they could not hold a representation of a representation. Metarepresentation is made possible by what Leslie (1987) calls a "decoupling" mechanism. (For detailed reviews, see Frith (1989), Happé (1994) and Hobson (1993), as well as Leslie (1987) and Leslie and Frith (1987)). The metarepresentational theory was designed to explain both pretense and Theory of Mind deficits in autism. The mechanism can be broken down into three parts, the main one being the decoupling process whereby a primary representation - for example, *the cup is empty* is decoupled from reality, as if in quotation and in pretense can become "the cup is full" - the secondary or meta-representation - accompanied by a mental state qualifier - I *think* or I *pretend* "the cup is full". This can be extended to include another person's mental state or pretend action - John thinks "the cup is full" and that is why he is lifting it to his lips. Obviously further

recursions can be added for second- and third-order mental state attribution: e.g. Mary thinks that John believes that the ice-cream van is in the park, which is why she goes to the park to find John.

Since 1985 many studies have reported similar findings on false-belief tasks although the percentage of children passing and failing varies from study to study. These are reviewed in detail a little later. It was proposed that this problem with false-belief was specific to autism (Baron-Cohen, 1991) yet there was a small percentage of autistic children who passed false-belief tests on each occasion. A more complicated, second-order false-belief task tended to eliminate this ability to pass in most studies (Baron-Cohen, 1989). However, some studies still have able autistic subjects passing even the most complicated false-belief tasks (Bowler, 1992; Tager-Flusberg & Sullivan, 1994). These later studies found that although able autistic and Asperger's subjects could pass false-belief, they could not give mentalistic justifications for their answers. Other studies have found that autistic children can give good mechanical explanations for stories or events but also give a mechanical explanation when a mentalistic explanation is most appropriate (Baron-Cohen et al., 1986). Baron-Cohen (1989) proposed that autistic children have a Theory of Behaviour rather than a Theory of Mind and this thought has been echoed by other researchers but in slightly different terms, for example Perner (1993) suggests that autistic children are "situation theorists", who don't graduate to become "representational theorists".

It is generally accepted that autistic children have a problem with understanding mental states, but how this arises is still under much debate, and I shall introduce some opposing theories shortly. However, before moving away from Baron-Cohen et al.'s theory it is important to point out that it is a decade old now and although the mentalising deficit is still seen as the core deficit which explains most of the behaviours seen or absent in autism, the researchers' own views have changed somewhat. For example, Baron-Cohen (1994) has recently published some new ideas on the origins of the Theory of Mind deficit, which he suggested lies much further back in development with the ability to read eye gaze. Autistic children are not impaired on visual perspective taking as such (Baron-Cohen, 1989, 1991; Hobson, 1984; Leekam et al. 1993; Tan and Harris, 1991), but they are impaired on

reading the mental significance of eye gaze - i.e. they are impaired in inferring thoughts, desires, references and goals from the eyes (Baron-Cohen, in press). Baron-Cohen (1994) suggested that four mechanisms are normally in place - Eye Direction Detector (EDD), the Intentionality Detector, (ID), the Shared Attention Mechanism (SAM) and the Theory of Mind Mechanism (ToMM) - although he stresses in his reply to the commentaries that some stages can be bypassed (for example, blind children, who obviously cannot have an EDD in place but yet can still have the Theory of Mind Mechanism (ToMM)). Normally, EDD comes first in the Mindreading system, to detect the presence of eyes and to detect eye behaviour, such as movement. Parallel to EDD works ID, which interprets behaviour in terms of goals and desires, or volitional states. These two mechanisms feed SAM, the Shared Attention Mechanism (joint attention) which in turn feeds ToMM and the mentalising capacity of the child. SAM is a necessary but not sufficient condition for the development of ToMM. In autism the halt in development can occur at two points - either SAM develops and ToMM does not, or SAM does not develop at all. The former is the most uncommon and such autistic children have not been much investigated; the latter is the type of autistic child most commonly studied. This theory is still in its infancy but much interesting discussion has arisen from it. Where and how exactly the deficit in autism disrupts the development of SAM is not altogether clear but there is potential for much future research based on this model.

b) Other "cognitive" theories

There have been many other theories which have attempted to explain both the social and non-social deficits of autism. Theories such as the joint attention theory (Sigman et al., 1986), the arousal theory (Rimland, 1964; Hutt, 1965) and the central coherence theory (Frith, 1989; Happé, 1994) are described in Happé (1994). For the purpose of this thesis, however, I will present only a few of the other theories of autism.

There are several other theories based on mentalising deficits but offering different versions of the theory to that offered by Baron-Cohen et al. (1985; Leslie, 1987; Baron-Cohen, 1994). For example, Perner (1993) took issue with Leslie's use of the term "metarepresentation" - which has become much broader than initially

defined by Pylyshyn (1978), where representation refers to the representational medium, not to the representational content, as it does in Leslie's theory. Perner, however, agreed that autistic children are impaired in their Theory of Mind but suggested that it may not be because they lack the decoupling process: instead, they may possess all the elements of a Theory of Mind but cannot combine them as easily as normal children can. He suggested that autistic children are "situation theorists", as young children are before they become "representational theorists" - that is, they have some understanding of, but do not completely differentiate, between the representational medium, e.g. a photo, and the representational content, someone in the photo wearing a blue dress. Their situation theory may be more sophisticated than young children's, as they can pass tasks like Zaitchik's photo task (Leekam and Perner, 1991), which requires the child to understand that what a photo represents is not necessarily a true representation of reality, but they cannot extend the information, which they can say the camera has seen, to another person's mental representation.

Another approach which is not necessarily contradictory to Leslie' theory is that of Harris (1990). Harris proposed that the lack of an understanding of psychological states, which he admitted might play an important part in the autistic disorder, is not a problem of failing to acquire a Theory of Mind but is instead the result of a failure to engage in an increasingly complex process of "simulation" or imagination. He suggested that the autistic child's impoverished pretend play results from a problem with overriding external or habitual control, and thus they have a problem planning actions and responses, and in essence an executive function deficit.

Rogers and McEvoy (1993) when testing able autistic children and young adults for imitation, found that they were also impaired on "executive function" tasks. Executive functions are described (Ozonoff & McEvoy, 1994) as the cognitive operations thought to be driven by prefrontal cortex, including planning, inhibition, flexibility and working memory. Tests such as the Wisconsin Card sorting task and the Tower of Hanoi tasks are examples of tests of executive function. Hughes and Russell (1993) proposed that the difficulties faced by autistic children in false-belief tasks are indicative of a deficit in mental disengagement from an object, rather than a problem with Theory of Mind and metarepresentations. They offer their results as

support for a primary deficit in executive functions, which explains both the social and the non-social deficits seen in autism. Other studies have also found that autistic children and adults are deficient relative to controls on executive function tasks (Ozonoff, Pennington and Rogers, 1991). Jarrold, Boucher and Smith (1994) found that executive function capacities involved in pretend play were not affected in autism. However, Ozonoff et al. (1994) found that autistic subjects had problems with cognitive flexibility, which would go a long way towards explaining the perseverative and obsessional behaviour often seen in autism. This ability to explain many of the behaviours normally not explained by a Theory of Mind hypothesis, makes the executive function hypothesis particularly attractive. Ozonoff and McEvoy (1994) found that Theory of Mind and executive function followed a similar pattern of development in autism and they concluded that rather than being independent modules of cognition, they may be related and interdependent and therefore when lacking, both affect development to produce the deficits seen in autism.

c) The Affective Hypothesis.

Hobson's theory has sometimes been called the "Affective" Theory (Baron-Cohen, 1988) in order to contrast it to the "Cognitive" Theory of Baron-Cohen et al. (1985). I shall continue to use this term here to differentiate it from the Intersubjectivity theory of Rogers and Pennington. It is, however, a theory concerning the absence of the ability to form intersubjective relations in autism. I cannot possibly attempt to do justice to this theory in the scope of this introduction and I would advise readers to read Hobson (1993) for an interesting and in-depth discussion of his and other theories of autism. However, I will try to summarise what I see as the most important aspects of this theory with regard to this thesis. The very premise of Hobson's theory was based on the original observation by Kanner (1943) that the children he had observed lacked the innate ability to interact emotionally with others. Intersubjective or interpersonal communication is widely believed to be the most formative influence in an infant's life and it begins the moment he/she is born. Many researchers (especially Trevarthen, 1979 and Hobson, 1986a, 1986b, 1993) believe that interpersonal relatedness is emotionally mediated and if this

ability to establish interpersonal relatedness is disrupted by autism, one can see how many of the social and language difficulties could arise. The best way to summarise Hobson's theory is to quote what he himself says:

> "There are many levels of interpersonal understanding. I shall be arguing that the very concept of "persons" with minds is founded upon preconceptual forms of awareness that people are different from things in affording intersubjective contact.....infants are biologically "prewired" to relate to people in ways that are special to people, and that it is through the experience of reciprocal, affectively patterned interpersonal contact that a young child comes to apprehend and eventually to conceptualise the nature of persons with a mental life". (Hobson, 1993 p104)

Hobson supported his theory by a plethora of evidence ranging from pronoun reversal to emotion perception, the latter being the most researched. Autistic children are generally known to not express themselves emotionally in the same way as normal children. When they do produce emotionally charged reactions they are often inappropriate or incomprehensible. Hobson has shown that autistic subjects have problems recognizing emotions from facial expressions, sounds, gestures and body postures, but few problems recognizing non-emotionally charged stimuli (1986a and b; 1991). Some researchers have found similar results on emotion recognition and sharing (Mundy, Sigman, Ungerer and Sherman, 1986; Snow, Hertzig and Shapiro, 1987; Weeks and Hobson, 1987; Hobson, Ouston and Lee, 1988 and 1989; and Ozonoff, Pennington and Rogers, 1991) while others have not been able to replicate the results (Prior et al., 1990). More details on emotion recognition will be given later in the Introduction.

With regard to other aspects of interpersonal understanding, Hobson suggested that by the end of the first year of life, children have grasped not only that people are beings with whom affective experiences can be shared, implying that there exists a basis for commonality between self and others, but also that people are differentiated from the self in their attitudes vis-à-vis the world. They can register emotional meanings and "subjective background" to bodily expressions of other people; they can perceive the directness of another person's psychological attitudes; they can relate to the same things and events as does their care-giver, *as* shared things or events, but are aware that others can have different "attitudes" to the same event; and a child can identify with another person and assume as well as respond to the other's

attitude. These abilities set the scene for reflective self-awareness and eventually not just other person awareness but other "mind" awareness. By the end of the second year or so a child can understand that another person represents something *as* frightening, for example, but still does not understand that a person holds a representation to be a representation of reality (i.e. as being true), important to an understanding of knowledge, belief and false-belief. Before the child can have this advanced stage of "theory of mind", Hobson suggests that she must, first of all, grasp that if an individual has a true version of reality then they will act appropriately; if they have a false version they will act inappropriately. Secondly, she must grasp that truth corresponds with what *anyone* would give as a description of a state of affairs, if that person were in an appropriate position to pass judgment, e.g. had *seen* what had happened.

Hobson suggested that autism is a severe disturbance in intersubjective personal engagement with others but that the homogeneity and depth of this affective disability may not be universal. He proposed that "they are relatively successful in following the I-It (i.e. self/object) developmental pathway, and they can even respond to aspects of people when such exchanges are not intrinsically "intersubjective" in nature. It is especially in I-Thou interpersonal relatedness that we find the abnormalities characteristic of "autism"....". (page 197). One criticism that has been levied at Hobson's theory is that some autistic children seem to develop normally in early childhood and abnormalities have not been picked up until 18 months of age, when there is a lack of pretend play and joint attention behaviours, both precursors to a Theory of Mind in Baron-Cohen et al.'s (1985) theory (Happé, 1994). Of course, the difficulty in testing Hobson's theory is that autism can still only be diagnosed reliably at 18 months at the earliest. One piece of evidence that autistic children do not show some of the very early emerging social behaviours when their MA suggests that they should show these behaviours, comes from a paper by Klin, Volkmar and Sparrow (1992). They tested 29 children with autism with a CA below seven years (mean 4.31) and a mean MA of less than 2 years, on the first twenty items of the Vineland Adaptive Behaviour Scales, examining interpersonal relationships and play and leisure time activities. They found that nine of the twenty items clearly differentiated autistic from non-autistic children ($p<0.01$) and suggested that autistic

children are severely impaired in many of the early emerging social behaviours. These included: anticipation of being picked up; affection towards familiar people; interest in other children; other than siblings; reaching for familiar people; engaging in simple interaction games; interest in the activities of others; imitation of simple adult movements; laughing or smiling appropriately in response to positive statements; and addressing at least two familiar people by name.

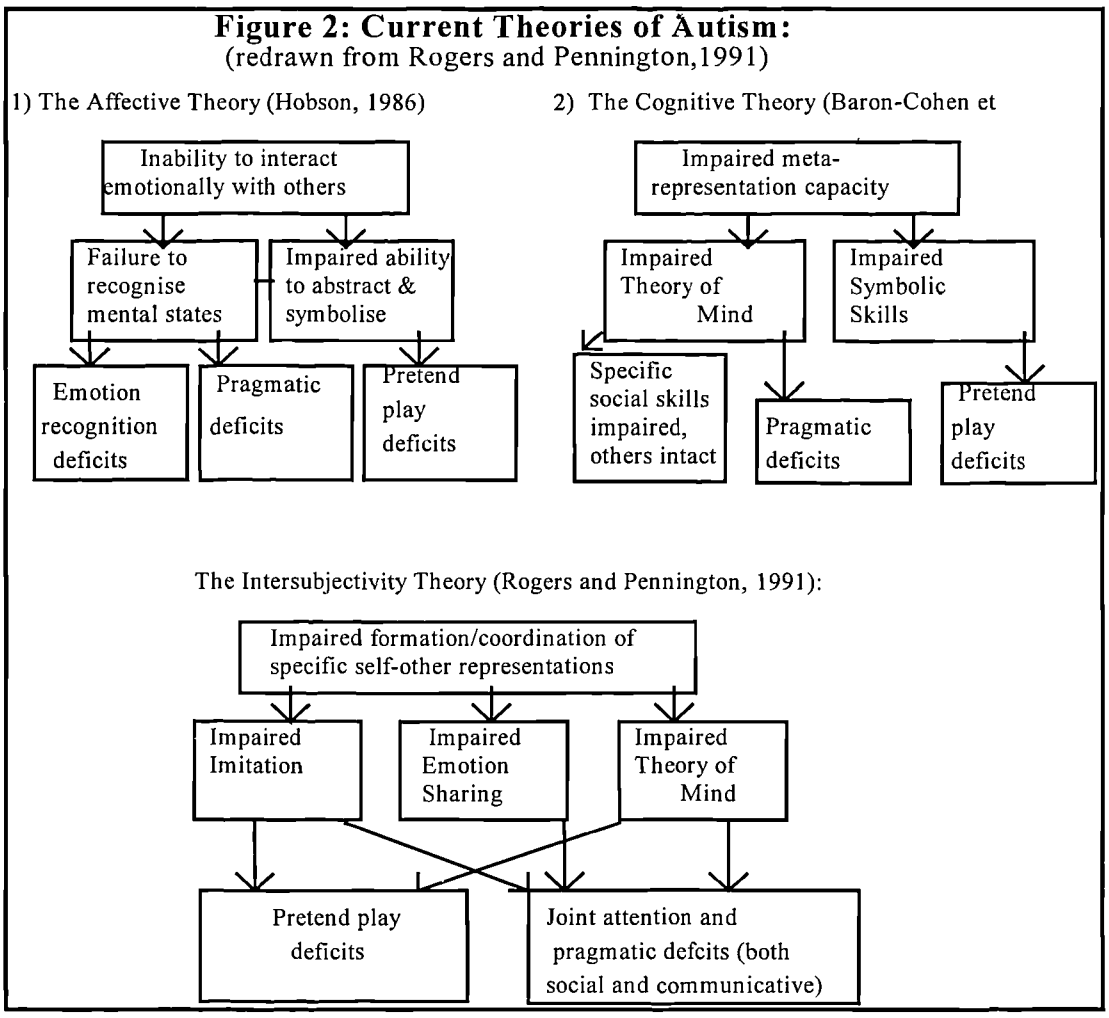
d) The Intersubjectivity Theory

Finally, I move on to present Rogers and Pennington's (1991) Intersubjectivity Model of autism. They focus on imitation but combine it with the two theories already mentioned. The deficit in imitation is the only truly testable aspect of this theory that really differentiates it from the other two. Rogers and Pennington (1991) wanted to find a way of looking at autism within the framework of normal development and chose Stern's (1985) theory of interpersonal development. Rogers and Pennington chose to focus on imitation as it had the potential to severely disrupt the normal development of interpersonal skills. However, as in Stern's theory, they chose to combine imitation with emotion sharing and mental state understanding or "Theory of Mind", which are the main deficits proposed by Hobson and Baron-Cohen et al., presented in the previous sections section. Rogers and Pennington reviewed the literature on social behaviours such as attachment and self/other recognition, which for the most part are intact in autism and they suggested that these intact social processes do not require imitation, emotion sharing or awareness of mental states - three skills that Stern (1985) suggested are essential in normal interpersonal development.

After a review of the literature on imitation Rogers and Pennington concluded that there did indeed seem to be evidence of a deficit in imitation in autism and not just, as Baron-Cohen (1988) had suggested, in higher (symbolic) imitation but also in simple gestural imitation. There are other studies not reviewed by Rogers and Pennington which have not found deficits in imitation in autism and still others that did find a deficit in some aspect of imitation. In general, the picture of imitation in autism is still rather foggy.

As we saw in the review of Hobson's (1986) theory, there is evidence for a deficit in emotion sharing and I shall present more literature in this area. Stern (1985) linked imitation with the development of affect sharing, affective communication and affect attunement, while both Stern (1985) and Hobson (1993) linked the development of affective mutuality with the awareness of other minds. This leads us to the final part of Rogers and Pennington's review - metarepresentation, joint attention, language pragmatics and symbolic play, all aspects of Baron-Cohen et al.'s theory. Rogers and Pennington suggested flaws in the metarepresentational account of autism, the main two being an inability to account for early deficits such as the imitation deficit (although it should be remembered that the evidence presented by Rogers and Pennington (1991) for a deficit in imitation, is not necessarily evidence of an *early* deficit) and the proposal of a sharp discontinuity in the development of a theory of other minds. Other theories, Stern (1985) in particular, suggest a more continuous developmental course. Rogers and Pennington stress the need to regard autism as a developmental disorder and therefore to bear in mind that deficits in specific tasks will not be constant across development. In fact, they propose that deficits will lessen over time to different degrees for each individual.

Stern's model of infant development suggested an integration of the affective and metarepresentational positions along a continuum. Based on Stern's theory of the emergent self, core self, subjective self, and verbal self, Rogers and Pennington proposed what they called a cascade model of autism. They proposed that a lack of certain aspects of interpersonal development at each stage disrupts certain developments at the next stage. They viewed imitation, emotion sharing and "theory of mind" as increasingly complex expressions of the ability to form and coordinate certain representations of self and others and the ability to use those representations to plan and guide behaviour (Rogers and Pennington's model is represented in Figure 1 below, along with a representation of the two previous theories of autism). The final aspect of their theory is a proposal that human infants are biologically prepared to develop these early social behaviours. This idea is of course in keeping with Kanner's (1943) original observations and Hobson's (1986 and 1993) theory.




A recent paper by Smith and Bryson (1994) offered an alternative explanation for the deficit of imitation in autism. They suggested that although a deficit in imitation may be very important in autism, the underlying problem may be non-social rather than the social/intersubjective deficits proposed by Rogers and Pennington (1991). Smith and Bryson, in a critical review of the literature on both imitation and action in autism, proposed that the problem of a deficit in imitation in autism may be due in part to "an impairment in the perceptual organisation of movements, manifested in abnormal representation of actions". In other words, a problem with perceiving how movements are made up and processing that perception means that the actions are not represented properly and are therefore reproduced inaccurately. The problem may be more a non-social problem of information-processing in a social environment which affects the social skills

including imitation in children with autism. This type of view explaining both the social and non-social deficits is similar to those mentioned earlier such as the executive function theory (Hughes and Russell, 1993) and the central coherence theory (Frith, 1992; Happé, 1994).

According to Smith and Bryson, the problem with understanding the role of imitation in autism is that first of all, the concept of imitation in autism has not been well defined or described in previous work, in that few studies have manipulated actions in such a way as to produce a comprehensive picture of imitation in autism and secondly, that few studies have used adequate controls to show whether any deficit in imitation is specific to autism. Smith and Bryson's suggestions for future research are presented in more detail in Part 3 of this Chapter.

However, in order to truly analyse Rogers and Pennington's theory or any other theory involving imitation, it is essential to consider some of the issues surrounding the concept of imitation before moving on to the evidence that imitation is lacking in autistic children. In the next section I will present a brief review of the literature on the normal development of imitation, and some of the issues involved in defining imitation, followed by a review of the literature on the existence of a deficit in imitation in autism.

## Part 2

## The nature of imitation.

Within the realm of child development a definition of imitation is not readily available. It is in animal research where we find imitation defined, although these definitions tend to be relatively narrow and restrictive due to the scepticism surrounding the investigation of "human" behaviours in non-human primates (See Whiten & Ham (1992), Tomasello *et al.* (1993), and Whiten and Custance (in press) for work on non-human imitation). To enable definition, it is essential to examine how imitation has been viewed and investigated in normal development. Before presenting the definition that I will use in this thesis, I feel it is essential to examine some of the other issues surrounding imitation as a concept.

### Evidence from the literature on normal development.

For the most part, previous research has dealt with the first 4 years of life and we know little about what happens as the child develops further and becomes an adult. Rogers and Pennington predicted that it would be the younger children who would be most impaired in imitation. However, since this thesis will be examining older children and adults as well as younger children, it is essential to look at how imitation develops normally in older people. One theory which did deal with imitative behaviour in older children and adults was the social learning formulation of Bandura (for a review see Yando, Seitz and Zigler, 1978). Bandura proposed that, while witnessing the actions of another person, people build up a mental image of that scene (acquisition) which can then be retrieved at a later time to aid performance of the modeled action (imitation), thus increasing social skills, knowledge or other abilities. However, although this acquisition of a mental photograph is important, it is not the only factor affecting the imitation of an action. Reward is also very important. In fact, in his 1977 paper Bandura proposed 4 factors that are important in acquisition and imitation of a modeled action: attention, retention, motor reproduction and motivation. I will come back to look at these in the next section on definition of imitation. Yando et al. (1978) proposed that although Bandura's theory concentrated on older children and adults, in some ways it could be applied to earlier

stages of development. The main problem was that Bandura's formulation required the existence of some very sophisticated cognitive abilities which would probably not be available to very young children.

Piaget (1962) was probably the first to detail the normal development of imitation. Piaget followed the development of imitation in his own children just as he studied sensori-motor development, and other aspects of development. Because his subject group was so small, it is difficult to accept his theories as definite, and later studies have somewhat discredited his work on imitation especially concerning imitation in newborn children (Meltzoff and Moore, 1987; Meltzoff, 1988). However, it is still important to consider the stages of the development of imitation that he proposed, even if his timescale may not be correct.

Piaget viewed imitation as an active process, not automatic or non-intentional. It is a continuation of the effort to accommodate (i.e. modify the internal schemas to fit a changing cognizance of reality) and part of the child's intelligence. He proposed that imitative ability develops along the same path as sensori-motor abilities and is linked to the ability to form representations. At different stages it becomes more complex and incorporates other abilities. The development of imitation begins with the reflex action in the first month of life but at this stage are not actually imitation according to Piaget. From the end of the first month Piaget proposed that children begin to imitate sporadically. Within this stage Piaget saw three types of vocal imitation progressing from vocal contagion to mutual imitation of familiar sounds to sporadic imitation of unfamiliar sounds. For action imitation the beginnings are at this stage when the child can imitate certain familiar actions of other hands.

Stage 3 of imitation development involves the systematic imitation of sounds and movements already made and seen by the child. Imitation of facial actions does not yet occur unless training is provided. This stage emerges around four months of age. Four to five months later the child progresses to the next stage and begins to imitate movements not visible to the child but already made by the child. Then, at about 10-11 months the child starts to attempt to imitate new auditory and visual stimuli. From one year onwards the child systematically imitates new models including those movements not visible to the child and as the 2nd year progresses imitation becomes more accurate. Stage 6, which occurs around 2 years of age, finds

the child beginning to produce representative imitation and further develops to imitation after a delay (usually called "deferred imitation"). Although Piaget deals principally with the first 2 years of life, he does note that from 2 until 7 or 8 years of age imitation develops further, being used spontaneously and often unconsciously. Piaget notes that in children from 2 to 7 years old imitation tends to be of a general nature and there is little attempt to imitate details; they imitate the immediate plan of actions but are easily satisfied about the details. At about 8 years of age, imitation becomes deliberate and takes its place in intelligence as a whole and execution becomes more accurate.

One very influential set of studies on imitation is that of Trevarthen on mother infant interactions. Trevarthen (1979) suggested that mother-infant imitative interactions form the basis for the development of affective understanding and mutuality and also the communication of affect. Much of the child's grasp of language comes from this interaction as well. Often what is most important at this stage is the mother's imitation of the child's facial expressions, actions and vocalizations, as she labels them. Pawlby, in an observational study on imitative interaction (1977), looked at imitative sequences as one form of communication in which one of the two partners reproduced the same act as performed by the other partner. She observed that these sequences could be combined into strings of actions and imitations and distinguished five main categories of actions - face/head movements, hand/body movements, speech sounds, non-speech sounds and manipulation of objects. Speech sounds were, for most partners, the most frequent type of act imitated; facial actions were least frequently imitated. For a few pairs, object manipulation was most important. Pawlby commented that this encouraged turn-taking in the child and that when the child was younger, imitation was performed more by the mother, but as the child grew older, the frequency of imitation by the child increased. The importance of the mother/infant imitative interactions seems to be that the mother is giving the child the ability to associate his interoceptive information about his own movements with their visual external representation (Papousek and Papousek, 1977).

In his book on the interpersonal world of the infant, Stern (1985) also suggests a prominent role of early imitation in the development of affect sharing, affective

communication and affect attunement. Stern's model for normal development proposed a relationship between imitation, affect sharing and theory of mind and, as we have seen, it is on this that Rogers and Pennington (1991) based their model for the deficits in the development of autistic children.

Although Piaget's views on imitation have much merit, they have since been discredited to some extent by various studies. Evidence from studies by Meltzoff (1988), Meltzoff and Moore (1987; 1989), and Kugiumutzakis (1993a and b; in press) among others (e.g. Abravanel *et al.*, 1976) has shown that new born babies have the ability to imitate simple body actions and sounds, even when the demonstrator has stopped modeling. Such imitation includes facial actions such as tongue protrusion, which Piaget argued was not real imitation but the result of training. At nine months, infants can demonstrate deferred imitation, i.e. they reproduced the modeled action at least 24 hours after modeling (Meltzoff, 1988). This implies that they were able to store the representation of that action and then reproduce it. Melzoff suggested that imitation in infancy can span wide enough delays to be of service in social development. Since Piaget, Trevarthen and Stern there have been many other researchers who have been convinced that imitation plays an important role in the learning of language, and in the establishment of skills such as understanding emotions and social skills. Hay, Stimson and Castle (1991) considered observational learning, modeling and imitation as means by which children learn to explore the environment around them and to interact socially. They also suggested that imitation is involved in helping the child understand emotion and mental states, since mental state terms are used frequently with the child before the child is verbal.

Tomasello *et al.* (1993) saw imitative learning as the earliest and most fundamental stage in the cultural learning process, true imitation appearing around 9 months (the other stages being Instructed and Collaborative learning). Imitative learning at this stage involves the establishment of object-directed actions and the use of communicative symbols - i.e. the foundations of language. The social-cognitive ability displayed at this stage is perspective-taking, for example, joint attention and social referencing. The child's concept of a person is as an intentional agent and as such requires only basic ( 0-order) representation. The later stages in

cultural learning progress from and expand on this initial stage - until children have grasped this perspective-taking ability they cannot move on to intersubjectivity or any concept of a person as a reflective agent as well as a mental one. Tomasello *et al.* suggest that autistic children are delayed in the imitative learning stage and therefore cannot progress to any higher understanding of the social world. Autistic children do not demonstrate collaborative learning and although they are capable of learning through instruction, they do not seem to internalise it and then reproduce that knowledge at a later stage, as normal children do.

Meltzoff & Gopnik (1993) made the role of imitation in infancy more explicit and suggested what might lie behind such an ability. They argued "that the bedrock on which a common sense psychology is constructed is the apprehension that others are similar to the self. Infants are launched on their career of interpersonal relations with the primary perceptual judgment: "Here is something like me". Meltzoff and Gopnik suggested that this process requires an infant to understand similarities (or cross modal equivalence) between "body movements-as-felt in the self and body movements-as-seen in others". This produces the ability to imitate and to understand being imitated, especially where facial imitation is concerned, since the infant cannot make a direct visual comparison between their own faces and those of adults, as they can do with most body movements. Meltzoff and Gopnik argued that early imitation is relevant to developing "theories of mind" because it provides the infant with the initial opportunity to make a connection between the visible world of others and its own internal states, the way they "feel" themselves to be. It also provides a mechanism for infants to learn about other people and distinguish them from things since they suggest that the "like me" test for people is that people can be imitated and can imitate the infant. This concurs with Hobson's theory although the latter might express it a little differently.

We have already seen evidence from other studies by Meltzoff that infants can imitate from as early as 12 days old (Meltzoff and Moore 1977). Meltzoff has also shown than an infant recognises when he/she is *being* imitated (1990b). Meltzoff and Gopnik also suggest that as the child gets older, imitation then begins to be used as a mechanism for learning about how things work before language can be used.

Finally, the work of Nadel reveals to us a slightly later use for imitation in children between 2 and 4 years of age as a preverbal medium for (Mertan & Nadel, 1991; Nadel & Fontaine, 1989; Nadel *et al.*, 1988; Nadel, 1986; Mertan *et al.*, 1991; Nadel-Brulfert & Baudonnier, 1982; Nadel, 1987). In several different experiments employing basically the same paradigm, Nadel observed pairs or triads of normal toddlers in a room furnished with 2 or 3 groups of identical objects and a hidden camera. She found that the most prevalent form of play usually was imitation - if one child took up a toy, the other(s) generally took up the same toy and did similar things with the object. She also found that this was accompanied by laughing and smiling, and often involved one child taking the role of leader (self-elected) and then waiting on the other child(-ren) to imitate. The role of the leader alternated between the children at different times in the session.

In summary, imitation plays an important role in early infancy, particularily in the ability to perspective-take, in the learning of language, in the establishment of social relationships and the learning of social rules, in the understanding of affect and mental states, and even in the process of symbolic play. As the child gets older imitation becomes an important method of communication until superseded by verbal communication. At this point, at about four years of age, imitation primarily becomes a learning tool again, used to pick up more social skills and knowledge, as well as intellectual and practical skills. It then develops with age, becoming more sophisticated and accurate as the child grows older.

If the autistic child does have a deficit in imitation then the rich learning experience that the normal infant gains from the imitative interactions with the carers would be lacking. This, as Tomasello *et al.*(1993) point out, would lead to problems with perspective-taking, which would be reflected in skills such as joint attention. There is evidence (Baron-Cohen, 1989) that autistic children do have problems with joint attention, especially lower functioning individuals, although perspective-taking itself tends to be relatively unimpaired.

A deficit in imitation could also manifest itself in the problems with social skills which all autistic individuals tend to exhibit to varying degrees and in an inability to understand or appreciate the emotional or mental state of another individual, which would in itself affect social behaviour (Hobson, 1993). This is as yet unproved and it

can only be hypothesised that a lack of appropriate social use of imitation could be one of the causes behind such intense social disabilities. Another behaviour which could be affected is symbolic play, which Piaget (1962) proposed evolved out of three abilities - the ability to show deferred imitation, the capacity for referential thought and the capacity for representational thought. There is some evidence that autistic children show increased symbolic play when instructed to do so (Lewis & Boucher, 1988) and imitation of the child by the mother can also increase play and social responsiveness ( Dawson & Galpert, 1990).

Finally, it is well documented (Kanner, 1945; Tager-Flusberg, 1981; Baron-Cohen, 1988) that autistic children have problems with language and only higher-functioning individuals can communicate to any extent using language. They especially have problems with the pragmatics of language and with comprehension. They rarely if ever use mental state terms and they show specific problems such as pronoun reversal, specifically a difficulty with "I" and "you", which Tomasello *et al.* (1993) suggested requires a special type of imitative learning in childhood. As mentioned before, much language, for example, vocabulary and pragmatics, is learned by some form of imitation or observational learning in infancy and childhood, as are rules of the local language.

Before moving on it is essential to point out at this stage that a deficit in imitation alone could not cause all these problems but it could be an important contributing factor which combines with the other primary deficits in autism to bring about these problems. Tomasello et al. (1993) acknowledged this and we have seen that this was the basis for Rogers and Pennington's (1991) developmental model of autism.

**Defining the concept of imitation.**

There is still much debate over whether imitation is a unitary concept and we have seen that it manifests itself in different ways at different stages of development. Previous developmental research can be summarised as investigating imitation on one or several levels. Some research has mentioned different *classes* of imitation, involving different underlying deficits. Some research has investigated imitation as one aspect of *social learning* while other have identified different *manifestations* of

imitation at different stages in development. Finally, some research has involved the proposal of different *functions* of imitation at different stages of development. Each of these levels should be considered before defining imitation.

*1) Classes of imitation:*

Firstly several authors have proposed different classes of imitation, arising from different underlying capacities. Hobson (1993a) proposed two distinct classes - the first is described as the "relatively automatic mechanisms" by which normal infants, children and adults "perceive and assume the actions and attitudes of others. Here imitation *leads to* interpersonal correspondences in action and attitude, but does not itself require a prior awareness on the infant's part that they are attempting to copy another person, conceptualised as such. The second class entails that the infant both identifies the goal-directed actions and/or attitudes of the other person, and identifies *with* the person in a deliberate attempt to copy the other. Autistic individuals are probably abnormal with respect to both forms of imitation: They seldom engage with others in such a way as to "find themselves" identifying with others and very rarely do they strive to adopt the stance of someone else".

This suggestion closely resembles that proposed by Whiten (1992) when considering both child and animal imitation. Whiten (1992) saw imitation as related to a type of mindreading, which could take one of two forms: "a) to imitate certain acts the imitator needs to be able to recognise the model's purpose in doing what they do, or b) the imitator needs to be able to translate, in three dimensional space, between the action done from the other's point of view (seen from their viewpoint) and what it is to perform it from their own point of view". In simpler terms imitation needs either the ability to understand another's intentions or the ability to understand and translate across self-other differences. The first of these two forms would be that upheld by Baron-Cohen et al.'s theory while the second would be encompassed by Rogers and Pennington's theory.

*2) Imitation as a type of social learning*

Although Bandura (1962, 1977) used the terms imitation and social learning almost interchangeably, researchers studying animals have made a distinction

between imitation and other forms of social or observational learning such as emulation (imitating the end product of an action but without using the same method to reach the end product), social facilitation (performing an action on an object after having one's attention drawn to that object but not necessarily performing the same action as the model) and contagion (where an idea catches on but can be performed differently by each individual, for example, laughing). Mimicry is also often differentiated from other imitation because it is thought that mimicry does not require the understanding of intentions that, for example, Tomasello et al. (1993) suggested is fundamental to the ability to imitate. This stricter definition has arisen from the need for much stricter controls in this area of research to counter the scepticism that non-human primates can imitate at all. As a result the occurance of imitation may well be underestimated.

Within the developmental literature, imitation has been called by many different names such as observational learning, identification, matching behaviour, modeling, to name just a few. In many studies the concepts which have been differentiated from imitation in the animal literature have been used interchangeably with imitation in the developmental literature. Although Piaget, Meltzoff and other researchers usually failed to define imitation in their work with human infants, many seemed to accept imitation as a unitary concept, albeit manifested in different ways at different stages of development. One definition can be found in the developmental literature and this is a very broad definition of imitation, encompassing other types of social learning and allowing theories to be united under one definition. Yando et al. (1978) define imitation as follows: "imitation is defined as the motoric or verbal performance of specific acts or sounds that are like those previously performed by a model". They suggest that this broad definition allows it to be used in connection with the different manifestations of imitation in development. For example, Piaget (1962) proposed that vocal contagion is one of the earliest signs of the development of an imitative capacity.

This study employed a slightly narrower definition (page 37) as there were two possible hypotheses: since imitation or social learning in any format involves social skills and some degree of social interaction, it may be that autistic children are impaired in them all. On the other hand, if it is the ability to imitate (according to the

stricter definition) that is impaired then autistic children might be more able or more inclined to emulate or take advantage of social facilitation. One of the tasks to be used in the present set of experiments was designed specifically to test the tendency to emulate versus the tendency to imitate (the artificial fruit).

Mimicry is, as I mentioned, often discriminated from other types of imitation because it does not require an understanding of the person's intentions or other mental states. It is possible that a child may mimic without much understanding of the social world. As such autistic children might be more inclined to mimic than to produce other types of imitation. Mimicry does, however, need some of the same motoric and cognitive capacities. As such it is intrinsically social in nature. Thus the definition adopted for this study includes mimicry (although a note was made during observations if imitation appeared to be mimicry). This of course, was based on subjective judgements of mimicry.

Finally, previous studies using the artificial fruit task and DAID scenario (Custance, 1994; Whiten et al. in press), were designed for use with non-human primates. As such they used a narrower definition of imitation. For later comparisons with the data from these studies, it was essential to adopt a definition that excluded emulation, social facilitation and other forms of social learning.

*3) Developmental manifestations of the ability to imitate.*

At different stages of development, the ability to imitate manifests itself in different ways and as the child gets older he or she can imitate more complex actions, can imitate after a delay and can improve the accuracy of the imitation. Piaget (1962) proposed that imitation starts with vocal contagion and moves through imitation of sounds, familiar then new, to imitation of actions (familiar/novel and visible/invisible) to imitation of symbolic actions and finally to deferred imitation. From about two years on imitation increases in accuracy and complexity. Smith and Bryson (1994) emphasised the need to investigate imitation of different types of actions in order to truly understand imitation and the role it plays in autism. They suggested that future research should examine various manifestations of imitation including distinctions between symbolic and non-symbolic actions, between actions

with objects and actions without objects, between one-handed actions and two-handed actions, and between facial and manual actions.

This thesis aimed to test these different manifestations of imitation. If a developmental perspective is the correct one then it should be possible to show that not only do the younger children perform relatively poorly on imitation (as Rogers and Pennington would predict) but that those who pass tests of deferred and symbolic imitation should also pass the simple tasks of body actions and simple actions with objects. Those who fail the simple ones should not pass the more complex ones.

However, it is not just the ability to imitate that might affect children's performance. Although Piaget did not discuss the abilities that combine with imitation at the different stages to increase its complexity, it is essential to mention that there are confounding factors when studying imitation. The first is motivation: When the child is young he or she must be motivated to imitate and rewards usually come in a social form. As the child gets older rewards may be social or they may become more physical such as getting a toy to work by imitating the actions of another. The second important confounding factor is symbolic capacity. In order to imitate action involving pretense, it seems reasonable that children should be able to pretend on their own. As such it also seems reasonable that autistic children will be less able to produce good imitations of actions involving pretense than their non-autistic peers. Finally, memory plays an important role in the ability to imitate after a delay.

Although these are confounding factors and may lessen the impact of results, it is important to study these types of imitation. It should be clear whether the children are motivated to imitate or not by whether they attempt to imitate. If autistic children are only impaired in those actions which require symbolic ability (pretense) or memory then we cannot say that they are impaired in their ability to imitate. It may be the need to combine different abilities with the ability to imitate that prevents imitation at this more complicated level, although Rogers and Pennington would predict that this will develop later providing there are no deeper memory problems.

*4) The function of imitation.*

As well as the possibility that the actual manifestation and underlying deficit are different at different stages in development, there is some evidence that the function of imitation differs with age. Meltzoff and Gopnik (1993) proposed that the function of imitation in very young children is to aid identification with others as living things and to come to an understanding of their own and others bodies. Both Stern (1985) and Hobson (1993) proposed something similar - imitating helps children come to an understanding of themselves and others in terms of body, emotions and mind. Trevarthen (1979) saw imitation as an important factor in establishing mother-infant interaction.

Nadel (Nadel and Camaioni, 1993) argued that imitation is not just a form of identification but also a form of communication for pre-school children. By imitating each other they are saying "Look at me, I'm like you. I'm your friend" etc. Once they go to school the need for imitation as a form of communication is lessened by the development of sophisticated language. As older children and adults we may imitate people in order to be like them or to flatter them.

So there are many different aspects of imitation to consider when embarking on a study of this nature. However, it is desirable to adopt a unitary definition that will take into account many of the factors described above and allow identification of imitation whatever the manifestation. In studies by Meltzoff (see pages 25 and 26), the reproduction of actions did not have to be exact and in the work of Nadel and colleagues (see Nadel and Camaioni, 1993, for a review) the child only had to pick up the same objects and do similar things to be coded as imitating. Such behaviour could have been the result of other types of social learning such as social facilitation. To summarise, then, we need a definition and coding system that will be wide enough to accept attempts at imitation even though not completely accurate but narrow enough to allow differentiation between imitation and other forms of social learning. This can be achieved by using a scoring system that records the accuracy of reproduction. For example, if the child picks up the object and does something completely different this could be thought of as social facilitation. The main type of social learning I want to distinguish from imitation is the use of emulation. Emulation implies creativity and the ability to experiment and usually occurs in

older children and adults. In this sense autistic children and adults may be impaired. On the other hand, emulation requires less social understanding than imitation and may thus be intact in autism. Additionally, if imitation develops in autism as it does in normal children, although more slowly, as Rogers and Pennington predicted, then the autistic adults might show more emulation just as normal adults would. Emulation will be investigated mainly in the artificial fruit experiment (Chapter 4). The definition also needs to be able to encompass the different manifestations of imitation including deferred imitation.

Bearing all these factors in mind, I will use the following definition in this thesis: *imitation occurs when the person reproduces with some accuracy the actions or vocalisations of another child or adult, having physically observed the actions of the model. Reproduction can be immediate or deferred.* By the end of this thesis I hope I will be in a position to assess the efficacy of this definition and to judge whether it really is possible to adopt a unitary definition of such a complex concept as imitation.

## Part 3

## Imitation in autism - Is there evidence for a deficit?

In the last few sections of this Chapter, we have seen that theoretically and developmentally it would seem very reasonable to conclude that if there is a deficit in imitation then this could be a very important causal factor in autism. So *is* there a deficit? Unfortunately the picture is not as clear as one might hope. Some studies have concluded that there is a deficit in autism; others have found that there is no deficit, at least relative to MA matched controls. Table 1.2 is a summary of the findings to date on imitation in autism, given in chronological order. Some of these studies did not set out to examine imitation per se but to examine the sensori-motor skills of which imitation is just one. Most of the studies presented here were used by Rogers and Pennington (1991) as evidence for a deficit in imitation, but the picture is by no means so clear cut. Heimann et al.(1992) have attempted a fairly comprehensive but preliminary study of different types of imitation but unfortunately the full study has not yet been published.

Previous studies of imitation in autism can be identified as falling into one of three categories. These categories relate to some extent to the different types of imitation mentioned in the previous section: first, those that looked at gestural and vocal imitation, mostly using tests of sensorimotor skills (based on Piaget's (1952) stages of development); second, those that looked at procedural imitation - using actions with objects; and finally, I will look at what are called pantomime actions - where no objects are used but a meaningful or pretend action is performed. The main studies are summarised in Table 1.2.

a) Vocal and gestural Imitation:

This is the area that has been investigated most frequently with regard to autism. Some studies have looked at imitation as one of the sensori-motor abilities, using tests such as the Uzgiris and Hunt Scale (1975). These tests examined a variety of actions along Piaget's continuum: from simple familiar actions to combinations of actions to unfamiliar actions; from actions visible to the imitator to actions invisible to the child. Two studies found that autistic children performed worse on imitation,

both vocal and gestural, than non-autistic children (Sigman & Ungerer, 1984; Herzig, Snow & Sherman, 1989) and a third study found that imitation was the least mastered sensori-motor skill and dependent on verbal ability, but did not use any controls (Abrahamsen & Mitchell, 1990). Two studies found no deficits in gestural and vocal imitation, relative to controls (Thatcher, 1977; Morgan et al., 1989) and Charman and Baron-Cohen (1994) also found no deficit in gestural imitation using a task based on the Uzgiris & Hunt Scale (1975).

DeMyer et al. (1972), the first to study imitation in autism, found that autistic children were impaired in body imitation relative to schizophrenic and non-autistic, but subnormal, controls. Although as we will see, DeMyer et al.'s study looked at several aspects of autism, their subject numbers were relatively small with just 9 autistic, 3 schizophrenic and 5 control subjects. Although the psychotic subjects (autistic plus schizophrenic) were fairly closely matched on chronological age with the non-psychotic, they were not matched on mental age of any description (although the verbal ages are presented in the subject information). Conversely, some of the control children suffered from motor problems which, especially in body imitation, could have lowered their performance and *reduced* any differences between psychotic and non-psychotic groups.

Jones and Prior (1985) found that autistic children did significantly worse than controls on imitation of both gestures and dynamic body movements, mostly involving hand and arm movements, with high variability from child to child. In general, they found that 6-10 year old autistic children were not even performing at pre-school level on these tasks. They still performed worse than their MA-matched counterparts. Jones and Prior suggested that the poor performance on imitation may be due to inadequate neuromotor development - an inability to coordinate their limbs when an appreciation of height and depth are necessary. However, an extra control where the children were asked to perform an action, or instructed to do so, could have gone a long way to backing up this suggestion.

Ohta (1987) looked specifically at gestural imitation and found deficits for autistic children. Those children who attempted the more difficult actions tended to produce what Ohta called "partial imitations", such as a reversal of the hands or a change in orientation. Ohta suggested that if they can show partial imitation then it is

evidence that it may be a disorder in, rather than a delayed competence of, gestural imitation. She proposed that this problem was sited in the ability for mental imaging, especially concerning body images, and that it was therefore possible that there was an impairment in symbolic representational functioning in autism.

Other studies looked at gestural imitation as one of several imitation abilities. Stone et al. (1990) examined body/gestural imitation using a battery of tasks based on DeMyer et al.'s (1972) study and found that autistic children were impaired in imitation relative to several different control groups. Another study which unfortunately is still preliminary, by Heimann et al. (1992), attempted a comprehensive investigation of imitation, including object manipulation, vocal imitation, facial imitation, motor imitation and object substitution with five autistic children. They compared the results from this study to the results from three normal four year olds and 28 twelve month old infants and found that all but one autistic child showed some imitation on the object manipulation tasks but only one or two showed imitation on the other tasks, with more difficulty experienced on motor and substitution tasks. The children in the other groups displayed an overall higher tendency to imitate.

In addition to investigating communication via imitation in normal toddlers, Nadel and Fontaine (1989) observed autistic children in a similar situation to the paradigm described earlier (page 27). They tested 16 autistic children, 8 of which were echolalic and showed some gestural imitation and eight who did not. They conducted a second-by-second analysis of social performance for four of the echolalic and gestural imitative children. They found that none of the four children attained the 3 year old level of social performance based on spontaneous imitations of the partner's gestures or verbal utterances. The non-imitative autistic children were not able to show any social involvement.

A study of imitation and executive function in high-functioning persons with autism was recently carried out by Rogers and McEvoy (1993). Seventeen subjects with autism were compared to 15 subjects with learning difficulties on executive function tasks and imitation tasks which varied with visibility, sequentiality and meaningfulness. They found that the autistic subjects performed worse on all praxis tasks except imitations of meaningful single hand and arm movements and

meaningful facial expressions. They were also impaired on executive function tasks, the performance on which was found to correlate with the performance on the imitation tasks. However, the authors suggested that the deficits in imitation could not be solely attributed to executive functioning problems, since the subjects appeared more dependent on visual feedback to carry out motor movements, especially single facial movements, than the controls.

b) Object imitation:

Some of the studies already mentioned above also examined actions with objects. Heimann et al's (1992) study found deficits with all types of imitation except for simple manipulation of objects. Imitating the functional or symbolic use of objects posed problems for most of the autistic children, although Heimann et al. noted that one or two children did show imitation on some of the categories. In contrast, the normal children had few problems with these tasks.

Secondly, in addition to testing four body movements, Stone et al. (1990) tested 8 actions involving objects but not entailing any pretense. Again they found that autistic children were worse than controls at imitating these actions. This study focused on imitation, play and the diagnosis of autism and the authors concluded that both skills could be important in distinguishing autism from the many other disorders with which it is often confused. Stone et al.'s study replicated the results of DeMyer et al. (1972), who found that autistic (psychotic) children were impaired on imitating actions on objects but not on spontaneous object use. The autistic children did perform slightly better on the actions on objects tasks than the body imitation tasks but on both were worse than controls. They also noted that when the actions with objects required some pantomime or symbolic quality the autistic children did worse still. DeMyer et al. concluded that autistic children had more difficulty with body imitation and symbolic imitation because they did not have a constant point of reference as they did in the action on object tasks. Once the action was complete there was no visible clue for the children. They suggested that the impairment affecting imitation might be some sort of specific agnosia about body parts or proxy, also recently suggested by Smith and Bryson (1994).

Charman & Baron-Cohen (1994) also examined what they called "procedural" imitation which consisted of four tasks involving actions on objects, based on tasks used by Meltzoff (1988b). As for gestural imitation, they found no deficits for autistic children relative to controls although their results showed a tendency for the autistic children to find the procedural task harder than the gestural imitation task, since 8 out of 20 subjects did not score 4 out of 4 on the procedural task but only 2 children failed to do so on the gestural tasks. Only one child did not score 3 out of 4 imitations on both tasks. While the children in this study did not seem to have a problem with imitation, it must be remembered that the tasks used can be successfully completed by 9 month old normal children (Meltzoff 1988b) and one must ask how autistic children would cope on tasks that older normal children can pass.

Hammes and Langdell (1981) investigated imitation of actions with objects and found that autistic children had few problems with non-symbolic actions, such as giving the doll a drink, when cup and doll are both present (although it could be argued that this still needs imagination, even if not the capacity to symbolise). However, when a real object was coupled with an imaginary object or when the task was fully symbolic, the autistic children had more problems. In addition to lower levels of imitation, Hammes and Langdell also found that those children who attempted to imitate, produced partial imitations, such as using a body part as object, e.g. stirring their finger in a cup.

Finally, Curchio and Piserchia (1978) tested 24 psychotic children (not necessarily autistic, although they compared their results to those of DeMyer et al., 1972). They tested these children on non-symbolic tasks as a control for pantomimic tasks and found that the children were 96% successful on the non-symbolic tasks. They found no difference between body and object directed actions.

c) Pantomime/symbolic action imitation:

The only study to really investigate this type of action was the Curchio and Piserchia (1978) study described immediately above. They found that, although few

children completely failed pantomimic tasks (only 8-9% failed to give any response), there was a huge majority of partial imitations. They found that the ability to imitate correlated with language ability and that if the demonstrator stopped demonstrating, the child could no longer imitate the action. In other words it is as DeMyer et al. (1972) suggested, that not having a point of reference affects the ability to imitate. Curchio and Piserchia concluded that the problem for autistic and psychotic children lies in a lack of a representational ability.

Because of the delay in diagnosing autism, it is not known whether autistic children show very early imitation. All the above studies have used autistic children above 3 years of age although a few studies have attempted to ask parents about their child's early behaviour. Klin et al. (1992) investigated early social behaviours and found that parents of autistic children consistently describe their children as lacking the elicited imitation skills usually seen in normally developing children who are one year old. Le Couteur et al. (1989) found that 94% of autistic children were described by their parents as having little or no spontaneous imitation, compared to only 9 % of non-autistic IQ matched children with learning disabilities. On the other hand, Lord (1991) found that a significant minority of parents reported evidence of imitation during infancy in autistic children who at a later age were quite unable to reproduce actions upon demand.

There are a few more studies which did not investigate the deficit in imitation but actually used imitation to improve the abilities of autistic subjects. These studies looked at the effects of imitation on behaviour and also the factors affecting imitation in autistic children. Tryon and Keane (1986) investigated the use of observational learning, using normal peer models, to promote imitative play. They tested 3 boys who watched a peer playing with a toy and then were allowed to play with that toy among others. They found that through observational learning the three autistic-like boys tested showed an increase in imitative play and a decrease in self-stimulation. An increase in appropriate play with novel toys was also recorded, over the experimental session. To begin with the subjects had shown very little evidence of imitation but by the end Tryon & Keane said it was clear that these boys were imitating. With only three subjects it is difficult to assess the significance of these findings. The boys did have a mental age of over 4 years and this could be seen as

evidence that perhaps even with an early deficit in imitation, autistic children can pick it up later, with a little help from those around them.

Table 1.2: A summary of the evidence for and against a deficit in imitation in autistic children, presented in chronological order and included subjects used, type of imitation investigated and the conclusions made by the authors.

| **Authors** | **Type of Imitation** | | | | **Conclusions** |
|---|---|---|---|---|---|
| **subjects** | **Body/gestural** | **Vocal** | **Non-symbolic objects** | **Symbolic objects/actions** | |
| DeMyer et al. 1972<br><br>9 autistic<br>3 childhood schiz<br>5 subnormal controls | *Examples* :<br>Easy: touch nose<br>Possible: hop<br>Difficult: march<br>*Results* :<br>E: AUS scored 34% less than controls<br>P: 35% less<br>D: no sig. diff. | | *Examples*:<br>E: bang spoons<br>P: Step over low board<br>D: Throw ball to basket<br>*Results*:<br>E: 7% less than controls<br>P: 20.5 % less<br>D: no sig. diff. | | The lack of a point of reference in body imitation could be an important factor in the case of autistic children. |
| Masagatani 1975<br><br>observation of 18 psychotic children | Hand gestures - some imitation was observed but this diminished over time. | | | | |
| Thatcher, 1977<br><br>autistic children | Used Uzgiris-Hunt scale (1975)<br><br>*Results*: autistic children pass both gestural and vocal items at an MA appropriate level. | | | | |

| Authors | Type of Imitation | | | | Conclusions |
|---|---|---|---|---|---|
| **subjects** | **Body/gestural** | **Vocal** | **Non-symbolic objects** | **Symbolic objects/actions** | |
| Curcio and Piserchia, 1978<br><br>24 psychotic children - verbal instructions and modeling conditions used | *Examples*:<br>Clapping 2 fists<br>Poking 1 finger into palm of hand<br><br>*Results:*<br>96% success | | | *Examples*:<br>brush hair with imaginary comb (body-directed)<br>Cut fruit with imag. knife (object-directed)<br><br>*Results*:<br>No significant differences between modeling and verbal conditions.<br>20% of children passed. Biggest % of responses was in partial imitations.<br>Imitation was better when modeling continued. | Problem is a lack of representational ability |
| Hammes and Langdell, 1981<br><br>8 autistic<br>8 retarded | | | *Example*:<br>1) giving doll a drink<br>2) drawing line on paper<br><br>*Results*: all but one child copied actions in this category. | *Examples*:<br>1) pour from pot into imaginary cup<br>2) pour from imaginary teapot into imaginary cup.<br><br>*Results*:<br>In tasks like 1), 6 of the autistic children didn't copy at all. In | Autistic children seem able to imitate concrete actions but not those that require a more symbolic quality. |

| Authors | Type of Imitation | | | | Conclusions |
|---|---|---|---|---|---|
| subjects | Body/gestural | Vocal | Non-symbolic objects | Symbolic objects/actions | |
| | | | | tasks like 2), 6 of the children showed closed gestures (partial imitations) or didn't imitate at all. | |
| Sigman & Ungerer, 1984<br><br>16 autistic<br>16 mentally retarded<br>12 normal | Used Uzgiris-Hunt ordinal scale of psychological development (1975)<br><br>*Results:*<br>Autistic group showed more deficits in the ability to imitate than controls. | | | | |
| Ohta, 1987<br><br>16 autistic<br>16 age and IQ matched retarded children<br>189 pre-school children. | | | | | Partial imitation is a disorder in, rather than a delayed competence of gesture imitation. It may be a disorder in mental image, especially body image - could be as a result of an impairment in symbolic representational functioning. |

| Authors | Type of Imitation | | | | Conclusions |
|---|---|---|---|---|---|
| **subjects** | **Body/gestural** | **Vocal** | **Non-symbolic objects** | **Symbolic objects/actions** | |
| Morgan et al. 1989<br><br>10 autistic<br>10 language matched retarded<br>10 normal | Used Dunst and Uzgiris-Hunt tests of sensorimotor skills<br><br>*Results*:<br>Found no autistic deficits for either vocal or gestural imitation. | | | | |
| Herzig, Snow & Sherman, 1989<br><br>autistic<br>IQ-matched retarded<br>language matched normal | Examined imitation as one of the sensorimotor skills.<br><br>*Results*:<br>Autistic children performed more poorly than all controls, especially on actions that were affective in content. | | | Examined symbolic imitation | |
| Abrahamsen & Mitchell, 1990<br><br>10 autistic children | Assessed sensori-motor skills and language.<br><br>*Results*:<br>Imitation is the least mastered sensorimotor skill. Correlation found between vocal imitation and the production of spoken language. | | | | Results do not explain why autistic children are less proficient at imitation. More pronounced discrepancies in less verbal children. |

| Authors | Type of Imitation | | | | Conclusions |
|---|---|---|---|---|---|
| **subjects** | **Body/gestural** | **Vocal** | **Non-symbolic objects** | **Symbolic objects/actions** | |
| Stone et al., 1990<br><br>22 autistic children<br>15 mentally retarded<br>19 language-impaired<br>15 hearing impaired<br>20 normal. | Examined play and imitation abilities as possible diagnostic criteria.<br><br>Four actions<br>*Examples*:<br>Clapping hands<br>Touching nose<br><br>*Results*:<br>Imitation abilities lower in autistic children than in controls. | | Eight actions<br>*Examples*:<br>Stirring spoon in a cup<br>Talking on a toy telephone<br>Building a pyramid.<br><br>*Results*:<br>Imitation skills of autistic children significantly lower than controls | | Imitation could be a powerful test for helping to diagnose autism as opposed to any of the disorders with which it is often confused at the earlier stages. |
| Heimann et al., 1992<br><br>5 autistic<br>3 four year olds<br>28 twelve month old infants. | Tested for all categories in a preliminary study.<br><br>*Results:*<br>All but one autistic child showed imitation on the object manipulation tasks. Difficulties were found on all other tasks, especially motor and substitution tasks. | | | | |

| Authors | Type of Imitation | | | | Conclusions |
|---|---|---|---|---|---|
| **subjects** | **Body/gestural** | **Vocal** | **Non-symbolic objects** | **Symbolic objects/actions** | |
| Rogers and McEvoy, 1993<br><br>17 high functioning autistic people<br>15 matched controls with learning difficulties. | Used meaningful and non-meaningful hand, arm and face movements, from praxis battery.<br><br>*Results*:<br>Autistic subjects did worse on almost all praxis tasks (not on meaningful single hand/arm movements or meaningful facial expressions). | | Imitation of object use was used as a control for the pantomime task.<br><br>*Results*:<br>Autistic subjects did not differ from controls. | (Tested ability to pantomime common actions such as using a toothbrush in response to a verbal instruction - autistic subjects did worse on this than controls.) | Even older, high-functioning people with autism have problems with imitation, independent of memory, motor or verbal abilities. Imitation deficit is NOT secondary to the symbolic deficit. Also impaired on executive functions but authors suggest this does not underlie all the deficits in imitation tasks. |
| Loveland et al. 1994<br><br>18 young adults with autism<br>24 with Down's Syndrome (DS). | Tested the imitation of and expression of facial affect.<br><br>*Results*:<br>Autistic subjects performed similarly poorly on both imitation and expression, although imitation was not sig. worse than for DS. | | | | Autistic subjects can imitate facial expressions about the same as subjects with Down's Syndrome, who are much better at producing facial expressions on an instruction to do so. |

| **Authors** | **Type of Imitation** | | | | **Conclusions** |
|---|---|---|---|---|---|
| **subjects** | **Body/gestural** | **Vocal** | **Non-symbolic objects** | **Symbolic objects/actions** | |
| Charman & Baron-Cohen, 1994<br><br>20 autistic children<br>23 children with learning difficulties. | Tested gestural imitation based on Usgiriz & Hunt Scale.<br><br>*Results*:<br>No group differences and reliability was quite high with only two autistic children failing to imitate reliably. | | Tested procedural imitation with tasks based on Meltzoff (1988).<br><br>*Results*:<br>No significant group differences but 8 autistic children failed to respond reliably. | | Ability to imitate may be delayed in autism but is not altogether absent. They stress the need to look at younger children still to see at what age imitate develops and whether it could be a useful tool in diagnosis. |

There has also been some success in using models to teach language, for example, to autistic children (Charlop, Schreibman & Tryon, 1983). Both peer and adult models have been used. Carr & Darcy (1990) used peer models to teach the game of Follow-the-leader. Charlop *et al.* suggested that peer modeling was more effective. But Ihrig and Wolchik (1988) compared the effectiveness of a peer and adult model in teaching expressive language, and found no significant difference - the autistic children learned independent of who was modeling.

Another interesting and potentially very important finding comes from the work of Dawson. In two studies, one with Galpert (1990), and one with Adams (1984), she has shown that the use of imitation of the behaviour of the child, by the experimenter, helped to make the child more socially responsive, produced more eye contact and decreased perseverative play, than when the experimenter modeled either a familiar or a novel action (Dawson and Adams, 1984). This would tie in with evidence from normal development, since the largest part of interactions with the mother in infancy, consists of the mother imitating the actions of the child - it is as the child increases in age that he/she imitates the actions of the mother (Trevarthen, 1979; Stern, 1985). Dawson and Galpert (1990) carried out a similar experiment except this time they used the mother as the model/imitator. They showed an increase in gaze at the mother's face and actions, when the mother imitated the child's use of the toys. Over the 2-week intervention period, they found a significant increase in these measures during the free-play sessions. Imitation also increased toy play over this period. Parent questionnaires showed that the parents felt their child's behaviour at home had improved at least slightly over the two weeks.

Finally, a study by Nadel and Pezé (1992) used an adult model in a repeated therapeutic session of imitating and being imitated. They found an increase in social behaviour with the exchanges at first being mostly imitative, controlled by the experimenter but later becoming spontaneous, with the autistic child switching from imitating to modeling but not vice-versa. Overall, there was an increase in cooperative exchanges and a decrease in imitative exchanges over the period of the treatment. It was concluded (Nadel and Camaioni, 1993) that "this suggests that imitative structures of interaction do not only generate imitative structures but can

serve as a template for other forms of exchanges as well. It also supports the idea that imitative exchanges are earlier and simpler than other interactive formats, in autistic children as in normal toddlers".

*Summary of evidence:*

First of all, it must be noted that the issue of imitation in autism is still very unclear. Ten studies found problems with body or gestural imitation. Three studies did not. Three studies found problems with imitating actions with objects that did not involve pretense, while three studies found no problem with non-symbolic actions. Five studies, in addition, found problems with symbolic actions with objects and pantomimic actions. So while more studies found evidence for a deficit in at least some aspects of imitation than found evidence against a deficit, the amount of evidence against each type of imitation is enough to make it extremely difficult to conclude whether a specific deficit really exists. The exception to this is symbolic imitation, in which all studies found autistic children and adults to have deficits. This is not surprising considering autistic children generally have problems with pretend play and other symbolic abilities.

In addition to the lack of clarity on the picture of evidence, there are many inconsistencies within the methodology used in previous studies. Some studies quoted here used very small samples, some used not just autistic children, but psychotic children. Other studies did not have any control subjects, and some that did had matched their controls on chronological age (CA), rather than mental age (MA). Few studies have looked at more than two aspects of imitation, e.g. gestural and vocal, or gestural and actions with objects, or action with objects, both non-symbolic and symbolic. Only one study attempted such a comprehensive investigation (Heimann et al., 1992) and we are still waiting for publication of the full study. Finally, only one study has looked at spontaneous imitation, in a naturalistic environment (Nadel & Fontaine, 1989) - all the other studies have examined immediate imitation in an experimental situation. No one has looked at the autistic child's ability for deferred imitation or their ability to problem-solve with a novel object, by imitation, both of which Piaget's theory suggested might be more developmentally difficult.

Finally, whether there is a general deficit in the ability to imitate or not, it seems probable that imitation of the autistic child by the caretaker or an experimenter can increase basic social interaction abilities such as mutual eye gaze, social responsiveness and appropriate behaviour, especially play behaviour. It is possible that interventions of this type at an earlier stage in development, combined with encouragement to imitate and the use of imitation as a teaching tool, may help to improve child/care-giver interaction, interpersonal relations, lessen the effect of later emerging deficits and thus improve prognosis at least for some autistic children.

Smith and Bryson (1994) in their critical review of imitation and action in autism mentioned earlier, suggested that several things are necessary in a future study of imitation in order to provide a better description of the imitative deficit. Firstly, as already mentioned above, better controls need to be adopted to test the specificity of imitation deficits to autism. Secondly, further manipulation of test variables are needed to test distinctions between visible and invisible actions, between actions with and without objects, between oral (facial) and manual movements, between one-handed and two-handed actions and between symbolic and non-symbolic actions. Thirdly, older children and adults who fall at different points of the continuum or with varying degree of disability need to be examined - only then can we build up a fuller picture of imitation in autism.

The main aim of this thesis was thus to conduct a comprehensive study into imitation, taking into account the different types of actions as well as adding in the developmental perspective and other distinctions such as the spontaneous/elicited distinction and the deferred/immediate distinction discussed in the previous section and also in the next section.

Now that I have examined the concept of imitation in both normal and autistic development and the evidence for and against a deficit in imitation specific to autism, it is time to present further analysis of the theory of Rogers and Pennington, bearing in mind the literature and those theoretical and conceptual issues which I have reviewed in the past two sections.

## Part 4
## Analysis of Rogers and Pennington's theory

So far we have seen that Rogers and Pennington's theory seems to be a very important one. There is some evidence that some types of imitation is deficient in some autistic children and that emotion perception and the ability to use a theory of mind is also deficient. Rogers and Pennington's theory appears to be well founded in normal development and a deficit in early imitation, combined with later deficits in the other abilities proposed, would seem to be a good explanation for the problems experienced by autistic children. However, I have a few concerns or rather reservations about this theory. I shall attempt here to deal with these as comprehensively but as concisely as possible.

1) As already mentioned the only aspect that differentiated Rogers and Pennington's theory from other theories is the presence of a deficit in autism. However, Rogers and Pennington do not define imitation or deal with the difficulties of testing imitation as a unitary concept. For the most part previous studies only examined immediate elicited imitation of one or two types of action. We saw how Piaget proposed that imitation develops through different types of actions. Although the ability to imitate may be a unitary phenomenon, imitation at different stages of development requires other abilities such as representation, pretense, memory and usually requires motivation. In addition to these problems with previous studies, we have seen that there is still some debate about whether a deficit in even immediate, elicited imitation exists.

Rogers and Pennington proposed that a deficit in imitation would be most noticeable and handicapping in young autistic children. Unfortunately they did not specify what they meant by "young", nor whether it was chronological or mental age that was most important. They used some of the previous studies described above as evidence for their theory yet the children in these studies were mostly described in terms of only chronological age and diagnosis. Those studies that did use mental age varied in the ages they used. In general, all the children tested were above 3 years chronologically and varied in mental age. This makes it extremely hard to 1)

interpret previous findings in terms of Rogers and Pennington's theory and 2) make predictions for the present study, at least not in specific terms.

2) As in most theories, Rogers and Pennington only explain some aspects of autism, although they do suggest that, especially in adults, the deficits they propose would be related to executive function tasks. Executive function tasks may explain the insistence on sameness and obsession with routines and lack of an ability to plan ahead or cope with new routines.

3) As mentioned in 1) above, Rogers and Pennington did not define imitation nor did they discuss the methodological difficulties of studying imitation. The confounding issues of motivation and memory are important, as are the differing manifestations of the ability to imitate at different stages in development. Piaget proposed that vocal imitation was the first "type" of imitation to emerge, followed by familiar actions and then unfamiliar actions, then actions involving representation and memory such as symbolic imitation and deferred imitation. If autistic children only show problems with deferred symbolic and problem-solving types of tasks, then it cannot be said that they have a general deficit in imitation. Piaget also made a distinction between imitation of visible and invisible actions. Rogers and Pennington did not acknowledge any of these issues and talk about imitation as a unitary concept, although as we have seen Smith and Bryson (1994) proposed that an thorough examination of imitation of different types of actions is essential to the true understanding of both imitation and autism. Rogers and Pennington did, however, propose a differentiation between vocal and gestural imitation which was found in many of the studies of sensorimotor skills in autistic children. It is also important to differentiate between spontaneous and elicited imitation for it may be that autistic children can imitate if asked but chose not to imitate in everyday life. Ambitious as it may seem, this thesis will attempt to make each of these differentiations.

4) Another suggestion from Rogers and Pennington was that the first symptoms of autism in infancy would be a subtle lack of imitation, affective mutuality and joint attention. Indeed Klin et al (1992) and Le Couteur (1989) found that parents reported a lack of both elicited and spontaneous imitation in their young autistic children. Lord (1991), on the other hand, found that autistic children who

imitated spontaneously according to the parents in early childhood, were not necessarily able to imitate when asked at a later stage.

5) Apart from the difficulties of testing imitation itself, it is very difficult to test the underlying problem in a way that would differentiate this theory from that of Baron-Cohen et al. (1985) or Hobson (1986; 1993). Rogers and Pennington did acknowledge that it would be very difficult to test their theory of early infant development because of the age of diagnosis but they suggested that any such an attempt should take the form of a longitudinal study. However, it is hard to visualise how even a longitudinal study would distinguish between an underlying problem of the formation and coordination of specific self-other representation, a deficit in the innate ability to form affective relations or a deficit in metarepresentation, all of which produce similar behavioural symptoms.

Rogers and Pennington proposed, however, that the important thing was not that imitation was deficient but how imitation interacts with the other deficits. This is the true test of their theory. They predicted that in a "longitudinal study of normally developing infants there would be positive, predictive correlations between imitation, emotion sharing, joint attention and later performance on theory of mind tasks". In addition, they predicted similar positive correlations in both longitudinal and cross-sectional studies of young autistic children. In young autistic children they predicted a profile involving related deficits in imitation, affect sharing, joint attention and symbolic play. For older autistic children and adults, they predicted relationships between theory of mind, affect praxis and pragmatics of language, with additional relationships between these deficits and executive function deficits.

As in all theories of autism the links between abilities are only hypothetical. Although the main focus of the present thesis is to examine imitation in autism, it is desirable to test at least some of the other deficits in order to examine Rogers and Pennington's theory. It was not possible within the scope of this thesis to conduct a longitudinal study so a cross-sectional study of autistic children of varying ages was conducted. The autistic individuals used in this study ranged from 4 to 34 years of age, with a mental age range of 18 months to 11 years. With this subject pool, I could attempt to investigate any developmental trend in autism. Such a comprehensive study of autism has never before been attempted.

**Associated Deficits in Autism**

To recap, Rogers and Pennington (1991) predicted that association with a deficit in imitation at an early stage would be deficits in emotion sharing and "theory of mind". For young children the later would be evident in problems with joint attention and pretend play, while in older children and adults, "higher" theory of mind abilities such as deception and false-belief would be impaired as well as pragmatic aspects of language. In the following section I will briefly present the existing evidence for each of these deficits followed by a short section on deficits in social interaction which will be used as a general index of autism in the observational study reported in Chapter 2.

*1) Emotion perception and sharing:*

"Typically, there is no display of affection..." (Kanner, 1943)

"Peter had outbursts of hilarity, and occasionally violent temper tantrums, although it was very hard to understand why he had them." (Frith, 1989; page 3)

We have already looked at some of the evidence for emotion perception deficits in autism when considering Hobson's theory. However, there are many other studies to consider. Deficits in emotion perception, using tests of matching facial expressions to other types of expression, namely sounds, gestures, body posture, and contexts in stories, have been carried out mostly by Hobson and his colleagues. Deficits in emotion perception have been found in the majority of studies (Hobson, 1986a, 1986b; Weeks and Hobson, 1987; Hobson, Ouston and Lee, 1988, 1989; Ozonoff, Pennington and Rogers, 1991). Additionally, Hobson, Ouston and Lee (1988) found that autistic children recognised faces better if they were presented upside-down. They proposed that the autistic children were recognizing a perceptual pattern rather than the face as a whole, meaningful entity. (See also Langdell, 1978). Hobson, Ouston and Lee (1988) also found that autistic children were better at recognizing emotionally spoken meaningless utterances than emotionally spoken real sentences. A third study along the same lines by Weeks and Hobson (1987), found that emotional expression had little salience for autistic

children in a sorting task. Autistic children tended to sort by hat worn and sex before expression whereas non-autistic children sorted by expression before hat.

Finally, in evidence for an emotion perception deficit in autism, Loveland et al (1994a) found that, in a test of cross-modal perception of affect, both autistic and Downs Syndrome children did better when rhythmic synchrony information was available, i.e. when the soundtrack was synchronised with the video of the animated emotional faces. When there was no synchrony, the autistic children did worse than the Downs Syndrome children, who still were able to match the soundtrack to the correct face. They concluded that there was a problem in matching sounds to faces, especially when the information available was non-synchronous. However, they did not test their children on recognizing facial expression per se. It could have been that the autistic children were even poorer at just recognizing the facial expression in the first place, and were actually better when they had more information to go on. i.e. utterances. A second study by Loveland et al. (1994b) looked at imitation and expression of facial affect in autism. They found that children with autism did produce some recognizable expressions in both tasks but fewer than Downs Syndrome children on the expression tasks. Autistic children performed similarly on the two tasks, i.e. imitation of and elicited expression of facial emotion, but the Down's Syndrome children did much better on expression of emotions.

There are two studies at least which do not provide us with evidence for a deficit in autism. Prior et al. (1991) attempted to replicate Hobson's 1986 study, with groups of autistic and control children matched on verbal MA and language ability. They failed, however, to find any deficit in emotion perception in autistic children relative to control children.

Secondly, a study by Davies, Bishop, Manstead and Tantam (1994) on face perception found that autistic children performed worse on both facial and non-facial tasks. Furthermore, the deficits in face recognition were not emotion specific - autistic children were just as bad on facial identity. However, this finding was only for those of higher ability. There were no differences between the control children and autistic children of lower ability. They made two proposals: 1) when autistic children are better at recognizing facial expression it is because of a delay in development. In normal development, children below ten years can recognise faces

and facial expressions equally well upside-down. However, once they reach ten years, they do much better when faces are the right way up. Autistic children have not reached this point in development where faces are much more salient when presented the right way up. 2) The deficits seen in high functioning autistic children on the facial recognition tasks may be due to executive function problems, namely being able to apply different categories to the same picture.

Finally, Rutter (1990) points out that there *are* problems in the production and perception of emotional expression in all modalities but some more able children are able to pass on one or two modalities. Therefore, emotion perception difficulties cannot be used as diagnostic criteria of autism, since not universal. However, this is an important piece of evidence when considering theories of autism, although one most remember that the primary affective problem, according to Hobson (1993), should be most important in infancy. It is quite possible that although autistic children have problems at this stage, they can learn to recognise most emotions, at least those that for the most part are externally observable, e.g. from facial expressions.

Little evidence of empathy is available but it is suggested that without being able to recognise emotions, empathizing would also be extremely difficult. Mundy (1986) and Snow et al (1987) both showed deficits in affective expression and affect sharing, which would suggest that empathy would be impaired in autism.

*2) Theory of mind*

(i) Pretend Play:

".....In his second year, he "developed a mania for spinning blocks and pans and other round objects". At the same time, he had "a dislike for self-propelling vehicles, such as Taylor-tots, tricycles and swings...He was always constantly happy and busy entertaining himself, but resented being urged to play with certain things"....

There was a marked limitation of spontaneous activity. He wandered about smiling, making stereotyped movements with his fingers, crossing them about in the air. He shook his head from side to side, whispering or humming the same three-note tune. he spun with great pleasure anything he could seize upon to spin. He kept throwing things on the floor, seeming to delight in the sounds they made. He arranged beads, sticks or blocks in groups of differing series of colours.....Most of his actions were

> repetitious.....If he spun a block, he must always start with the same face uppermost. When he threaded buttons, he arranged them in a certain sequence that had no pattern to it but happened to be the order used by the father when he had first shown them to Donald." (Kanner 1943)

Once again, as we see above, lack of spontaneous activity is one of the things Kanner noted in all the children he described. The autistic children produced only manipulative, repetitive and obsessional play, especially at a young age. However, Kanner does note that some of the children he had seen improved with age and produced a reasonably high level of functional play with objects, in addition to the manipulative or repetitive play. However, there was always a severe lack of imaginative play, or pretend play.

More recent studies have tended to concentrate on pretend play, although a few studies have looked at functional play, too. However, while many of these studies set out to examine symbolic play, most of them provide comment on the types of play autistic children produce in place of symbolic play. Wing, Gould Yeates and Brierley (1977) was one of the first studies to look at symbolic play. Using the same children from the Camberwell study as produced the triad of impairments and types of autistic child, they examined play behaviours and found that the group of children could be divided on the basis of play types into exactly the same groups as when social interaction was used to categorise them - those showing the triad of impairments, and therefore autism, showed less symbolic play than those without the social deficits, indicative of autism.

Ungerer and Sigman (1981) examined both functional and symbolic play in an observational study and found that non-autistic children tended to engage in relatively more frequent, more varied and more integrated actions in both functional and symbolic play categories than their autistic counterparts. Autistic children were less likely to produce object-directed and doll-directed play. This finding is reflected in a study by Mundy et al. (1987 and Sigman and Mundy, 1987) who looked at joint attention, play and language and found that in general those who showed joint attention did produce more elaborate symbolic play. There were a number of children who engaged in some functional and symbolic play but not in joint attention and visa-versa. Although the autistic children did engage in some

functional and pretend play, they rarely used a doll as an agent nor did they direct play to other people or dolls.

Gould (1986), Mundy et al (1986) and Sigman and Ungerer (1984c) assessed autistic children's capacity for symbolic play in both a free play session and in a structured or prompted situation and found that they produce much more pretense when a prompt is used, than they do spontaneously. Baron-Cohen (1987) also found that autistic children could engage in some symbolic play but that this was much impoverished compared to the play of non-autistic children.

Finally, a further study in this vein by Lewis and Boucher (1988) found that autistic children produce little if any pretend play spontaneously and also produce less functional play than controls. However, they do seem to perform better when the pretend play is elicited from them and even better when they are given an instruction. Lewis and Boucher identified five categories of behaviour: no play, manipulative play, functional play, intermediate play and symbolic play. They found that autistic children spent less time playing functionally and that as many autistic children produced at least one act of spontaneous symbolic play as non-autistic children. They also found that functional and symbolic play assessed together was as complex as that of controls. They admitted, however, that the quality of the behaviours required further examination. More details are given about this study in Chapter 6, as Lewis and Boucher's study was used as the basis for the experiments on play in the present thesis.

ii) Joint Attention

> "Peter was fascinated by the noise of the buses that passed by on the street. He never failed to rush to the window when he heard the familiar engine noise. When he did this he never pointed to the bus, or shouted excitedly, in order to attract somebody's attention." (Frith, 1989 page 3).

Joint attention, sometimes called shared attention, and sometimes used interchangeably with the term "visual perspective taking", is one of the earliest abilities that can be noticed as deficient in autism. For the most part, autistic children show relatively intact visual-perspective taking, i.e. they can identify the target of someone's visual attention when asked to do so (Hobson, 1984; Baron-Cohen, 1989,

1991, 1994; Leekam et al., 1993; Tan and Harris, 1991). The ability to spontaneously follow another person's eye gaze or centre of attention, is generally found to be impaired (Curcio, 1978; Mundy et al. 1990; Baron-Cohen, 1989; Leekam et al, 1993). Mundy et al. (1990) found deficits in joint attention in autistic children with an MA below 30 months of age. In normal development, joint attention emerges between 6 and 12 months. Mundy et al. also reported that joint attention does seem to precede the development in pretend play and pretend play in turn precedes the development of Theory of Mind as explicit in the ability to attribute false-belief. Curcio found that autistic children displayed fewer joint attention gestures as opposed to requesting gestures and these findings were replicated by Baron-Cohen (1989) when he looked at joint attention in the light of protodeclarative versus protoimperative pointing. Leekam et al (1993) also tested joint attention using head direction and eye gaze and found that compared to non-autistic controls, autistic children were worse at spontaneously following eye gaze/head direction, although they could identify the object of attention when asked to do so.

Finally, a recent study reported by Mundy, Sigman and Kasari (1993) examined joint attention in very young autistic children and found that only those children with an MA below 20 months did significantly worse than normal controls and retarded controls. Those of an MA above 20 months showed responses to joint attention, at a similar level to the control children. They observed the children in a play session with the experimenter and assessed requesting behaviours and social interaction behaviours as well as joint attention behaviours. There were two levels of behaviours and they found that those children above 20 months, although better at lower level joint attention behaviours, were not as good at higher level behaviours.

In general, most people agree that autistic children are impaired to some extent on tests of joint attention. But Mundy et al.'s (1993) study suggests that a deficit in joint attention might be more important at a younger age, i.e. before 18 months of age.

iii) Use of mental state understanding - evidence of deception, teasing, joking.

> "Peter did not appreciate teasing. It just made him cross...He liked to watch television, and was glad to sit I in front of the set with others for company. When there was slapstick comedy, he joined in the laughter. As for soap operas, ...he could not fathom the plots. Yet he knew all the characters' names and the actors who portrayed them. He liked the goodies to be good and the baddies to be bad, but was confused if somebody was a bit of both...Peter is still totally naive and does not understand the ways of the world, for instance, why people lie or cheat." (Frith, 1989; page 5-6).

It is difficult to find evidence of these types of behaviours in autism. However, there have been a few experimental studies, which have tested some of these abilities. Frith & Sodian (1993) tested autistic children's abilities to deceive a puppet. They used two types of scenario, one based on sabotage, where the child only had to attempt to change the *behaviour* of the antagonist and one based on deception, where a *mental state* had to be manipulated. They found that autistic children were as good as controls on the *sabotage* condition but could not *deceive* the puppet. Other evidence comes from one of the false-belief paradigms, the deceptive contents task (Wimmer et al., 1983) where the autistic child cannot transfer their own experience of deception onto another person.

St.James & Tager-Flusberg (1994) conducted an observational study of humour in children with autism and Downs Syndrome. They observed six children in each group at home, over one year (6 sessions of one hour) and found that during interaction with the mother autistic children produced much fewer episodes of humour. Downs syndrome children not only produced more episodes overall, but more complicated humour and they accounted for more of the intentionality episodes. However, there was high variability between each visit and all children produced some examples of humour. As far as jokes were concerned, only two children (and both of these were children with Downs Syndrome) told even simple jokes.

Leekam and Prior (1994) looked at whether autistic children could distinguish lies from jokes and whether this was harder or easier than understanding beliefs and intentions. Although there is little evidence that autistic children can use joking and

lying in real life, autistic children have been shown to have problems with both first and second order beliefs (Baron-Cohen, 1989; Ozonoff, Pennington and Rogers, 1991). However, there have been studies that have shown that some autistic children can pass even second order belief tests (Bowler, 1992; Happé, 1991) but still do not show better understanding of mental states in an everyday situation. Leekam and Prior found that neither normal children nor autistic children found second order intention easier than belief. However, normal children did find belief easier than saying whether a person was lying or joking, while autistic children showed no differences between the two judgments. Finally, only those autistic children who passed first order false-belief, also gave consistently correct answers to second-order mental state questions.

Finally, a study by Baron-Cohen, Leslie and Frith (1986), presented autistic children with cartoon strips each of which had a story line which could be described as either mechanical, behavioural or mentalistic. The children had to put the pictures in the correct order so as to make up a story and then tell the story in their own words. I shall present the results of the later part in the next section, but for the picture-sequencing part of the task, it was found that the autistic children could handle the mechanical and behavioural picture sequences but not those requiring an mentalistic understanding of events.

This category of behaviour was investigated in the observational study as was the next.

iv) Language pragmatics

"He used the person pronouns for the person he was quoting, even imitating the intonation. ...Words to him had a specifically literal, inflexible meaning. He seemed unable to generalise, to transfer an expression to another similar object or situation. if he did so occasionally, it was a substitution, which then "stood" definitely for the original meaning....." (Kanner, 1943 page 219)

"He has a wonderful memory for words. Vocabulary is good, except for pronouns. He never initiates conversation, and conversation is limited, extensive only as far as objects go". (Kanner, 1943 page 236)

"...His language showed marked improvement, though he continued to echo phrases and to use them inappropriately. He spoke in a strange singsong voice when he was not parroting what other people said. His understanding of language seemed strangely

> limited. He knew some quite rare words and their meaning, and was able to name all shades of colours. He knew what a dodecahedron was, but he did not seem to know the meaning of such a common word as 'think'.." (Frith, 1989 page 4)

Rogers and Pennington predicted that the older autistic children and adults would show deficits in pragmatics of language and there are several ways in which language ties into evidence on "theory of mind" deficits in autism. Firstly, it has been remarked, ever since Kanner (1943) that autistic children have problems with personal pronouns, specifically with "I" and "You". By 2 years of age, normal children have mastered the use of "I/You" and "mine/yours" (Hobson, 1993). Autistic children, however, remain inept at these distinctions for many years (Tager-Flusberg, 1989; Lee, Hobson and Chiat, 1993). Hobson (1993) proposed that this deficit is an early sign that there is a problem making or appreciating the self/other distinction necessary to progress to the next level of intersubjectivity and ultimately a theory of others minds and mental states. In addition, Tomasello et al. (1993) suggested that the appropriate use of "I/You" required a special, more complex imitation capacity.

Secondly, autistic children show a poverty of mental state language, not seen in other clinical groups (Tager-Flusberg, 1989). Autistic children, when they do use mental state terms, tend to do so in an egocentric manner, (i.e. self-referencing) or using idiomatic phrases such as "I think so" and "I don't know" (Table 1.3 below shows the words used in Tager-Flusberg's study). Mundy et al (1990) found that there was no significant difference for mental state language referring to desire and perception and actual references to mental states but significant differences were found for attention and mental state references to cognition. They also found that when any of the cognitive terms were used by autistic children, not one was elaborated in any way. Subjects talked more about their own cognitions, perceptions and desires, although there was no differences between self-reference and other-reference for emotional mental states. Baron-Cohen et al. (1986) found that autistic children could give mechanical accounts of a picture story but could not give mentalistic accounts when these were more appropriate. Tager-Flusberg and Sullivan (1994) found that autistic children failed to give appropriate explanations for behaviour, with less use of terms of emotion, desire or cognition. Happé (1994a)

reported that autistic subjects used as many mental state terms as controls but did not use these appropriately for the story context. Finally Bowler (1992) found similar results with Aspergers subjects - a lack of appropriate mental state explanations.

Table 1.3: Lists of psychological state terms used by autistic and Down Syndrome Subjects in Tager-Flusberg (1992). It was from this list that words were chosen for use in the observational part of this study and on the questionnaire.

| Psychological state | | Words used by children in both groups | Words used by Downs Syndrome children only | Words used by autistic children only |
|---|---|---|---|---|
| Desire | | care, want | | wish |
| Perception | Vision | look, see, watch | | |
| | Hearing | hear, listen, noise | | loud |
| | Touch | cold, hard, hot, hurt, ouch, touch, wet | feel, messy, yucky | dry, soak |
| | Smell | smell | | |
| | Taste | | | taste, sour, yucky |
| Emotion | Behaviour | cry, hug, kiss, smile | | laugh, scream |
| | Emotion | calm, fun, happy, hate, like, love, sad, scare, | angry, better, good, mad, surprise | bad, upset, worry |
| Cognition | | dream, know, pretend, remember, think, understand, wonder | believe, figure, forget, guess, idea, mean, trick | make believe |

v) False-belief.

I have already made mention several times of false-belief tests. It is thought that the ability to predict behaviour on the basis of a false belief is the most developmentally advanced ability of an understanding of mental states and the first indication that a person has a fully developed "theory of mind". It develops further with age, for example in the number of recursions possible. There are different levels of false-belief - first-order (She believes that the ball is in the basket), second-order (She believes that he thinks that the ball is in the box), although in this case the belief in each case is mistaken because the believer has not been party to a specific piece of information. One of the first studies of false-belief was done by Wimmer & Perner (1983) with normal children and they found that normal children are capable of attributing first order false-belief at approximately 4 years of age. Second order

false-belief is possibly in the 5-6 year old and higher levels are possible as the children increases in age. However, the basic ability seems to be there by four years of age. Two different scenarios have been used to test for false-belief - the displaced or disappearing contents task (Max and the Chocolate box, Wimmer Perner, 1983; Sally/Anne task, Baron-Cohen et al., 1985) and the mistaken or deceptive contents task (Pencils in the Smarties box, Perner, Frith, Leslie and Leekam (1989). These have been done using picture stories, using dolls and using real people as actors.

The first study done on the autistic child's understanding of false-belief was carried out by Baron-Cohen, Leslie and Frith (1985). This study was the inspiration for the Metarepresentational Hypothesis of autism and sparked off many studies on false-belief in autism. This first study used the Sally/Anne Scenario (See Baron-Cohen et al, 1985; Frith, 1989; Happé, 1994 for descriptions and illustrations) and they found that 80% of autistic children failed a first-order false-belief task. Leslie and Frith (1986) replicated this finding using real people instead of dolls in the Hidden Coin paradigm and again in 1989 with Perner and Leekam using the Pencils in the Smartie tube task. Baron-Cohen (1989) tested the children who passed the first-order false-belief task on a second-order task and found that these children now failed on false-belief. Leekam and Perner (1991) tested autistic children on two different types of representation tasks - false-belief and Zaitchik's (1990) false photographs. They found that normal children found the two tasks equally difficult but that autistic children did much better on the false-photo task than on the false-belief task.

A few studies have not replicated Baron-Cohen et al.'s results. Prior et al. (1990) found problems but only for 50% of the autistic subjects, compared to 16% in the original study. Brandt & Zubris (1994) found that the autistic children in their study did not differ from controls on tests of false-belief. Ozonoff, Pennington and Rogers (1991) found that high functioning autistic subjects showed selective deficits in false-belief, executive functioning, emotion perception and verbal memory. Executive function and second order false-belief deficits were more widespread in the autistic group but first order false-belief deficit was only present in a subset of the group.

Other studies have found that there are autistic subjects who can pass both first and second order false-belief, albeit high functioning autistic subjects, and that the ability to do this is correlated highly with other abilities such as the ability to use mental state justifications (Bowler, 1992; Leekam and Prior, 1993; Tager-Flusberg and Sullivan, 1994; see Happé, 1994 for a review).

A recent and very comprehensive study on Theory of Mind had been carried out by Van der Wees and Buitelaar (1994). They tested autistic subjects on 6 first-order tasks, 6 second-order tasks and 2 emotion perception tasks. They found that there was a lack of constancy over the six first order tasks. The performance on second order tasks and emotion recognition depended on both IQ and CA. Some of the tasks were also highly correlated with verbal and visual memory skills. They also tested overt social behaviour using Matson Evaluation of Social Skills (1985) and found that there was no relationship between either Theory of Mind or emotion perception and overt social behaviour. The autistic children were worse than normal children, however, on all Theory of Mind tasks and emotion perception tasks. There were no differences between children with autism and children with other pervasive developmental disorders (PDD) but the PDD groups were much worse than the non-PDD group. However, verbal memory, IQ and CA explained more variance than diagnostic group.

In summary, it has to be said that although there is much evidence of a problem with "theory of mind" and specifically with understanding mental states, there is also still some uncertainty as to the universality and specificity of these deficits in autism. There seem to be a subgroup of autistic subjects who can pass complicated tests of Theory of Mind, yet observations of the same subjects do not show evidence of such an ability being applied to everyday life. The most convincing evidence seems to be of an inability to use mental state language, or to do so in a very limited, egocentric or inappropriate manner, even when they can pass second order false-belief tasks (discussed in Happé, 1994). However, most researchers would agree that autistic children and adults do seem to be impaired in their ability, at least in everyday life, to understand mental states.

*Social interaction*:

> "It was observed at an early time that he was happiest when left alone, almost never cried to go with his mother, did not seem to notice his father's homecomings, and was indifferent to visiting relatives.... "he seems almost to draw into his shell and live within himself"..... He paid no attention to the persons around him. When taken into a room, he completely disregarded the people and went for objects, preferably those that could be spun...He was never angry at the interfering *person*... he angrily shoved away the *hand* that was in his way.....If a child took a toy from him, he passively permitted it...." (Kanner, 1943)

Such behaviours cannot really be classed into one category for they affect play, language and include behaviours such as joint attention, which will be dealt with in the section on "theory of mind". For now some evidence on general social interaction will be considered, since this is the category that will be used as a general index of imitation in the observational study. This is probably, along with language, the most noticeable and best-known to the layman, of the autistic impairments and evidence for such a problem is strong and undisputed (for example, Rutter & Schopler, 1988; Wing, 1976). As the quotation above illustrates, it was something that Kanner noted in all the subjects that he called autistic (1943). The very term "autistic" means "alone", itself indicative of the child's lack of social interaction from these children. In fact he notes it over and over again in each case study, at several points in the child's development.

I will therefore only present a few illustrations of studies on social interaction (this category included physical contact, verbal contact, eye-contact, joint attention). First of all, I will mention the studies of Nadel and colleagues once again to remind the reader that even in the second and third year of life contact with a peer is the normal state of affairs. Contact with adults is ingrained into a child's behaviour from birth, usually due to the fact that a child is completely dependent on an adult. There is evidence that autistic children tend to show normal attachment behaviours, and many do enjoy interactions with adults (Sigman and Ungerer, 1984b), especially rough and tumble play, to take but one example (Frith, 1989). However, it is well documented that interaction with peers is greatly lacking. A study by Richer (1976) looked at the social avoidance behaviour of autistic children and confirmed that autistic children don't just fail to seek attention from others, they actively avoid it.

He quotes studies by Hutt & Ounsted (1966), Hutt & Vaisey (1966), Currie & Brannigan (1970) and Richer & Nicol (1971), all of which showed avoidance of eye contact, more time spent on the edge of a group and predominance of "flight" behaviour. Richer observed 8 autistic subjects and two non-autistic control groups, during morning and afternoon breaks in the playground. He found that they engage in very few social interactions; they often act to reduce the approaches of others; frequently move away from others; are rarely aggressive and react to approaches by other children with avoidance or flight behaviour, even when the approach is not threatening.

This, in a way, was a preemption of Wing et al.'s (1979) suggestion that there are three types of autistic children as far a social interaction is concerned - aloof children, who resemble those described above by Richer, passive children, who don't avoid contact and don't react to others picking them up either with pleasure or with protest, and finally the odd child who often actively seeks contact but whose behaviour, especially their verbal behaviour is noticeably abnormal. These are the autistic children who come up to you, may say hello, and then proceed to ask you your age, address, shoe size and the route on which you travelled to get to them (Wing and Gould, 1979; Happé, 1994; Frith, 1989).

A final study in this section is one by Lord & McGill (1989). They note in their beginning paragraph that although "autistic children's social skills with adults improve as they grow older, interactions with other children and with adolescent age-mates remain significantly impaired (Baltaxe & Simmons, 1983; Cantwell, Baker & Rutter, 1977 - in Lord & McGill, 1989)". This is a very comprehensive review of social interaction in autistic children and it also discusses many of the methodological issues which must be borne in mind when investigating a topic like social interaction. It offers further examples of studies which have shown that autistic children fail to interact socially, at least with their peers.

This category of behaviour was only used as a general index of autism in the observational study presented in Chapter 2.

To return to Rogers and Pennington's model (1991), we can see that from previous literature, the areas of impairment they propose seem to be backed by some sound evidence. Only the evidence for a deficit in imitation remains controversial. The majority of research points to a problem with emotion expression, recognition and sharing. There is an almost unanimous agreement that autistic children have problems mindreading or mentalising and thus in using a Theory of Mind. The origins of this disability are still under debate and intersubjectivity problems are just one of the many proposals. Pretend play certainly is impaired at least when spontaneous - a structured environment can increase the amount of pretend play produced by autistic children. Social interaction is generally agreed to be impaired, and there seems evidence that at least in early childhood, joint attention is impaired as are other means of non-verbal communication, such as showing and pointing. Language pragmatics are unequivocally impaired, specifically the use of personal pronouns and mental state language. The most important thing, however, is to look at how each of these behaviours are linked - only then, if a deficit in imitation is found, can Rogers and Pennington's theory really be compared and preferred to other theories of autism. This is what this thesis attempts to do.

**Aims and Predictions**

The main, overall aim of this thesis is to examine the evidence for a theory of autism such as was proposed by Rogers and Pennington (1991). In achieving this overall aim, the thesis examines the existence of a deficit in imitation. Unlike previous research, this thesis aims to test imitation comprehensively - as it emerges at different stages in development, following the theories of Piaget, in both spontaneous and elicited situations and as it combines with other abilities such as problem-solving abilities, memory and symbolic capacity. Performance on tests of joint attention, emotion perception, pretend play and false-belief will also be tested in order to examine any links which may exist between these abilities or deficits in the case of autism and thus to further test Rogers and Pennington's (1991) theory. Not only is this examined using a mixture of experiments designed specifically for this study and experiments based on existing studies, but it is also examined using

observations in a naturalistic environment of the spontaneous activity of this particular group of subjects.

In order to examine the development of the abilities under scrutiny, a cross-sectional study of autistic individuals was conducted, as suggested by Rogers and Pennington. For most of the experiments, a group of 12 autistic children and 12 autistic adults were used with a CA range of 7 to 33 years. For the imitation experiments a third group of six autistic children were used and these were young children aged between 4 and 8 years of age. This wide CA range also represented a wide range of verbal MAs and developmental ages, from 18 months to 11 years. The control groups were also chosen with this issue of development in mind. For example, there were two groups of normal children, one aged 3-4 years and one aged 5-6 years. These groups were chosen to represent the change in many aspects of development around 4 years of age (Wimmer and Perner, 1983; Nadel and Camioni, 1993). In addition, since my choice of autistic subjects was limited, it was necessary to have a younger group of children against which those autistic children who had an MA below four years could be compared. Finally, a group of children with mild to moderate learning difficulties were included so as to establish whether any deficits found in autism were specific to autism or whether they were a result of general learning difficulties. Again due to difficulties in recruiting subjects, it was not possible for this group to be matched identically with either of the autistic groups. However, a subset of non-autistic children were matched identically with a subset of autistic subjects on the basis of chronological age, mental age on the British Picture Vocabulary Scale and on the raw score for the Test for Reception of Grammar, a more stringent test of verbal ability. [3]

Few studies have used autistic adults, except when they have been very high functioning (Bowler, 1992; Happé, 1994b) so seeing how autistic adults perform on these tasks, in comparison to autistic children should prove very interesting. It is therefore very difficult to predict the results for the present study from previous literature. However, we must recap that Rogers and Pennington (1991) predicted that

[3] It had been intended to also test for non-verbal mental age after the school holidays, but on preparing to do so, I discovered that almost a third of my experimental group at the autistic school had left to go elsewhere. Since these children were from all over Scotland it was not possible to

young autistic children would show a profile of deficits in elicited imitation, joint attention, pretend play and emotion sharing. Older children and adults, on the other hand, would show a profile of deficits in theory of mind (false-belief), affect praxis and language pragmatics. Unfortunately, Rogers and Pennington did not specify what they meant by young so it is only possible to make some general predictions for the three groups.

As far as imitation is concerned, the autistic adults should be reasonably able on the tests of elicited imitation although they may have more problems with deferred and problem-solving behaviour, since these involve other abilities as well as imitation. The group of young autistic children would for the most part have the most problems with imitation. Within the school age group there should be positive relationships between age and elicited imitation. The amount of imitation showed spontaneously should be negatively related to age, as Nadel proposed. Deferred imitation and imitation as a problem-solving tool on a novel object have not been examined before in autistic subjects, so it is not possible to make predictions. I would also predict that imitation involving any form of pretense (Stone et al., 1990; Heinmann et al., 1992; Curcio and Piscerchia, 1978), should be affected while others remain intact, at least in the older children. With regard to the other distinctions between imitation of different actions (Smith and Bryson,1994), few predictions can be made as no one has examined this before.

Other more specific predictions are as follows:

1) In the observational study, autistic subjects should show less social interaction, especially with peers (Richer, 1986; Strain and Cooke, 1976; Lord and McGill, 1989); less imitation, pretend play, and evidence of a "theory of mind", e.g. joint attention, use of mental state language, empathy and teasing, lying, joking and deception. Autistic subjects should also show more manipulative and relational play than non-autistic subjects (Kanner, 1943; Wing and Gould, 1979; Lewis and Boucher, 1988; Baron-Cohen, 1987 and 1989; Frith 1989; Tager-Flusberg, 1989).

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follow them up to complete testing, so testing for non-verbal mental age was abandoned, although it is acknowledged that this would have been an invaluable addition to this thesis.

2) On the false-belief task, autistic children and adults should do significantly worse than non-autistic children, although it is expected that some of the autistic subjects might pass (16-20% in Baron-Cohen et al. 1985).

3) Autistic subjects (especially the younger children) should be more likely to show problems with joint attention tasks but not with visual perspective-taking tasks (Baron-Cohen, 1989; Leekam et al., 1993; Tan and Harris, 1991).

4) Emotion perception tasks are likely to prove more difficult for autistic subjects than non-autistic subjects (e.g. Hobson, 1986a).

The next chapter will look at all these behaviours as they occur spontaneously in a naturalistic setting.

# CHAPTER 2

# IMITATION, THEORY OF MIND AND PLAY IN AUTISM - AN OBSERVATIONAL STUDY

## INTRODUCTION:

As was discussed in Chapter 1, the underlying cause of autism is now considered to be biological (Morton, 1989; Frith *et al.*, 1991) but where the precise problem lies is still a long way from being established. Theories of what underlies the disorder have concentrated on behavioural and psychological characteristics. This study uses as a guiding line the Intersubjectivity Theory of Rogers and Pennington (1991). Rogers and Pennington have drawn together two earlier theories - the Affective Theory of Hobson (1986) and the Cognitive Theory of Baron-Cohen, Leslie and Frith (1985) but have incorporated an additional factor - a deficit in imitation. Although the researchers involved have somewhat changed or expanded their original theories (See for example, Hobson, 1993; Frith, 1992; Baron-Cohen, 1994), the basis of these theories have remained either respectively intersubjective or cognitive in nature, the latter still advocating mentalising as the main deficit seen in autism.

It is well known that imitation, the new focus in Rogers and Pennington's (1991) theory, plays an important part in normal children's development, for example, in acquisition of language and social skills (Tomasello, Kruger & Ratner, 1993). Imitation has been shown to function in normal development when the child is very young, in fact as soon as the child is born (Meltzoff, 1988; Meltzoff and Moore, 1989; Kugiumutzakis, in press). As the infant grows up imitation becomes an important aspect of mother-infant interactions (Trevarthen, 1977, 1979; Stern, 1985). Meltzoff & Gopnik (1993) proposed that imitation is essential in establishing primary intersubjectivity as described by Hobson (1993b) - through imitation an infant comes to learn the similarities between other persons and itself. In later childhood, imitation becomes an important tool for pre-schoolers, as a way of playing and communicating with peers (See Nadel, 1986 and Nadel and Camioni, 1993 for reviews). After four years of age, language becomes an efficient means of communication and imitation is then mostly used for learning, both consciously and unconsciously or for being funny

or naughty, as, for example, in mimicking (Nadel and Camioni, 1993; personal observations).

As was described in chapter 1, there is as yet little conclusive support for Rogers and Pennington's theory, as there are ambiguities and disagreements in the evidence that autistic individuals show a deficit in imitation, and that such a deficit is specific to autism. Some studies used no control children, some had small sample groups. Only one study by Heimann et al (1992) promised a comprehensive look at immediate imitation but this was only a preliminary study and the full study is still awaited. Some studies found that autistic children had problems with gestural and vocal imitation as one of the sensorimotor skills (Jones and Prior, 1985; Sigman and Ungerer, 1984; Herzig, Snow and Sherman, 1989; Abrahamsen and Mitchell, 1990), while others found no deficits using tests of sensorimotor skills (Morgan et al., 1989; Thatcher, 1977). Other studies looking at gestural imitation found deficits (DeMyer et al, 1972; Ohta, 1987; Stone et al., 1990; Heimann et al, 1992) while, once again, others found no deficits in simple gestural imitation (Charman and Baron-Cohen, 1994; Curcio and Piserchia, 1978). Most studies found that autistic children had no problems with imitation of actions with objects, unless the actions were of a symbolic nature - all those studies that examined imitation of symbolic actions agree that there is a deficit, which is consistent with the poor pretend play skills of autistic children. (DeMyer et al., 1972; Curcio and Pischeria, 1978; Hammes and Langdell, 1981; Heimann et al., 1992; Rogers and McEvoy, 1993; Charman and Baron-Cohen, 1994). Stone et al. (1990), on the other hand, did find some impairments in imitation of actions with objects, but this was the only study to do so. Finally, there is also evidence that, even if autistic children cannot imitate, they can benefit from being imitated. Imitation of the child can increase mutual eye gaze, social interaction and appropriate behaviours (Dawson and Adams, 1984; Dawson and Galpert, 1990).

The main aim of the study reported in this chapter was to conduct observations of *spontaneous behaviour* in four major categories - (1) Play, (2) Evidence of "theory of mind", (3) Imitation and (4) Social Interaction, this final category being used as a general index of behavioural differences in autism. The behaviours for which the children were observed within these categories were designed to correspond to deficits proposed by Rogers and Pennington (based on the theory of Stern, 1985) as linked to

imitation in development, although not all the categories observed mapped directly onto Rogers and Pennington's model. Subcategories of behaviours within the category of evidence of "theory of mind", for example, included joint attention, use of mental state language, empathy and evidence of mental state understanding and manipulation such as teasing, joking, lying and deception. Rogers and Pennington only mentioned joint attention and lump the others together under "Theory of Mind", emotion perception and sharing, and social pragmatic problems. Only the deficit in *pretend* play was mentioned in Rogers and Pennington's theory but it was felt interesting to observe other types of play too, especially to aid with the design of later experiments. Different types of imitation were observed such as vocal, gestural, and actions with objects, both non-symbolic and symbolic. These categories were designed to map unto the different manifestations of an ability to imitate such as proposed by Piaget. Finally, different levels of play were observed from manipulative and relational play to symbolic play.

The observational study reported here was carried out in the spirit of ethology, the main aim being to establish the natural frequency of some of the behaviours to be tested for experimentally in later studies. Given the fact that it was not feasible to bring the children into the unnatural environment of a laboratory (or in the case of many autistic subjects, into any standardised and thus alarmingly novel setting) this study was necessarily not an attempt to directly compare the behaviours between groups It was instead a quantified examination of what the autistic children and adults chose to do in the natural situation in which they spent most of their lives. This must be born in mind when interpreting the results.

Such an observational study is important for several reasons. Firstly, remarkably few naturalistic data are available for any of the categories described above, except for social interaction (Richer, 1976; Strain & Cooke ,1976; McHale, 1983; Lord and McGill, 1989). A number of studies have looked at the *spontaneous* behaviour of autistic children, especially with regard to play behaviours, but most of these have been conducted in an experimental setting, i.e. in a separate room, usually with the experimenter present (Lewis and Boucher, 1988; Baron-Cohen, 1987; Mundy et al., 1986; Gould, 1986; Sigman & Ungerer, 1984c). There have been two studies to my knowledge that have looked at autistic children in a naturalistic environment. Firstly,

Wing, Gould, Yeates and Brierly (1977) report data mostly of an observational nature from the Camberwell study. Secondly, Ungerer and Sigman (1981) observed autistic and non-autistic children at home for 6 x 16 minute sessions over the course of a year.

The second reason for conducting an observational study of an ethological nature was that observational data would provide a profile of everyday behaviour against which the significance of later experimental results could be evaluated. Additionally, observations of the autistic children have allowed confirmation of a diagnosis of autism and aided the design of imitation tasks for use in the later experimental battery. Finally, the observational study allowed the experimenter to become familiar with each child (and vice-versa), with whom experiments would later be conducted.

Rogers and Pennington (1991) predicted that there would be a dissociation between vocal and body imitation, with any impairment being in body imitation. It is well known that autistic children engage in a form of vocal imitation called echolalia. They also predicted a different pattern of deficits for young autistic children and adults as is described in Chapter 1. To recap, they predicted that autistic children would show deficits in imitation, joint attention, symbolic play and emotion sharing, while older autistic children and adults would show deficits in theory of mind, affect praxis and language pragmatics. Unfortunately, we can not be sure at what age Rogers and Pennington felt this change would become noticeable. The broad aim of this study was therefore descriptive and open-ended, in the spirit of ethology. However, review of the literature on autism and Rogers and Pennington's theory permitted a number of predictions, as follows:

- Young autistic individuals would show less imitation of actions than older autistic children and adults (Rogers and Pennington, 1991) and than the comparison groups ( De Myer *et al.*, 1972; Jones and Prior, 1985; Stone *et al.*, 1990.) The vocal imitation known as echolalia, the "mindless" repetition of a word or phrase is a well-known product of the disorder of autism, and was coded separately where possible. Rogers and Pennington predicted that vocal imitation in autistic individuals would not differ from that of controls because of echolalia.

- Autistic individuals would show more manipulative and relational play/activity than other groups (Kanner 1945; Wing, 1976; Frith, 1989 among others), but less symbolic play (Baron-Cohen, 1987; Lewis and Boucher, 1988) and less functional play (Lewis and Boucher, 1988).
- Contact with adults would be relatively equal across groups but contact with peers would be impaired in the autistic groups (Richer, 1986; Lord and McGill, 1989; Strain & Cooke, 1976).
- A Theory of Mind would be less in evidence in autistic individuals (Baron-Cohen *et al.*, 1985; see Happe, 1994 and Frith 1989 for reviews). Problems with joint attention would be more noticeable in younger autistic children, while autistic adults would show more problems with other aspects of theory of mind such as deception and less empathy relative to controls.

**Methods.**

Subjects:

Table 2.1 shows the subjects in each group. All subjects were tested on the British Picture Vocabulary Scale (BPVS) and all except some of the youngest normal children were tested on the Test for Reception on Grammar (TROG), which is considered a more stringent test of verbal ability. The TROG raw scores are only age-calibrated for those scoring higher than five, with this equalling a verbal mental age (MA) of 4 years. Since most of those 3-4 year olds who were tested, and some of the autistic children, did not manage to score 5 on the TROG, the raw scores were used for comparison purposes rather than the age equivalents. The CA of each group and the mean raw score on the TROG and Mean raw score and verbal MA on the BPVS are presented in Table 2.1 below. In addition to the group of autistic children (CA 12;1 MA: 4;9) and the group of autistic adults (CA 24;8; MA 6;9), two groups of normal children, one aged between 3-4 years of age (CA: 3;4 MA: 3;6) and one between 5-6 years of age (CA:5;4, MA 5;7) were observed. These ages were chosen for two reasons. It was mentioned in Chapter 1 that the age of 4 years seems to be a magical age in development. It is at this age that the purpose of imitation changes (Nadel, 1986; Nadel and Camioni, 1993), false-belief ability emerges (Wimmer & Perner, 1983) and the children first begin to go to school. The age of four years has

often been called the Theory of Mind "watershed" and because of this most studies intending to examine Theory of Mind related behaviours have chosen autistic children above 4 years in mental age. Unfortunately, I could not be quite so selective with the subjects in this study and so this study had to use some children and adults of a verbal age less than four. but whom the experimenter was satisfied could understand the instructions to be used in later experiments. This was the second reason for including the two normal groups so that comparisons could later be made. Finally, a group of children with mild to moderate learning disabilities (MLD - CA:11;8 MA 6;2) were used as a comparison group. Although the children with learning disabilities had a higher MA than the autistic children, they performed on the mental age tests at a similar level to the autistic adults. In the following experimental studies, subgroups of children from the autistic and non-autistic groups were able to be matched on CA, MA and TROG raw score.

The autistic children were all attending the same special school for children with autism and communication disorders (Struan House School in Alloa). They had all been assessed by the headmaster of the school as autistic, having been referred by clinical or educational psychologist. All but one child in the study group, who lived locally, were residential at the school during the week but went home to their parents at the weekend. The full clinical background for the autistic group was not madde available to the author but a series of initial observations satisfied the first author that all the children in the autistic group met the DSM-111-R criteria for autism and did not have any noticeable motor problems, which might affect imitation. Additionally, a questionnaire, designed around both the DSM-111-R and the Childhood Autism Rating Scale, (See Appendix 2.2) was given to the parents and care staff of the autistic children, to confirm the diagnosis and to indicate whether the observations in the school situation were consistent with the rest of the autistic children's life. All the care staff returned their questionnaires and these confirmed the autistic symptoms displayed by the children. Of the 6 parents who replied (50%) all reported that their child had been diagnosed as autistic and they described an onset of symptoms roughly around 30 months, commenting that they had become worried about their child sometime between birth and 2 years of age.

Table 2.1: Subject groups used in the observational study, with mean chronological age (CA), Mental age on British Picture Vocabulary Scale (MABPVS) and mean raw score on the Test for Reception of Grammar (TROG).

| GROUP | TROG SCORE | MA BPVS | CA |
|---|---|---|---|
| autistic children<br>n=12 | 6<br>(3.9)<br>(1 -> 12) | 4;8<br>(1;8)<br>(2,2 -> 8,3) | 12;6<br>(2;9)<br>(7,2 ->15,10) |
| autistic adults<br>n=12 | 7<br>(3.8)<br>(2->14) | 6;9<br>(1;10)<br>(4,10->10,2) | 24;11<br>(4;7)<br>(17,5-33,11) |
| MLD<br>n=12 | 6.5<br>(2.3)<br>(2 -> 10) | 5;7<br>(3;2)<br>(2,2 -> 13) | 11;5<br>(2;10)<br>(8,2 -> 16,0) |
| 5-6 year olds<br>n=12 | 11<br>(3.8)<br>(5 -> 17) | 5;7<br>(1;8)<br>(3,2 - > 7,9) | 5;4<br>(0;4)<br>(5 -> 6,2) |
| 3-4 year olds<br>n=12 | 4 (N=8)<br>(1.7)<br>(2->6) | 3;6<br>(1;1)<br>(2,6 -> 4;5) | 3;7<br>(0;3)<br>(3;3 -> 3;11) |

The autistic adults were all attending a residential training centre (Balmyre Training Centre, Alloa) and varied in the amount of independence they had - most of them lived in the residential house but some of them were able enough to live in flats of four people with a carer. During the day they engaged, depending on their abilities, in various activities such as woodwork, pottery, glasswork, computer studies, general studies, music, drama, art and crafts, community based work and sports. Once again the medical records were not made available but staff provided the necessary information and initial observations satisfied the author that all the adults to be studied were autistic.

There were problems recruiting children with learning disabilities who did not show any autistic tendencies. In the end it was necessary to recruit from the special education units of three local schools - one primary and two secondary schools. In the selection process, the author was given, by the headmaster or headmistress of each school, a list of children who were not diagnosed as autistic. The author then observed the children during their normal school activities and selected those not showing autistic tendencies. The children were of mixed aetiology, but in general they had mild to moderate learning disabilities. One boy had Down's Syndrome.

The 3-4 year old children all attended the Puffin Playgroup, attached to the School of Psychology at the University of St.Andrews. The attendance of each child varied from two mornings a week to 5 mornings a week. The 5-6 year old children all attended Preprep 1 at New Park School, St. Andrews.

Procedure:

All the groups except the 3-4 year old children were observed in their school/training centre situation, in as naturalistic a way as possible. Six sessions of direct observations were taken per child using a one-zero sampling method, with a time interval of one minute. Each session lasted 15 minutes so that the total time each child was observed was 90 minutes. Each child was observed in broadly similar situations, for example at academic activities, in gym, at music, and at free play. Behaviour was scored as spontaneous when it was initiated by the child and not prompted by any adults, although if the child continued a behaviour for more than one minute after being prompted and without further prompting, then this behaviour was noted as spontaneous. (This usually occurred in the category of functional activity). Each category was divided into subcategories, illustrated in Figure 1. Full definitions of each category and subcategory can be found in Appendix 2.1. Examples of the types of behaviour coded for each subcategory are available in Appendix 2.3.

Figure 2.1: Categories and subcategories for the observational study, with keys for Figures 2.2-2.11 (See Appendix 2.1 for definitions of categories and subcategories).

| Categories | Subcategories | Graph codes Study1 | Study 2 |
|---|---|---|---|
| Play | General Motor | (GM) | 1 |
| | Manipulative | (Man) | 2 |
| | Relational | (Rel) | 3 |
| | Functional | (Func) | 4 |
| | Symbolic | (Sym) | 5 |
| Social Interaction | With Adult | (Adt) | 6 |
| | With Peer | (Peer) | 7 |
| Evidence of Theory of Mind | Mental State Language | (MSL) | |
| | Joint Attention | (JA) | 8 |
| | Empathy | (EMP) | 9 |
| | Use of Mental State Understanding | (UMS) | 10 |
| Imitation | Vocal - speech | (VI) | 11 |
| | - non-speech | | |
| | Body/gestural | (B/G) | 12 |
| | Non-Symbolic actions with objects | (NSO) | 13 |
| | Symbolic actions with objects. | (SO) | 14 |

A video-taped sample of a fifteen minute observation for six children in three groups (autistic children, 3-4 year olds and 5-6 year olds) was independently coded by a second observer, i.e. 18 children were coded independently, with a total observation time of 270 minutes. The total scores for each group (6 children in each group), over all 17 behaviours as coded by the two observers (i.e. 17 pairs of numbers), were compared using a Pearson's product moment correlation. Inter-observer reliability was high, with an average r value of 0.87 over the three correlation's (Pearsons Product Moment Correlation, range = 0.77 to 0.96)

Data Analysis:

One-way Analyses of Variance and Newman-Keuls post-hoc tests were used to compare behavioural frequencies between groups of subjects on each general category and each major sub-category of behaviour. Since a large number of ANOVAs had to be conducted in this analysis, only those where the main effect was significant at 0.01

level will be reported. The degrees of freedom were the same for each analysis - between groups = 4; within groups = 57. All F-values reported are for the main effect analysis. Differences between groups are reported when the Newman-Keules posthoc tests were significant at 0.05 level.

**Results:**

The Questionnaire:

Because the questionnaire was intended mainly as a tool by which to confirm the autistic diagnosis of these children and to provide extra anecdotal evidence of behaviours present or absent in autism, the results from the questionnaires were not analysed statistically. However, there are a few interesting points that should be mentioned. A copy of the questionnaire can be found in Appendix 2.2.

There was a 50% return rate from the parents and a 100% return rate from the care staff at the residential part of the school. For the six children for whom two questionnaires were available, there was an average agreement between what parents and care-staff said on only 51% of the questions (agreement was coded as when both the parents and care staff reported that the child never did something, or when they both said they child did a behaviour at least sometimes). The differences between the parents and school staff were accounted for by the fact that parents were more likely to say that their child did the behaviours which a specific question was targeting. Parents also tended to provide more information and examples of their children's behaviour and also tended to attempt to paint a better picture of their children than the care staff did. For example, the parents were more likely to say their children never lied or deceived them, whereas the care staff provided some examples of simple deception and lies. Some of the examples given by care staff are presented along with other observational case records in Appendix 2.4.

The questionnaire confirmed a diagnosis of autism or at least the presence of severe autistic tendencies for all the children assessed. On a few of the questions the judgement of either the parents or care staff or both did not agree with what was observed in the present study. For example, within the category of social interaction, six of the children were scored as interacting often with other children (50%), although many of these instances were rough and tumble play. Two children used

verbal means to communicate and interact socially. Within the category of imitation, seven children showed vocal imitation, six showed body/gestural imitation, four imitate facial expressions and five imitated actions with objects (out of 12 children). However, what cannot be ascertained by questionnaire was the exact definition the parents and staff were using for imitation. Echolalia could have accounted for most of the actions with objects and social facilitation for the imiation of actions with objects. Within the category of play, seven children were considered as never engaging in any manipulative or relational play, which is very different from the picture seen in the schooltime observation - again this may have been a problem with definitions. Within the category of evidence of "theory of mind", judgements agreed with what was observed, although seven children were scored as comforting people who were upset (an example of empathy) and one as getting upset when someone else was upset. The parents were more likely to score positively on this.

However, for the most part, judgements about specific categories of behaviour agreed with the observational results to be reported in the remainder of this chapter, although this tended to be the judgements of the care staff. There are two possible explanations of the descrepencies between the reports of the parents and care staff. Firstly, perhaps autistic children do behave differently at home than at school, even at residential school. Perhaps the home environment does make their autistic symptoms appear less severe. Secondly, it is also possible that parents were doing one of two things when answering the questionnaire - they could either have been interpreting the questions differently than intended when the questionnaire was designed or they could have been using a form of positive thinking or optimism as a way of coping with their child's disorder. Either way, this is an interesting question which should spark further research.

Observational results: Major Behaviour Categories:

**Figure 2.2: Mean number of minutes (and standard error) in which each category of behaviour was observed at least once during 90 minute session, for each group during the schooltime (ToM = Evidence of Theory of Mind, W/O ech = imitation without echolalia).**

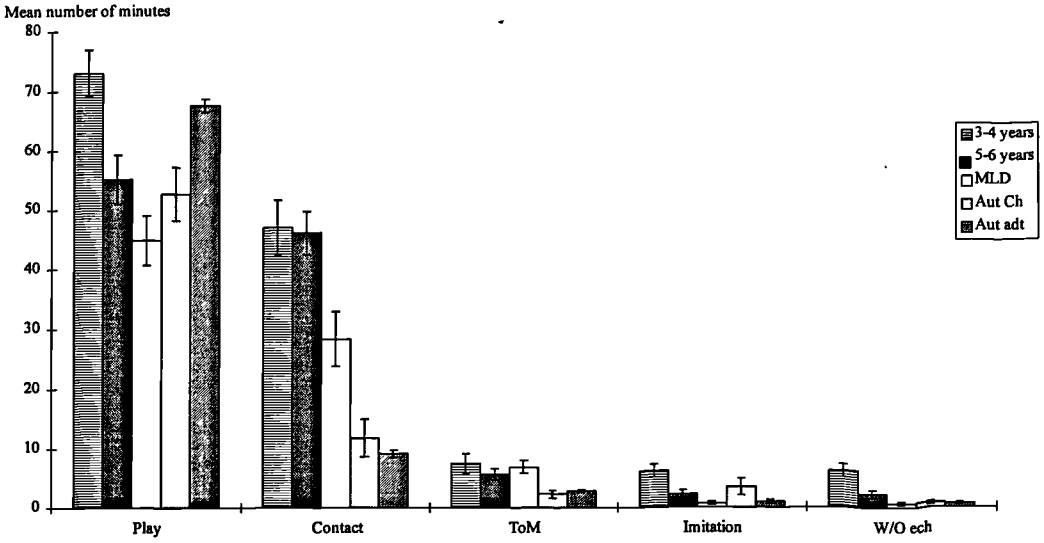


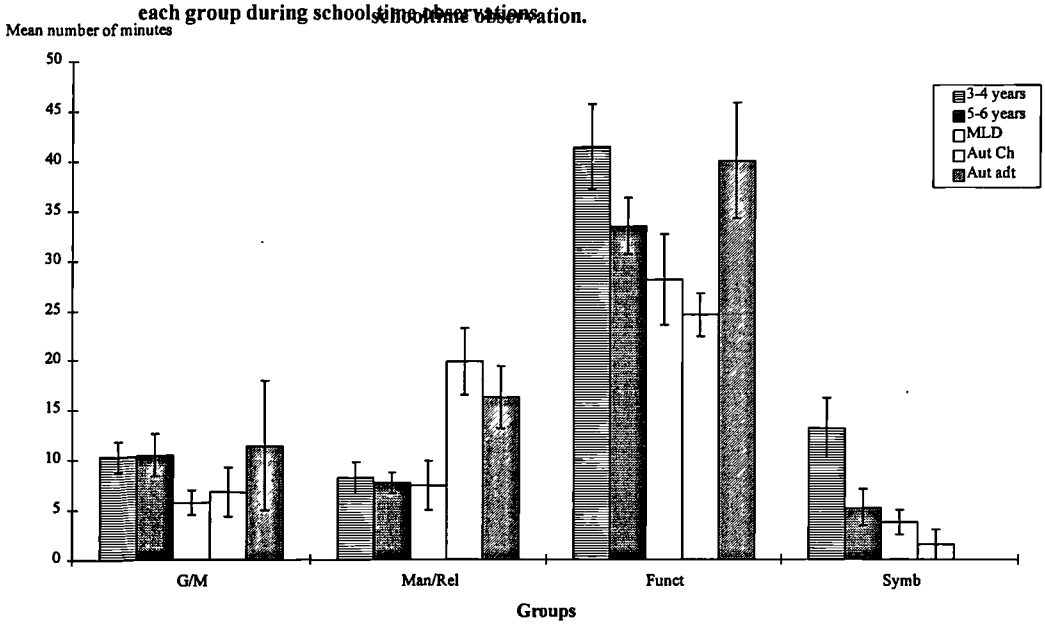

Figure 2.2 summarises comparisons between the four samples of children and one sample of autistic adults for the main behaviour categories. An ANOVA found a main effect within the category of play ($F=5.64$ $p<0.001$) and post hoc tests revealed this to be accounted for by the 3-4 year old group, who showed more play than all other groups. The autistic adults also showed more spontaneous play/activity than the autistic children. There was also a group difference within the category of social interaction ($F=23.05$ $p<0.001$) - the 3-4 year olds and the 5-6 year olds showed more social interaction than all other groups but the MLD group also showed significantly more social interaction than the autistic children and adults. On evidence of Theory of Mind there was a main effect ($F=4.91$ $p<0.01$), with the 3-4 year old group and the MLD group both showing more evidence than both autistic groups. There were no differences between control groups. There was no difference between the four "school" groups on imitation: only the 3-4 year olds in the play group showed more imitation than all other groups (main effect with echolalia: $F=6.02$ $p<0.001$; main effect without echolalia $F=13.79$ $p<0.001$). Overall in these everyday contexts,

evidence of ToM and imitation was rare relative to the frequency of play and (for the non-autistic groups) social behaviour.

Subcategories of behaviour:

*Play*

**Figure 2.3: Mean number of minutes (and standard errors) in which each subcategory of behaviour within the main category of PLAY, was observed at least once within the 90 minute session for each group during school time observation.**




N.B. G/M = General motor play

Man/Rel = Manipulative or relational play.

Funct = Functional play.

Symb = Symbolic play.

Within the category of play (Figure 2.3) there were main effects on ANOVAs for manipulative/relational play ($F=5.44$ $p<0.001$) and symbolic play ($F=8.77$ $p<0.001$). In manipulative/relational activity, the autistic children and adults both showed more of this type of this type of behaviour than all control groups. In functional activity there was a difference between both the 3-4 year old children and autistic children, and the autistic adults and the autistic children but this was only significant at 0.05 level (main effect $F=5.44$). The final difference was between the 3-4 year olds and all other groups on symbolic activity.

*Social Interaction*

**Figure 2.4: Mean number of minutes (and standard errors) in which social interaction with adults and peers, was observed at least once during 90 minute session for each group during schooltime observations.**

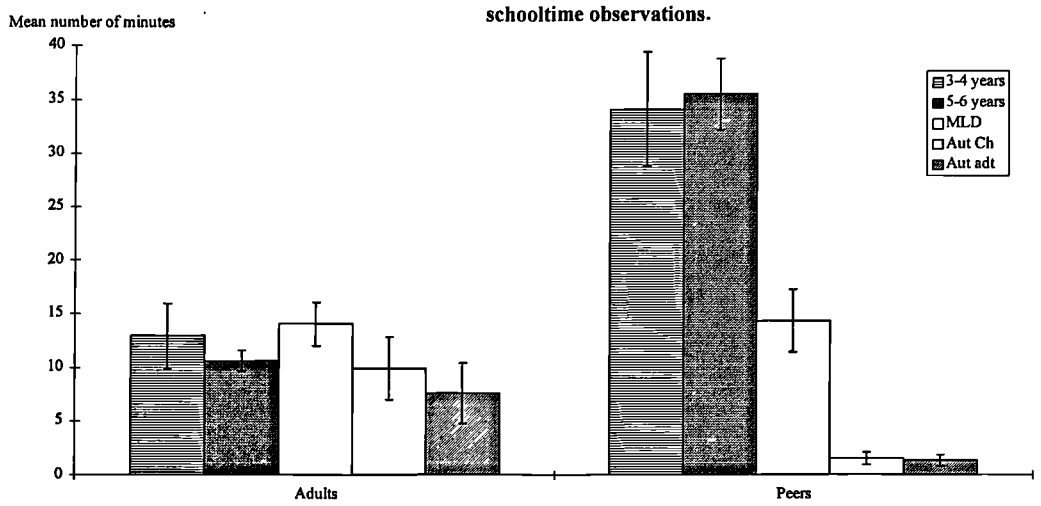
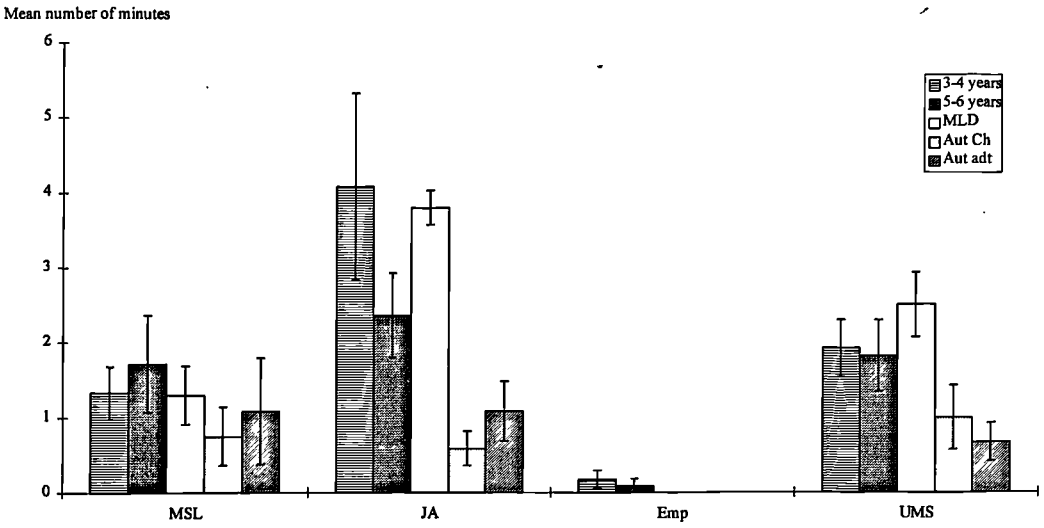



Figure 2.4 illustrates the results within the category of social interaction. There were no group differences for social interaction with adults, but all control groups showed more social interaction with their peers than the two autistic groups. There was also a difference between the normal groups and the MLD children (Main effect: $F=29.52$ $p<0.001$).

*Theory of Mind*

**Figure 2.5: Mean number of minutes (and standard errors) in which each subcategory within the category of Evidence of Theory of Mind, was observed at least once, during 90 minute session for each observation group during schooltime observations.**




N.B. MLS = Mental State Languge

JA = Joint Attention

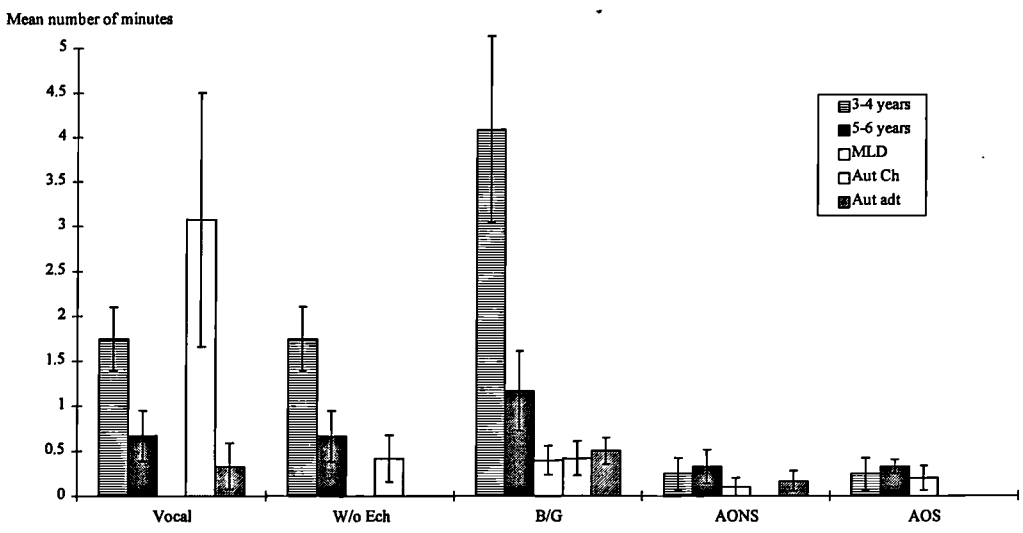
Emp = Empathy

UMS = Use of mental state understanding.

Within the category of evidence of Theory of Mind (see Figure 2.5) there was no difference between groups for Mental State language but the was a main effect within the category of joint attention ($F=4.76$ $p<0.01$). The 3-4 year olds and MLD groups showed more Joint Attention than both autistic groups There were no significant differences for either empathy (which was rarely observed) or use of mental state understanding.

*Imitation*

**Figure 2.6: mean number of minutes (and standard errors) in which each subcategory of IMITATION was observed for each group during 90 minutes of schooltime observations**




N.B. Vocal = vocal imitation

W/O Ech = vocal imitation disregarding clear examples of echolalia.

B/G = Body/gestural imitation

AONS = Actions with objects - non-symbolic.

AOS = Actions with objects - symbolic.

Finally, within the category of imitation (See Figure 2.6) there were main effects for vocal imitation when echolalia was discarded ($F=8.96$ $p<0.001$) and body/gestural imitation ($F=9.08$ $P<0.001$). It was the 3-4 year olds who showed more vocal imitation than the other groups and also more body/gestural imitation.

Table 2.2 summarises the percentage of each group showing each subcategory of behaviour for the schooltime observations. Fisher tests were carried out for the number of children in each group carrying out each behaviour at least once. The results of these Fisher tests are also presented in Table 2.2. The most striking results are for symbolic play, interaction with peers and joint attention.

To examine the relationship between the abilities observed and both the mental age and the chronological age of the autistic children, a series of Pearson Product Moment correlations between childrens behaviour score and their CA, MA BPVS and TROG raw score were carried out. When the correlations were caried out across all groups there were three correlations significant between chronological age and contact with peer ($r = 0.65$ $p<0.001$), vocal imitation without echolalia ($r = -0.36$ $p<0.01$) and symbolic play ($r = -0.48$ $p<0.01$). Although only significant at 0.05 level, there was also a trend for other negative correlations between CA and body/gestural imitation ($r = -0.38$) and joint attention ($r = -0.29$). Because of the extreme ages of the autistic adults, the analysis was repeated without the adults - most of the relationship with CA remained. In addition to relationships with symbolic play, contact with peers, vocal imitation without echolalia, symbolic play, joint attention and body gestural imitation, there was also a trend towards a negative relationship between CA and both functional play ($r = -0.36$) and imitation of non-speech sounds ($r = -0.33$), although both of these were only significant at the 0.05 level. There is a trend for children with lower TROG scores to produce more relational play ($r = -0.30$ $p<0.05$) and for those with higher a MA (on the BPVS) to show more evidence of mental state understanding ($r = 0.30$ $p<0.05$). When the autistic groups only are analysed the only significant correlation is a nigative one between TROG score and the amount of manipulative play produced ($r = -0.42$ $p<0.05$). This relationship is not found when just the autistic children and analsyed.

Because of previous findings (Nadel, 1993) and the comments given by parents on the questionnaires, it was decided to look in a little more detail at imitation and symbolic play. When the autistic group was divided into two groups, above and below the median age for the group (done for both MA and CA: Median MA = 4;0; median CA = 12;7), and a series of Fisher tests carried out and it was found that those below the median CA tended to imitate at least once, while those above the median CA tended not to imitate ($p<0.01$). For symbolic play, those above the median age on both CA and MA did not engage in any symbolic play, while those below the median age tended to do so ($p<0.05$ for both CA and MA). To summarise, the pattern seen in this group of autistic children seems to reflect normal development in that it is the

youngest children in the group (with an MA below 4 years) who engage in imitation and symbolic play. The CA of those children who show imitation is much higher than the normal children but it *is* the youngest children in the group who tend to show these behaviours. They do not do so as prolifically as normal 3-4 year olds but there is a "normal" developmental trend for at least these behaviours in autism.

**STUDY 2:**

During observations it was recognised that there were many differences between groups' typical environments, particularly between school and play group, which could have affected some play behaviours, social interaction with peers (frowned upon in some settings), imitation and evidence of Theory of Mind. Thus, a second study was carried out on the same autistic children, the same 5-6 year old children and a new group of three year old children but observed in the same Playgroup as those children in the first study. This time the children were observed at morning break and dinner time, to avoid the direct constraints of the school situation and make the groups more comparable environmentally. One hour's observation was taken for each group using video recordings and each hour was analysed in two ways. Firstly, the whole group was coded for each behaviour, so that when one of the twelve children in each group initiated one of the target behaviours, that behaviour was coded as occurring. The number of minutes during which each behaviour was observed once was recoded a percentage of the total time observed, in order to make comparisons. Secondly, six children in each group were focused on and their behaviour was coded as a percentage of the total time observed (each child was observable for different lengths of time). An ANOVA showed no statistical difference between these two methods so only the results of the six focal observations per group are presented in the figures below.

Two time intervals were used in the coding of this study. To compare the play situation with the school situation an interval of one minute was used, as well as an interval of 10 seconds to allow more detailed analysis. The check sheet was divided into 10 second intervals for the coding of the video-taped sessions and then recoded into which behaviours appeared at least once in every 6 10 second intervals.

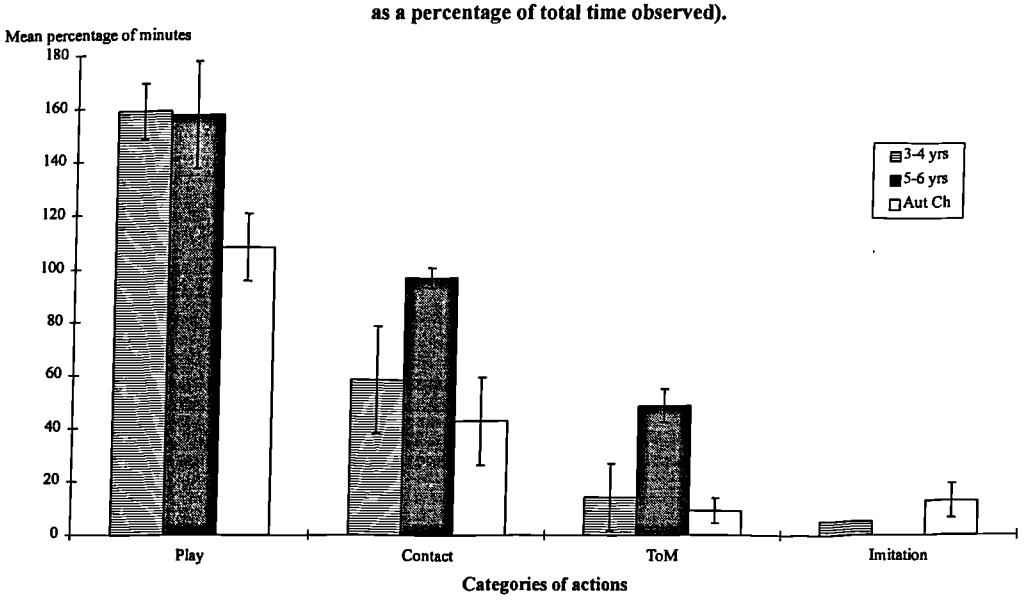
Interobserver reliability was tested using Pearson's product moment correlations. An independent observer watched video-taped observations of the six

focal children in the 5-6 year old group and the autistic group. The average scores of the six children in each group were calculated for the two observers and these were compared in an overall correlation across all fourteen behaviours. An r value of 0.63 ($p<0.01$) for the autistic group and 0.99 ($p<0.01$) for the 5-6 year olds, confirmed that interobserver reliability was high.

**Results of Playtime observations:**

*Results for the general categories of behaviour*:

**Figure 2.7: Mean time (and standard errors) in which each major category of behaviour was observed once during 90 minutes of playtime observations (expressed as the sum of the subcategories, which were expressed as as a percentage of total time observed).**




In the general categories of behaviours (See Figure 2.7), there were significant group differences for play ($F=3.78$ $p<0.05$), social interaction ($F= 7.10$ $p<0.01$), and evidence of theory of mind ($F=13.77$ $p<0.001$; within groups df. = 17, between groups = 17 for all analyses in this part of study 2). Autistic children showed less play than the two control groups and less social interaction than the 5-6 year old group as did the 3-4 year old children. The autistic and 3-4 year old children also showed less evidence of Theory of Mind than the 5-6 year olds. There were no significant differences for imitation.

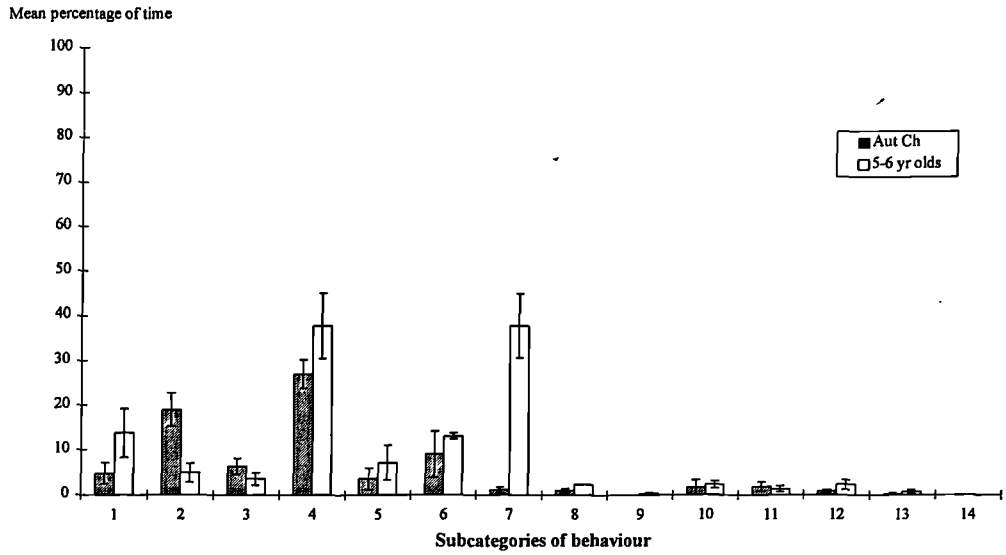
For the analysis of the 10 sec intervals, the results followed a similar pattern to the one-minute-interval analysis. There were significant group differences within the

categories of play $F=11.04$ $p<0.01$), social interaction ($F=21.85$ $p<0.001$) and evidence of Theory of Mind ($F=4.45$ $p<0.05$). The autistic children showed less of all three categories than the 5-6 year old children (Newman-Keuls $p<0.05$). Within the subcategories of behaviour, the same pattern also emerged as for the one-minute interval. The only difference was that, as indicated by larger F-ratios, there was an accentuation of the group differences in the 10 second interval analysis. One possible explanation is that the 5-6 year old children engage, for example, in social interaction with peers for longer periods of time - i.e. for more than one 10 second interval in every minute. The autistic group might engage in each behaviour once in the minute but the other groups would engage in the behaviour 3 or 4 times in a minute.

*Results from subcategories of behaviour:*

In the subcategories there were significant differences in functional play ($F=7.503$ $p<0.01$), contact with peers ($F=8.71$ $p<0.01$) and joint attention ($F=13.77$ $p<0.001$). The autistic children showed less functional play than both the control groups. The autistic children showed less interaction with peers than the 5-6 year olds. Finally, joint attention was seen much more prominently in the 5-6 year olds.

**Figure 2.8a: Mean percentage of minutes and standard errors in which each category of actions was observed once during SCHOOLTIME observations.**

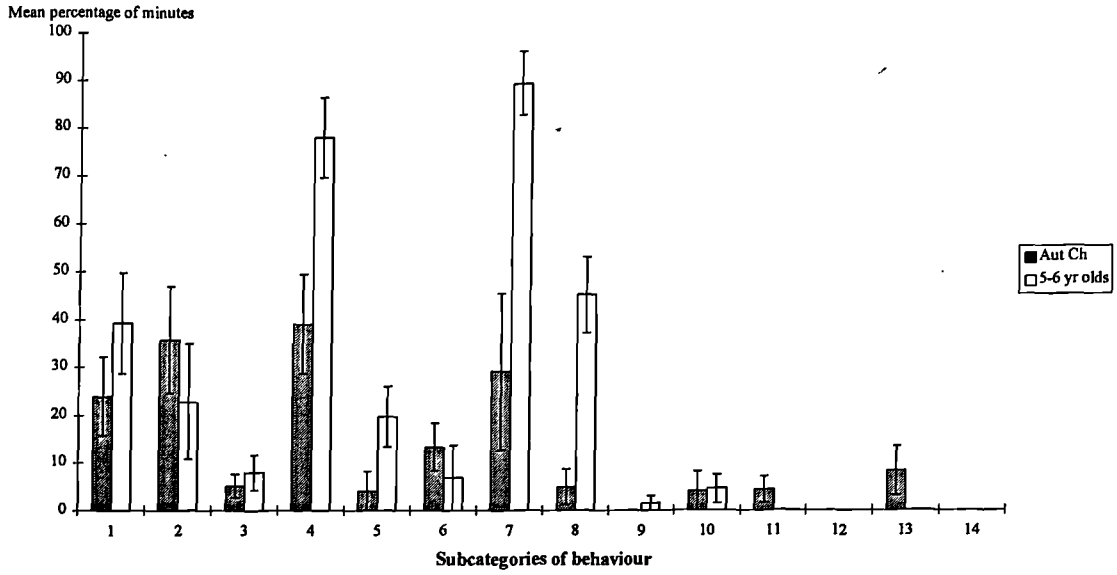



N.B. 1 = general motor play; 2 = manipulative play; 3 = relational play; 4 = functional play; 5 = symbolic play; 6 = social interaction with adults; 7 = social interaction with peers; 8 = joint attention; 9 = Empathy; 10 = use of mental state understanding; 11 = vocal imitation; 12 = body/gestural imitation; 13 = imitation of actions with objects (non-symbolic); and 14 = imitation of actions with objects (symbolic).

There were no statistical differences overall between the two 3-4 year old groups, who were, after all, observed in the same Playgroup. Therefore, no further detailed analysis was warranted on the subcategories for this age group ( the analysis for the Playgroup situation has already been described above).

Figure 2.8a is a summary of the results of the *school time* observations for the autistic and 5-6 year old children. It reminds us that the autistic children showed more manipulative play, less functional activity and less contact with peers than the 5-6 year olds. Figure 2.8b summarises what was found for the two groups at *play* - the autistic children show less functional play, less contact with peer and less joint attention than the 5-6 year old groups.

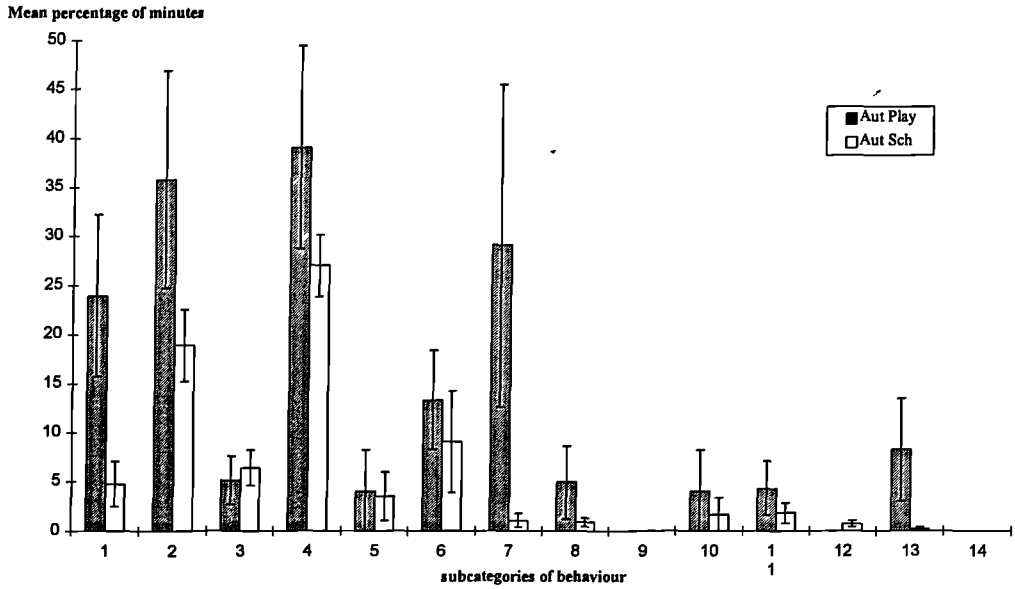
**Figure 2.8b: Mean percentage of minutes spent in which each subcategory of behaviour was observed once during PLAYTIME observations.**




N.B. 1 = general motor play; 2 = manipulative play; 3 = relational play; 4 = functional play; 5 = symbolic play; 6 = social interaction with adults; 7 = social interaction with peers; 8 = joint attention; 9 = Empathy; 10 = use of mental state understanding; 11 = vocal imitation; 12 = body/gestural imitation; 13 = imitation of actions with objects (non-symbolic); and 14 = imitation of actions with objects (symbolic).

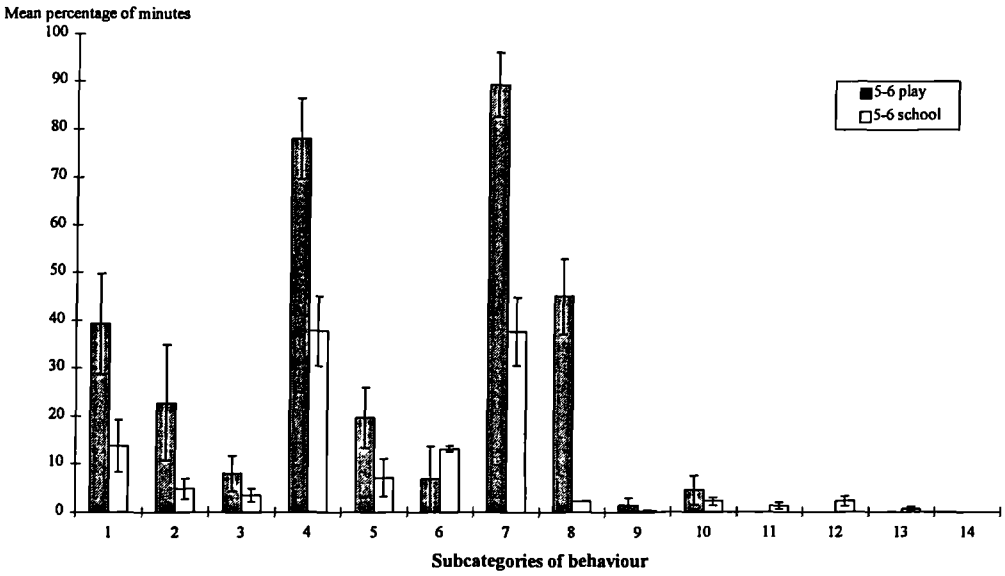
Comparing the two situations via Figures 2.8a and 2.8b, it can be seen that the main difference is an accentuation of the group differences in the play situation. However, there is a similar pattern of differences in both situations (there were also a few differences between the two situations for each group, explained further in the discussion below). Within the subcategory of joint attention ($F=25.28$ $p<0.001$ within subjects df = 23, between subjects = 3), the 5-6 year old children showed more joint attention at play than at school. Within social interaction with peers (13.05 $p<0.001$), both the 5-6 year olds and autistic children showed more contact with peers at play than schools. The 5-6 year olds also showed more functional activity at play (main effect: $F=7.82$ $p<0.01$). These are summarised in Figures 2.9a and 2.9b.

**Figure 2.9a: Mean Percentage of minutes spent by the autistic children in each subcategory of behaviour during school and playtime observations (see Figure 2.1 for key to subcategories).**




N.B. 1 = general motor play; 2 = manipulative play; 3 = relational play; 4 = functional play; 5 = symbolic play; 6 = social interaction with adults; 7 = social interaction with peers; 8 = joint attention; 9 = Empathy; 10 = use of mental state understanding; 11 = vocal imitation; 12 = body/gestural imitation; 13 = imitation of actions with objects (non-symbolic); and 14 = imitation of actions with objects (symbolic).

**Figure 2.9b: Mean percentage of minutes for the 5-6 year old children in which each subcategory of behaviour was observed once during school and playtime observations.**




N.B. 1 = general motor play; 2 = manipulative play; 3 = relational play; 4 = functional play; 5 = symbolic play; 6 = social interaction with adults; 7 = social interaction with peers; 8 = joint attention; 9 = Empathy; 10 = use of mental state understanding; 11 = vocal imitation; 12 = body/gestural imitation; 13 = imitation of actions with objects (non-symbolic); and 14 = imitation of actions with objects (symbolic).

To further compare the two situations, the percentage of total play for each subcategory of play was calculated. This was only done for PLAY since this was where the main group differences lay. In the School situation there were significant differences for the categories of manipulative play($F= 8.85$ $p<0.001$) and symbolic play ($F=6.32$ $p<0.05$). The 3-4 year olds showed significantly more symbolic play as a percentage of total play observed and the autistic children showed a significantly higher percentage of manipulative play. In the playtime observations, there were no group differences for general motor play, functional or symbolic play. The autistic children showed a higher percentage of manipulative play (main effect: $F=4.65$ $p<0.05$) and the second group of 3 year olds showed more relational play than the other groups. The 3-4 year olds used in the second study were less sociable and more timid than those used in the first study which may explain why there is more relational play and less symbolic play in the second group (See Table 2.3 for a summary of these percentages). However, overall, the amount of play between the two groups of 3-4 year olds did not differ significantly. As we can see below, the amount of overall spontaneous activity is almost doubled in playtime observations for the 5-6 year olds and autistic children.

Table 2.3: Percentage of total time spent by each group in each subcategory within the main category of PLAY during the school (Study 1) and playtime (Study 2) observations.

| Behaviour | 3-4 year olds | | 5-6 year olds | | autistic children | |
|---|---|---|---|---|---|---|
| | Study 1 | Study 2 | School | Play | School | Play |
| G/M | 14.3 | 1.4 | 20.5 | 23.4 | 7.9 | 22.2 |
| Man | 7.1 | 10.1 | 7.3 | 13.6 | 31.3 | 33.1 |
| Rel | 4.0 | 17.8 | 5.3 | 4.8 | 10.6 | 4.7 |
| Func | 57.6 | 61.7 | 56.4 | 46.5 | 44.7 | 36.1 |
| Symb | 17.0 | 8.9 | 10.6 | 11.7 | 5.5 | 3.7 |
| Total n | 877 | 847 | 334.9 | 838.1 | 362.4 | 648.2 |

Note. n = total number of minutes (expressed as a percentage of total time observed) in which play was observed at least once.

In summary, there is a similar pattern of results for the school and play situations. Both groups do certain activities more when at play, such as interaction with peers, functional play, and joint attention for the 5-6 year olds and interaction with peer and action-with-object imitation for the autistic group, than in class. However, the differences which were observed between groups were within the same categories as for the school situation.

**Discussion:**

Before discussing the significance of the observed differences between subjects, it is important to reiterate the initial premise of this study. These observations were carried out in the spirit of ethology and therefore I acknowledge that there is a lack of direct compatibility between groups. The significance of observed differences between groups is thus at the level of the relative frequency of their behaviour in their everyday experiences and I am not attempting to answer the confounding questions of whether these differences are because of differences between the subjects or the settings they typically experience.

I will now discuss the findings from each of the main categories observed, starting with social interaction, which was used as a general index of autism.

*Social Interaction*:

Within the category of Social Interaction, autistic children and adults showed less peer interaction than the MLD group, who showed less than the 5-6 year olds. This is as predicted from previous literature (Kanner, 1943; Strain and Cooke, 1976; Rivher, 1986; Lord and McGill, 1989) and confirms that these samples show the basic behavioural profiles required to make the other categories of behaviour of interest.

*Play:*

In the category of play, autistic groups showed more relational and manipulative activity than the comparison groups, which was predicted as a sign of the limited repertoire of activities seen in autism. This is in keeping with Kanner's original observations (1943). The autistic adults showed less symbolic activity than the 5-6

year olds but there was no difference between the autistic children and the 5-6 year olds and MLD children for either functional or symbolic activity. There was generally a paucity of symbolic play in all groups but the 3-4 year old children. This may be linked to the age-appropriateness of pretend play. One of the parents of an autistic boy, for example, commented in the questionnaire that her son was "too old to pretend play". The autistic children and some of the MLD children had chronological ages far above the normal age when pretend play is most prominent. However, it is likely that qualitative differences exist between samples within certain categories, especially what we coded as symbolic play (See Appendix 2.3 and 2.4 for some examples of what was coded as symbolic play). Play coded as "symbolic" in the autistic children was often very limited, in that little expansion of an initial theme occurred, unlike in the normal children. It was also often repetitive in nature. On many occasions it was ambiguous whether the behaviour was symbolic for the child or not, due to a lack of language accompanying the actions. Examples coded here as symbolic (mostly play with dolls - dressing the doll, making the doll sit up, talk etc. - and with toy animals - making them roar, fight etc.) often expressed the conventional actions which people do with these toys. There is therefore a real problem in identifying symbolic activity in these situations and this difficulty is encountered in some of the experimental studies as well. In Chapter 3 there is further discussion on this problem from an experimental point of view.

As such these results do not show the clear differences between autistic and non-autistic children that one would have expected from other studies such as those of Lewis and Boucher (1988) and Baron-Cohen (1987). This may be because the present study used a truely spontaneous situation, where environment cannot be controlled. The other two studies both tested spontaneous pretend play within an experimental set up.

*Evidence of Theory of Mind:*

The autistic children and adults showed less evidence of Theory of Mind than the other groups and in particular they showed less joint attention (JA) than the MLD group. As with pretend play, use of mental state language indicated differences in quality, with language used by autistic children being almost always self-referencing

and/or idiomatic. The few examples seen of JA and use of mental state understanding also appeared different in quality than the examples seen in the 5-6 year olds. To illustrate this, I describe two incidents - first, one in the 5-6 year old group and one in the autistic group. In the first incident, Child A approached child B to see which page he was working on. Child B told him that he could not do the page he is on. Child A had already completed this task and took child B's book, giving him his own book. He sat in his own seat and filled in the answers in B's book while B leant over child A's book, pretending to write. When A has finished they quietly swapped books again, and B went up to get the teacher to mark the work. The teacher had seen none of this.

The second incident involved a 15 year old autistic boy, who got up from his chair and approached the observer, saying "those are lovely boots". When the teacher, who had spotted him up "wandering", asked him what he was doing, he immediately picked up some books and said "Putting these books away". This was one of the more convincing examples of deception/lying seen in the autistic children.

Although few examples of lying or deception were observed directly, the questionnaires completed by the care staff suggested that this type of behaviour is quite common and some of these examples are quoted in Appendix 2.4. However, all the incidents quoted could have been simple, learned routines for the avoidance of immediate punishment/disapproval, or gaining of immediate rewards. For example, subjects would say they had brushed their teeth when they hadn't; they would say they had done their chores so that they could watch T.V; or they would complain of earache so that they could go to the doctor's and read the magazines in the waiting room. Of course, it could be said that this is what the other children were also trying to achieve with lying and deception.

The differences between the autistic and non-autistic groups could be summarised as blatant versus subtle. The examples seen in the normal children were not only more complicated but much more subtle attempts to avoid punishment or to get their own way (or, in the example quoted above, to help someone else avoid punishment/disapproval). In the autistic groups, the goal of their deception (e.g. to watch T.V.) is more blatant and usually limited to concrete and relatively immediate goals like reading their favourite magazine, or watching their favourite T.V.

programme, as distinct from pleasing their teacher or keeping in their goodbooks, or impressing their friends, which seemed to be the goals of the normal children.

There seems little evidence that the autistic children attempted to change the mental state of another person - the examples of deception seen in this autistic group do not necessarily require a theory of mind - in fact they could be explained more easily by a theory of/understanding of another's behaviour, which can be learned by trial and error (As Byrne and Whiten, 1988 and 1991, suggest is the case for the examples of deception seen in most non-human primates). This idea is also in keeping with Baron-Cohen's (1989) view of autistic children as "behaviourists" and Perner's (1993) use of the term "situation theorists". In the absence of sophisticated language, coding of these types of incidents, normally signs of understanding and attempting to change other's mental states, becomes difficult and ambiguous. One cannot even be sure that these behaviour subcategories are actually satisfactory ways of diagnosing a Theory of Mind, at least not in a spontaneous situation.

*Imitation:*

Finally, turning to imitation, the main focus of this study, only the 3-4 year olds showed much spontaneous imitation. This may have been due to a situational factor, associated with the Playgroup setting, which Study 2 did not rule out. Alternatively it may reflect the fact that 3 year olds tend to use imitation as a method of communication, before sophisticated language takes over as discussed in Chapter 1 (Nadel and Camioni, 1993).

The results from the play situation of study 2 suggested that the school situation had a general effect on the quantity of most behaviours within the groups, rather than which behaviours were performed more by each group. Those behaviours most affected by the school situation were those which we would expect from the limitations imposed by a structured, school environment. The most surprising finding was an almost complete absence of imitation in any form in the 5-6 year old group. In the first study, imitation emerged in gym class for example, and often was a way of misbehaving in class. At play, it is possible, as Nadel and colleagues (1982-1993) suggest, that there is no need for the older children to use imitation as speech has

superseded the need to use imitation to communicate. The 3-4 year olds showed most imitation, at least once they started to settle into play group. The time of year at which they were observed (during the first term) probably affected the type of play produced, specifically, increasing the amount of relational play and decreasing the amount of symbolic play. Because their play was less social, they also produced less imitation. However, none of these differences were significant in this case.

This study found that the frequency of several behaviours of interest, including imitation, evidence of ToM and symbolic play, was quite low even in the non-autistic control groups. Observing the children at play did not increase the frequency of most of these behaviours; in fact, as we have seen above, the 5-6 year olds showed less imitation during play than in class. The age of the children may also be an important factor in that some behaviours may be seen as not age appropriate and therefore not encouraged.

Despite the infrequency of some behaviours there did seem to be a relationship between chronological age and pretend play, in a negative direction. This is not so surprising bearing in mind the fact that children who pretend most prolifically tend to be aged between 3 and 5. This is the age at which pretend play is encouraged both at home and in school. Once the children get older, pretend play seems to be frowned upon as "babyish" - i.e. not age appropriate. Feedback of this nature was received via the questionnaires. There also seemed to be a relationship between both mental age and chronological age and body/gestural imitation, in a negative direction. This result is consistent with the idea that body/gestural imitation may be most prominent in those children who have not yet acquired a more sophisticated language ability (Nadel and colleagues, 1982 - 1993). The 5-6 year olds, MLD children and some of the autistic adults had, for the most part, this sophisticated language ability which relegates imitation to the lower levels of a tool for learning and being funny, as described above.

It must also be noted that evidence of Theory of Mind, imitation and symbolic play was not altogether missing from the autistic group. In fact, on imitation, the MLD group produced even fewer imitations than the autistic groups. Therefore, we cannot at this stage say that a deficit in spontaneous imitation is autism specific.

Almost half the autistic children were of the same MA as the three year olds, and indeed it is these younger autistic children who showed any imitation at all, but they do not show the same *amount* of imitation as their normal counterparts. Perhaps, then, there *is* a problem with imitation for autistic individuals, possibly in using it spontaneously to communicate, as Nadel suggested is its function in young children. However, it is still unclear from this study whether the majority of these autistic children are just too old for using imitation to communicate, or whether there is a real deficit in the ability. However, imitation may still be used in other ways, for example to aid learning both academically and of appropriate behaviour. It is also unclear as to whether a problem with imitation is specific to autism. Although the MLD children showed a lack of imitation, they mostly had an MA over 4 years and so on the basis of age changes in the normal group, less imitation might be expected. A study on younger autistic children is required to check if imitation is used spontaneously by younger children, as could be predicted from normal development. On the other hand, Rogers and Pennington would predict that the younger children should show less imitation at least in an elicited situation. There seems that there may be some dissociation between spontaneous imitation and elicited imitation. A different pattern is emerging for spontaneous imitation than that predicted by Rogers and Pennington (1991), although this pattern follows the normal developmental pattern as proposed by Nadel and colleagues (See Nadel and Camioni, 1993).

Finally, the infrequency of imitation and theory of mind behaviours made it impossible to really examine the profiles that Rogers and Pennington (1991) suggested would occur. The possibility of a dissociation between spontaneous and elicited imitation also makes it extremely difficult to speculate on Rogers and Pennington's predicitions. The only result that should be mentioned here was that it did seem to be the autistic children who showed less joint attention and the difference between the 3-4 year olds and autistic children of a similar mental age was significant. The autistic adults did not show significant impairments in joint attention relative to the MLD group or 5-6 year old group.

So, from the results of this study, we cannot offer any strong evidence for Rogers and Pennington's (1991) theory. There certainly seems to be a developmental

trend in autism as they proposed and indeed this trend is similar to that seen in normal development, but in the oposite direction to some extent than what they predicited for elicited imitation. However, due to the lack of specificity to autism, we cannot say that a lack of imitation plays the primary role in autsim that Rogers and Pennington would propose. Further studies of imitation in an experimental situation are clearly needed to test whether the ability itself is present even if used little spontaneously and it is to this purpose that I now address the following chapter.

# Chapter 3

# Imitation - can it be elicited from autistic children and adults?

## Introduction.

For centuries, people have been interested in the role imitation plays in the development of normal children (Kugiumutzakis, in press), but it is only in the last three decades that researchers have focused on atypical populations such as those with autism. Much is known about the role of imitation in normal development, in language acquisition, social interactions, communication, play and appropriate social behaviours (Piaget, 1962, Trevarthen, 1979; Tomasello et al., 1993; Nadel and Camaioni, 1993). So much so, that it would be easy to accept that if there is a problem with imitation, many of the main deficits in autism could be explained. Indeed, in 1991, Rogers and Pennington proposed a general, primary deficit for imitation in autism. They combined this deficit in imitation with deficits in emotion sharing and theory of mind (thus integrating two of the previous theories of autism) along a developmental continuum based on the intersubjectivity model proposed by Stern (1985). Rogers and Pennington's model is discussed in much greater detail in Chapter 1. They predicted that on imitation tasks, it would be the youngest autistic children for whom a deficit in imitation would be most noticeable and most handicapping. Older autsitic children and adults would for the most part have few problems with imitation and more problesm with "theory of mind" and language pragmatics.

Convenient as a deficit in imitation would be for accounting for at least early deficits in autism, there are many problems with Rogers and Pennington's model and as such there is a need for more work on this area. Firstly, Rogers and Pennington (1991) did not specify the age at which they felt imitation would emerge, nor did they take into account the fact that imitation is used in different ways and manifests itself in different forms at different stages of development. Piaget (1962) followed the development of imitation through the sensorimotor stages of development to the beginning of the preoperational stage. The first imitation he noticed in his children was vocal imitation, followed by imitation of familiar actions, then unfamiliar actions (with visible actions being first imitated then invisible

actions) and then eventually symbolic and deferred imitation, the later emerging about 2 years of age. Since Piaget, researchers have shown that although children may go through the stages Piaget suggested, his time scale was wrong. Melzoff and Moore (1978) showed that even neonates could produce simple imitations of actions already in their routine. By 9 months of age many infants can show imitation after a delay of 24 hours (Meltzoff, 1988).

Nadel and colleagues (reviewed in nadel and Camaioni, 1993) found that normal toddlers engaged prolifically in imitation during spontaneous play sessions with peers. They proposed that at this stage imitation acts as a form of communication before being replaced by sophisticated language. Like Nadel and Camaioni, Meltzoff and Gopnik (1993) proposed that imitation in very young children is used as a means of identifying people as like themselves and as familiar. It can be seen as a means of communication and as a means to learning both about people and about themselves. This is also similar to the arguments put forward by Hobson (1993). Once the child goes to school, imitation becomes more acurate but still used unconsciously to learn and to be like others. By about 8 years of age, imitation becomes more conscious and becomes a tool that can be chosen to help master certain situations or problems.

Secondly, Rogers and Pennington did not take into account imitation of different types of actions, except for vocal imitation in the form of echolalia and body imitations, for which they predicted a dissociation, with less impairment in vocal imitation. Smith and Bryson (1994) suggested that studies of imitation needed to take into account imitation of different types of actions in order to be able to fully describe the deficit in autism or to propose theoretical models involving imitation. They suggested that it was important to examine actions with and without objects, actions that were visible and those not visible, actions that were symbolic and those involving no symbolic understanding, actions that used one one hand compared to those that used two hands and oral versus manual actions. This is what this study aimed to do, along with examining the development of imitation using Piaget's theory as a guide.

Thirdly, there is still much debate about whether there *is* a deficit in imitation. As we saw in Chapter 1, nine studies found problems with body or gestural imitation

(DeMyer et al., 1972; Sigman & Ungerer, 1984; Jones and Prior, 1985; Ohta, 1987; Herzig, Snow & Sherman, 1989; Abrahamsen & Mitchell, 1990; Stone et al., 1990; Heimann et al., 1992; Rogers and McEvoy, 1993). Three studies did not (Thatcher,1977; Morgan et al, 1990; and Charman and Baron-Cohen, 1994). Three studies found problems with imitating actions with objects that did not involve pretense (Stone et al, 1990; DeMyer et al., 1972; Heimann et al, 1992), while three studies found no problem with non-symbolic actions (Charman & Baron-Cohen, 1994; Hammes & Langdell, 1981; Curcio & Piserchia, 1978). Five studies, in addition, found problems with symbolic actions with objects and pantomimic actions (De Myer et al., 1972; Heimann et al, 1992; Curcio & Piserchia, 1978; Stone et al., 1990; Hammes & Langdell, 1981). So while more studies found evidence for a deficit in at least some aspects of imitation than found evidence against a deficit, the amount of evidence against each type of imitation is enough to make it extremely difficult to conclude whether a specific deficit really exists. The exception to this is symbolic imitation, in which all studies found autistic children and adults to have deficits. This is not surprising considering autistic children generally have problems with pretend play and other symbolic abilities.

However, most of the studies included either insufficient controls, or examined only one or two types of imitation, investigating, for example, only vocal and gestural imitation (using, for example, the Uzgiris and Hunt Scales, 1975) or imitation of symbolic actions. Few studies tested imitation of actions with objects. Most studies used either small numbers of children or only a few actions in each category and no study tested older autistic children and adults on harder tasks of imitation such as problem-solving tasks or deferred imitation.

In addition to these methodological problems, many teachers and clinical psychologists are surprised at the theory of Rogers and Pennington because they use imitation as a learning tool with autistic children and they feel that it works. However, although teachers do use imitation as a learning tool, personal observations indicate that it is often accompanied by instructions or even physical guidance to help the child complete the task. Whether imitation can be elicited from the children, without such specific instructions, remains to be seen.

The main aim of this part of the study was, therefore, to conduct a comprehensive study of elicited imitation. Nine different categories were used to examine the idea that only certain types of imitation might be affected in autism. These nine categories also helped to examine Piaget's developmental model and the distinction between vocal and gestural imitation and symbolic/non-symbolic imitation will help to clarify the postition of Rogers and Pennington's theory. The nine categories also map unto some of the suggestions made by Smith and Bryson. The action categories were vocal (both speech and non-speech sounds), facial (mostly oral, all invisible), body related (some visible and some invisible), one-handed actions, two-handed actions, whole body actions, meaningful/symbolic actions (no objects), symbolic actions (objects present) and non-symbolic acttions with objects. The actions in each category were compiled from those used in the previous literature both from studies with autistic children (such as Heimann et al., 1992; DeMyer et al., 1972) normal children (Meltzoff, 1988; Piaget, 1962) and with non-human primates (Custance, 1994) and a list of the actions and their sources can be found in Appendix A.

Therefore, on the basis of normal development, previous research and Rogers and Pennington's theory, we would expect that in general the youngest autistic children will be those that will show most problems with accurate elicited imitation. The older autistic children and adults will generally be able to imitate. The 3-4 year old children will produce less accurate responses on the elicited imitation than the older normal children and possibly the older non-autsitic children with learning disabilities. As far as types of imitation are concerned, I predict that vocal imitation will not be impaired in the autistic groups relative to other groups because of the presence of echolalia (Rogers and Pennington, 1991). Most previous studies found that imitation of actions with objects was only impaired when pretense was involved (Hammes and Langdell, 1981; Heimann et al., 1992). It is also well known that autistic children have problems with pretense in general (Wing et al., 1977; Baron-Cohen, 1987; Lewis and Boucher, 1988). Therefore, I predict that autistic children will be most impaired on actions that require pretense but not on non-symbolic actions with objects.

Finally, it is essential to remind ourselves of the definition which was used in this study of imitation. The rationale behind the definition was explained in Chapter 1. The definition was as follows: *imitation occurs when the person reproduces or attempts to reproduce with some accuracy the actions or vocalisations of another child or adult, having physically observed the actions of the model. Reproduction can be immediate or deferred.* The coding system described below was designed to allow coding of the accuracy of imitation as previous research suggested that this might be where the differentiation between autistic and non-autistic exists (Ohta, 1987; Curcio and Piserchia, 1978). Normal development would also predict that accuracy would increase with age (Piaget, 1962).

**Methods.**

Subjects:

The subjects used in this experiment were drawn from those described in Chapter 2, (see Table 2.1 for subject characteristics). However, three subjects were tested but their results discarded since it was impossible to show them more than 20 actions. These included one subject from each of the autistic groups. One other autistic adult refused to cooperate and so was not tested. Two of the 3-4 year olds also refused to participate. This left the following numbers in each group:

All the children in the present study had an MA greater than 18 months of age, the age when symbolic play first begins to be noticed in normal children.

Table 3.1: Numbers of subjects and summary of age characteristics in each group for the elicited imitation experiment (Ages presented in years and months).

| Group | CA Means | MA means | Number of subjects |
|---|---|---|---|
| Autistic adults | 24;8 | 6;9 | 10 |
| Autistic children | 12;1 | 4;9 | 11 |
| Young autistic children | 5;8 | n/a | 6 |
| MLD | 11;8 | 6;2 | 11 |
| 5-6 year olds | 5;4 | 5;7 | 12 |
| 3-4 year olds | 3;4 | 3;6 | 11 |

Procedure:

*(1) Test presentation:*

All actions to be imitated were presented with the child sitting opposite the experimenter. The session began with explaining to the child that they were going to play a game with the experimenter and that they were to do whatever the experimenter did. For the first few actions the child was prompted to "do what I did" (Hence the "Do-As-I-Do" or DAID test), if they did not do it spontaneously. The prompts were faded out as the session proceeded. However, if at any point the child did not respond to the first presentation then the action was presented again with a further prompt. If the child did not respond a second time then a "no response" was coded and the next action presented. In general the actions were presented only once. However, if the experimenter felt that the child was not paying attention when first presented, the action was shown a second time. If no problems with motivation arose (see below) then the actions were presented in the order seen in Appendix 3.1.

*(2) Actions for Imitation:*

The imitation test battery consisted of ninety-three actions altogether and these included "easy" actions, "more difficult" actions, and "motivating" actions, in mixed sequence. Easy actions were those that had been used in previous literature with younger normal children and those that were familiar to the children. Also during the observational study the author had a feel for what was within the children's capabilities, so in the design of the task this was kept in mind. Obviously there

would be actions that were difficult for the younger children but still easy for the older children. There were nine different categories of actions (Verbal speech sounds, non-verbal sounds, facial actions, one-handed actions, two-handed actions, whole body actions, symbolic/meaningful actions, non-symbolic actions with objects and symbolic actions with objects). These were also dispersed throughout the session. The actions are listed and described in Appendix 3.1. Some of the actions used by Meltzoff (1988) with nine-month old infants and by Charman and Baron-Cohen (1994) with autistic children were included to allow comparison with these authors' results. The other actions were drawn from both the human and animal literature with the addition of "motivating" actions. The motivating actions were actions which, on the basis of the observational study, were seen as interesting (or even obsessional in some cases) to at least one child. These actions included playing a xylophone, shining a torch, and turning clock hands to the correct time.

*Flexibility in procedures:*

Not every child saw every action. It was necessary for the actions to be presented according to the children's level of interest, motivation and ability. For the 3-4 year old children and the autistic children, the actions were presented in several shorter sessions to keep motivation as high as possible. Motivating actions were normally interspersed with the other actions but were also used opportunistically at any point in the session where the child seemed to be losing interest. If the child refused to respond on more than 10 actions consecutively, the session was abandoned and tried again the next day, or later the same day. One or two sessions were sufficient for all groups except the very young autistic children who needed shorter, more frequent sessions.

Some of the older and more able children were very self-conscious about doing the DAID, so only the most difficult actions were presented. Three of the actions were adapted to be more appropriate for the older children and adults. For example, one action for the younger children involved stringing three beads together; this was adapted to allow five or six beads to be strung together by the

older children. On the other hand some of the actions were very difficult for the 3-4 year old children, (for example, tearing a piece of paper to make a spyhole), but this was taken into account on the scoring of these actions - if the child attempted the correct action, then this was still coded as some level of imitation, even if the child had to be helped to actually tear the hole.

Data analysis and coding:

A six point score system was developed to measure children's imitative response. When a child was judged to have reproduced an accurate imitation, down to the fine details, such as the finger used to push the button, then a score of six points was awarded. Partial imitations, including reversals of actions (e.g. reversing hands when doing "peekaboo" or "grasp thumb"- see photographs in Appendix 3.2) or using body parts as objects - e.g. using a hand as a saw, or a finger as a spoon - were given a score between 3 and 5 depending on how complete or accurate they were. If the child picked up the object or used the hands, for example, in any way but not resembling the target action, a score of 2 was awarded. A score of one was given if no response or a refusal followed the presentation of the target.

Table 3.2: Three examples of how the children's responses were coded on the six-point scale.

| | Action | | |
|---|---|---|---|
| Score | Grasp thumb | Pretend to saw | Make spyhole |
| six | Hold's up one hand, palm facing away, curls other hand around thumb of first hand, palm of second hand also facing away from body. See Appendix 3.2 for illustration. | Holds board with one hand, on its longer edge, and holds hand, fingers curled as if holding saw and makes a sawing movement, back and forth across board but without touching board. | Child folds paper in half, smooths folded edge, attempts to tear a small hole in middle of folded edge and then opens and looks through hole. |
| five | Holds up one hand palm facing away, curls other hand around thumb but palm of second hand is towards the child. | Holds hand straight out, using hand as saw and makes sawing motion on board, which is held on long end by other hand, but without touching board | Child folds paper, tears a hole on the non-folded side and opens up and puts to eye. |
| four | Reverses first hand so that palm is facing child and then grasps thumb either way. See Appendix 3.2 for illustration. | As above, except child touches board with sawing hand. | Child folds paper and tries to poke hole in middle - not on folded edge. Looks through if successful. |
| three | Holds up hands and combines them in any way - one example is to put closed hand against side of other hand but with palm facing towards child, so that thumb is on the opposite side to closed hand. See Appendix 3.3 for illustration. | Puts board down flat and touches with hand, or chops as if with an axe. | Child doesn't fold paper but attempts to pull or poke hole in middle of paper. |
| two | Waves hands around or bangs on knees | Pushed in nail or throws board | Throws piece of paper away. |
| one | No reponse | No reponse | No response |

Of the ninety-three actions, fifteen were discarded altogether, since there were more than two groups in which six or more children did not see the action. If six or more children in one or two groups did not see the action then this/these groups were not included in the analysis for that particular action. Of the 78 actions used, 35 were seen by at least 70 % of the children in each group (except the young autistic children) and the score for these actions was calculated and analysed separately.

Medians were used as the descriptive statistics, since the scale was ordinal rather than interval. Kruskall-Wallis one-way independent ANOVAS were used to test for sample differences in (1) medians for each of the nine categories of actions, (2) medians of all the actions (n=78) together, (3) medians of the 35 actions seen by 70% in each group and (4) the score for each individual action. Since this involved a large number of analyses being carried out and therefore an elevated risk of finding a significant difference by chance, significance was set at 0.01 within the main effects. To determine where the group differences lay, Kruskall-Wallis multiple comparison post-hoc tests were carried out. The K-W value presented is for the main effect. Group differences on these post-hoc tests were reported when significant at the 0.05 level.

For a more basic view of whether the autistic groups either imitated or did not imitate, an additional analysis was conducted on the individual actions - the data were recoded using a strict definition of imitation where the child had to score 6 to be said to have imitated. This was analysed using a chi-square for those actions which produced significant differences at the 0.05 level but not the 0.01 level on the Kruskal-Wallis analysis. Two less stringent definitions of imitation were also used for each of these 12 actions, namely 1) imitation = score of 5 or 6 and 2) imitation = any score above 3. Finally, the analyses were repeated for subgroups of children. In one pair of subgroups, autistic and non-autistic children were matched on CA, in another they were matched on MA using BPVS and on the third, they were matched on the raw score of the TROG (See Table 3.3).

Table 3.3. Means and ranges for two subgroups matched on chronological age (Years; months), mental age using the British Picture Vocabulary Scale (BPVS) and the Raw Scores for the Test for Reception of Grammar (TROG).

| Group | CA (n=8) | MA BPVS (n=20) | TROG Score (n=16) |
|---|---|---|---|
| Autistic | 12;8<br>7;11-16;4 | 5;10<br>2;2-10;2 | 7.4<br>1-14 |
| Non-autistic | 12;6<br>8;9-16,4 | 5;9<br>2;2-10;2 | 7.7<br>2-13 |

*Observer reliability:*

A subset of actions was independently coded by a second observer, who was trained to recognise the actions and how to score the response. This was done for twenty actions and two children from each group. The scores for the children in each group were averaged and the statistics carried out on these averages for each of the twenty actions. The resulting Pearson's Product Moment Correlations for each group (therefore six correlations) produced an average r value of 0.67 (range 0.34 to 0.88) which is significant at the 0.01 level. The correlation for one group, the autistic adults, just failed to reach significance. When the scoring was carefully examined for this group it is evident that the first coder had coded the reactions of the adults slightly higher than the second coder, except on one occasion. However, the differences between the coders was very small - e.g. if the first coder scored an average score for the two adults of 6, the second scorer, did not rate it less than a 5. If the average score for the first coder was 5.5, the second coder generally scored a 5. The largest difference, on one occasion, was between 5.5 and 4.

**Results.**

*Overall scores and general categories:*

The only analysis where all 93 actions were used was concerned with the percentage of 6s, 5s, 4s, 3s, 2s, and 1s scored by each child. The group medians for each score are illustrated in Figure 3.1. The most important point to note is that for most groups the trend is towards high scores. More than 50% of responses were 6s for the autistic children and adults, as well as the 5-6 year olds and MLD children. Only the 3-4 year olds and young autistic children did not score a 6 on 50% of the actions. As can be seen from the graph the trend for the young autistic group was towards refusal/no response or an alternative action (scores 1 and 2). They showed significantly more 1s than all other groups except the 3-4 year olds (K-W=24.43, $p<0.001$). However, there were no other group differences on the number of 1s scored and this remains the case if the young autistic children are discarded. In order to ensure that the low results of the young autistic children did not bias the results of

other group comparisons, each analysis was repeated without the young autistic children.

For the number of 2s shown, both the young autistic children and the three-four year old children produced more than the five-six year old and the MLD children (K-W=26.17 $p<0.001$). Some qualitative differences should also be noted here. When young autistic children produced a 2 score, it was usually by mouthing or throwing the object to be used, therefore producing a manipulative behaviour as described in Chapter 2. The 3-4 year olds tended to use the object functionally but did not perform the target action. For example, when shown "bang spoons", they might put the spoons in their mouth as if eating or when shown "draw line on paper" they would take the pencil and draw a picture of a house. When the young autistic children were discarded from this analysis the older autistic children also showed more 2s than the MLD children (K-W=20.73 $p<0.001$). The quality of their response tended towards another functional use of the object, rather than the sensorimotor response seen in the young autistic children, although some instances of this were noted.

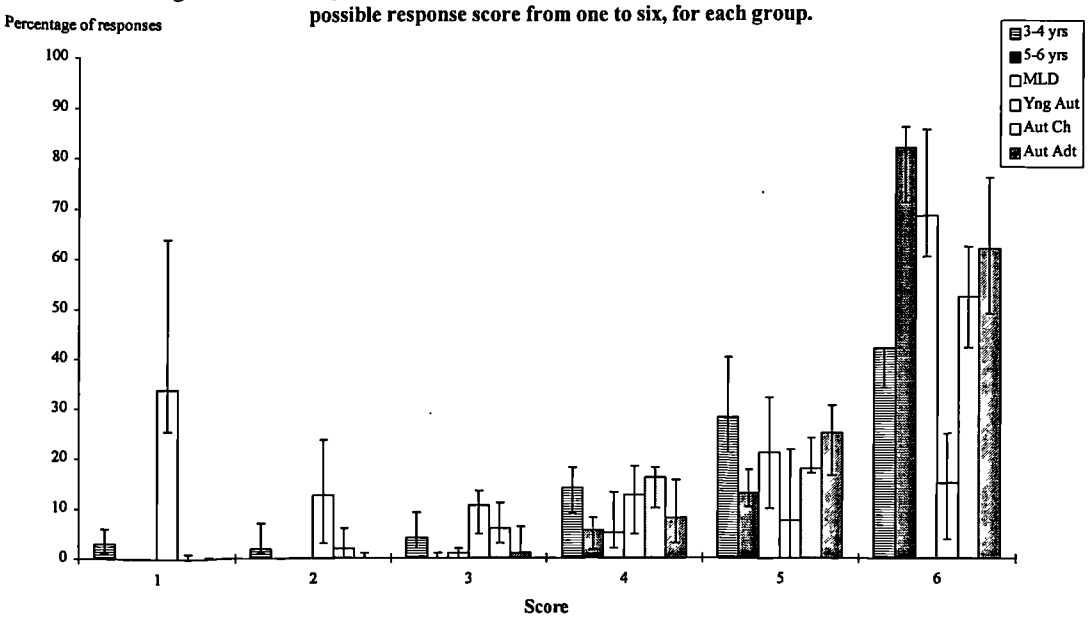
With the number of 3s scored, we are beginning to look at the lowest level of partial imitations. Here the young autistic children still showed more of these low scores than the 5-6 year old and MLD groups but in addition the 3-4 year olds and the older autistic children showed more 3s than the five to six year old children (K-W=24.64 $p<0.001$). This latter result remained basically unchanged when the young autistic children were discarded. The number of 4s scored produced a significant difference between the 3-4 year old children (whose scores mostly fall below 4) and the 5-6 year olds and between the older autistic children (whose scores mostly fall above 4) and the 5-6 year olds (K-W=17.39 $p<0.01$). When the young autistic children were discarded the older autistic children also showed more 4s than the MLD children (K-W=16.93, $p=0.002$).

When we move on to the number of 5s scored there was an interesting set of differences. Firstly, the 3-4 year olds showed more 5s than both the young autistic children (for whom there is a tendency for the majority of the responses to fall below 4), and the 5-6 year olds (for whom the majority of responses tend to be 6s). Also the autistic adults showed more 5s than the 5-6 year old children (K-W=18.63,

p<0.01). However, when the young autistic children were removed from the analysis, only the 3-4 year olds show more 5s than the 5-6 year olds (K-W=18.85 p=0.0008).

Finally, as already suggested, the number of 6s produced was greatest in the 5-6 year olds group and the MLD group, who both showed more than the 3-4 year olds and the young autistic children. The autistic adults also showed more 6s than the young autistic children (K-W=34.52, p<0.0001). When the young autistic children were discarded, the 5-6 year olds showed more than both the 3-4 year olds and the older autistic children. The MLD children still showed more than the 3-4 year olds (K-W=25.21, p<0.0001).

**Figure 3.1:Median percentages ( and interquartile ranges) of responses alloted to each possible response score from one to six, for each group.**




When each of the nine categories were examined in this way, there were some interesting results. Table 3.4 (in Appendix 3.4) presents the mean percentage of actions on which the children were coded as scoring 6,5,4,3,2 and 1 over all 93 actions, and also for three categories of actions, of special theoretical interest as explained later in the chapter. The nine categories were analysed using oneway ANOVAs and student Newman-Keuls post hoc tests.

Most of the nine categories of actions showed a similar pattern to the overall pattern described above.

*Body/gestural - whole body*

Whole body actions produce the now familiar picture of the the young autistic children scoring more 1s and less 6s than all other groups and the 5-6 year olds also score more 6s than the 3-4 year olds. ($F=10.84$, $p<0.0001$ and $F=7.68$ $p<0.0001$).

*Meaningful/symbolic gestures*

The mean percentages for the meaningful/symbolic actions are contained in Table 3.4 (Appendix 3.4). The young autistic children score more 1s and 2s than all other groups ($F=8.76$ and $F=8.08$ $p<0.0001$). The older autistic children score more 4s, which represent mostly reversals of actions or using body parts as objects, than the 5-6 year old and MLD children and the autistic adults ($F=4.408$ $p<0.01$). Finally the 5-6 year olds, the MLD children and autistic adults all score more 6s than the young autistic children, 3-4 year olds and older autistic children ($F=7.79$ $p<0.0001$).

*Non-symbolic actions with objects*

Finally, to look at the actions with objects, the non-symbolic actions show the young autistic children producing more 1s than all other groups ($F=6.1774$ $p<0.001$), more 2s ($F=7.317$ $p<0.0001$) and more 3s than the 5-6 year olds, MLD children , older autistic children and autistic adults ($F=7.137$ $p<0.0001$). The 3-4 year olds also show more 3s than the 5-6 year olds, the MLD children and the autistic adults and they show more 5s than the same groups ($F=4.31$ $p<0.01$). On the number of 6s all groups scored more than the young autistic children and the 3-4 year olds. The 5-6 year year olds also scored more 6s than the autistic children ($F=13.067$ $p<0.0001$).

*Symbolic actions with objects*

Table 3.4 (Appnedix 3.4) shows the mean percentages for the symbolic actions with objects. On these actions the differences between groups were not so large. The young autistic children still showed slightly more 1s ($F=3.11$ $p<0.05$), 2s ($F=2.54$ $p<0.05$), fewer 5s than the 3-4 year olds and autistic adults ($F=3.85$ $p<0.01$) and fewer 6s than the 5-6 year olds and MLD groups ($F=5.79$ $p<0.001$). The autistic children showed more 4s than the 5-6 year old and MLD children ($F=2.57$ $p<0.05$). The 5-6 year olds show more 6s than the autistic children ($F=5.79$ $p<0.001$). The 3-4 year olds show more 5s than the two groups of autistic children and the adults more than the young autistic children ($F=3.85$ $p<0.01$).

*Verbal speech sounds*

In the category of verbal speech sounds, only four of the groups were compared - the autistic children and the three control groups. In this category there were no significant differences between groups on any of the scores at 0.01 level.

*Verbal non-speech sounds*

For the non-speech sounds the young autistic children showed more 1s - i.e. refusals - than all other groups ($F=13.98$ $p<0.0001$). There was also a significant difference at the higher end with all groups scoring more 6s than the young autistic children and the 5-6 year olds scoring more than the autistic adults and 3-4 year olds ($F=8.33$ $p<0.0001$).

*Facial actions*

For facial actions the pattern was as for the non-verbal speech sounds - the young autistic children show more 1s ($F=7.67$ $p<0.0001$) and slightly more 2s ($F=3.294$ $p<0.05$). All groups show more 6s than the young autistic children and the 5-6 year olds show more than all other groups ($F=8.02$ $p<0.0001$).

*Body/gestural - one-handed actions*

If we move on to the body/gestural categories and look at the one-handed actions, the young autistic subjects showed more 1s than all groups except the 3-4 year olds ($F=4.49$ $p<0.01$) and also more 3s than all groups ($F=5.096$ $p<0.001$). The adults and 3-4 year olds showed more 5s than the young autistic children ($F=3.45$ $p<0.01$). All groups scored more 6s than the young autistic children and the 5-6 year olds scored more than the 3-4 year olds ($F=7.398$ $p<0.0001$). As can be seen from Table 3.4 the young autistic children again showed mostly refusals and this was significant ($F=12.99$ $p<0.0001$).

*Body/gestural - two-handed actions.*

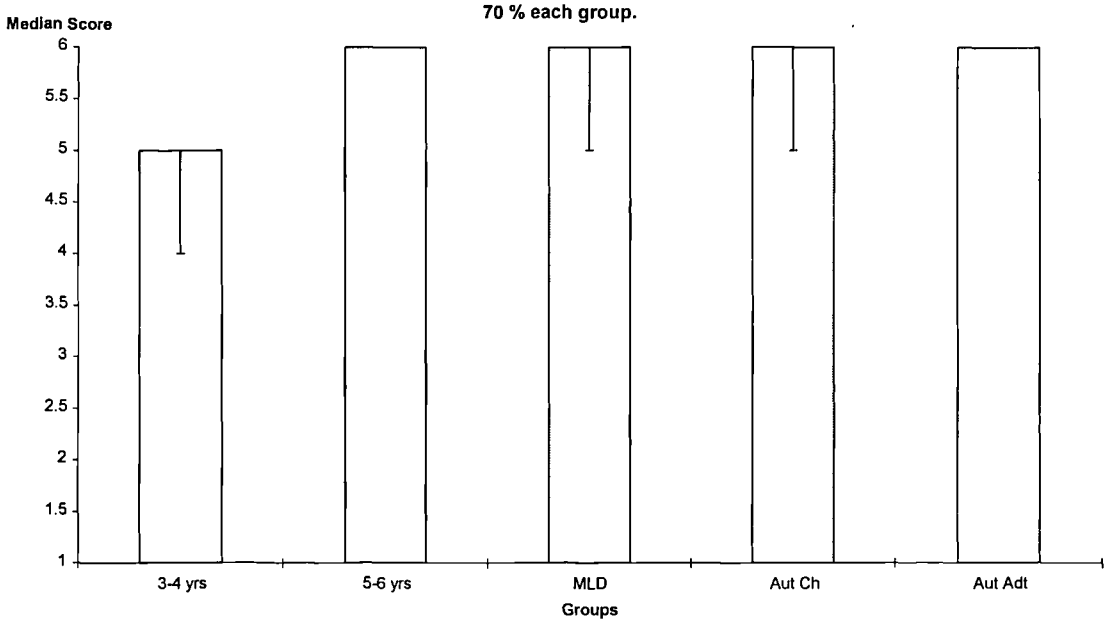
What is interesting is that in this category the autistic children showed more threes (i.e. most innacurate imitation) than the 5-6 year olds, MLD children and autistic adults ($F=3.63$ $p<0.01$). All groups again scored more 6s than the young autistic children, the 5-6 year olds, MLD children and autistic adults all scored more than the 3-4 year olds and the 5-6 year olds also scored more than the autistic children ($F=13.74$ $p<0.0001$).

To summarise these results, it can be said that the principal trend is towards the higher scores for all groups except the young autistic children. The older autistic children and the 3-4 year olds show a very similar pattern with respect to the other groups, scoring more on the lower partial imitations than the older control groups. Except for the young autistic children and the 3-4 year olds, all groups produced 6s on more than 50% of the actions seen; the 5-6 year olds produced a 6 on 81% of the trials. The scores by the 3-4 year olds tended to be more evenly distributed across the scale but with a gradual increase up to 6. The other groups made a sharper jump up to 6. The same trends were apparent in most of the categories of actions, except for the three included in Table 3.4. In these actions we see the autistic children doing worse than the older control groups and the autistic adults - producing more partial imitations and less accurately than the 3-4 year olds. In general, on these three actions, the adults do better, scoring more 6s than the autistic children, although on symbolic actions with objects, the autistic adults do not do significantly better than the autistic children but the trend is for more 5s for the autistic adults, while the autistic children score more 4s. We will see this trend repeated for other analysis. Since the young autistic children seemed to be showing a tendency for refusal/non-response, it was decided that each of the following analyses should be conducted both with and without the young autistic children, to account for any differences their high frequencies of refusals might be making to the results.

*Results for the subset of actions seen by almost all children.*

On the thirty-five actions where 70 % of each group of children (except the young autistic children) saw the actions, there was a significant difference between both the 5-6 year olds and autistic adults and the 3-4 year old children, with the former both showing higher median scores than the 3-4 year old children (K-W =17.74 $p<0.001$). There were no other group differences, as Figure 3.2 illustrates.

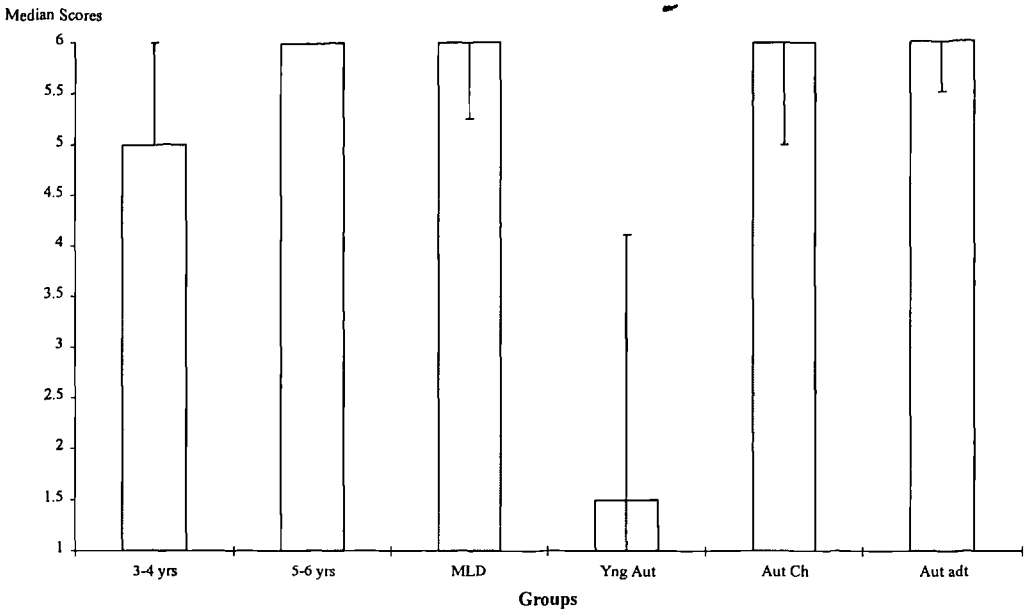
Figure 3.2: Median Scores and interquartile ranges over all actions seen by at least 70 % each group.




*Results from all actions shown.*

Over all seventy-eight actions (ninety-three minus the fifteen that less than half of two groups saw), and including the young autistic children, the 5-6 year olds, MLD children and Autistic adults all showed higher medians and therefore better imitation than the young autistic children (K-W=22.55, $p<0.001$ See Figure 3.3). When the young autistic group were discarded there were no significant differences between groups on this overall measure.

**Figure 3.3: Median Scores and interquartile ranges for all groups over all 78 actions.**




*Results from each category of actions.*

If we go on to examine separately the nine categories of actions (using all 78 actions), we find that the differences mostly lay between the five-six year old children and the young autistic children. This was true for:1) verbal non-speech sounds, where the MLD and autistic adults also showed higher scores than the young autistic children (K-W=18.23, P<0.01); 2) Body/gestural two handed actions, with 5-6 year olds and autistic adults performing better than the young autistic children (K-W=18.27, P<0.01); 3) Whole body actions, with only the 5-6 year olds doing better than the young autistic children (K-W=16.25, P<0.01); 4) Actions with objects, non-symbolic, with both the 5-6 year olds and autistic adults doing better than the young autistic children (K-W=21.58, P<0.001; and 5) Meaningful/symbolic gestures, where the 5-6 year olds showed more than both the young autistic children and the older autistic children (K-W=19.21, P<0.01). When the young autistic children are discarded from this analysis most of the significant differences disappear. However, one difference at 0.01 level remains and that is for body/gestural meaningful actions, when the 5-6 year olds still show better imitation than the autistic children (K-W=14.09, P<0.01). There were two significant differences at the 0.05 level and these were between the 5-6 year olds and the 3-4

year olds on two-handed gestures and on non-symbolic actions with objects. These results are summarised in Table 3.5 and Figures 3.4 to 3.6.

**Figure 3.4: Median Scores and interquartile ranges for the categories of verbal speech sounds, non-verbal speech sounds and facial actions.**

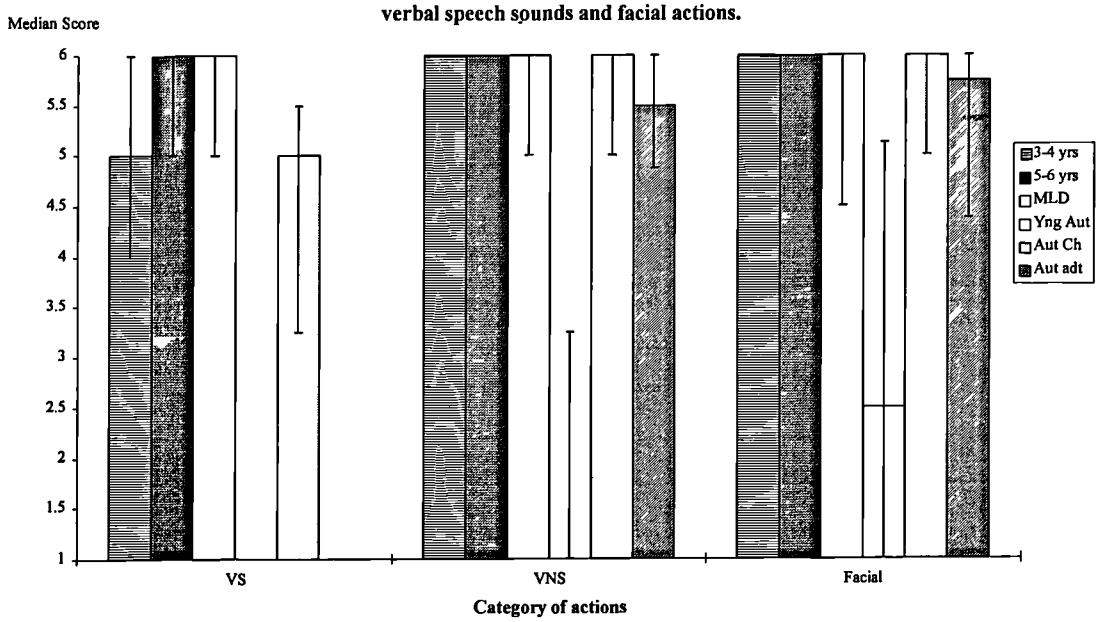
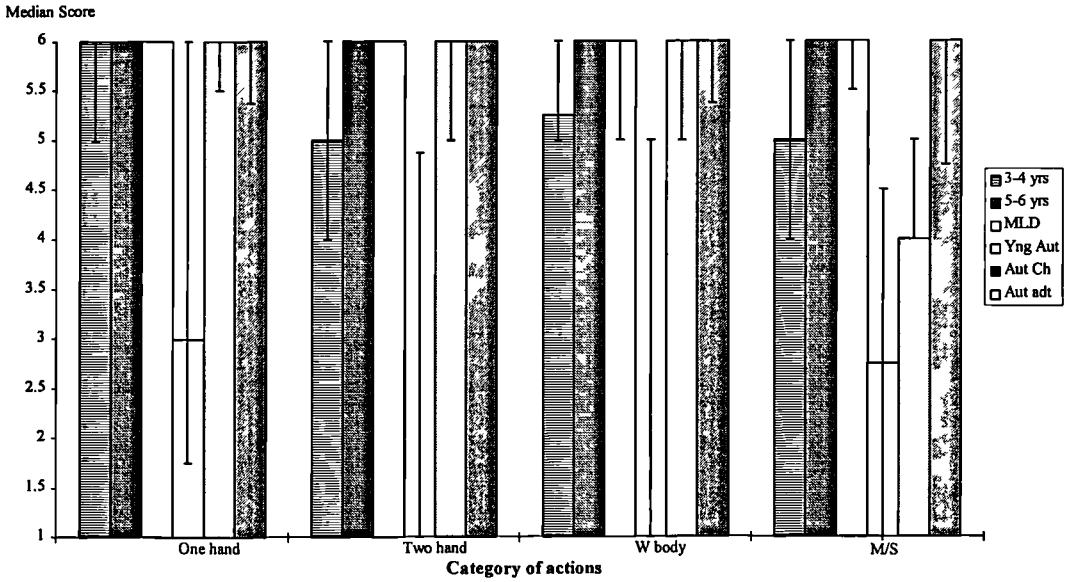



**Figure 3.5: Median Scores and interqartile ranges for each group on one-handed actions, two-handed actions, whole body actions and meaningful/symbolic action (M/S).**



The most general finding is that the young autistic children performed worse on most actions. However, this may not be because of a lack of ability to imitate but of a high level of distraction and non-compliance, suggested by the higher percentage of ones and twos being scored than for the other groups (Figure 3.1 above and Table 3.4 - Appendix 3.4). In order to examine this point, an additional analysis was run for all the actions within the categories of one-handed and two-handed gestures, discarding the results of those children who had a score of one. In other words only those children who responded to the demonstration were considered. For these nineteen actions, there were differences on the same actions for both analyses - i.e. both with and without the children who refused to respond. Obviously the differences were greater when refusals were included but the main effect differences were evident for both analyses. Perhaps the more noticeable finding of this analysis is that the 2 groups of autistic children do significantly worse at imitating actions that require pretence and do not involve an object, than the 5-6 year olds. The trend is that they perform worse than all the groups but only the difference with the 5-6 year olds is significant. On symbolic use of objects they also perform poorly but this is not statistically significant.

**Figure 3.6: Median Scores and interquartile ranges for each group for the actions with object categories - non-symbolic actions and symbolic actions.**

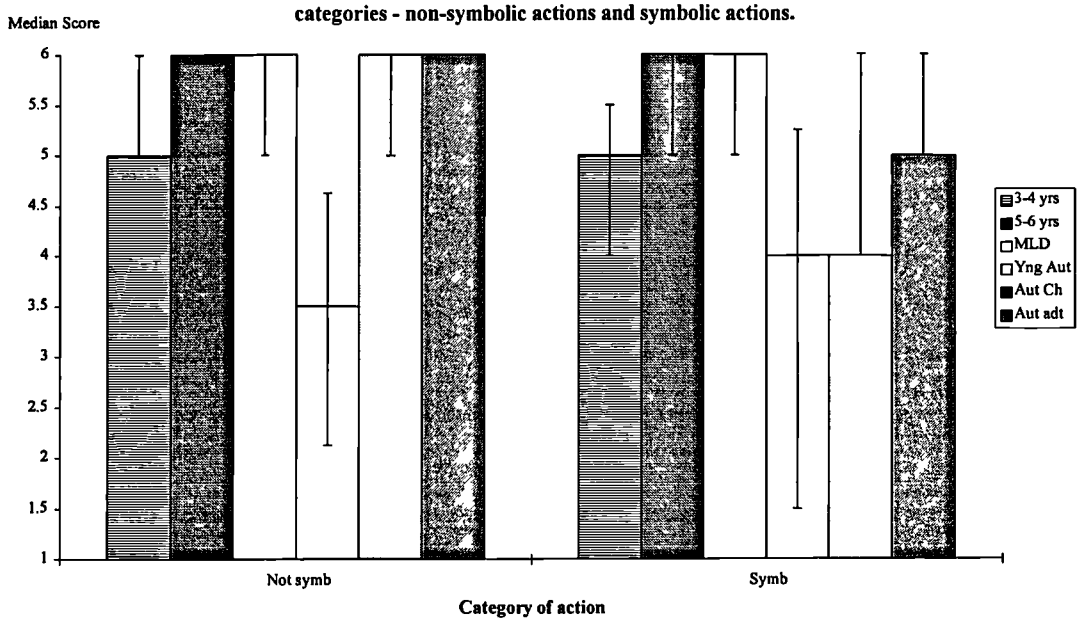


Table 3.5 Summary of results from the general categories and overall score measures on a Kruskal-Wallis analysis with a significance level of 0.01; a) for all groups including young autistic children and b) excluding young autistic children. * indicates a significant result at 0.01 level, ** indicates significance at 0.001 level).

| | Action | Result | Post-hoc result |
|---|---|---|---|
| Overall Score | a) | * | 5-6 > young autistic<br>MLD > young autistic<br>Adults>young autistics |
| | b) | Not significant | |
| Over 35 actions | a) | N/A | |
| | b) | ** | 5-6 > 3-4 year olds<br>Adults > 3-4 year olds |
| Individual categories | Vocal - speech a) | Not significant | |
| | b) | Not significant | |
| | Vocal - non-speech a) | * | 5-6 > young autistic<br>MLD > young autistic<br>Adults > young autistic |
| | b) | Not significant | |
| | Facial a) | Not significant | |
| | b) | Not significant | |
| | One-hand a) | Not significant | |
| | b) | Not significant | |
| | Two-hands a) | * | 5-6 > young autistic<br>Adult > young autistic |
| | b) | * | 5-6 > 3-4 year olds |
| | Whole body a) | * | 5-6 > young autistic |
| | b) | Not significant | |
| | Meaningful actions a) | * | 5-6 > young autistic<br>5-6 > autistic |
| | b) | * | 5-6 > autistic |
| | Objects - non-symb a) | * | Adults>young autistic<br>5-6 > young autistic |
| | b) | Not significant | |
| | Objects - symbolic a) | Not significant | |
| | b) | Not significant | |

*Results for subgroups matched on CA, MA BPVS and TROG raw score.*

To control for both mental and chronological age effects, a subset of the autistic subjects was matched with a subset of the non-autistic subjects on CA, MA on BPVS and TROG raw score (c.f. Table 3.3). There were no significant differences on imitation scores for each of the groups of actions when the two subsets matched for MA on BPVS were compared. When matched on TROG raw score, there were two differences at the 0.05 significance level - the non-autistic children showed better scores than the autistic individuals on verbal speech sounds and body/gestural meaningful actions. When the groups were matched for CA, the non-autistic group showed significantly better imitation at the 0.05 level for symbolic actions on objects and meaningful body/gestural actions.

Individual Actions:

Due to the large number of actions which were used, the results have been organised into Table 3.7 below. The results presented here are for differences significant at 0.01 level on the Kruskal-Wallis analysis. Only those of special interest due to the principal results already presented above will be discussed in further detail, namely those within the categories of body/gestural meaningful actions, symbolic actions with objects and body/gestural two handed actions. Further details on individual categories are presented in Appendix 3.4 (Figures 3.7 - 3.9 and Table 3.8 and 3.9). To summarise these results there were very few actions where there were differences between the older autistic and the older non-autistic groups. The young autistic children and the 3-4 year old normal children, both imitated less often than the non-autistic groups on almost all actions. In some actions, the autistic adults also had better scores than both the young autistic (Peekaboo, Mime brush teeth) and 3-4 year old children (T-sign, two-finger clap).

There was one action where the school-age autistic children imitated significantly less than the 5-6 year old children - grasp thumb. This is one of the actions where a reversal of the hands was noted as the most common mistake by all groups but more so for the younger autistic children. The difference between the autistic and non-autistic group on this action was not explained by mental age on the

BPVS, although the difference was reduced to just below significance level when the groups were matched on the TROG. Table 3.8 (Appendix 3.4) illustrates the significant results from the matched samples for individual actions.

Although the autistic children were not significantly worse on any of the body/gestural meaningful actions, as we have already seen, their lower scores combined to show a significant difference over all the actions in this category. Also on the actions within the symbolic action category, the scores were lower for the autistic children, although not significantly so

Table 3.7. Specific actions which account for significant diffferences on the Kruskal-Wallis analysis described above (a) including young autistic children; (b) excluding young autistic children. (** denotes significance at 0.001 level, * denotes significance at 0.01 level). Definitions in Appendix 3.1.

| Action | | Result | Posthoc result |
|---|---|---|---|
| Finger wiggle | a) | ** | 5-6 > 3-4<br>5-6 > Young autistic<br>MLD > Young autistic |
| | b) | not significant | |
| Peekaboo | a) | * | MLD ><br>5-6 > Young autistic<br>Adults > |
| | b) | not significant | |
| T-sign (T) | a) | * | MLD ><br>5-6 > 3-4 year olds<br>Adults > |
| | b) | ** | as for (a) |
| T-sign (--\|) | a) | not significant | |
| | b) | * | 5-6 >3-4 year olds |
| Two-finger clap | a) | * | MLD > 3-4 year olds<br>5-6 > |
| | b) | * | All groups > 3-4 year olds |
| Grasp Thumb | a) | * | 5-6 > autistic |
| | b) | * | as for (a) |
| Turn (ballet) | a) | * | 5-6 > 3-4 year olds<br>autistic > |
| | b) | * | as for (a) |
| Sit and rock | a) | * | 5-6 > young autistic |
| | b) | * | 5-6 > 3-4 year olds |
| Mime brush teeth | a) | * | MLD > young autistic<br>Adults > |
| | b) | not significant | |
| Mime rope pull | a) | * | 5-6 > young autistic |
| | b) | not significant | |
| Make spy hole | a) | ** | 5-6 > young autistic<br>MLD > young autistic<br>MLD > 3-4 year olds |
| | b) | ** | 5-6 > 3-4 year olds<br>MLD > 3-4 year olds<br>MLD > autistic |
| Roll and flick | a) | ** | 5-6 > young autistic<br>MLD > young autistic |
| | b) | not significant | |
| Baa! | a) | * | MLD > young autistic<br>5-6 > young autistic |
| | b) | not significant | |

**Discussion.**

Performance of different samples:

I predicted in the introduction to this chapter that it would be the youngest autistic children who would have most problems with imitation in general and this certainly was the case for almost every action tested. Unfortunately, it is difficult to form clear conclusions about the young autistic children because of the high level of distraction that they showed, illustrated by the number of refusals and "actions not resembling target action" which they produced. The two children in this group who did respond to the demonstrations for the most part, were the two oldest children, both with a CA over 7 years. They both seemed to enjoy "the game" and performed at much the same level as some of the 3-4 year old children. However, although firm conclusions cannot be drawn, the results found here for the younger autistic children may point to the fact that it is earlier in development that autistic children are impaired in imitation and that this ability improves with age and experience. This is what Rogers and Pennington (1991) predicted in their model of autistic development. Rogers and Pennington did not specify what age they expected the ability to imitate to emerge. I will deal in a later chapter (Chapter 6) with the development of imitation in autism and the relationship with age. For now I will concentrate on the group specific results.

The 3-4 year old children, despite often using imitation spontaneously in play and in learning (See Chapters 1 and 2 for details), were poor at imitating most of the actions presented to them. Some of them were very keen and highly motivated to take part, others were not. Some wanted to play but also wanted to *choose* which actions to imitate. However, the number of refusals produced by this group was not more than for the other groups and so it is safe to say that this group of normal children performed poorly on many tasks in comparison to older normal children and often in comparison to children with learning difficulties and autistic adults. On several actions they even did worse than the autistic children. However, for the most part there were few significant differences between the autistic children and the 3-4 year olds. Not only were the errors produced the same for both groups (indeed for all

groups) but they were just as common in both these groups. These included reversing the hands when performing an action such as peekaboo or grasp thumb, using a body part as the object (e.g. the hand as a saw or the finger as a spoon) or not "allowing room" for the pretend object in the hand when miming an action. As far as overall performance goes, the autistic children's scores tended to be higher than the 3-4 year old children's, but not significantly so. Since the average mental age of the autistic group was 4 years 6 months (on BPVS), with half the children falling below 4 years and half above, then it could be said that the autistic children were performing broadly at a mental age-appropriate level.

The autistic adults consistently performed at a higher level than the autistic children, although not significantly so. There are no significant differences between the performance of the adults and the two older control groups. The adults often joined the 5-6 year olds and MLD children in showing better imitations than the 3-4 year old children. Although some of the same errors occured in the adult group, they were often self-corrected, without any prompts and the frequency of inaccurate imitations was much lower as the number of 6s scored illustrates.

When the identically matched subgroups were compared on the action categories there were also interesting results which suggested that there were a few types of actions which autistic children and adults were less able to imitate than mental age matched controls. There were no significant differences for those matched on MABPVS but for children matched on TROG score, the non-autistic groups showed better imitation on meaningful/symbolic actions and on vocal speech sounds. This latter result was surprising given that there is a prevalence of echolalia in autism but may be explained by the fact that the sound was presented with an action - the autistic children often chose to do either the sound only or the action only, therefore not receiving a perfect score. Perhaps two actions at once is confusing for the autistic children, in the same way that longer sequences may be. The significant difference on meaningful/symbolic actions, despite being identically matched on TROG raw score, proves that this is one area where autistic children may have difficulties. Finally, when matched on Chronological age, although the adults were not included here, the autistic children did worse on meaningful/symbolic actions and symbolic actions with objects. This, of course,

strengthens the finding that autistic children, in general, do worse on these actions, especially in comparison to 5-6 year old children. This deficit then is not a result of a higher MA or CA on the part of the non-autistic children.

Islets of difficulty in autism:

The principal finding was that younger autistic children have more problems with imitation than older autistic children and adults, who, at least those used in this study, do not show a general deficit in elicited imitation. Both the schoolage autistic children and autistic adults operated at mental age appropriate levels, performing slightly better than the normal 3-4 year old children. There were very few individual actions where the school-aged autistic children did worse than any of the control groups and none where they do worse than both the older control groups. However, there were a few actions were the school age autistic children did have poorer scores than non-autistic children, although for the most part this was not significantly so. The most striking example was the grasp thumb action where most autistic children performed more poorly than the 5-6 year old children, although this difference was reduced when TROG raw score was controlled for. However, even on this action there was no differences between the autistic children and the 3-4 year olds and also no difference between the autistic children and the children with learning disabilities. The three groups of actions where the autistic children seemed to have some difficulties were 1) body/gestural two handed actions, although out of 12 actions only one (Grasp thumb) showed a significantly worse performance and the overall category produced no significant differences; 2) symbolic actions with objects, where the autistic children had lower scores for most actions but not significantly so. When matched for chronological age the non-autistic children performed better than the autistic children, although this difference was wiped out when subgroups matched on mental age were compared; and 3) Meaningful/symbolic gestures produced the only really significant difference between school aged autistic and non-autistic children.

All these actions have something in common - the need for symbolic capacity. In many of the two-handed actions the difficulty may arise in the time needed to

make the mental rotation from what the child sees to what the child does. In a small pilot study conducted the children would often correct themselves if shown the action again or the action was held for longer. Since these mistakes were most common among the younger autistic children, younger MLD children and the 3-4 year olds, then perhaps the problem is not with "cannot do" but with the time needed to make the more difficult transformations. The symbolic actions with objects involved the use of one object, in combination with an imaginary object - in the spirit of pretend play. Finally, the meaningful/symbolic gestures used no object so there was no concrete point of reference for the child - pure pantomime was required. This, of course, requires the child not only to transpose the action from the opposite perspective to his/her own but also requires the ability to pretend in what may be the hardest circumstances - with no objects present. For the two familiar actions that were meaningful but did not require pretense - the thumbs up and okay sign - the autistic children did not have a problem.

This problem with symbolic imitation ties into what we know of the normal development of imitation and indeed normal development in general. Piaget (1951) suggested that symbolic imitation (and deferred imitation) were the final two basic manifestations of imitation in early development. These are the last to develop and after this it is only really the accuracy of the imitations that changes. If symbolic imitation is the most advanced form of early imitation then it is not surprising that some of the older autistic children had problems with these actions, even when they could imitate the developmentally easier actions such as vocal, body actions and non-symbolic actions with objects. The very fact that they involved symbolic capactiy of course, also ties in with their inability to engage in pretend play.

In general then my predictions regarding imitation of symbolic actions were correct - this was the type of imitation with which autistic children, even those who were older and showed no general deficit in imitation, showed most problems.

Comparisons with previous literature.

This study supported different aspects of the previous literature. In finding no general deficit, this study is consistent with results found by Morgan et al (1990), Thatcher (1977) and Charman and Baron-Cohen (1994). These previous studies

found no deficits on either gestural imitation or procedural imitation. Although there was not a general deficit in gestural imitation in this study, some actions were found to be harder and produced partial imitations. These results tend to fall more in line with studies like those by Ohta (1980), who found partial imitations of gestures such as T-signs; Curcio and Piserchia (1978), who found no deficits on simple body actions but a large percentage of partial imitations when imitating symbolic actions; and Hammes and Langdell (1981) who found that all autistic children could copy non-symbolic actions with objects, but half of them did not copy symbolic actions with objects and those who did produced partial imitations, such as using body parts as objects or closed gestures.

The results from this study did not support the deficit in imitation seen in most of those studies which looked at gestural and vocal imitation (Abrahamsen and Litchell, 1990; Sigman and Ungerer, 1984; Jones and Prior, 1985), except for the results from the present group of very young autistic children, who did have more problems with all types of imitation but also tended to refuse to attempt the task. More work on this younger autistic group could prove important in confirming whether there is a deficit in imitating simple gestures at a younger stage or whether this group is simply harder to motivate. The results reported here did not find a problem with non-symbolic actions with objects, unlike the study by Stone et al. (1990). As already seen, this study replicated results of problems with symbolic actions, particularily when fully symbolic or pantomimic in nature (Hammes and Langdell, 1981; Curcio and Piserchia, 1978). However, there were also some problems for autistic children when objects were used in a symbolic manner (Hammes and Langdell, 1981; Heimann et al., 1992; Curcio and Piserchia, 1978).

It should be noted that this study differed from some of the previous studies in that imitation was much more explicitly elicited, while some previous studies could be said to have examined more spontaneous imitation. However, it is impossible to establish the exact nature of this difference because some studies did not explicitly state what instructions children were given, or how their attention was drawn to the task in hand. This is especially true of those studies which examined gestural and vocal imitation as one of the sensori-motor skills. Those that did explicitly state the instructions given include the following studies: Ohta (1987), who instructed

children to watch the action being modelled and then "mimic" it; Hammes and Langdel (1981), who instructed their subjects to "watch the boy, and do what he does"; Rogers and McEvoy (1993), who asked their older, more able subjects to imitate the actions presented; and Stone et al (1990) who modeled the action and then gave a verbal such as "Do this" or a non-verbal prompt, such as giving the child the object. Heimann et al. (1992) stated that the imitation tasks they used were elicited but did not say *how* the response was elicited from the children. Charman and Baron-Cohen (1994) did not verbally instruct the children to imitate, but, if the child failed to lift the object, the experimenter handed the object to the child and/or gave a non-specific prompt such as "what can you do with this?". Finally, DeMyer et al (1972) did not verbally instruct children to imitate, but gave the children five trials in which to repond. They attracted subjects' attention by saying "Look!" along with the child's name.

In the present study, instructions were kept to a minimum. However, the children were prompted to "Do As I Do" to begin with, and again during the session if they refused to attempt to imitate (Using prompts such as "Look! Do this!" or "It's your turn now"). They were, however, only shown the action a maximum of three times, and then only, when they had not been paying attention on the first presentation. The actions were also only shown again if there was no reponse on the first presentation. The children had an opportunity to refuse to imitate and this opportunity was taken by most of the young autistic children, for example. So although the actual testing scenario may have encouraged the children to at least attempt to imitate, more than a less instructed scenario, this in itself is important for three reasons: first, some previous studies used a very similar scenario to the one used here and found similar results. Second, a few very specific deficits were found, despite the instructions, with regard to symbolic imitation and some of the two-handed actions which required a more complex reversal of perspective. Third, these results illustrated that autistic children may be able to learn by imitation, when it is accompanied by minimal instructions.

Finally, although the results were not analysed in a way that relates directly to Smith and Bryson's (1994) suggestions of distinguishing imitation of different types of actions such as actions with and without objects, non-symbolic and symbolic

actions, one-handed and two-handed actions, visible and invisible actions etc. Although the 9 categories were not directly compared with each other, it is possible to say that scores were higher for most of the actions with objects than the actions without objects, non-symbolic actions were easier compared to symbolic actions and one-handed actions produced slightly higher scores than two handed actions. The results for visible and invisible actions were not analysed separately although this would be possible and may be done for future papers. As such then I will refrain from speculating on the possible implications for Smith and Bryson's theory, except to say that there does seem to be some dissociation between imitation of different types of actions, even for older autistic children and some adults, the theoretical implications of which need much deeper analysis than I can possibly provide in this thesis.

Conclusions and implications:

To summarise the results, then, young autistic children did show less imitation than all the other groups involved in the study. This is as Rogers and Pennington (1991) predicted, although we must be careful in interpreting the present results because of a general problem with motivation and a setting that was different for this younger group of children. However, both of the older autistic groups showed no general deficit in imitation. In fact the autistic adults generally had higher scores than the school-age autistic children, although not significantly so. In general, neither autistic group had problems with actions on objects, when no pretence was required. Nor with vocal imitation or body/gestural imitation, unless these involved pretense or a more difficult mental rotation, such as needed to imitate two-handed actions compared to one-handed actions. In general, both groups performed at high levels on all the actions presented to them.

Apart from the very young autistic children, there were no problems motivating the autistic subjects. In fact of all groups, the autistic children seemed to enjoy their sessions most. It was felt that in sessions with the autistic children, something very close to a normal social interaction was engaged in. Although this was not studied formally, it may be important for future interventions. Encouraging

the child to imitate, perhaps in addition to imitating the child, may be instrumental in helping to increase and expand the autistic child's ability to engage in social interaction. This has been already been suggested by other researchers, e.g. Dawson and Adams (1984), and Nadel (in press). Whether it would improve peer interaction remains to be seen but if introduced at a very early stage in the home, one might follow from the other, as it does in normal development.

From a theoretical point of view, these findings seem to point towards support for Rogers and Pennington's theory to some extent. However, it must always be remembered that Rogers and Pennington's theory was very non-specific in its predictions and is difficult to test due to the nature of the underlying deficit. The only aspect which differentiates it from other theories of autism is imitation, but whether that is strong enough proof remains doubtful. Intersubjective communications may well be important at an earlier stage of development (Meltzoff and Gopnik, 1994). The results from the younger autistic children in this study, suggest that if a satisfactory way of testing very young children can be found, it is these and even younger autistic children who might have problems with imitation. Unfortunately, the lack of an early diagnosis makes this very difficult to test and only a longitudinal study will really be able to answer questions about the early development of imitation in autistic children.

These issues will be discussed further in later chapters when all the other behaviours have been examined and any links between them can be analysed. Chapter 6 will examine in more detail the development of imitation and the relationship with age, while Chapters 7 and 8 will look at the relationship between imitation and other abilities as predicted by Rogers and Pennington (1991). However, the investigation of imitation itself should not stop with elicited imitation. Several questions remain to be answered. Can autistic children imitate an action on an object after a delay (e.g. as long as 24 hours)? Do they spontaneously imitate a sequence of problem-solving actions carried out by another person on a novel object? Does the ability to imitate that we have seen in immediate elicited imitation generalise to other types of imitation and other developmentally similar behaviours? These questions will be answered in the following chapters of this thesis.

# Chapter 4
# Spontaneous imitation on a novel object - artificial fruit task

## Introduction.

The rationale behind this experiment was to investigate the autistic child's ability to imitate spontaneously on a task that involved solving a problem. In 1991 Rogers and Pennington proposed that a deficit in imitation in young autistic children could be important in understanding autism. Although they made a distinction between vocal and gestural imitation, they did not distinguish between spontaneous and elicited imitation or consider the different manifestations of imitation that emerge at different stages in development such as immediate imitation of gestures, delayed imitation, imitation of actions with objects, both symbolic and non-symbolic and using imitation as a problem-solving tool. Chapter 2 looked at imitation in the spontaneous, everyday environment of autistic children and adults, while Chapter 3 examined autistic children and adults ability to produce elicited imitation. In Chapter 3, it was seen that imitation could be elicited from older autistic children and adults to a high level, so that, except in isolated cases of pretence, there were no significant differences between autistic individuals and older control children. Younger autistic children, on the other hand, had more problems in general with imitation. At a very general level, this was as Rogers and Pennington (1991) had predicted. In addition, the normal 3-4 year old children performed poorly on elicited imitation, yet the observational study reported in Chapter 2 showed that they imitated the most in a spontaneous situation, while the autistic individuals and older non-autistic children imitated rarely. Those there was a dissociation between spontaneous and elicited imitation. These results are consistent with those of Nadel and colleagues (1982-1993), who on many occasions found that three year old children prolifically imitate peers in a spontaneous situation. They found that autistic children did not imitate as much spontaneously, but that imitation could be *elicited* from autistic children by the right type of model in certain circumstances. The observational results of this study did not show any differences between autistic and control children but rather a general paucity of imitation. It was therefore important to

examine spontaneous imitation in a systematic experimental context. In addition the experiment was designed to distinguish imitation and emulation. Emulation has been defined as reproduction of the end product but using different means (see Tomasello et al. 1993 for a fuller discussion on the differences between imitation and emulation). If, through observation, the child succeeded in the task, but without using the same method which the experimenter used, then the child would be emulating. If the child attempted to reproduce the modelled action, then they could be said to be imitating.

If we think back to Chapter 1 again, we can extrapolate from normal development. Piaget (1962) proposed that imitation of novel actions on novel objects was a more advanced type of imitation than either vocal imitation or imitation of familiar actions. Problem-solving itself comes at a much later stage in development so we might expect that problem-solving by imitation would fall somewhere in between. Piaget found that his children imitated unfamiliar actions with objects at about one year onwards. Meltzoff (1988) would place it earlier in development (at about 9 months). However, at whatever point in development this ability may emerge, all the children in this study had a higher mental age than either estimation. Since, however, this task is conceptually more difficult than the imitation of simple body actions or even actions on objects, it is expected that the younger autistic children will have as many problems imitating the actions necessary as they did in the elicited imitation task. In fact it may be possible that some of the older autistic children may also have problems with this task for the same reason.

On the other hand, work by Nadel (Nadel and Camioni, 1993) would suggest that since this is a task of spontaneous imitation, it is the children with a mental age around 3-4 years who would be more likely to imitate on this task, while those who are older will use their advanced skills to find their own way to solve the task.

The artificial fruit experiment which was used here was first tested by Custance (1994) and is reported in Whiten et al. (in press). Custance used a "plastic fruit", (see photographs in Appendix 4.1 and the description of each action in Table 4.1. More details of the equipment and methods used can be found in Whiten et al, in press) with normal 2 year old, 3 year old and 4 year old children, as well as chimpanzees.

In those experiments the box was presented closed, the lid held either by a handle and pin, or by two bolts. Half the children saw one method of opening each

component part and half the children saw the other method. So, for example, half the children saw the pin turned and the handle pulled straight out and the other half saw the pin spun and the handle turned 180°. On the bolts, half saw the bolts poked from front to back with index finger and half saw the bolts twisted and pulled from the front. No child nor animal saw all three, pin, handle and bolts. It is important to note (and this also applies to the present study) that the turning, spinning and twisting motions were not necessary to remove the relevant component parts. Thus if the child reproduced something of these irrelevant actions, they could be said to be imitating. If they pulled out the part without any turning/twisting or used any other method, emulation would be a more relevant description. It was found that all groups of children were coded as imitating faithfully at least on some of the components of the fruit. They also showed large amounts of less faithful imitation, in particular on the pin. The chimpanzees produced less faithful imitation than children in general but did imitate enough that the coders were able to say which action they had seen, in the case of the bolts. Of the children the 2 year olds were less likely to produce faithful imitations and the 3 year olds most likely to do so. Custance also tested capuchin monkeys, who as a group did not respond much at all to the artificial fruit - when they opened it, they did it extremely fast but no significant resemblance to the target action was demonstrated (Custance, 1994).

In the present experiment several changes were made from the original methodology. Firstly, the fruit was presented with all the pin, handle and bolts in place (not separately as in the previous studies) and the manipulation of the pin, handle and bolts were presented in that order. This was to examine whether the children would manipulate these in the order presented. Whiten and Custance (in press) note that that was one thing the fruit was originally designed to do, but in their first experiments with primates they simplified the task because of recent findings that apes show less imitative ability than previously thought (Whiten and Ham, 1992). Whiten and Custance suggest that sequence imitation is one measure of program-level imitation as discussed by Byrne (1994). Byrne suggests that the program-level imitation gives us a different level at which to judge whether subjects, either human or non-human, are imitating. This would be imitation of the "logical structure" of an act, without slavishly copying *each* component in the sequence.

Secondly, on the handle, the turn method was changed so that the handle was turned 180° and *then* pulled out. Thirdly, on the poke method, the bolts were pushed out from the back instead of the front and then pulled out the last bit from the front. The principal actions were the same, but these two alterations allowed us to control more strictly for emulation, since the end product is the same for both methods used - the pin is removed, the handle is lifted up and out, and the bolts are removed towards the model and child.

Rogers and Pennignton (1991) did not make specific predictions about the autistic person's ability to spontaneously imitate actions on a novel object. It is difficult therefore to know how this type of imitation would fit into their model. However, since they are predicting that it is the youngest children who are generally impaired in the ability to imitate, they would presumably predict that the case would be the same for any imitation task. In this case, as we see in normal development, we would expect the youngest groups of children to show less imitation on this task. Those children who have a mental age above 5 (i.e. school age) would on the other hand also show less imitation. as they do not use it as much spontaneously (Nadel and Camioni, 1993). Finally, those in the middle group with a mental age between 3 and 4, will use imitation more than both the youngest and oldest children and adults (Nadel and Camioini, 1993). This chapter will only look at the three groups of autistic children and adults (development with age will be dealt with in a later chapter). The youngest autistic children were not tested on the same tests as the older children and adults but they had a mean approximate developmental age of ..... (21 months for 3 at Paris). The mean MA of the school age autistic children was 4;9 on the BPVS. The mean MA of the autistic adults was 6;9 on the BPVS. As such the three groups fall roughly into the three stages of development described above.

## Method

Subjects.

The subjects used for this part of the experiment were as for Chapter 3 except that nine of the MLD children took part in the experiments. Six young autistic

children, twelve autistic children, eleven autistic adults, thirteen 3-4 year olds and twelve 5-6 year olds acted as subjects.

Procedure.

The artificial fruit was closed using all three components out of sight of the child. Inside the perspex fruit, and therefore visible to the child, was a sticker or a sweet or some appropriate reward to motivate the child. The child was instructed to watch while the experimenter opened the box, slowly and deliberately performing each action and then opening the lid and taking out a reward to show the child. The fruit was then re-closed, as before, out of sight of the child, then presented to the child with the instruction "Now it is your turn. Can you open the box?". No reference was made to imitating the actions of the model. The aim made clear to the child was simply to open the box. Once the child succeeded in opening the box, they were allowed to touch the reward but were asked not to take it and the box was reclosed so that the experimenter could open it again, using the same method as before. The child was re-presented with the closed box and this time was allowed to take the reward if they opened the box. The instructions between the first and second presentations were that both the experimenter and child would have another go at opening the box. Most of the children saw two presentations. A few of the children were only shown the box once as they were either very distracted during the first presentation or obviously did not want to do any more. Some of the children saw the action three times if they failed to open the box on the first or second attempt; however, it was only the first two attempts that were included in analysis.

If the child failed then they were helped to open the box, stage by stage, so that they got the reward in the end and went away from the test session happy. Table 4.1 summarises the two action sequences shown to the children - with half of each group seeing one sequence and the rest seeing the other sequence. All children saw the same method of opening the lid - the index and third fingers were hooked through the set of hoops on the lid and the lid was pulled open in this way.

Table 4.1 Actions shown to the children on each part of the box with brief description. Photographs of each method can be found in Appendix 4.1

| Part of box | Method 1 | Description | Method 2 | Description |
|---|---|---|---|---|
| Pin | Turn (T) | Pin is held between the thumb and index finger and turned several times using a wrist rotating movement (usually six) in a clockwise direction, and then pulled out. | Spin (S) | Pin is spun in a clockwise direction, using tip of index finger and then is pulled out. |
| Handle | Pull (P) | Handle is pulled straight up and out of the holder, using index and third fingers | Turn (T) | Handle is turned $180^0$, so that flat part is facing model/child and then lifted out. |
| Bolt | Poke (P) | Bolts are poked out most of the way, one at a time, from the back of box to the front using the index finger. They are then pulled out the rest of the way from the front. | Twist (T) | Bolts are grasped with right hand and turned in a clockwise direction, using a wrist twisting motion, while being pulling out from the front. |

Coding/Analysis

As for the deferred imitation analysis, two independent, naive observers coded video recordings of the children's responses to the box. Both coders were asked to code both the first and second attempts by the children and coded the response on the pin, the handle and the bolts separately. The interobserver reliability was significant and high on all the actions/presentations (average r value on Pearson's Product Moment Correlation over 12 correlations (each method for each component for each presentation) of 0.80). The results of the two coders were averaged for the rest of the analysis, so that there was only one set of data per child per attempt on each component of the box.

The coding was done on the basis shown below in Table 4.2 and was achieved in two stages - (1) a decision of which action the child saw and (2) the certainty with which the coder made the decision. This was then re-coded onto a five point scale so that 1 = very like one method; 3 = could not really tell - a guess in one direction or another; and 5 = very like the second method. Table 4.2 below illustrates this for the actions on the pin.

Two questions needed to be answered. Firstly, was spontaneous imitation evident for each group? Would each child reproduce an action like the action shown by the demonstrator, more than an action not shown? For example, on the pin, would those children who were shown spin produce more actions that resembled spin than resembled turn? To answer this question in a way that would allow comparison to the original Whiten et al. (in press) study, a Wilcoxon Mann-Whitney test was carried out to compare the scores of those who saw one method with those who saw another method for each component part of the fruit.

It must be noted that the group of young autistic children was very small in size (n=5) and therefore could not be compared using the method described above. They were, however, included in the second analysis described below.

Table 4.2: The three stages of coding used to answer the experimental questions. Here the example used is for the actions on the pin.

1) First coding by observers (Figures in brackets are the certainty rating):

| Turn (2) | Turn (1) | Not Sure (0) | Spin (1) | Spin (2) |
|---|---|---|---|---|

2) First re-coding by experimenter - Similarity of response.

| Very like turn | Quite like turn | not like either/ mixture both | Quite like spin | Very like spin |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

3) Second re-coding by experimenter - Imitation Index (action demonstrated = spin)

| Very like action not seen | Quite like action not seen | Not like either/ mixture of both | Quite like action seen | Very like action seen |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

Secondly, the experiment aimed to establish whether there were any differences between groups - would autistic children and adults perform worse or better than any of the other groups? To allow a response to this question the scores on the five point scale were recoded for one of the two actions in each pair, i.e. turn pin, pull handle and poke bolts, in such a way as to reverse the scales. In this second re-coding (Featured in Table 4.2) a score of 5 always corresponded to imitating the action seen; a score of 1 always corresponded to the action not seen and a score of 3 signified a tendency to produce either a mixture of the two actions or a completely different action. This was again analysed using a Wilcoxon Mann-Whitney test. If no differences were found between the three autistic groups and between the three non-autistic groups, then these two sets were collapsed into an autistic and a non-autistic group for additional analysis.

In interpretation of this additional analysis, the results between the individual groups and the results of the analysis when the autistic and non-autistic groups were matched on CA, MA on the BPVS and the raw score on the TROG, must be borne in mind at all times. The autistic/non-autistic comparison, was intended as a baseline measure against which the CA, MA and TROG matched analysis could be considered (Mann-Whitney tests were chosen in order to allow comparisons with the Whiten et al. study (in press) at a later date).

**Results.**

Of the sixty-four children and adults who saw the box on at least one occasion, only three refused to open the box. Two of these children did not even touch the box, one young autistic child tried to throw it. In addition to these three, one child could not be coded on either presentation due to an editing problem on the video tape (the coders were able to see which actions the child was shown). Similarly for a few other children the coders could not code *one* part of the box, because they could see the action that the children had watched. This, however, occurred rarely. The percentage of each sample that completed the opening of the box is shown in Table 4.3 below.

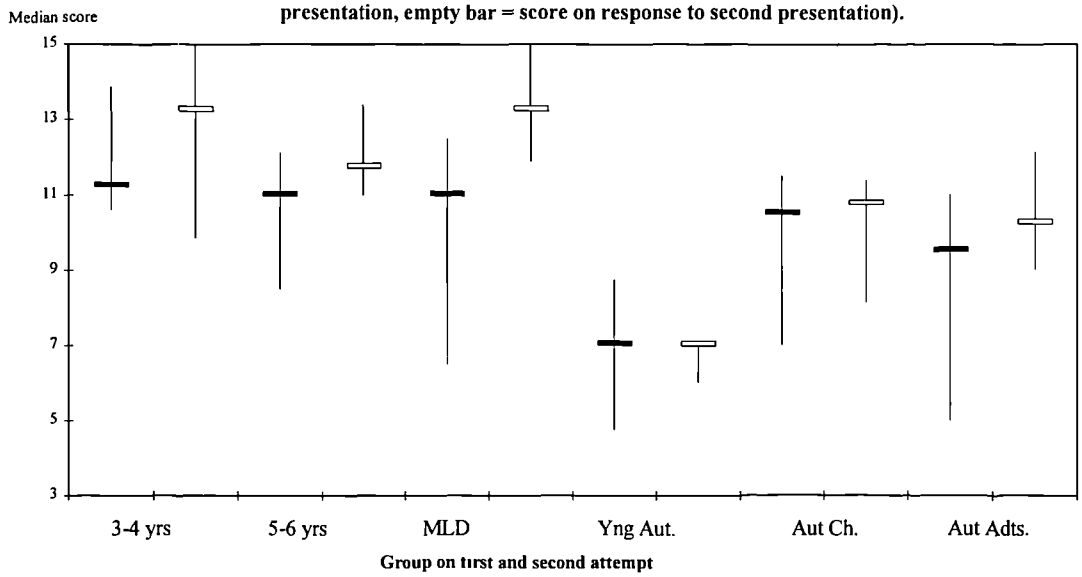
Table 4.3 Percentage of children/adults in each group who succeeded in opening the box on the first attempt (not including those children who did not respond at all).

| Group | Percentage of children opening box |
|---|---|
| Young autistic children | 60 (n=5) |
| Autistic children | 75 (n=12) |
| Autistic adults | 73 (n=11) |
| MLD | 89 (n=9) |
| 3-4 year olds | 92 (n=12) |
| 5-6 year olds | 100 (n=12) |

Is there a tendency to imitate?

Figure 4.1 illustrates the median scores on the imitation index (recoding 3) for each group of children on first and second presentations. There were no significant differences between the first and second responses, although the general trend was for a higher imitation score on the second response. In general terms the scores were highest for the three to four year olds, then the 5-6 and MLD children, then the autistic adults, and finally the young autistic children.

**Figure 4.1: Median Score and interquartile ranges for the overall scores of each group across all three components of the plastic fruit - pin, handle and bolt (filled bar = score on reponse to first presentation, empty bar = score on response to second presentation).**




When the subsets of autistic and non-autistic subjects were matched identically on chronological age or mental age on BPVS and TROG raw score, the differences were as illustrated in Table 4.4. When matched on CA (n=9 in each group) the non-autistic children had higher scores than the autistic children for the second response but not the first response ($z = -0.482$ $p>0.05$ for first response; $z = -2.586$ $p<0.01$ for second response). When matched on mental age, either on BPVS (n=12 in each group) and TROG (n=10 in each group), there were no differences between the autistic and non-autistic groups on either first or second responses.

Table 4.4: Summary of results for overall performance on artificial fruit imitation experiment for the autistic versus non-autistic group, when matched on chronological age, mental age on BPVS and TROG raw score. The results for the Mann-Whitney, which tested whether the non-autistic children showed more imitation than the autistic children, are shown in the shaded columns, opposite the non-autistic groups.

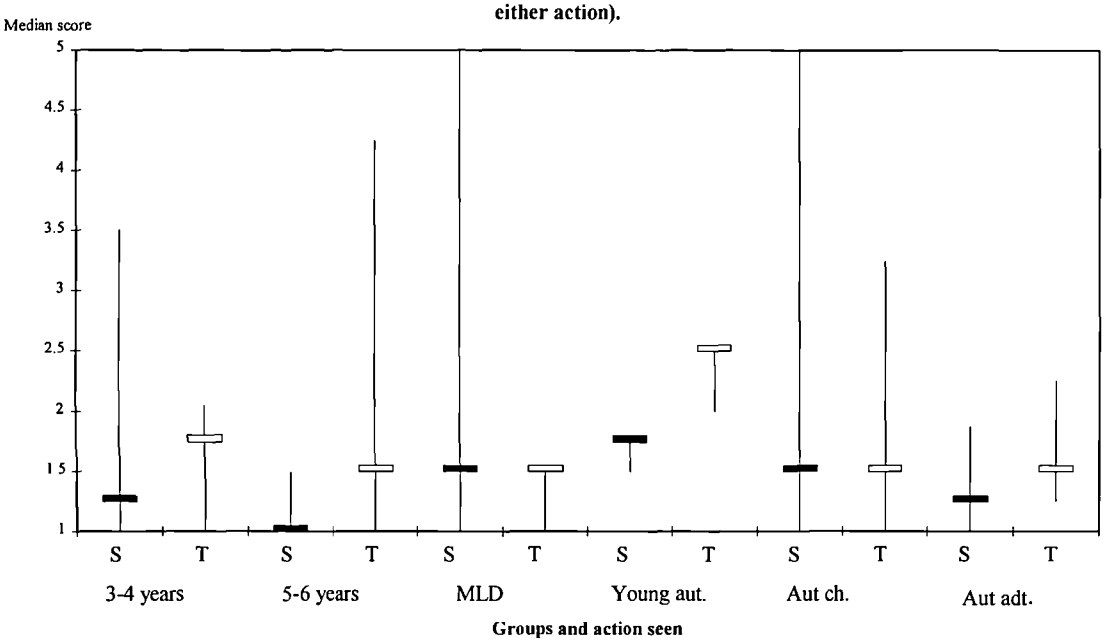
| **Group** | **Matched on CA** **Medians** | **Mann-Whitney results** | **Matched on BPVS** **Medians** | **Mann-Whitney results** | **Matched on TROG** **Medians** | **Mann-Whitney results** |
|---|---|---|---|---|---|---|
| **Autistic First attempt** | 7.25 | | 7.5 | | 9.5 | |
| **Second attempt** | 9.5 | | 11 | | 11 | |
| **Non-autistic 1st attempt** | 9.75 | N.S. | 11 | N.S. | 10.75 | N.S. |
| **second attempt** | 13.75 | higher score than autistic second attempt $z = 2.59$ $p<0.01$ | 13 | N.S. | 11.5 | N.S. |

When each of the six groups were compared using a Kruskal-Wallis test on median overall scores, it was found that on the first attempt the 3-4 year old children showed higher levels of imitation than both the young autistic children and the autistic adults (K-W = 12.67 $P<0.05$). On the second attempt it was the MLD children who improved their performance so that they showed higher imitation scores than the young autistic children (K-W = 15.40 $p<0.01$). There were no other group differences evident.

Individual components of the box:

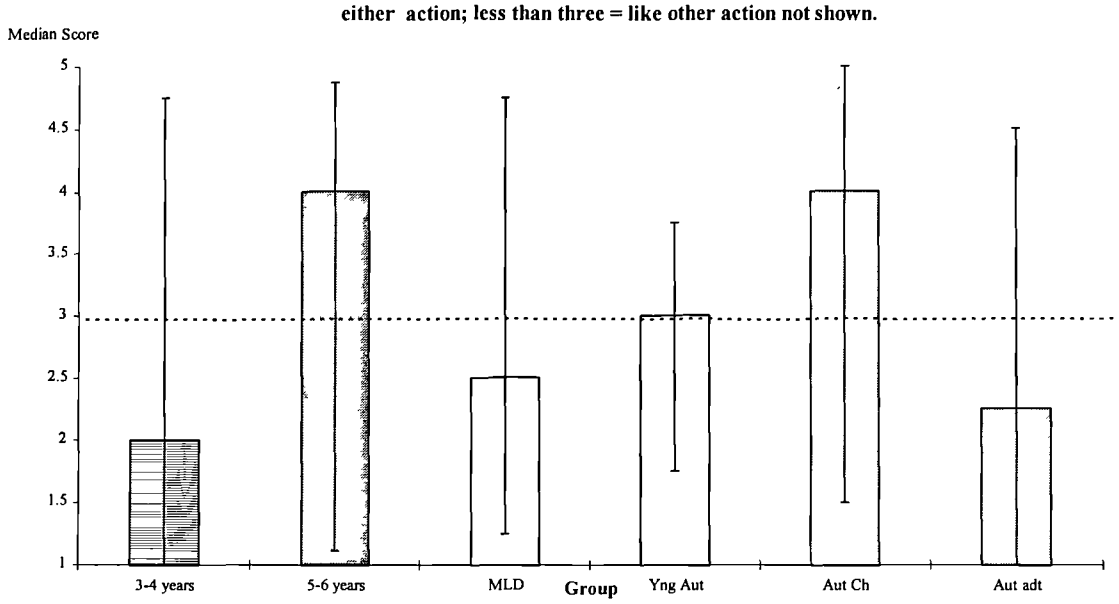
*Results for actions on pin.*

**Figure 4.2: Median scores and interquartile ranges for each group on the PIN. filled bar= saw spin, empty bar = saw turn (N.B. A score of five = very like spin, 1 = very like turn, 3 = a mixture of both or not like either action).**




Figures 4.2 and 4.3 illustrate the median scores and interquartile ranges for the children's responses to the pin. None of the groups who had watched *spin* showed a significantly higher score for *spin* than *turn*, which should have been the case if the children were imitating. (N.B. Although featured on the graph, the young autistic children were not included in the data analysis, for the reasons described on page 171) The overall imitation scores for *spin* were much lower than the scores for turn and this was significant on a Mann-Whitney at 0.05 level (z = 3.53). All groups clearly found *spin* more difficult - those shown *spin* tended to turn the pin, rather than spin it.

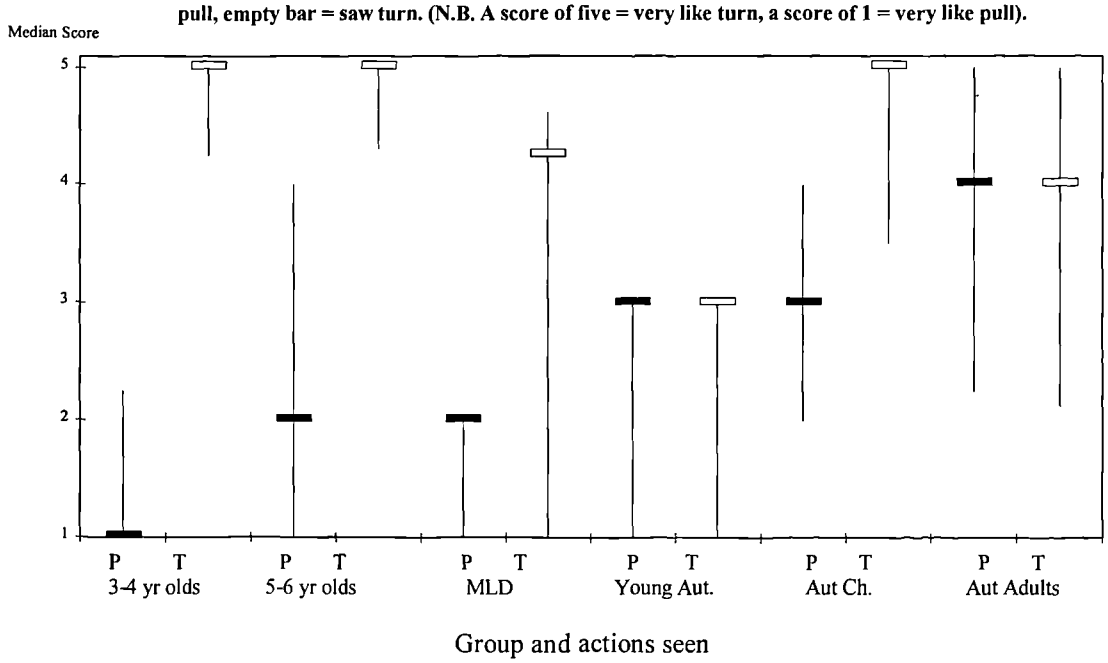
**Figure 4.3 Median Score and interquartile ranges for each group on the imitation index on the Pin (N.B. A score above three = like action seen and therefore, imitation; A score of three = not like either either action; less than three = like other action not shown.**




There were no differences between groups when divided into autistic and non-autistic and no differences between first and second responses, although the 5-6 year old and autistic children both had a median overall score of 4, which was the highest score. These are illustrated in Table 4.5 below. One interesting anecdotal result with regard to the pin, is that many of the children shown either method tended to keep spinning or turning for much longer than the model had demonstrated. This was also evident in Whiten et al (in press). It may be that they were expecting the pin to be threaded. The younger children especially take much longer to discover that the pin needs to be pulled out. This discovery is often made by accident, when a change in hand position while turning the pin results in the pin coming out part of the way. On the other hand some of the older children just pull the pin straight out, realising perhaps that this turning is not necessary.

*Results for actions on handle.*

**Figure 4.4: Median Scores and interquartile ranges for each groups on the HANDLE. filled bar = saw pull, empty bar = saw turn. (N.B. A score of five = very like turn, a score of 1 = very like pull).**

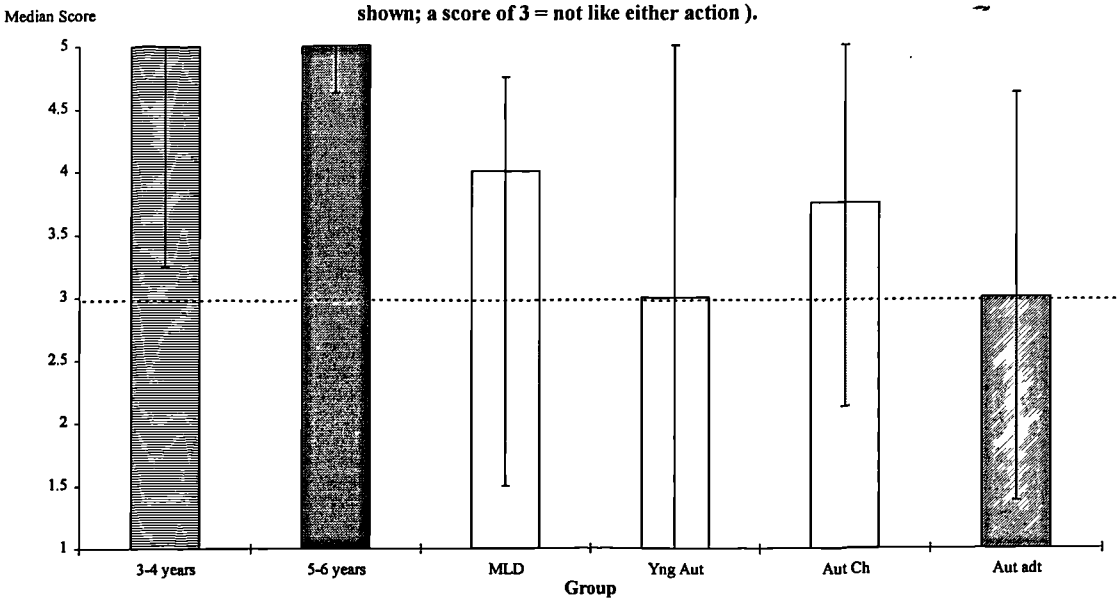



For the handle the picture is a little different as Figures 5.4 and 5.5 illustrate. Over all the children, irrespective of group, those who saw *turn* scored significantly higher than those who saw *pull,* which is as we would expect if imitation was being used ($z = -3.51$, $P<0.001$). However, when the groups are taken separately, none of the autistic children or adults show a significant difference between the scores of those shown *pull* and those shown *turn.* The same occurred in the MLD group (although for both the MLD and autistic children then tendency was towards higher scores for turn than pull). It is the 3-4 year old children and the 5-6 year old children who both had significantly higher scores for turn than for pull (Significant on Mann-Whitney at 0.01 level and 0.001 level respectively), illustrating that they are more likely to produce an action like *turn* if shown *turn* and an action like *pull* if shown *pull* (N.B. this analysis not done for young autistic children).

The autistic and MLD groups appeared to perform well on turn, however, they also tended to *turn* when shown *pull.* The autistic and MLD children seem then to have

been using their own method to accomplish the task for the *pull* method. This method resembled *turn*, for the most part, thus the lack of a significant difference on the statistics.

**Figure 4.5: Median scores and interquartile ranges for each group on imitation index on the handle. ( N.B. a score of more than 3 = like action shown; a score of less than 3 = like action not shown; a score of 3 = not like either action ).**



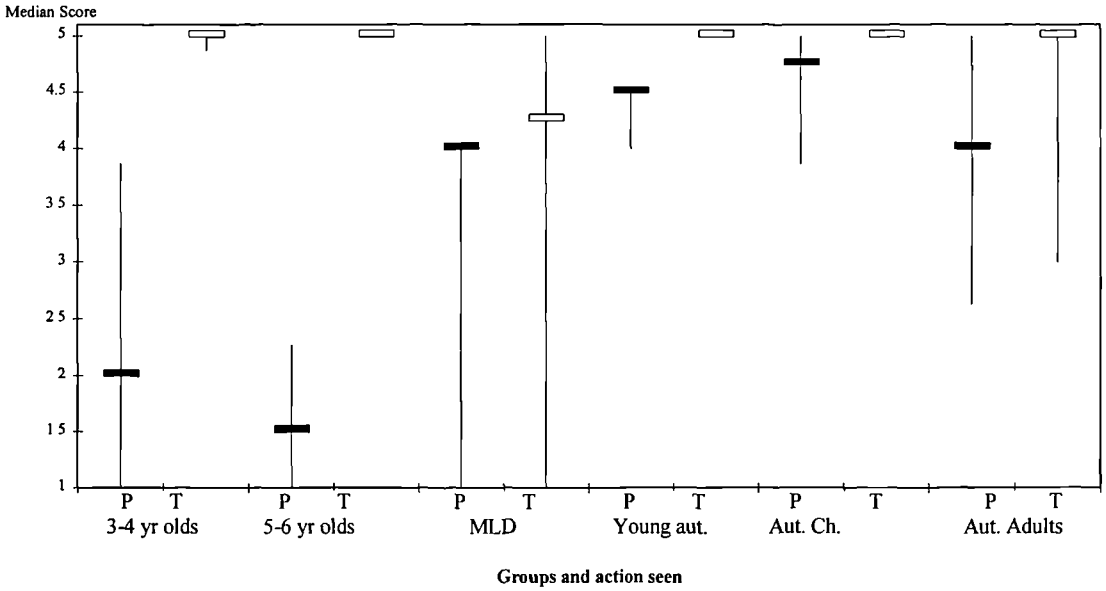

When collapsed autistic and non-autistic groups (c.f. page 143-144) were compared across imitative score the non-autistic children had higher imitation scores than the autistic children/adults ($z = 2.05$, $p<0.05$), as the above results would suggest. The median scores for each of the six groups combined over pull and turn can be seen in Table 4.5. The basic picture is that the young autistic children and adults have a median score of three, suggesting that the coders found it hard to label the action one way or the other. The autistic children and MLD children have medians close together, nearer the 4 mark, suggesting that more children tend towards imitating the action shown than the action not shown but some children still use their own method. Finally, the two normal groups both have a median score of five, illustrating that at least on this action they tend to use the method demonstrated rather than any other method.

It was observed that, as in the Whiten et al (in press) study, the subject turned the handle more rotations than had been demonstrated. Many of the younger children kept

turning and turning and once again it often seemed to be by accident that they discovered that the handle could be pulled upwards to be lifted out.

*Results for actions on bolts.*

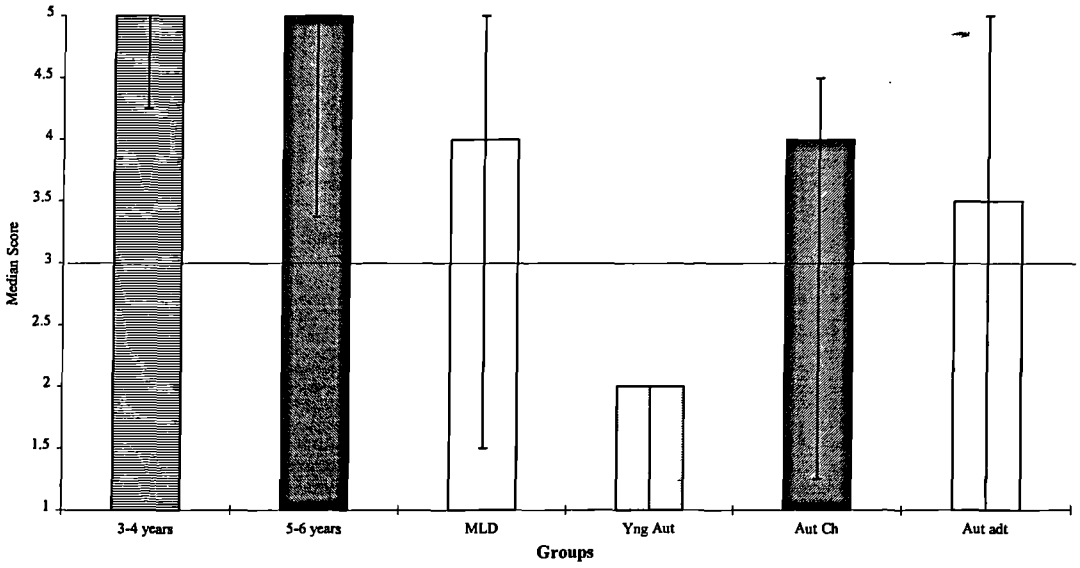
**Figure 4.6: Median Scores and interquartile ranges for each group on the BOLTS. Filled bar = saw poke, empty bar = saw twist (N.B. A score of five = very like twist, a score of one = very like poke).**




On the bolts the general picture was the same as for the handle. Over all the children there was a tendency for subjects who saw *twist* to score higher for *twist* than for *poke*, which would suggest an overall tendency to imitate the action demonstrated ($z = 3.12$ $p<0.01$). Again, however, only the 3-4 year olds and 5-6 year olds produced significantly higher scores for *twist* than *poke* at 0.05 level (N.B. Young autistic children not included in this part of the analysis). For overall imitation scores (see Figure 4.7) the picture is similar to the pin, *poke* seems to be more difficult for the autistic children/adults than for the non-autistic children. On *twist*, all groups showed a median of five so there was a strong tendency to produce an action like *twist* when shown *twist*. But *poke*, often produced an action more like *twist* because the child tended to pull the bolts straight out from the front, pointing perhaps to a tendency to emulate rather than imitate. For the MLD group there is a wide variation in the scores for both *twist* and *poke*. However, like the autistic groups, the MLD children performed

quite well on *twist* but also tended to perform an action more like *twist* when shown *poke*.

**Figure 4.7: Median Scores and interquartile ranges on the imitation index for the BOLTS. ( A score greater than 3 = like action shown i.e imitation; a score less than 3 = like action not shown; a score of 3 = not like either action - no imitation ).**




When the groups were divided on the autistic/non-autistic basis (c.f. page 143-144), the non-autistic children showed significantly higher scores on the imitation score than the autistic children ($z = 2.12$ $p<0.05$). From the median scores for each of the six groups (See Table 4.5), all groups except the young autistic children and autistic adults score between four and five on the scale, suggesting a high overall tendency to imitate. The non-significant result for the autistic and MLD groups, along with the large interquartile ranges seen on Figures 4.6 and 5.7, emphasise the large variability within groups. Some children can be clearly coded as reproducing the modelled actions while some children can clearly be coded as producing the action *not* modelled to those children.

Table 4.5. Median Imitation Index Scores for each group when the scores for the two methods are combined - turn plus spin for the pin, turn plus pull for the handle and poke plus twist for the bolts. (** denotes a significant difference between collapsed autistic (n=29) and non-autistic (n=34) groups at 0.01 level on a Mann-Whitney test, in the direction of non-autistic groups having higher scores than autistic groups; *** denotes a significant difference at 0.001 level; n.s. = not significant).

| Part of Box | Result on Mann-Whitney test | Median Scores | Groups |
|---|---|---|---|
| Pin | n.s | 3 | Young autistic |
| | | 2.75 | Adults |
| | | 4 | Autistic |
| | | 2.5 | MLD |
| | | 4 | 5-6 year olds |
| | | 2 | 3-4 year olds |
| Handle | *** | 3 | Young autistic |
| | | 3 | Adults |
| | | 3.75 | Autistic |
| | | 4 | MLD |
| | | 5 | 5-6 year olds |
| | | 5 | 3-4 year olds |
| Bolt | ** | 2 | Young autistic |
| | | 3.5 | Adults |
| | | 4 | Autistic |
| | | 4 | MLD |
| | | 5 | 5-6 year olds |
| | | 5 | 3-4 year olds |

Table 4.6: Summary of results for each part of the box showing the Mann-Whitney results for each group for 1) the pin, with spin having higher score than turn, 2) handle, with turn having higher score than pull and 3) bolts, with twist having a higher score than poke. (n.s. = not significant, * = significant at 0.05 level, ** = significant at 0.01 level and *** = significant at 0.001 level). When the scores are significantly higher in the directions described above this implies a tendency to imitate the action which was used by the model.

| Group | Pin | | Handle | | Bolts | |
|---|---|---|---|---|---|---|
| Young autistic | not tested | n=5 | not tested | n= 4 | not tested | n=3 |
| Aut adults | n.s. | n=10 | n.s. | n=11 | n.s. | n=10 |
| Autistic children | n.s. | n=11 | n.s. | n=12 | n.s. | n=11 |
| MLD | n.s. | n=9 | n.s. | n=9 | n.s. | n=9 |
| 5-6 year olds | n.s. | n=10 | *** | n=12 | * | n=12 |
| 3-4 year olds | n.s. | n=11 | ** | n=12 | * | n=12 |

Sequence imitation:

Finally, the children's responses were scored for the order in which they attempted the sequence of actions - a 2 for attempting the pin and then the handle (and then the bolts - although this last part of the sequence was not scored since there was no other choice for the child to take); a score of 1 was given if the pin was attempted first but followed by the bolts and a zero indicated that either the handle or the bolts was attempted first.

Table 4.7 shows the mean score on the order scale for each group. Figure 4.8 illustrates the percentage of children in each group scoring 2, 1 and 0. It is important to note that although the handle could not be removed with the pin still there, some children did attempt to pull out the handle before removing pin. This had to be scored as 0 since the chance of finding the right sequence after this due to trial and error increased. Some children took out the pin, then the bolts and finally the handle

at the end. However, most of the children attempted the box in the sequence presented.

Table 4.7 Mean and median scores for each group for the order in which the child attempted each task in opening the box after the first presentation. (A score of 2 = in correct order, pin, then handle (then bolts); 1 = pin attempted first but not followed by handle before bolts; 0 = pin not attempted first). Also shown is the mean and median overall scores on imitation.

| **Group** | **Mean score on order of task (out of 2)** | **Mean Score on imitation (out of 15)** | **Median score on order** | **Median Score on imitation** |
|---|---|---|---|---|
| **Young autistic children** | 1.4 | 6.8 | 2 | 7 |
| **Autistic adults** | 1.36 | 8.23 | 2 | 9.5 |
| **Autistic children** | 1.5 | 9.95 | 2 | 10.5 |
| **MLD** | 1.78 | 9.72 | 2 | 11 |
| **5-6 year olds** | 1.92 | 10.62 | 2 | 11 |
| **3-4 year olds** | 1.58 | 11.92 | 2 | 11.25 |

Table 4.7 shows that the median scores are the same for each group and there seems to be no link between the score on imitation of all the components, and the order in which the task is attempted. From the mean scores the autistic groups and 3-4 year old children tended to make more errors in the sequence attempted but it is difficult to say if this was due to a memory or attention problem or just a larger extent of emulation. From the results previously discussed, the latter could be the case for the autistic children, since in general, they often found their own ways of opening the box, rather than imitating what the model did. The 3-4 year old children, on the other hand, did imitate the box actions very closely, so for them it may have been a problem with memory for the actual sequence. This is emphasised by the fact

that a few of the youngest children in each group followed the sequence on the component parts perfectly but when they came to opening the lid, seemed to have forgotten the way to do it. Some of the children managed to open the lid themselves but after trying to touch different parts of the lid. Some of these children attempted to pull on the first set of hoops, i.e. those attached to the side of the box, not the lid, and then tried the right set of hoops.

When the results are looked at in more detail, on response to the first presentation, the only groups to show significantly more full scores (2) than any other scores were the 5-6 year old and MLD children ($X^2 = 7.36$, $p < 0.01$ and $X^2 = 5.44$ $p < 0.05$, receptively). On the second presentation, however, the 3-4 year olds and autistic children also showed more 2s than any other score ($X^2 = 7.36$ and 8.33 receptively, $p<0.01$). The autistic adult's results were almost significant on the second presentation ($p = 0.058$).

There was no correlation between score on order and score on imitation of actions (n=63) but when the results were grouped into those above and below a score of 9 (children who scored more than 9, were averaging more than 3 on each component and therefore must have imitated at least on one component) then a higher percentage of those scoring 9 or less fail on the order task (do not score 2) than those scoring above 9 (30 % and 25 % respectively). If an overall score of 12 (child scoring at on average 4 on each component and therefore imitating on at least two components) is taken as the cut-off point then the differences between a score of two and a score less than two on the order task is significant at 0.01 level ($X^2 = 8.42$).

## Discussion

Motivational Factors:

All the children taking part in this experiment seemed to enjoy using the box. Even the 5-6 year old children found it motivating and asked to do it again in other sessions. The reward of the sweet or a sticker seemed to motivate all children except the young French autistic children who did not particularly want the sticker or sweet. The two oldest of this group were the exception but one of the youngest of this group was very motivated when a toy that made a buzzing noise was put inside the box - this

was his favourite toy. The autistic adults were also given a sweet, usually an Opal Fruit or Quality Street. The subjects were not allowed to take the reward after the first presentation, so that the motivation was still there for the second presentation. However, it is possible that the motivation to change to a more exact imitation of the modelled action, in the case of the normal and MLD children, did not come solely from the desire to get the reward but from the implication that the first attempt could not have been completely correct since they were asked to do the task again.

Differences between first and second attempts:

There were few statistical differences between first and second attempts within groups. There was a tendency for all groups except the young autistic children to improve at least slightly on the second attempt, although this was not statistically significant. This held for both the overall scores and the scores for each component of the box. Between groups there was a slight difference in that the 3-4 year old children performed higher on the first attempt than both the young autistic children and the autistic adults. On the second attempt this was not the case - the 3-4 year olds did not improve their performance on the second attempt in proportion to the improvement seen in the other groups. The MLD children - some of the oldest and most able children - improved so much on the second attempt that they then showed significantly better imitation than the young autistic children, which they didn't do on the first attempt. How the results are related to age will be discussed a little further on.

Individual components:

a) The pin: The most notable result here was that no group significantly imitated the action of *spin* - in response to being shown *spin*, most children produced a turning action. This may not be due to a lack of ability or inclination to imitate but to the fact that *spin* may be a much more difficult action for a child to reproduce. On the other hand there were several children, including two autistic children, who produced *spin* when shown *turn*. This was also evident in the previous studies (Whiten et al., in press). So *spin* cannot be said to be outwith all the children's repertoire. This point

serves to emphasise that many of the autistic children, in particular, were using their own methods to open the box, and not paying attention to what they were shown.

b) The handle: The handle showed the greatest significant differences between presentation conditions and therefore significantly higher levels of imitation of the three components. However, the differences lay within only two groups - the normal 3-4 year olds and the normal 5-6 year old children. Both these groups tended to imitate the action shown to them. The autistic children, adults and the MLD children all produced what looked like high levels of imitation when shown *turn* but yet also produced an action like *turn* when they were shown *pull.* It is possible that, in their experience most handles are threaded and therefore need to be turned before being removed. This, of course, could also be true of the normal children but they seemed able and willing to imitate what was shown to them, despite what they may have experienced with handles in the past. This speculation is also supported by the extreme turning that some children in all groups used on the pin, handle and bolts. This was also a finding made in the Whiten et al. (in press) study.

c) The bolts: The picture here is a combination of the results seen with the pin and the handle. Again the normal groups both tended to imitate the action modelled for them while the other groups tended to "do their own thing". The autistic children and adults seemed to imitate *twist* on the bolts but not *poke*. This can be explained by the fact that many of the autistic children just pulled out the bolts straight from the front. The action of pulling the bolts straight out is more likely to be coded as a twisting movement by the observers, since the child does not touch the back of the bolts as in poking through. What may have been happening, therefore, was that the autistic child was ignoring what the model had done and simply removed the bolts in the way that seemed most efficient to them - by pulling straight out from the front. As with all the components there was huge variability within groups. From the individual differences seen in the imitation index scores, some children appeared to imitate strongly and some children seemed to emulate. Although more of the children in the control groups imitated, there were still some children who tended to emulate, rather than imitate. In future studies it is essential that a third condition is introduced for a third group of

subjects, where they are presented with the box, without any action being modelled. This way one can be sure that the children who do imitate are actually imitating and that they would not have produced that action by chance.

The whole box:

The overall scores, combining all the components of the box and all the methods shown, illustrate that it was the young autistic children who did most poorly on the box. However, the same problems discussed in chapter 3 apply here, with regard to this group, in that the children were easily distracted and unmotivated to do this task. The adults also had low scores overall, (scores around the 3 mark which suggests they, like the young autistic children, were difficult to code because the action produced was not like any of the actions modelled or was a mixture of both). Unlike the elicited imitation, the autistic children generally had higher imitation indices than the autistic adults on this task, although with high variability and without statistical significance. The MLD children tended to have slightly higher imitation indices than the autistic children but not significantly. In fact, no group imitates significantly more on the overall imitation index than the autistic children. We therefore cannot say that autistic children did worse on imitation assessed in this way, than any control groups.

When all the autistic subjects were compared to all the non-autistic subjects on overall imitation score for each component the autistic children had lower scores than the non-autistic children on all components except the pin. This reflects the fact that the autistic groups tend to emulate more on the individual tasks, while the non-autistic groups tend to imitate. This also suggests an important paradox in the performance of the autistic children - From Figure 4.1 and other results presented, one can say that there is no significant evidence of imitation, yet no group imitates significantly more than the autistic children on overall imitation index, and their median overall score suggests that there is a tendency to imitate more than the younger children and adults. This pattern is reflected if we look at Figures 4.3, 4.5 and 4.7 - the autistic children tend to have a median score greater than three, suggesting that there is a tendency for imitation. However, the paradox may be accounted for by the fact that most of the high

scores on the imitation index in each case comes from one method of opening the box. To clarify this issue, it is essential to include another control group where they are given the artificial fruit without any demonstration. Without such a control it is impossible to say whether they are really imitating one method and not another method, or whether what seems like imitation is what they would have done without any demonstration.

Emulation versus imitation, and sequence adherence:

Most of the children tested adhered to the sequence in which the actions were presented. Those children who did not, were for the most part either autistic children or 3-4 year old children. The autistic adults had the lowest mean score when the order was coded, perhaps reflecting their tendency to emulate rather than imitate even at the "program" level. Only one child in each of the 5-6 year old and MLD groups did not attempt the box in the order presented. If program-level imitation (Byrne 1995) involves the individual following a sequence of actions in the correct order then the measure used here could be important as a way of quantifying program-level imitation. This task, like the food processing tasks of the gorillas in Byrne's account, could be attempted in any order but could only be successfully completed if at least one requirement was fulfilled - i.e. the pin had to be removed before the handle could be removed and both had to be done before the box could be opened. The bolts also have to be removed before the box can be opened. Although the lid was not included in the sequence for the purpose of this analysis, it should be for any further work in this area, since there were several children who followed the sequence to this point and then tried several methods to open the lid.

But can we say that the child was only truly imitating when they attempted the box in the correct order and imitated the action shown to them? Although there was no correlation between those who scored low on the order score and those who scored low on imitation, this can be thought of in another light. Since there were children who scored high on the imitation (up to 14 points) but did not follow the correct sequence, should these children be viewed as imitating or are they part imitating and part emulating? The same question could be asked for those that followed the sequence but did not "slavishly copy" (Byrne 1995) the component actions in the sequence. Byrne

would call this programme level imitation, but could it also be programme level emulation, rather than imitation?. Those children who opened the box, but who used a method not resembling the method shown and not in the right sequence could be said to have been emulating, but only if they would not have done the same action by chance, i.e. without seeing the model opening the box. Although for the purposes of this experiment the results reported here will stand, future analysis of both human and non-human action imitation may be more precisely analysed using these methods of the combined sequence following and imitation scores. It must however, be remembered that in any sequence some sections can be discovered by trial and error, for example that the pin must be removed before the handle can be removed, or by chance, for example, if the pin and handle have been removed then the only logical final step is to remove the bolts. It is also difficult to tell whether a failure to follow the sequence may be due to a problem with memory or a tendency to emulate. Finally, to control for what the imitator would do by chance a further condition of no model should be incorporated.

To summarise this chapter, then, there is some evidence that autistic children and adults and even MLD children tend to emulate rather than imitate, in a spontaneous situation. This tendency is stronger for the young autistic children, who would match the 2 year old children from the Whiten et al. study (in press), and for the autistic adults more than for the MLD children and autistic children. It is only the normal children of both age groups who tend to imitate the actions shown to them. It seems probable that these tendencies are linked to age and experience, specifically the school experience.

Previous research had not tested this type of imitation before, and Rogers and Pennington (1991) did not make specific predictions for this type of imitation. However, what can be said is that it is obvious that there is a dissociation between spontaneous imitation and elicited imitation along those lines which were suggested by Nadel and colleagues. Just because older autistic children and adults can imitate, doesn't necessarily mean that they do it when given a choice. Autistic children of all ages show a reasonably normal pattern of development as far as spontaneous imitation is concerned.

Although we can say that autistic children show a normal developmental pattern with regard to spontaneous imitation and it is the youngest autistic children who are impaired in tasks of elicited imitation, there is, as with many abilities/deficits in autism, a wide range of exceptions and high variability. The next chapter will look at one final type of imitation as described in Chapter 1 - of which this is the first experimental investigations - deferred imitation. From this we will have an even fuller picture of imitation in autism. In Chapter 6, the relationship between imitation and age and between types of imitation will be analysed further.

# Chapter 5
# Deferred Imitation

## Introduction.

As in the previous three chapters, this experiment was designed to test one type or manifestation of imitation. In response to Rogers and Pennington's theory (1991), Chapter 2 examined spontaneous imitation, chapter 3 examined elicited imitation of many different types of actions and chapter 4 again looked at spontaneous imtiation but this time in an experimental set-up. In research on imitation to date, autistic individuals have generally not been tested for their ability to reproduce an action on an object after a delay. Piaget (1962) proposed that deferred imitation was the last type of imitation to develop and did so about 18 months of age, along with the emergence of pretend play. However, it has since been shown that normal infants as young as nine-months old can reproduce a simple action after a delay of 24 hours (Meltzoff, 1988). Whether older normal children and autistic children can reproduce a more difficult action after a similar delay remains to be seen. None of the studies reported in Chapter 1 included a delayed imitation condition. Only immediate imitation was tested and usually using sensorimotor tasks such as the Uzgiris-Hunt Scale (1975). It was therefore decided that this study on imitation should take some account of deferred imitation in order to be more comprehensive.

The ability to imitate after a long delay is extremely important in everyday life, especially with regard to social skills and knowledge. It is also important for working with children in an educational environment, if we want to be sure that if children are shown an action at one point, they can retain and reproduce that action at a later stage. Rogers and Pennington (1991) did not deal with deferred imitation as a separate type of imitation so from their theory and from normal development it would seem that it should once again be the youngest autistic children who would show least deferred imitation. More of the older autistic children might show a problem with this type of imitation because it is a more advanced ability and is intrinsically related to memory and recall abilities. However, this is also a test of

spontaneous imitation. It is possible that the younger children will be the ones who will at least attempt to imitate, even if unsuccessful, while the older ones use their own method to complete the task - not because they cannot remember what to do but because they tend to emulate rather than imitate as older normal children do. Unfortunately because memory is so bound up with the concept of deferred imitation, it will be difficult to put non-imitation down to either emulation or lack of memory. However, it seems possible that if the child attempts to open the object in any way then they must remember something of what they saw the day before.

**Method.**

Subjects and Procedure:

The subjects used were the same as for the elicited imitation study but with 12 children in all groups except the MLD group, which had eight children, who saw the action; the autistic adults, which had 11 members; and the young autistic group which had 7 children. The subject groups were divided into two subgroups and each subgroup was presented with a different action which could be used to open a drawer-like object to gain a reward inside. This can be seen, along with the actions used, in Appendix 5.1. Thirty-three children saw Wiggle and Pull (W&P), thirty-one saw the Push to Side (PtoS) method. Each of these methods are described in Table 5.1.

Table 5.1: Description of the actions demonstrated on drawer object, to test for deferred imitation.

| Action | Description (see also photographs in Appendix 5.1) |
|---|---|
| Wiggle and pull | The drawer was placed on the ground, between child and experimenter. The left hand was used to steady the box by putting pressure on the top surface and the right hand was placed on the brass handle. The handle was wiggled from side to side and then pulled straight out to reveal a sweet in the drawer. The child was allowed to take the sweet out of the drawer but was not allowed to touch the object. |

| | |
|---|---|
| Push to side | The drawer was placed on the ground and the left-hand used to steady the box. The demonstrator did not touch the handle but using the tips of all fingers of the right hand, palm upwards, pushed on the side of the box so that the drawer slid out towards the child to reveal the sweet. |

Demonstration:

The action was presented to the children at the end of another session, either an imitation session or a play session (Chapters 3 and 6). The action was demonstrated twice and after the second demonstration they were allowed to take the sweet out of the drawer. They were prevented from touching the object after the demonstration and they did not see the object again until the next time they came to the experimental room, when they were tested for their response to the drawer.

Test:

At the beginning of the next session the subjects were presented with the drawer and allowed to play with it. As far as possible the child/adult was presented with the object 24 hours after presentation of the target action. However, this was impossible with some of the children, mainly the 3-4 year olds who did not attend play group every day. The delay for these groups was 48 hours and this must be born in mind when interpreting the results. Except for one or two children who were off school the next day but were tested as soon as possible thereafter, the rest of the children were presented with the action after 24 hours. No specific instructions were given - the subjects were given the object and asked if they would like to play with it. If the child did not respond they were prompted to play with the object. If the child continued to do nothing or tried but could not open the drawer, which was quite stiff for the young children, then they were asked if they remembered what had been shown to them and they were helped, physically or with instructions, to open the drawer and retrieve the sweet. Obviously only the child's first response, before further prompting or help, was coded.

*Coding and data analysis*:

Two independent observers were shown each method used to open the drawer. They were then asked to watch video-taped sessions of the child playing with the box. They had to judge to the best of their ability which action, Wiggle-and-Pull (W&P) or Push-to-Side (PtoS), they thought the children had seen and score their certainty on a two point scale. For example, if they were sure the child had seen Wiggle-and-Pull they would code it as W&P (2). If they were not at all sure and were just guessing that the child may have seen wiggle and pull then they would score it as W&P (0). These codings were then transcribed to a five point scale as illustrated below:

| | W&P(2) | W&P(1) | W&P/PtoS(0) | PtoS (1) | PtoS(2) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Scale: | | | | | |

A Pearson's product-moment correlation was carried out between the two observers' scores on the five point scale and providing there was a high correlation the scores were averaged for further analysis.

Two questions needed to be answered. Firstly, was deferred imitation evident for each group? If the child saw W&P would the child produce an action like W&P more than the children who saw PtoS? To answer this question a Wilcoxin Mann-Whitney test was carried out to compare the scores of those who saw W&P with those who saw PtoS.

Secondly, are there any differences between groups? For example, do autistic children/adults perform worse or better than any of the other groups? To tackle this question the scores on the five point scale were recoded for one action i.e. PtoS, in

such a way as reversed the scales. This produced an index of the extent of imitation and the groups could be compared on the tendency to imitate after a delay.

**Results:**

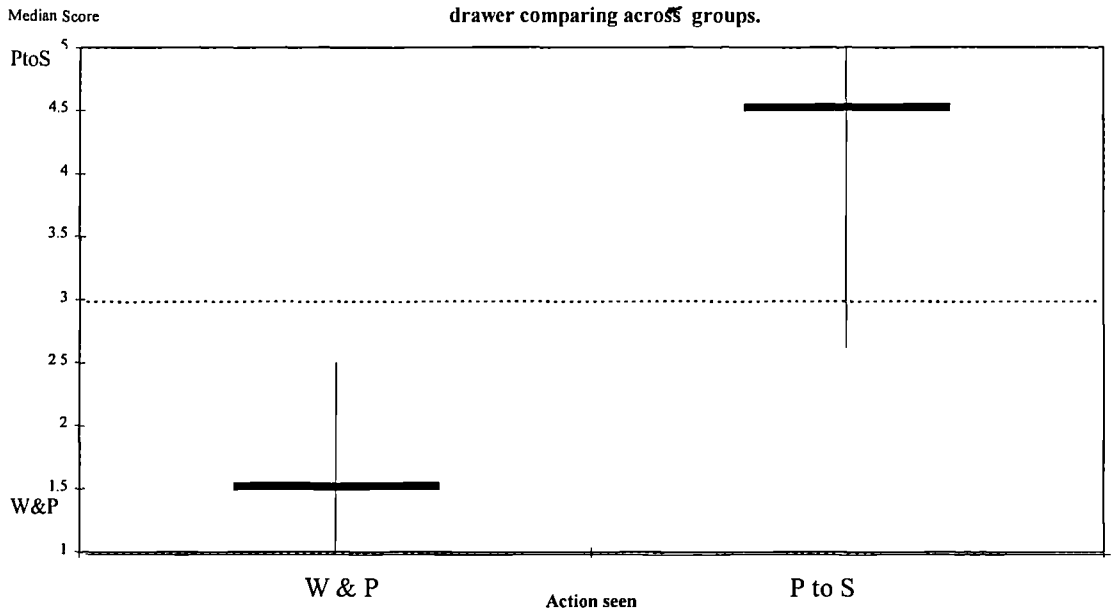
Of the 61 children who were shown the action, only two children did not respond to the drawer at all. In addition one child did not attempt to open the box and just lifted and tried to throw it. Four could not be included because both the coders said they saw the action that was presented. So out of 61 children, scores were possible for 55 children.

The interobserver reliability on a Pearson's product moment correlation was significant at 0.01 level ($r = 0.67$ for W&P method and $r = 0.64$ for PtoS). One autistic child who saw W&P and one adult who saw PtoS, produced conflicting results from the two coders, one coder coding definitely one way and one coding definitely the other way. If these two results are discarded the r values increase to 0.92 and 0.76 respectively. However, for the rest of the analysis these two results are included because when averaged they produce a score of three, which represents the difficulty in coding (i.e no clear response).

1) Did autistic children show deferred imitation?

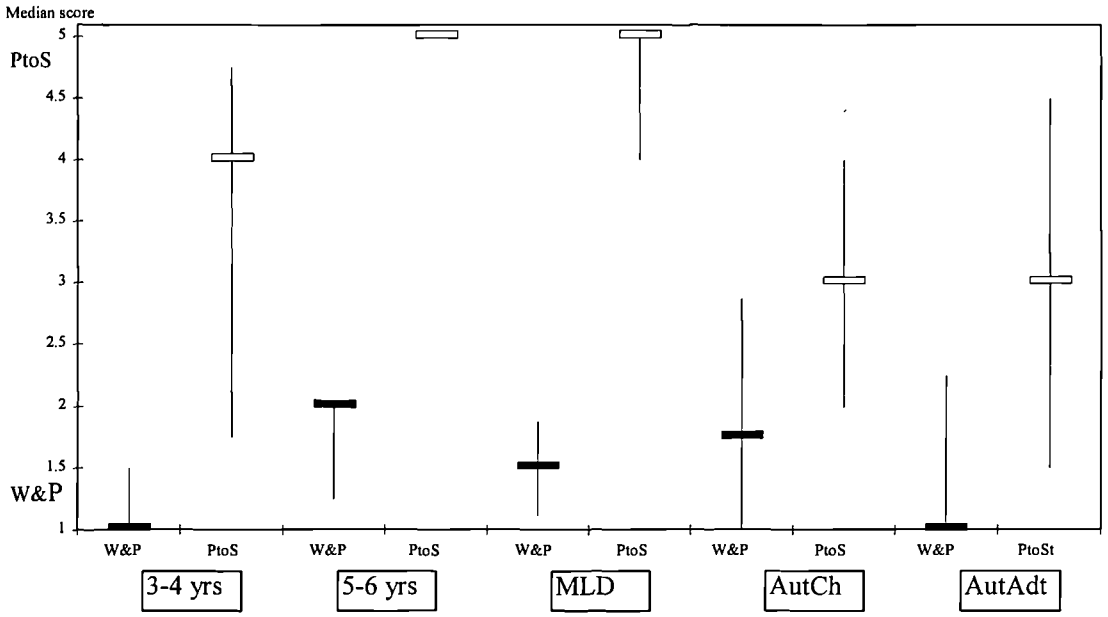
As an overall measure, across all subjects of all groups, the scores for those children shown PtoS were higher than for those who saw W&P and this difference is significant on a Mann-Whitney test ($Z=5.79$ $p<0.001$). Thus there seems to be a general tendency to reproduce something like the method shown ( See Figure 5.1)

**Figure 5.1 Medians and interquartile ranges of coders' scores for the two methods of opening the drawer comparing across groups.**




Each group was examined separately (the young autistic children could not be compared since only two children responded to the drawer for the PtoS method). The Wilcoxon Mann-Whitney tests were carried out by hand for these comparisons as the numbers in each group were less than 10. Figures 4.2 illustrates the results for the five groups. The autistic children, autistic adults, and 3-4 year old children did not show significantly higher scores for PtoS than for W&P (although the trend was in that direction), which should have been the case if imitation was being used to open the drawer ($P>0.05$ in all cases). The lack of a significant difference between methods is due to large variability for the PtoS method. Those who saw W&P performed very consistently. For the MLD group, the children shown PtoS had a higher score than those shown W&P ($P<0.05$). The 5-6 year old children also showed a similar trend ($P<0.01$). So only the MLD children and the 5-6 year olds seem to be clearly imitating the method shown them the day before.

**Figure 5.2 Median scores and interquartile ranges for each group, when shown each method.**



2) Group Differences in index of deferred imitation:

**Figure 5.3 Medians and interquartile ranges as an index of deferred imitation ability for each group, irrespective of the action seen. (N.B. a score of three represents no obvious matching of response to demonstration ; a score below three represents a response resembling the action not seen).**

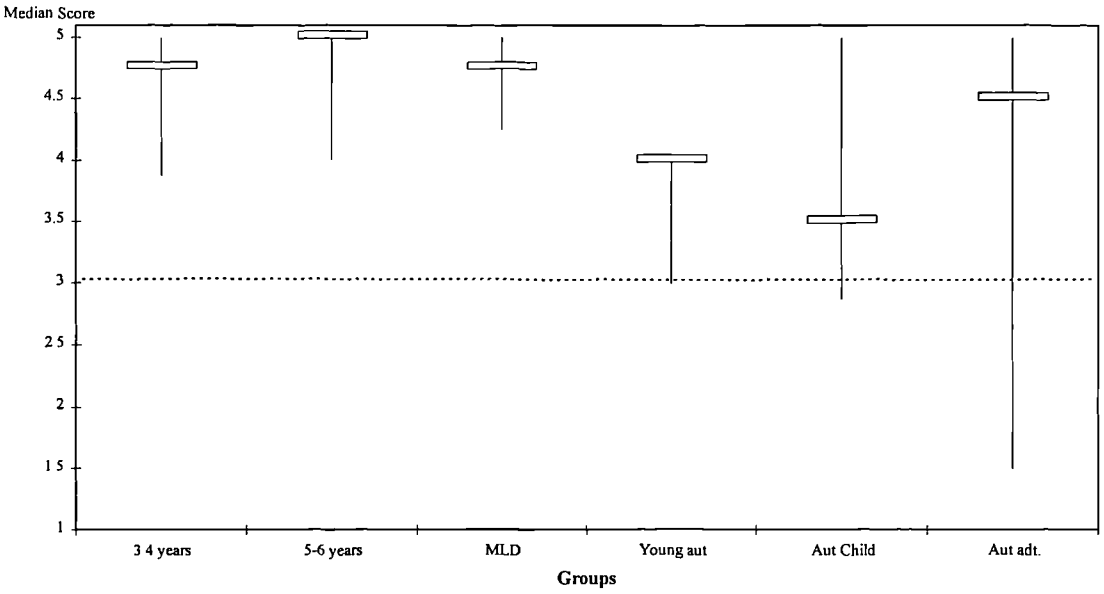
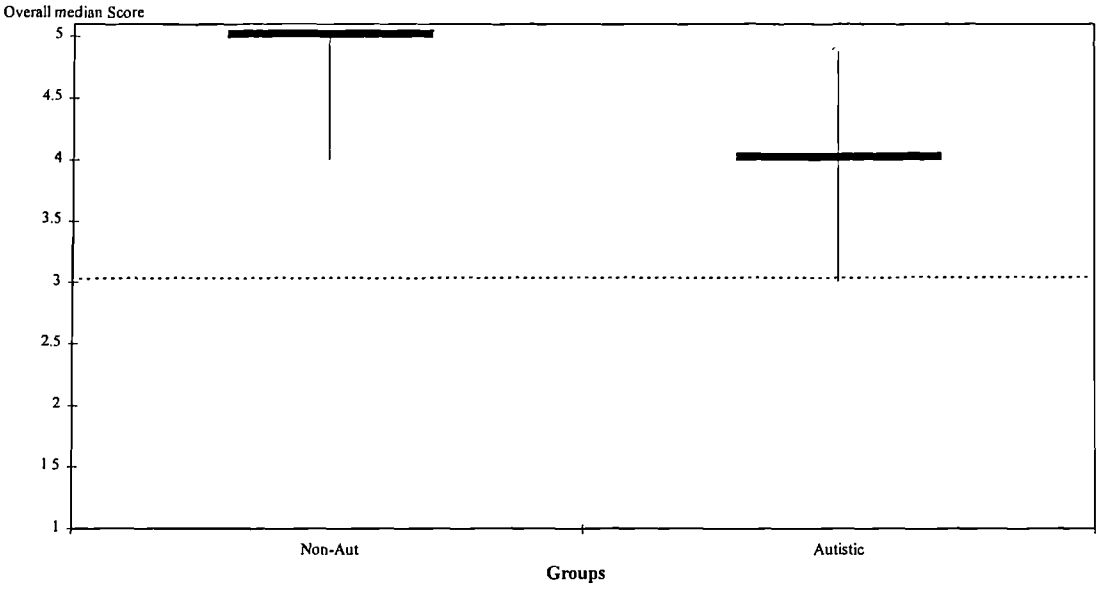


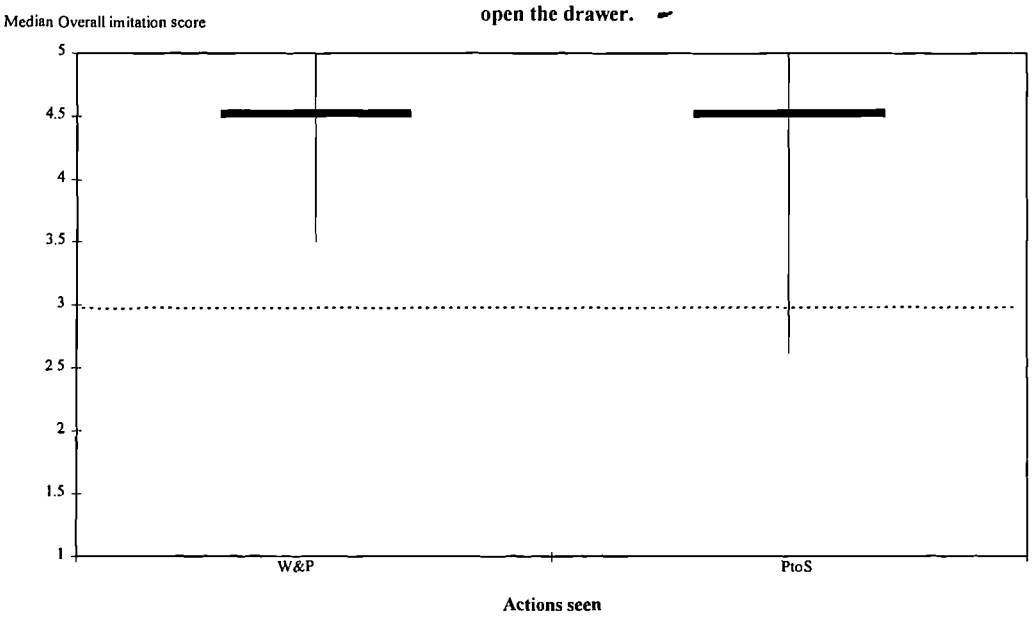

Figure 5.3 shows that the medians of the three control groups are very similar (4.75, 5 and 4.75). The medians of the three autistic groups (4, 3.5 and 4.5) are not quite as close together, which together with the larger interquartile ranges suggest more variablility. Although not featured here, the mean scores of the autistic groups are very similar - 3.65, 3.6 and 3.6. These mean scores of little more than 3 suggest that these children/adults tend to produce neither method clearly, use a mixture of the two methods or do their own action altogether. On the otherhand, the mean scores for the non-autistic groups (4.4, 4.25 and 4.5) illustrate how much more clearly these children reproduce the method shown to them. The differences between the three non-autistic groups were tested using Mann-Whitney tests and found almost non inexistant, as were the differences between the autistic groups, so they were combined in each case and Figure 5.4 illustrates the autistic versus non-autistic comparison. The group differences here were significant at 0.05 level on a Mann-Whitney test - the non-autistic subjects showed a slightly better ability for deferred imitation than the autistic subjects ($z = -2.26$).

**Figure 5.4 Median scores and interquartile ranges as an index of imitative ability, irrespective of action seen, for the autistic and non-autistic groups.**




Finally, it was felt that perhaps the handle on the drawer provided a cue for the children, especially if they did not remember exactly what had been shown to them the day before. So when presented with the drawer there may well have been a tendency to reach for the handle even if shown PtoS method, simple because the handle was prominent and most children are used to opening things by the handle. If this is true then the scores for all children and for each group will be higher for W&P than for PtoS method. Comparing all children there was no significant difference ($z = 1.07$ $p>0.05$) between the scores on PtoS and W&P (see Figure 5.5).The median scores were exactly the same for both methods, although PtoS had a higher variablity.

**Figure 5.5 Median Scores and Interquartile Ranges over all children for the two methods used to open the drawer.**




When each group was analysed separately, there were again no differences for any group on the scores for the two methods. So it seems that the presence of the handle did not significantly effect the way the child chose to open the drawer. In fact, although not significant, with the control groups the scores on the PtoS method were higher but perhaps this was because it was easier for the coders to be sure that this was what these children were trying to do. For the autistic groups the scores were slightly higher for the Wiggle-and-Pull than for Push-to-Side.

## Discussion.

The two older control groups showed significantly better deferred imitation when analysed on their own. If shown "Push-to-Side", then they tended to reproduce "Push-to-Side" or something closely resembling it. However, on an overall score of deferred imitation, independent of the action modelled, there was a significant difference between the autistic groups and the control groups, in the direction of worse performance by autistic subjects. It seems, then, that autistic individuals are worse at deferred, spontaneous imitation than non-autistic children. However, there is still a tendency to imitate rather than not imitate for the older autistic children on

overall imitation scores. The results from the younger autistic children could not be analysed due to the small numbers of children in this group who even attempted the task. As such we cannot say whether the same pattern as seen in the preceding chapters occurs and therefore we cannot say whether the younger autistic children are worse than the older autistic children on deferred imitation. Although there was no specific deficit in spontaneous imitation, the autistic groups (especially the older children and adults) did tend towards not imitating much more than the non-autistic groups did. This chapter has shown that in addition to this tendency not to imitate sponantaneously, a delay heightens this tendency. Whether this is due to a problem with imitation or a problem with memory itself cannot be decided on the basis of this experiment, although most subjects in all groups at least attempted to open the drawer in some way. As such they must have remembered something of what they had seen. Further research should include a control for memory such as asking the children to watch a video clip of the two methods and then report which one they were shown.

In addition to controlling for memory in further research it would be interesting to design another object where one method of opening is not more salient or obvious than the second method. Another possibility would be to do something unusual with a familiar object, where half the children saw the action and half did not see any action with the object but their attention was drawn to it. This would provide a baseline measurement for what would be produced by the children when not observing a model.

Finally, Chapter 6 will look at the relationship between deferred imitation and other types of imitation. If autistic development follows a normal developmental pattern with regard to imitation, then we would expect that those children who show imitation on the deferred task should also show imitation of all other types, since deferred imitation is considered to be the latest emerging manifestation of imitation (Piaget, 1962).

# Chapter 6

## Summary of findings on imitation and the developmental trend of imitation in autism.

As we saw in Chapter 1, Rogers and Pennington's (1991) model of autism was a developmental one, proposing that it is the youngest autistic children who would be most impaired and that imitative capacity would increase with age. They proposed that autistic adults would show a more noticeable impairment in "theory of mind" and language skills than in imitation. From normal development we would predict that this would be the case for elicited imitation, that is the capacity for imitation would increase. However, Nadel (see Nadel and Camaioni (1993) for review) found that preschool children showed prolific imitation spontaneously, and they proposed that imitation is used by toddlers as a means of communication until superseded by sophisticated language. This function of imitation may not so obvious as the child gets older. Instead imitation continues as a tool for learning but becomes much more accurate than the imitation seen in younger children. It may not be so noticeable when observed because it often takes the form of deferred imitation.

The previous four chapters have attempted to clarify the rather muddy picture of imitation in autism. Before going on to look at the existence of relationships between the various tests of imitation, I will summarise the results we have found so far and deal with the development with age. Table 6.1 below presents a summary of the results. In essence what the previous four chapters have found is that there seems to be no general deficit in elicited imitation for older autistic children and adults. However, as Rogers and Pennington predicted, the younger autistic children do have a problem with elicited imitation. On types of imitation that develop later in normal development and require extra capacities such as symbolic imitation, memory, and more complicated mental rotation or perspective-taking (such as two-handed actions and symbolic actions), some of the older autistic children were also impaired (Chapter 3). The autistic adults showed no less imitation than non-autistic controls and usually showed more than both the young autistic children and the 3-4 year old

children. In general their imitation was much more accurate than that seen in the younger children, both autistic and non-autistic.

So the results from the elicited experiments do provide some support for Rogers and Pennington's model and also seem to follow the same pattern as normal development at least in terms of Piaget's (1962) theory. However, we were not just interested in elicited imitation but also how autistic individuals used imitation in more spontaneous situations. The results from these experiments and the observational study showed a different picture to that suggested by either Rogers and Pennington (1991) or Piaget (1962) but in keeping with theories of Nadel and colleagues (See Nadel and Camaioni, 1993). What was found for spontaneous imitation was that it was the younger children - those around 3 years of age who tended to imitate most prolifically in a natural situation. In an experimental situation where they could choose how to perform an action they tended to chose imitation of the model's actions.

The young autistic children were not observed in this naturalistic setting but on the experimental tasks they did show least imitation. This was in keeping with the original Whiten et al. (1996) study, which found that normal 2 year olds show less imitation than 3-4 year olds. The older children with learning disabilities still imitated to some extent but more of them tended to find their own way of doing things. The 5-6 year old children in this study did tend to. Piaget (1962) proposed that children continued to use imitation quite unconsciously until about 7 years and then it became a conscious decision whether to imitate or not. Older children do not use imitation in the communicative way that Nadel and colleagues suggested (1982-1994) but they do use it to learn new tasks and their imitation becomes more accurate with age. In this study, most of the older autistic children, the MLD children and all the autistic adults were older than 10 years chronologically, so even though language was not sophisticated the communicative function of imitation may have been . Although they showed they could imitate very well when asked to do so, these older children tended not to imitate spontaneously even to solve a task. They did not refuse to attempt the task but rather used their own methods (i.e. emulated) to succeed.

Table 6.1: Summary of the ability of autistic people to imitate - results from Chapters 3-5.

| Type of imitation | Subcategories | Results |
|---|---|---|
| Spontaneous, immediate imitation (Chapter 2) | | Only the 3-4 year olds showed more imitation than the autistic children. There was a general paucity of imitation in all other groups. However, those autistic children who did show spontaneous imitation, were the youngest children in the group. |
| Immediate, elicited imitation (Chapter3) | Vocal | No group differences |
| | Simple body movements and object use | Only the young autistic children and the normal 3-4 year olds did significantly worse than other groups on any of the actions in this category. A few actions did produce theoretically interesting responses such as hand reversals, even in older autistic children. |
| | Meaningful actions | This was the category where both the young autistic children and the school aged autistic children had most problems. The autistic adults did not perform worse on these actions than control groups. |
| | Symbolic actions and object use | There was a trend for the older autistic children to perform worse on these actions than controls but this trend was not significant. The young autistic children had problems here as on all other categories. |
| Spontaneous problem-solving imitation (Chapter 4) | | The autistic children and adults did show a tendency to imitate on some components but this was not as clear cut as for both groups of normal children. The MLD group did not in general do better than the autistic groups, although their scores were usually slightly higher. |
| Spontaneous Deferred imitation (Chapter 5) | | No significant differences between groups on overall tendency to imitate, although the scores of the non-autistic groups were all higher than the 2 autistic groups. When each group was examined separately for imitation, there was a tendency to imitate for all groups but this was only significant for the 5-6 year olds and MLD children. |

Further relationships between imitative ability and age.

The summary above has compared three groups of autistic individuals at the crude level of age group differences. However, in several of the chapters, more detailed analysis of the developmental trend of imitation was impossible. 1) In Chapter 2, the observational study, it was found that, although the trend was not significant, it was indeed the younger children in the autistic group who did any spontaneous imitation.

2) In the experiment on elicited imitation (chapter 3), it was possible to explore this trend in quite some detail. Correlations were carried out between each category score and CA, MA and TROG raw score, 1) over all children and 2) over all the autistic children/adults. For the analysis of the general categories of actions, correlations were carried out between imitation scores and CA, MA and TROG raw scores (33 correlations in all). Over all the samples (n=61) one correlation was significant at 0.01 level. This was between TROG raw score and two-handed actions ($r = 0.49$). At 0.05 level, there was also a positive correlation between both BPVS and CA and two-handed actions ($r = 0.31$ and $r = 0.29$ respectively). TROG score was positively correlated with the score on Body/gestural meaningful actions ($r = 0.31$). Finally both MA measures were positively correlated with the score over the 35 actions seen by 70 % of children ($r = 0.33$ for BPVS and $r = 0.31$ for TROG).

When the correlations were carried out for just the autistic children and adults (n=28) the results were somewhat different. In this case there was a positive correlation between CA and two-handed actions ($r = 0.57$) and meaningful actions ($r = 0.64$) at 0.01 level and between CA and non-symbolic actions on objects at 0.05 level ($r = 0.47$). In addition there was a positive correlation between CA and overall score ($r = 0.48$) at 0.05 level. There was also a significant positive correlation between TROG raw score and two-handed actions ($r = 0.55$, $p=0.01$) and Meaningful actions ($r = 0.47$, $p=0.03$). The results of the correlation analysis are represented in Table 3.6 below.

In general then, there was a trend for those who were older in both chronological and mental age to perform better on elicited imitation tasks. In other words, they produced more accurate imitations of the actions modeled. This was true of all categories, including those with which the autistic subjects had most difficulty

(i.e. meaningful symbolic actions). This is in keeping both with Rogers and Pennington's predictions and with evidence from normal development (Piaget, 1962).

Table 3.6: Results of correlation analysis (r value and significance level) for imitation score (on overall actions, on the 35 actions seen by all children and on the nine categories of actions) and chronological and mental age as measured by TROG and BPVS. This was done 1) over all samples of children 2) over the autistic samples. (* denotes significance at 0.05 level; ** denotes significance at 0.01 level).

| | Category | CA | MA BPVS | TROG score |
|---|---|---|---|---|
| **Overall Score** | 1 | | | |
| | 2 | 0.48 * | | |
| **35 actions** | 1 | | 0.33 * | 0.31 * |
| | 2 | | | |
| **Individual categories** | VS 1 | | | |
| | VS 2 | | | |
| | VNS 1 | | | |
| | VNS 2 | | | |
| | Face 1 | | | |
| | Face 2 | | | |
| | One-hand 1 | | | |
| | One hand 2 | | | |
| | Two-hands 1 | 0.29 * | 0.31 * | 0.49 ** |
| | Two hands 2 | 0.57 ** | | 0.55 ** |
| | Whole body 1 | | | |
| | Whole body 2 | | | |
| | M/S 1 | | | 0.31 * |
| | M/S 2 | 0.64 ** | | 0.47 * |
| | AONS 1 | | | |
| | AONS 2 | 0.47 * | | |
| | AOS 1 | | | |
| | AOS 2 | | | |

3) In the artificial fruit task the relationships between performance on the task and MA and CA were examined but in a more general way than in the elicited experiment. As was seen when samples were matched on both BPVS and TROG measures of mental age, there were no significant differences between autistic and non-autistic groups on overall imitation score. On chronological age-matched comparisons there was a significant difference, with non-autistic children having a slightly higher score than autistic children. So independent of age there was a tendency for non-autistic children to imitate more than autistic children.

An interesting age difference occurred when performance on first and second responses were compared. When all the children were divided into those 4 years and below on BPVS and those above 4 years mentally, there were no significant differences between first and second responses for the children below four years ($z = -0.9049$ $p>0.05$). However, the children above four years did show significantly better second responses than first responses on the imitation score ($z = -2.7849$ $p<0.01$). On each of the individual objects (pin, handle and bolts), there were no differences within groups on the first and second attempts. Perhaps being asked to perform the action again made some children think they had done it poorly the first time so they made an effort to imitate more closely the second time. It is interesting that none of the autistic groups showed this tendency for a better score on the second attempt - only the 5-6 year old and MLD children.

When the pattern of results from this experiment was compared to the pattern seen in the elicited tasks, we find an apparant "reversal" of results. The young autistic children, the 5-6 year olds and, to a lesser degree, the school-aged autistic children do not change their performance. The autistic adults, on the other hand, were good when asked to imitate, often imitating so faithfully that they imitated the unconscious actions of the model, such as scratching the cheek (Chapter 3). However, in the present experiment when they had the choice themselves of what to do, they tended to emulate. This may be an age-related issue since the MLD children show a similar pattern, with high scores on elicited imitation but lower spontaneous scores. In addition, the 3-4 year old children imitate much more faithfully in the spontaneous situation than in the elicited situation. All of these results reflect those from the observational study of Chapter Two.

Finally, although the 5-6 year olds usually produced higher scores than the autistic children, this was rarely significant. In fact, the pattern across these two groups is very similar. In the elicited imitation, the autistic children performed reasonably well, and with few significant differences between them and controls. The pattern was similar in the spontaneous imitation. The 5-6 year olds' performance in both spontaneous and elicited imitation was also very similar and the two groups produced very similar figures in the observational study.

Perhaps these two groups are at a stage in development where the school situation has begun to affect them in such a way that they are willing to comply with instructions and do as they are asked (the 5-6 year olds more than the autistic children) but that they have not completely surpassed the need to use imitation rather than emulation to complete novel tasks. Although more experimental than the younger children, they have not completely stopped wanting to be like adults and wanting to please them by imitating them. The younger, 3-4 year old children have not had the school experience to change their use of imitation and to train them in how to use imitation in conjunction with instruction to learn. They seem to use imitation unconsciously both to communicate and to learn. On the other hand, the older MLD children and the autistic adults have had more experience using imitation to learn. The emphasis for these individuals is to find their own way of doing things - to experiment and to learn. They learn how to make use of even subtle forms of feedback and can change their actions to achieve the desired result. Imitation is not needed to communicate as language is in general more sophisticated and spontaneous imitation is often seen by care-takers and teachers as bad or annoying behaviour and inappropriate for the age group and therefore discouraged.

All in all, the age of the individuals involved, and therefore the school/life experiences undergone, could effect the child's inclination to imitate spontaneously, but not the ability to imitate *per se*. It would be interesting to see if children who have not been educated, at least not in a disciplined school environment, would follow a similar trend. Alternatively would they remain more like the 3-4 year olds for longer?

In addition to these analyses specific to each chapter, further analysis was carried out and this included the results from the deferred imitation experiment. In this analysis, the relationship between the scores of those children and adults above the

median CA and MA were compared with those below the median CA and MA. These results are plotted on the profile graphs (Figures 6.1-6.4) and examined using Fisher Exact tests. The figures were also designed to illustrate the relationships between both the overall DAID score and the score on three of the types of elicited imitation (two-handed actions, meaningful/symbolic actions and symbolic actions with objects - three actions which were more difficult for the autistic children and which are indeed more developmentally advanced (Piaget, 1962)) and performance on other imitation tasks such as the deferred imitation and the artificial fruit tasks, as well as CA and MA. I shall discuss the consistency across imitation tasks below but first I turn my attention to the relationship with age. Each line on the graphs represents one child, although the first line on each graph does not represent the same child every time. The children used for this analysis were the school-aged autistic children as we did not have comparable mental or developmental ages for the very young autistic children. Analyses were also carried out for the adults but these have not been plotted on profile graphs.

Comparisons (one-way ANOVAs) between the autistic adults and children for the DAID scores showed no differences at the 0.01 level between the two groups. There were differences at 0.05 level for imitation of two-handed actions ($F=5.26$ $p=0.03$) and meaningful/symbolic actions ($F=7.45$ $p=0.01$), with the adults scoring higher than the children.

There were, therefore, relationships between elicited imitation and both mental and chronological age as the correlations described above show. But what about performance on other imitation tasks? A simplified analysis of the relationship between elicited imitation and mental and chronological age was conducted using Fisher tests for those above and below the median CA and MA who passed and failed each of the tasks. Examining Figures 6.1 to 6.4 there appears to be no obvious trend for the autistic children and this was confirmed by the Fisher test, with none of the comparisons being significant at 0.05 level. The same was true for the adults. So there seems to be no interaction between performance on the artificial fruit experiment or the deferred imitation task and either mental or chronological age. This may have been because the artificial fruit experiment tested spontaneous imitation and it very much depended on the individual whether they wanted to imitate or to emulate. All

the children and adults may have been "too old" for age to make a noticeable difference in performance. Perhaps if it had been possible to use the young autistic children in this analysis, this is where we would have seen an age effect.

Consistency across tasks:

It is also important to look at the consistency across the tasks since the tasks vary in their appropriateness to normal development and in the level of difficulty. From Piaget (1962) and even work by Meltzoff (1988), one would expect that if a child can engage in and become proficient in symbolic and deferred imitation, then he would also be able to imitate sounds, simple body actions and actions with objects, both familiar and unfamiliar and visible/invisible. So far the picture of imitation in autism seems to follow the same path as imitation in normal development. If imitation follows a stage development in autism as Piaget suggests for normal development, then there should be some consistency for tasks passed and tasks failed.

To investigate this, the profile graphs (Figures 6.1 - 6.4) plotted for each of the autistic children were examined. Their ranked performance on the elicited imitation task (using the overall score on the Do-As-I-Do task (DAID), the score on the two-handed actions, meaningful/symbolic actions and symbolic actions with objects) was compared to their performance on spontaneous imitation, the artificial fruit and the deferred imitation task. This relationship was then tested using a Fisher test to compare the number of children who scored above the median score (on the DAID) who passed or failed each task, and the number of children below the median score who passed or failed each of the other tasks.

Spontaneous imitation was simply judged by those who did and did not do it. For the artificial fruit, two measures were used - firstly, those who scored at least four out of five were said to have passed the task by showing imitation; and secondly, those who had a score of two on the order task were said to have passed that part of the task. On deferred imitation, a score of at least four out of five was used as a pass. Although the graphs are not shown here, the same analysis was carried out for the autistic adults.

*Results.*

Figures 6.1 to 6.4 below illustrate the relationships between score on DAID and the other imitation tasks, such as deferred imitation, spontaneous imitation during observations and spontaneous imitation on the artificial fruit task. For the autistic children, there is a trend for a high overall score on DAID and a high score on symbolic-actions-with-objects to be accompanied by a pass on the order task for the artificial fruit experiment. However, using above the median as a high score and equal to or below the median as a low score, these trends were not significant on a Fisher test. Since the deferred and artificial fruit tasks were both tests of spontaneous imitation, it is perhaps not surprising that no specific relationship was found for elicited imitation, given the differentiations already made between the two situations.

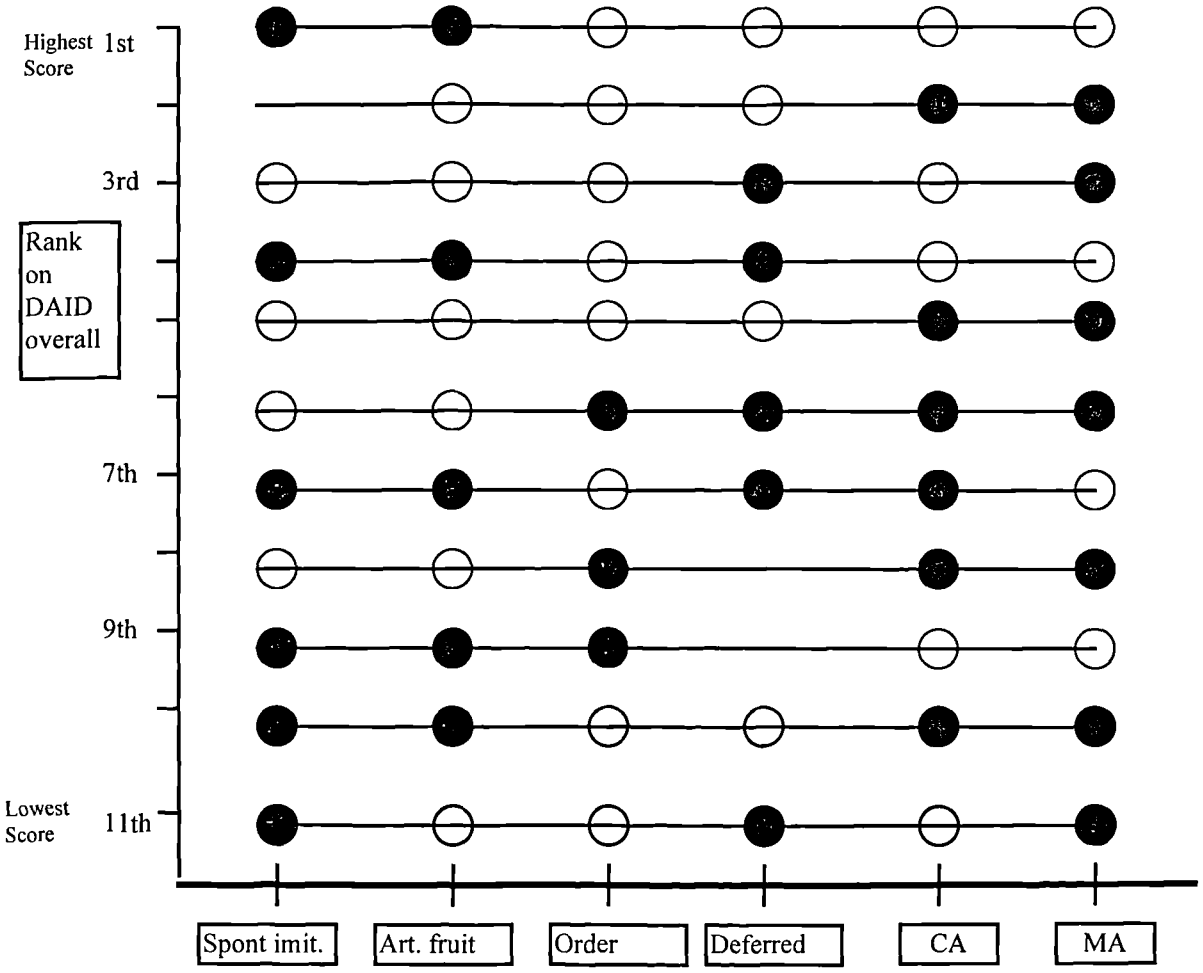
For consistency within the elicited imitation tasks, the group of autistic children, showed strong correlations between meaningful/symbolic actions and both symbolic-actions-with-objects ($r = 0.7095$ $p < 0.001$) and two-handed actions ($r = 0.615$ $p<0.01$). When MA and CA were controlled for in a partial correlation, these latter correlations remained significant for meaningful/symbolic actions and the other two categories ($r = 0.652$ $p<0.01$ for AOS and $r = 0.61$ $p<0.05$ for two-handed actions). Thus the picture seems to be of some consistency across the more difficult DAID categories, at least for the autistic children.

Fisher tests were carried out to examine the relationship between each of the other imitation tasks - deferred imitation, spontaneous imitation, imitation on the artificial fruit task and the order task. Only one analysis was significant and that was for the performance on the artificial fruit task and the production of spontaneous imitation during the observations ($p<0.05$). This, of course, makes sense as they are both tests of spontaneous imitation.

For the autistic adults, the picture was a little different. There was a trend for those adults who passed the order part of the artificial fruit task, to also score high on some of the categories of actions on the DAID. For both two-handed actions and symbolic actions with objects, the interaction was not quite significant (Fisher test, $p=0.08$), although the trend was in a positive direction for symbolic actions. For

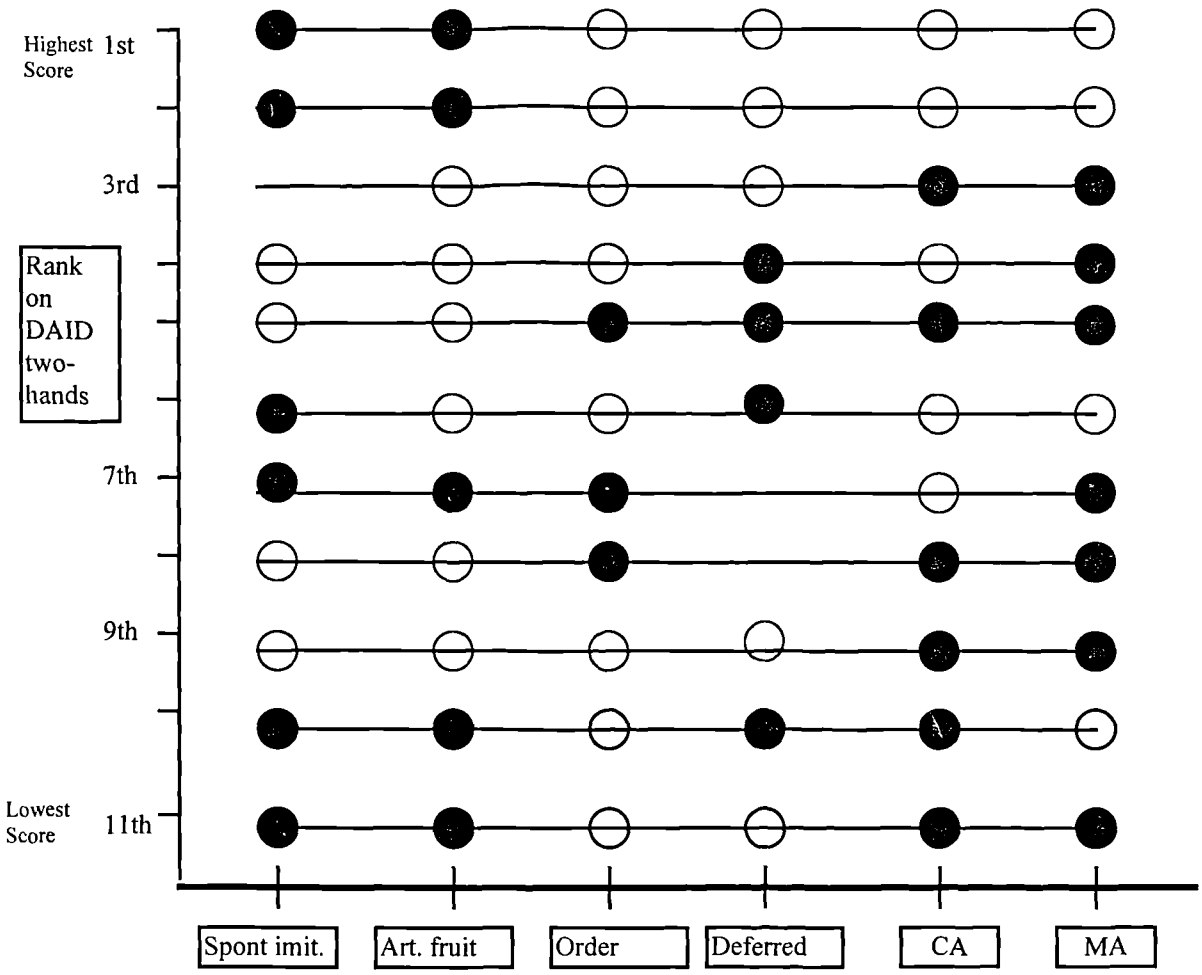
meaningful/symbolic actions, there was a significant difference but in a negative direction between those who pass and those who fail, with those who fail the order task more likely to score above the median score on the DAID ($P<0.05$). This may be because they are the older or more experienced individuals, who will do as they are asked but tend not to use imitation spontaneously. Those who imitate spontaneously on the artificial fruit may be those who do worse on the elicited imitation, as suggested in Chapter 5. Finally, there is also a trend in the direction of a negative correlation for deferred imitation and symbolic actions with objects - those who pass the deferred task tend to score below the median on the DAID score. Statistically, this trend is not quite significant ($P=0.09$). Finally, when comparing performance across the other imitation tasks - deferred imitation, spontaneous imitation in the observational study and performance on the artificial fruit spontaneous imitation task, there are no relationships between any two tasks for the autistic adults (Fisher test: $p>0.05$).

Figure 6.1: Graph to illustrate the relationship between overall score on the DAID task (ranked performance) and the other imitation tasks - spontaneous imitation, artificial fruit, order on artificial fruit task and deferred imitation - and CA and MA for the autistic children (a solid point means the child failed on the task and an empty point means the child passed; for the ages, a solid point means on or below the median group age, an empty point means above the median age).



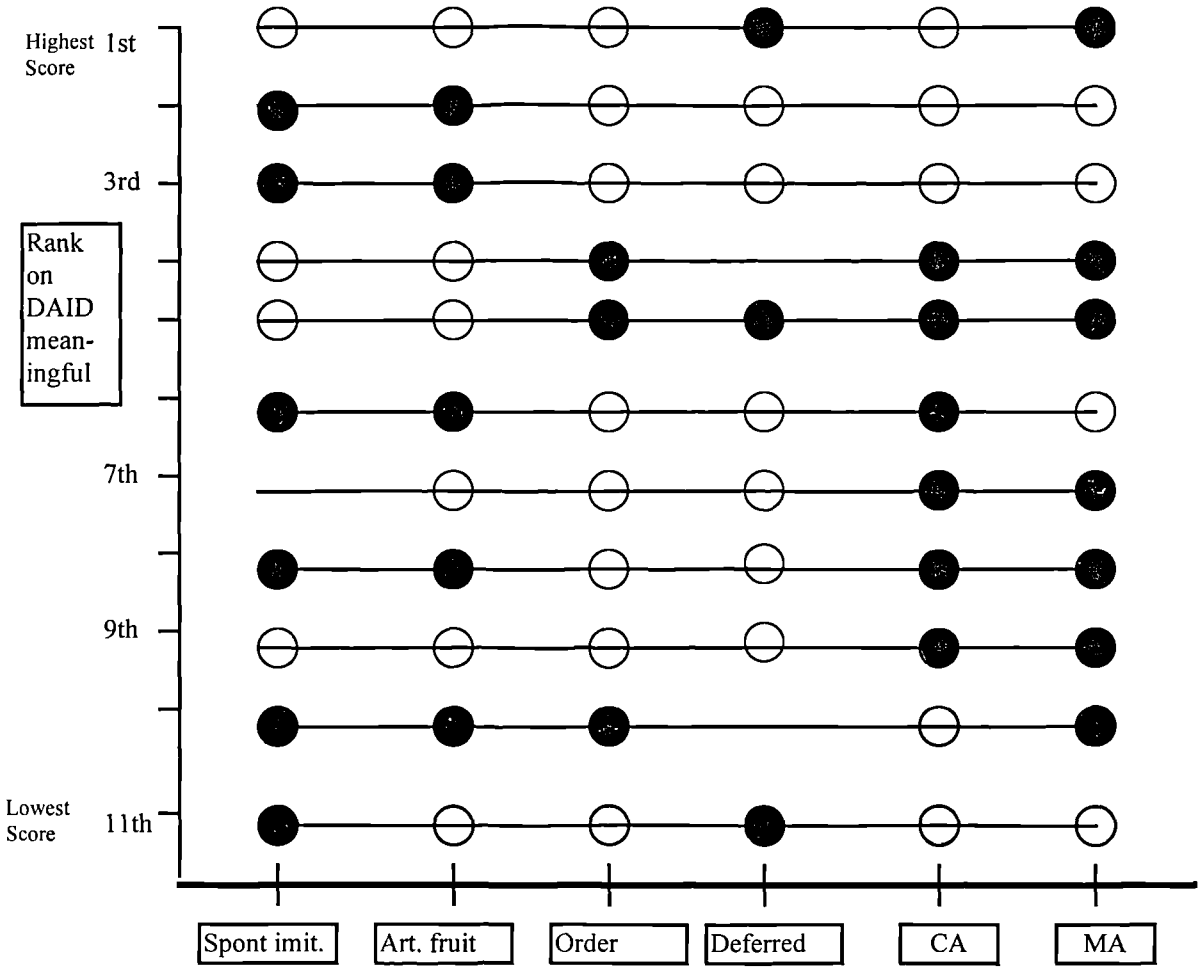

N.B. 1) The median CA was 13;1 and the median MA was 4;0.

Figure 6.2: Graph to illustrate the relationship, for the autistic children, between the ranked score on two-handed actions during the DAID task and the other imitation tasks - spontaneous imitation, artificial fruit task, order score on artificial fruit and deferred imitation, and CA and MA (a solid point means the child failed on the task and an empty point means the child passed; for the ages, a solid point means below the median group age, an empty point means above the median age).



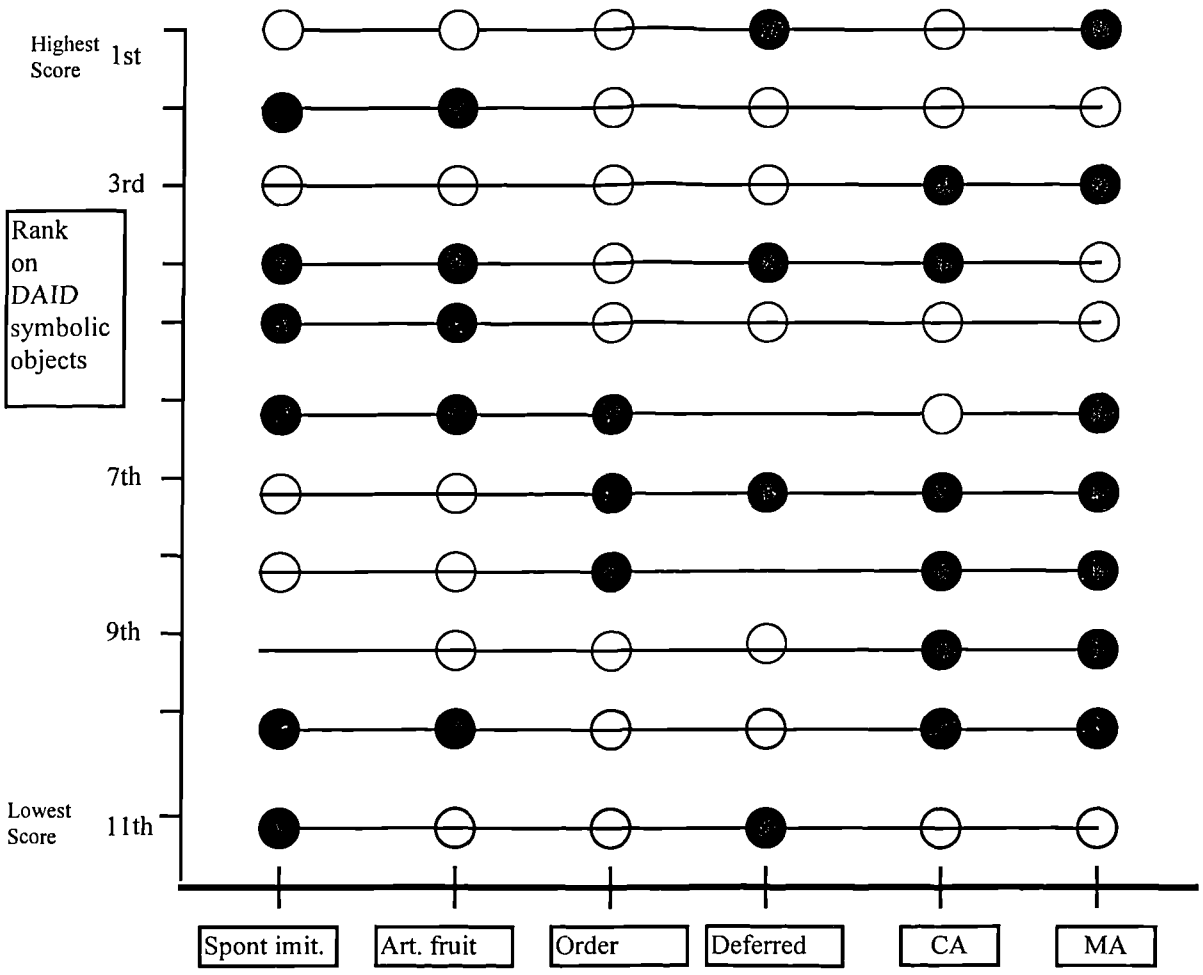

N.B. The children ranked 5 and 6 both had the same high score.

Figure 6.3: Graph to show the relationship, for the autistic children, between ranked score on meaningful/symbolic actions of DAID test and the other imitation tasks - spontaneous imitation, artificial fruit task, order score on artificial fruit and deferred imitation, and CA and MA (a solid point means the child failed on the task and an empty point means the child passed; for the ages, a solid point means below the median group age, an empty point means above the median age).




N.B. Children ranked 5,6 and 7 all had the same score on the DAID, meaningful/symbolic actions.

Figure 6.4: Graph to illustrate, for the autistic children, the relationship between ranked score on symbolic actions with objects from the DAID task and the other imitation tasks - spontaneous imitation, artificial fruit task, order score on artificial fruit and deferred imitation, and CA and MA (a solid point means the child failed on the task and an empty point means the child passed; for the ages, a solid point means below the median group age, an empty point means above the median age).




N.B. The children ranked 6 and 7, both had the same score on the DAID, symbolic actions with objects.

**Conclusions**

We can see then that the picture is not as clear as one had hoped. Although in general terms it seemed that the pattern of development of imitation seen in autistic individuals was similar to that seen in normal development, the consistency one might have expected across tasks, at least when the more difficult tasks had been successfully completed, was not found. If a child or adult produced deferred imitation then that did not necessarily mean that he scored high on the elicited tasks or the artificial fruit task. I have already hinted at what I would propose could lie behind this inconsistency. Firstly, the fact that some of the tasks were assessed spontaneously while others were elicited is an important factor. We have already seen evidence of the dissociation between spontaneous and elicited imitation with regard to the effect of age. I would predict that if the children and adults had been specifically asked to copy the actions in the artificial fruit task or had been prompted in the deferred imitation task to remember what they had been shown the day before, the pattern of scores would closely resemble those in the elicited task. Conversely, if the observations reported in Chapter 2 had been for longer and with more subjects, it is likely that more incidents of imitation may have been observed. In this way, there may have been more of a relationship between imitation produced in every day life and performance on at least the artificial fruit experiment.

Secondly, the spontaneous actions also involved more complex skills, such as memory, problem-solving abilities, and comprehending and interpreting what was required from them in the task. Future research should find a way to control for memory, comprehension and information processing deficits in order to truly examine spontaneous imitation of an immediate or a deferred nature.

Of course, there is still the possibility that autistic children and adults cannot, in general, imitate spontaneously rather, than that they will not. In everyday life, imitation is accompanied by many, often complex, social factors. However, in the test situation, even the artificial fruit task, there are not as many variables for the autistic individuals to cope with. On the other hand, since some of the younger school aged autistic children did imitate spontaneously, and so much of the normal pattern was seen in the autistic performance on these tasks, I feel it is more likely that the older children and adults chose not to imitate and were in fact performing quite normally as

far as imitation was concerned. It is only the younger autistic children, in whom the development is delayed, who have problems with this important social learning skill. This, of course, is what Rogers and Pennington (1991) predicted and as such there seems to be some evidence for their theory. However, it is essential to emphasise one finding that Rogers and Pennington did not predict and that is the dissociation between spontaneous and elicited imitation. It does on the other hand seem to be the case that this too resembles the pattern seen in normal development and as such is indirect evidence for a delayed acquisition of imitation, rather than a complete absence of this ability in autism.

In the next two chapters I am going to attempt to examine the relationships between imitation and other abilities such as were proposed by Rogers and Pennington (1991). These will include pretend play, joint attention, emotion perception and sharing, and theory of mind (false-belief) attribution.

# Chapter 7

# Spontaneous, elicited and instructed play and the relationship between play and imitation.

## Introduction.

It is well established that autistic children engage in very little symbolic activity spontaneously. Kanner (1943) noted that one of the characteristics of the children he called autistic was a lack of imaginative activity. This lack of imaginative activity is used as one of the diagnostic criteria for autism by the Autistic Society itself, in the DSM-IV (1994) and in most other diagnostic systems. Leslie (1987) suggested that pretend play may be a precursor for a "Theory of Mind" ability which emerges fully developed around the age of four years. Pretend play is thought to emerge around the age of 18-24 months of age (Dunn, 1991) Thus, according to Leslie, a problem with pretense can be explained by a problem in metarepresentational ability and a failure to decouple the pretend situation from reality (See Chapter 1 for more information on Leslie's theory).

In the observational study, discussed in Chapter 2, it was found that there was no difference in functional activity between groups although some of the behaviour classed as functional in my study perhaps cannot be equated with play. Also, some of the autistic children produced some symbolic play, although rather limited. In fact, there was no significant difference between groups for spontaneous symbolic play. However, this may have been a situational affect, due to the school situation in which they were observed. The results of a playtime-only observation have shown that this effect remains when the autistic and 5-6 year old children are observed at playtime, with little difference in the amount of pretend play produced. It was therefore important to investigate experimentally the ability of each of the present subject groups to play spontaneously and also whether play activity, specifically pretend play, can be elicited from them or produced through instruction.

Rogers and Pennington (1991) suggested that the problem with symbolic play seen in autism arises from a deficit in imitation combined with deficits in early "theory of mind" abilities. They predicted that it would be the young autistic

children for whom a deficit in symbolic play would be most noticeable and that it would be part of the young autistic profile, along with deficits in imitation, joint attention and emotion sharing. Autistic adults on the other hand would not show a deficit in symbolic play relative to controls mainly because it is not an age appropriate behaviour. On the other hand, I was interested in finding out whether autistic adults *could* engage in symbolic activity, even if it wasn't age appropriate in a spontaneous situation. Imitation ability seems to improve with age but does symbolic capacity also improves with age? To fully investigate Rogers and Pennington's theory it was necessary to look at symbolic play and how it relates to imitation. This was done with both autistic children and adults, although a slightly different scenario was used with the adults as will be described later.

Although this study was most interested in symbolic play, all types of play were observed in a scenario that tested spontaneous, elicited and instructed play. The experiment was based on the scenario used by Lewis and Boucher (1988), which is described both in Chapter 1 and below. Where relevant I will include details on play other than symbolic play, but for the most part, this chapter will present only the most relevant results on symbolic play. The additional results can be found in Appendix 7.3.

Baron-Cohen (1987) has shown that autistic children show significantly less pretend play than controls when given a set of toys to play with. Lewis and Boucher (1988), however, proposed that autistic children's problem lies not in an inadequate symbol system but in a failure to use an adequate system due to some conative abnormality. (They refer to this as the " the symbol deficit hypothesis" and the "conative hypothesis"). They tested autistic children on free-play, elicited play, and instructed play. They found that functional play was much reduced in the autistic groups but that little symbolic play was produced by any group spontaneously. They suggest that had a different set of objects been used they might have had an effect for symbolic play in the freeplay condition. No impairments were found in the autistic children's instructed symbolic play nor in their elicited play relative to the controls used.

It was decided that this study should follow a scenario like that carried out by Lewis and Boucher (1988), with a few changes. These will be presented at a later stage in the procedure.

First of all, it is important to define what is meant by symbolic play. Baron-Cohen (1987) uses Leslie's (1985) definition which refers to:

1) "deviant reference" - objects are substituted for one another.

or 2) "deviant truth" - 'false' properties are attributed to objects.

or 3) "deviant existence" - absent objects are present.

Baron-Cohen summarised this definition of pretend play as follows:

" Pretend play can be said to occur if there is evidence that:

1) the subject is using an object as if it were another object, and/or

2) the subject is attributing properties to an object which it doesn't have, and/or

3) the subject is referring to absent objects as if they were present."

Lewis and Boucher (1988) used Baron-Cohen's definition although they refered to it as "symbolic play" rather than "pretend play" because they saw pretend play as referring to any type of imaginative play, including some instances of functional play. They defined functional play, as does Baron-Cohen, as "play in which objects (including miniature representations of real objects) are used in ways appropriate to their conventional function". As such they included examples of play such as stirring a toy spoon in a toy saucepan as functional. It may be, however, that the children are pretending that there is soup in the saucepan, and as such would this not fit into category 3 of the symbolic play definition? Lewis and Boucher included a category which they called intermediate play, for actions which fall between functional and symbolic. However, they did not give any examples of what they would include in this category, so it is difficult to know what exactly they meant by it.

For the purpose of this study it was decided to use Baron-Cohen's definition of symbolic play and of functional play in order to be able to compare the results with those found by Baron-Cohen and by Lewis and Boucher. Behaviours such as are mentioned above, which could be interpreted as either functional or symbolic, were coded by an additional category - functional/symbolic mixtures. A sixth category was used to code all play sequences that were a mixture of two or more of the main categories (other than functional and symbolic mixture). Language was a vital clue which helped to identify a play action as one or other category. When absent it was

difficult to be certain what category the behaviour should fall into. So to summarise the six categories used were as follows (See Chapter 2 for further definitions):

1) manipulative

2) relational

3) functional

4) symbolic

5) functional/symbolic

6) Other mixtures - these were originally coded as relational/functional or relational/symbolic (e.g.when the hairbrush was used to play the xylophone), or manipulative/functional (when the child spent five minutes bending the arms of the soft plastic orang-utan, in many different ways), but collapsed into this one category for analysis.

In addition to Rogers and Pennington's (1991) prediction that it would be the younger autistic children in whom an impairment in symbolic play would be most noticeable, the following predictions can be made based on the observational study and previous literature:

1) Functional play would not be impaired in autistic children and adults, relative to non-autistic children (despite Lewis and Boucher's findings).

2) Chronological age might affect the overall amount of play and the production of certain types of play. Specifically, the autistic adults and oldest MLD children might not respond in the same way to this situation as younger children.

3) Autistic individuals would produce more manipulative style play than non-autistic individuals.

4) There might be a difference between the different test sessions, as described below, with more manipulative and exploratory play being produced when the children first met the objects, compared to their second and third encounters.

Finally, as far as the autistic adults are concerned, it is difficult to make predictions as no one has tried to elicit pretend play from autistic adutls before. However, on the basis of Rogers and Pennington's predictions, it is possible to say that they should show a similar pattern of behaviour to that seen in the older children of the MLD group.

**Methods:**

*Subjects:*

The subjects for the most part were drawn from those described in Chapter 2, although a few changes had to be made. The experimental groups (approximately 6-9 months older than when observed for spontaneous activity) are described in Chapter 3. Those children used in the experiment are summarised below.

All the children (except some of the young autistic children, whose mental age (MA) could not be tested by the British Picture Vocabulary Scale (BPVS)) had an MA of more than 18 months of age, which is the age at which pretend play is thought to emerge (Dunn, 1991; Baron-Cohen, 1987). The lowest MA of the whole group was 26 months of age (on BPVS) and this was in one autistic boy and one MLD boy. Chronological age may be important as to what the children do spontaneously - for example, it is not seen as age appropriate by parents and teachers, for the older autistic and MLD children to be playing at pretence, nor for the autistic adults. A subset of the autistic children (n=16) was individually matched on the Test for Reception of Grammar (TROG) raw score with a subset of the non-autistic children (n=16) and another subset on BPVS age equivalence (n=18 in each group). A smaller subset of each group was also matched on chronological age (CA) for the warm-up sessions (n=14 in each group). Table 7.1 below presents the number of children in each group for this experiment with the mean CA, MA on the BPVS and the raw score on the TROG.

Table 7.1: Mean ages, mental and chronological for each group of subjects used in the Play experiments.

| Group --> | 3-4 year olds | 5-6 year olds | MLD children | Young Autistic children | autistic children | autistic adults |
|---|---|---|---|---|---|---|
| number in group | 10 | 12 | 12 | 8 | 11 | 11 |
| Mean CA | 3;5 | 5;2 | 12;6 | 5;8 | 12;7 | 24;10 |
| Mean MA on BPVS | 3;8 | 6;0 | 6;0 | not available | 4;6 | 7;0 |
| Mean TROG score | 5.8 (n=5) | 11.75 | 9 | not available | 6.2 | 8.2 |

The young autistic children were only tested on the initial warm-up session, which was used as a familiarisation session before the imitation tasks of Chapter 3 were presented. The elicited and instructional sessions were not presented due to the language difficulties these French children, and the experimenter faced! For the most part, the numbers for each part of the experiment were as described above. However, the video recordings for five of the twelve 5-6 year olds were misplaced so, although a description for the play produced in the first warm-up session was available, this could not be timed to acheive the data necessary to be analysed. Therefore, the number of children in the 5-6 year old group was only seven on the warm-up session but twelve thereafter. In addition, the procedure was quite lengthy and some children refused to complete the experiment, and several children were either not available for testing, or just refused to come with the experimenter for one of the sessions. One 3-4 year old boy was keen to begin the second session and played quite contentedly until the first set of objects were presented in the elicited condition. He then walked out of the experimenting room. The number of children included in each analysis will be noted, when they differ from Table 7.1

*Procedure:*

1) Warm-up session:

The purpose of this was to allow the children to familiarise themselves with the toys and become familiar with the elicited and instructed conditions using toys not included in the test set of objects. Lewis and Boucher (1988) included a familiarisation session, but only with mechanical toys, not included in the test phase. They had 2 test sessions, however, and found that there was a significant increase in symbolic play between the two sessions, which they suggest was due to the children having become familiar with the toys. It was decided for this study, just to have one test session (The two half hour sessions used by Lewis and Boucher, was felt to be too much for this group of autistic individuals and too disruptive to the school, since the children would have to be taken from class for other experiments), but to allow the children to familiarise themselves with the toys in a freeplay situation several days before the test session. This warm-up session occured at the end of a session

testing for emotion perception and joint attention and lasted for a maximum of 10 minutes, although if a child was in the middle of a play action when the ten minutes were over, they were allowed to continue until there was a pause in their play. Not all subjects played for ten minutes, but they were encouraged and prompted to play for at least five. Most of the adults and the oldest MLD children could not be encouraged to experiment with the objects for very long, so they were asked "What else can you do?" twice, after the intitial instruction, and if there was no response, the session was abandonned. At the end of the freeplay, the experimenter took several of the non-test objects and gave them to the child saying, "what can you do with this?". After a pause for the child's response, the experimenter then gave an instruction involving the object. This was to familiarise the children with the elicited and instructed conditions.

2) Test session - freeplay.

Lewis and Boucher used a minimum time of 5 minutes in this session but no maximum time. It was decided that for these experiments a maximum time of 10 minutes would be imposed. If the subject stopped before this then they were given two prompts to continue before the experimenter moved on to the elicited condition. They were encouraged as far as possible to play for at least five minutes. During the freeplay session the experimenter sat with a clipboard, and told the child "I have some writing to do - you play with these toys for a few minutes and then I will play with you". While the child was playing the experimenter made a shorthand account of what the child was doing. The whole process is recorded on video camera. If the child was distracted by what the experimenter was writing then the experimenter stopped writing and just completed the observations from the video recording.

3)Test session - elicited play.

At the end of the freeplay time, the experimenter got on the floor beside the child and put all the objects to one side. She then took one set of objects and asks the child "What can you do with these?". If the child made no response after 2 such prompts the experimenter moved to the instructed condition for that set of objects. If the child did respond then he/she was allowed to continue to do so for a maximum of

5 minutes. If the child responded once then stopped, he or she was prompted with "What else can you do with these?". If there was no response after 2 prompts then the experimenter moved to the instructed condition. Four sets of objects were used in the elicited condition for both children and adults.

4)Test session - instructed play.

After play had been elicited as described above, a set of instructions was given for each set of objects. This depended on which actions the children had performed during the freeplay and elicited conditions and included instructions for symbolic and functional actions, as described above and in Appendices 7.1 and 7.2. A minimum of eight instructions were given (i.e. two per set of objects), unless the action had occurred in the other conditions.

5) Freeplay

A further freeplay session then followed for as many children as possible. For the oldest subjects this was not done as some of them were already bored and asking them to play with the objects again was not feasible. However, the final freeplay was done with as many children as possible.

*Objects used and instructions given*:

The objects used in this study were taken from the lists of objects used by Baron-Cohen and by Lewis & Boucher. Other objects, which were not used by these two previous studies were included as a result of observations on the behaviour of the children involved. Lewis and Boucher commented that they may have found a significant difference in symbolic play if different objects had been used. They did not elaborate on this, however, so it is difficult to know which objects they felt did not work well. What they did do was to use 4 sets of objects - 2 sets were toy/toy pairs, 2 were toy/junk pairs. The two main toys were a car and a doll and these were presented either with a toy accessory, e.g. a petrol pump, or a junk accessory, e.g. a cardboard box. Only one accessory was given, so it may have been that when the child was asked to show how the car goes into the garage, they were able to deduce that the box should be used as the garage. A final point was that the two toys they used - the car and the doll - are very conventional toys and it may be that the

children had learned or been taught to use these toys and later repeated what they had seen another person do with the object. The list of instructions used by Lewis and Boucher was very long and may have caused problems for the attention span of the autistic children. The sets of objects in the list used by Baron-Cohen for free-play experiments could not all be used for both symbolic and functional play. This was felt important in order to attempt to replicate the Lewis and Boucher study. However, some of the objects in the second set of objects in Baron-Cohen's study were used in the present study - the spoon, doll, toy telephone, and small pieces of sponge.

In the present study it was decided to present, in the elicited and instructed conditions, groups of objects which could be used both functionally and symbolically. In addition a much greater range of toys were presented than in the Lewis and Boucher study. This was intended to give the children more choice in the elicited condition, since they could use the objects together or separately and also helped to eliminate the forced choice response in the instructed condition. For the instructed condition, the form took that used by Lewis and Boucher - "show me how ....." or "make the.....". Where the same objects were used the same instructions were given as in the Lewis & Boucher study. Sometimes the instruction was prefixed by a statement, for example, "dolly's face is dirty. Show me how you wash her face."

A list of the objects used and the instructions given are presented in Appendix 7.1, along with some photographs of the sets of objects used.

For the older children and adults a more age appropriate set of objects and instructions were given. For this group of subjects - those over 12 years of age (13+) - the emphasis was put on the objects as props in the drama class, usually with themselves as the actor. Again in each set of objects some could be used functionally and some could be used symbolically. Some of the objects did appear in both the children's set and the adults' set, and the same instructions were used for these, in both conditions. This would hopefully illustrate whether a set of age appropriate toys, used in an age appropriate way (even the autistic adults did attend drama classes), would make any difference, at least in the spontaneous and elicited

conditions. A list of objects and instructions, for this group of subjects is included in Appendix 7.2.

The instructions for both the younger and older children were originally classed into three types - those predominantly functional, those predominantly symbolic and those that could easily be interpreted either way. There were not equal numbers of each and all three types of instruction were not necessarily given for each set of objects. One set of objects was more conducive to functional behaviour, one set was more conducive to symbolic behaviour and the other two sets were a mixture of both, with some instructions that could be interpreted either way. Not all children were given four instructions per set of objects - it depended on the play that had been produced in the elicited and freeplay sessions and on the time available and the interest of the child.

*Coding and data analysis:*

1) Freeplay - The number of objects used and the type of object was recorded. The type of play in which the child used the object(s) was scored as for the observational study - i.e. whether it was : manipulative (this can include sensorimotor movements such as mouthing, throwing, swinging etc.), relational, functional, symbolic or one of the mixtures described above. The experimenter, where possible scored the types of play at the time of the session and then completed the scoring and timed each action from the video recordings. The video recordings were also scored for each type of play by an independent observer who was trained to recognise each type of play.

The total duration of play, the total time available for play and the length of time spent in each action was timed from the video tape. The total duration of play, was calculated as a percentage of the total time available for play - since each subject played for a different length of time. Knowing the number of objects used and the number of actions produced, then the average time per action and per object was calculated. The figures used in analyses were the average percentage of the total time played per object and per action. The number of actions and objects per minute was also calculated to illustrate whether some of the children played with more objects for a shorter time or with fewer objects for a longer time. The total time

spent in each type of play was also converted to a percentage of the total time played, to illustrate the balance in the play of each group. The frequency of each type of play produced was also calculated as a percentage of the total number of actions produced. So the measures analysed for each of the freeplay sessions were as follows:

a) Percentage of total time available in which child played with an object.

b) Percentage of total time played spent in manipulative play, relational play, functional play, symbolic play , functional/symbolic play and other mixtures of the four main categories.

2) Elicited session:

Basically the same procedure as for the freeplay session was used and the same measures were analysed. However, the data for each child was an average over the number of sets presented to them. This had to be at least three out of the four sets and to be included the child had to be allowed at least 20 seconds and two prompts before moving on to the instructions.

3) Instructed play:

The response to each instruction was coded as follows (similar to system used by Lewis and Boucher):

Example: Show me how you park the car in the garage:

5) Child places box on its side, drives the car up to the box, drives inside box and closes down the lid of the box, or puts card in front as door.

4) Child places box on end or builds a wall of bricks and drives the car inside the box/wall,

3) Child places box, opening up, lifts car into box, having driven to the box.

2) Child lifts box and car and puts car inside box or drives box on to a piece of card or beside box and stops.

1) Child stops car somewhere on roadway.

0) No response to instruction.

The scores of each child were analysed as the average score over the number of instructions given, so that each child, even if they did not completely finish the

task, could still be in included in the results.. This was also important because the number of instructions given ultimately depended on what each child did in the free-play and elicited conditions. So for example, if the child produced two of the intended instructions in the elicited situation, then their instructed score was the average of their score over two instructions. If they were given all four instructions then their score was the average of their score on all four instructions. It was expected that the normal children might produce some of the instructed behaviours spontaneously but it was still necessary to have a measure of how they performed on the instructed conditions to compare with the performance of the autistic groups. So each child had an average score on functional instructions, symbolic instructions and functional/symbolic instructions.

Several other measures were also taken on the quality of play. The percentage of objects used in the second freeplay session, which were also used in the first session was calculated and compared across groups, using a Kruskall-Wallis one-way analysis of variance. Secondly, the number of children in each group who reproduced actions from the instructed or elicited session in the final freeplay session, was anlysed using a chi-square analysis.

Kruskall-Wallis ANOVAs were used to analyse each of the measures and scores within each of the conditions. It is the results of these main effect analyses that are reported in the results section. Due to the number of analyses which had to be conducted (36 when comparing the six groups for the warm-up and the five groups for the other conditions), only those significant at the 0.01 level were considered significant (Some of the most interesting results significant at 0.05 will also be mentioned but not used as concrete evidence of any group differences). Once a main effect at 0.01 level was found, Kruskall-Wallis post-hoc tests were then carried out to establish where the group differences lay and differences are then reported if significant at the 0.05 level on the post hoc analysis. The K-W values presented are for the main effect.

To compare the data produced in each of the sessions, in order to consider whether there is a novelty effect, a Wilcoxon Signed Ranks test was carried out to compare performance by each child in the categories of manipulative, functional, symbolic and functional/symbolic play during the warm-up session, the second

freeplay and the elicited sessions. Also compared was the total percentage of time during which the children played. Four sets of analyses were done -1) for all children, 2) for the autistic groups together, 3) for the non-autistic children together and 4) for each of the five groups, with 15 paired comparisons in each set. Since this is quite a large number of analyses, only those significant at 0.02 level or lower will be considered.

As mentioned earlier, subgroups of the autistic and non-autistic groups were matched on MA, CA and TROG raw score and the Kruskall-Wallis analyses were repeated for these matched groups. Again only those significant at 0.01 level were considered significant. CA matched groups were only compared for the warm-up session, as most of the autistic children included were in the young autistic group.

Finally, Spearman's Rank Correlations were carried out for the relationship between each of the age measures and performance on different phases of the task. This was done specifically to analyse whether a higher chronological age may play an important role in inhibiting spontaneous symbolic play but not elicited or instructed play, which these individuals may do because an adult has asked them to do so.

Interobserver reliability:

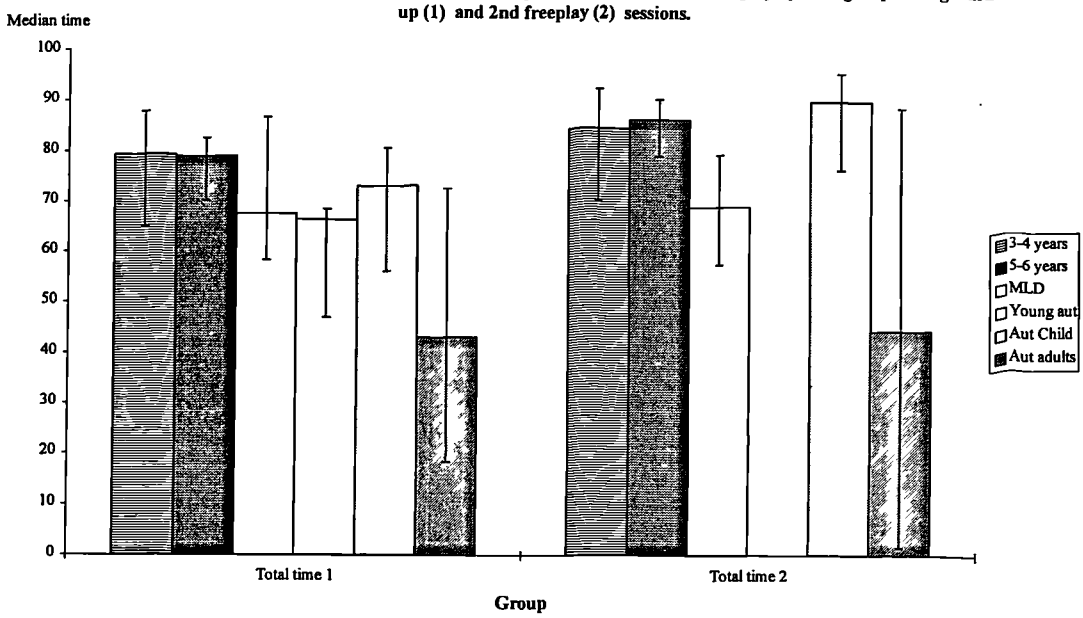
A second independent coder watched video recordings for 10 subjects (from both autistic and non-autistic groups) in the freeplay session, 10 subjects in the elicited session and 11 subjects in the instructed sessions. For the spontaneous and elicited section the number of each category of play (manipulative, relational, functional, functional/symbolic, symbolic, no action and other mixes plus the number of objects and the number of actions) produced by each child was totalled over all children. There were therefore two sets of numbers for 9 categories/measures of play and these were compared across the two coders using Pearson product moment correlations. For the freeplay session, there was high reliability with an r value of 0.98 ($p<0.0001$). For the elicited session comparison there was an r value of 0.97 ($p<0.0001$). For the instructed session, the correlation was done on the average score for the number of instructions given, for the 11

children observed by both coders. There was therefore 11 pairs of numbers compared using the Pearson product moment correlations. The results was a relatively high interobserver agreement, with an r value of 0.72 ($p<0.001$).

**Results.**

Total time played and types of play engaged in during warm-up and second freeplay sessions.

**Figure 6.1: Median time spent playing as a percentage of total time available to play by each group during warm-up (1) and 2nd freeplay (2) sessions.**




During the warm-up session, and comparing all groups, the only difference statistically significant at 0.01 level was the difference between the 3-4 year olds and the autistic adults on the percentage of time (K-W = 16.07 $p<0.01$) and the percentage of actions (K-W=15.59 $p<0.01$) spent on other mixtures of the four main categories (i.e. not functional/symbolic) (See Figures 7.1 to 7.4). Since there were no differences between the three autistic groups and the three non-autistic groups, these were collapsed into two groups and compared. There were no significant difference between the two groups and this held true for the CA, MA and TROG matched subgroups. There were a few behaviours where there were differences at 0.05 level, such as the non-autistic individuals matched on MA and also those matched on TROG raw score, played for a higher percentage of the time available than the autistic groups. Those matched on MA also spent longer in symbolic play than the

autistic subjects and those matched on TROG spent longer in functional/symbolic play.

There was a paucity of symbolic play in all groups during the warm-up session. Only the 3-4 year olds showed any tendency for symbolic play but as we have seen this was not significant.

**Figure 6.2: Median time, expressed as a percentage of the total time played, and interquartile ranges for each group, during the Warm-up session (1) and during the 2nd freeplay session (2) for manipulative (Man) and relational (Rel) play.**

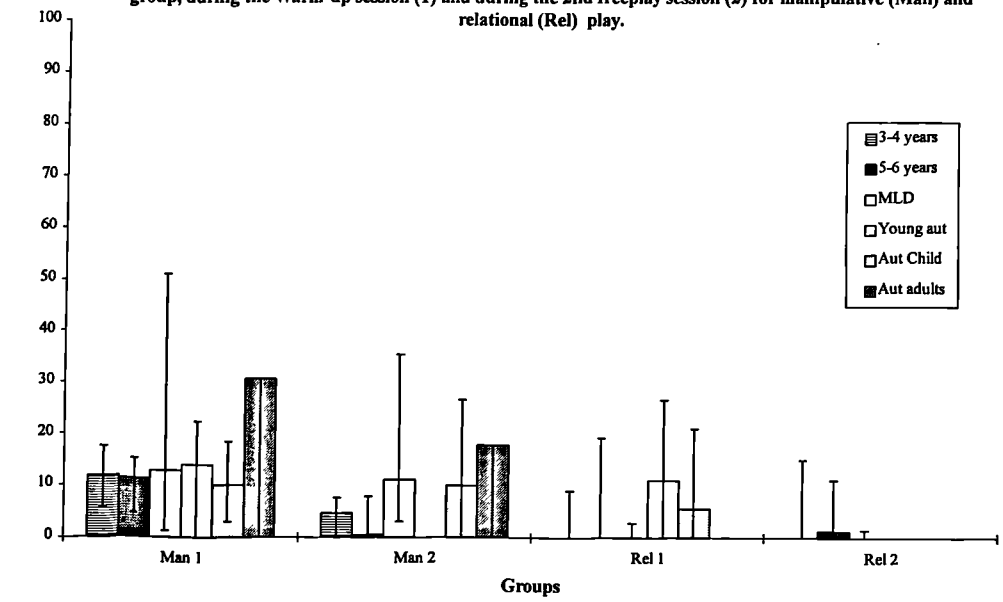
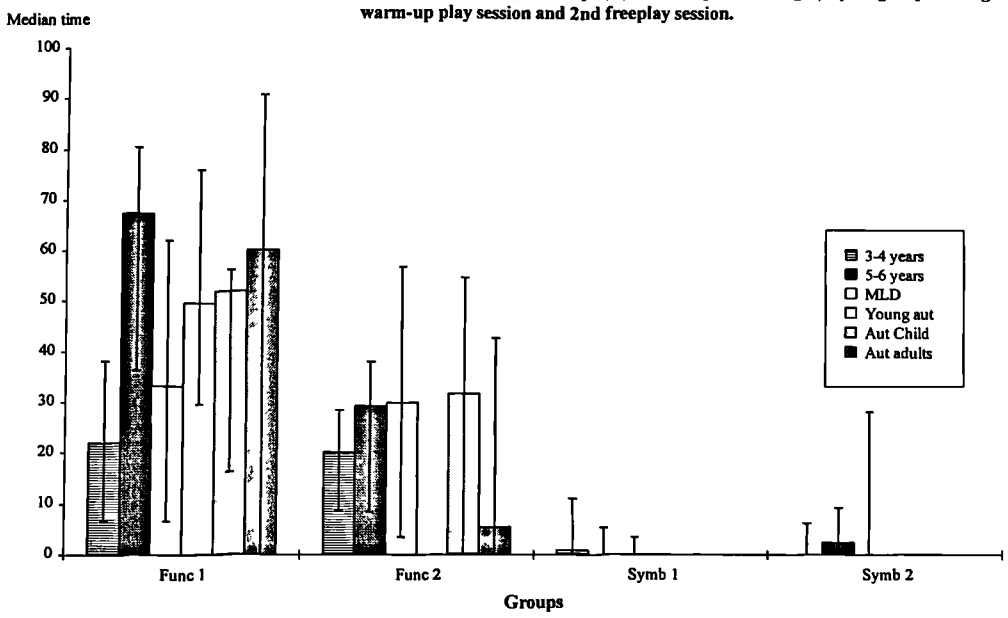



**Figure 6.3: Median time spent in Functional and symbolic play (and interquartile ranges) by all groups during warm-up play session and 2nd freeplay session.**



Second freeplay session:

The results from this session are also portrayed in Figures 7.1 to 7.4. When analysed statistically, none of the groups performed significantly better or worse than another on any type of play. When the three autistic and three non-autistic groups were collapsed into two groups - autistic and non-autistic, there was only a significant difference for time spent in relational play (main effect, K-W=6.15 $p<0.01$), with the non-autistic children spending more time in relational play than the autistic children. This difference was reduced to 0.05 level when MA and TROG were controlled for but did not disappear altogether.

As in the warm-up session, it was mostly the normal groups who showed any symbolic play and also functional/symbolic mixtures. However, once again, this difference was not significant.

**Figure 7.4: Median time ( and interquartile ranges) spent by each group engaging in a mixture of functional and symbolic play (F/S) and other mixtures of the four main categories, during the warm-up and second freeplay sessions.**

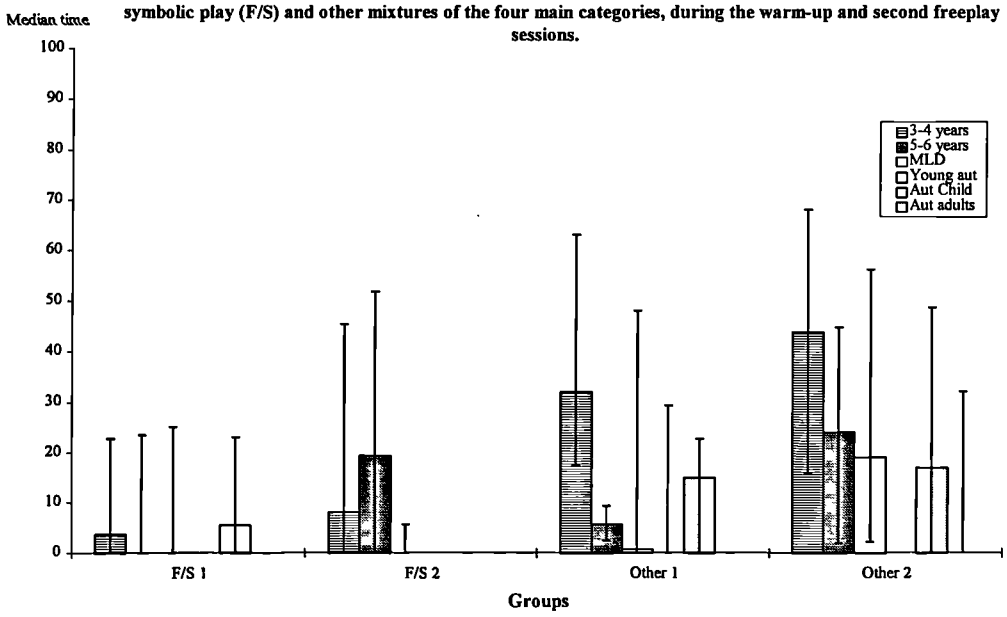



Table 7.2 summarises the results for the first and second freeplay sessions in a slightly different way. Table 7.2 presents the percentage of children in each group engaging in each type of behaviour at least once. During the warm-up session there was a high percentage of all groups engaging in manipulative and functional play. In symbolic play, the percentage of children was lower in all groups, but especially low

for the autistic groups. Fisher tests revealed that more 5-6 year olds showed symbolic play than both the autistic children ($p<0.01$) and the autistic adults ($p<0.05$) during the second freeplay session. More MLD children also showed some symbolic play than the autistic adults ($p<0.05$). Although close to significance in the warm-up session there were not more 3-4 year olds showing symbolic play than autistic children ($p=0.055$) and adults ($p=0.08$). During the second freeplay session, more 5-6 year olds showed some functional play than autistic adults ($p<0.05$) and during the warm-up session more 3-4 year olds and more 5-6 year olds both showed some functional/symbolic play than the autistic adults ($p<0.05$ and $p<0.01$ respectively).

Table 7.2: Percentage of children in each group engaging at least once in each type of play, during the warm-up and freeplay sessions - manipulative (Manip.), Relational (Relation.), Functional (Function.), symbolic, mixture of functional and symbolic (F/S) and other mixtures of the four main categories of behaviour.

| Group | Session | Manip. | Relation. | Function. | Symbolic | F/S | Other mix |
|---|---|---|---|---|---|---|---|
| 3-4 years | warm-up n=10 | 90 | 40 | 80 | 50 | 50 | 90 |
| | Freeplay2 n=8 | 62.5 | 25 | 87.5 | 25 | 62.5 | 100 |
| 5-6 years | warm-up n=7 | 91.7 | 58.3 | 100 | 33 | 41.7 | 83.3 |
| | freeplay2 n=12 | 50 | 66.7 | 91.7 | 58.3 | 66.7 | 75 |
| MLD | warm-up n=12 | 75 | 44.4 | 92 | 33 | 55 | 50 |
| | freeplay2 n=12 | 83.3 | 41.7 | 75 | 41.7 | 25 | 83.3 |
| Yng Aut | warm-up n=8 | 62.5 | 37.5 | 87.5 | 12.5 | 0 | 37.5 |
| | freeplay2 | | | | | | |
| Aut Ch | warm-up n=10 | 81.8 | 63.6 | 90.9 | 9.1 | 54.5 | 72.7 |
| | freeplay n=10 | 72.7 | 9.1 | 54.5 | 0 | 27.3 | 63.6 |
| Aut Adt | warm-up n=9 | 75 | 0 | 75 | 12.5 | 0 | 12.5 |
| | freeplay2 n=11 | 54.5 | 0 | 45.4 | 9.1 | 9.1 | 45.4 |

Additional data on the novelty effect and the number of actions and ojects per minute can be found in Appendix 7.3 (Figures 7.5-7.7)

Elicited session:

Figures 7.8 to 7.10 illustrate the results for the elicited sessions. The autistic adults (n=9) spent significantly less time playing than the 5-6 year olds (n=12), although only at the 0.05 level (K-W = 11.07). However, there were no differences betwen the two autistic groups nor between the three non-autistic groups. Thus they were collpased into one autistic and one non-autistic group and performance compared. There were no significant differences, although when TROG was controlled for, there was a significant difference, with the non-autistic spending more time playing than the autistic groups, but this was only just significant at the 0.05 level (K-W = 3.86 p=0.046).

**Figure 7.8: Median time spent in play during the elicited session for each group, espressed as a percentage of total time available and the group medians for average time per action, during the elicited play session.**

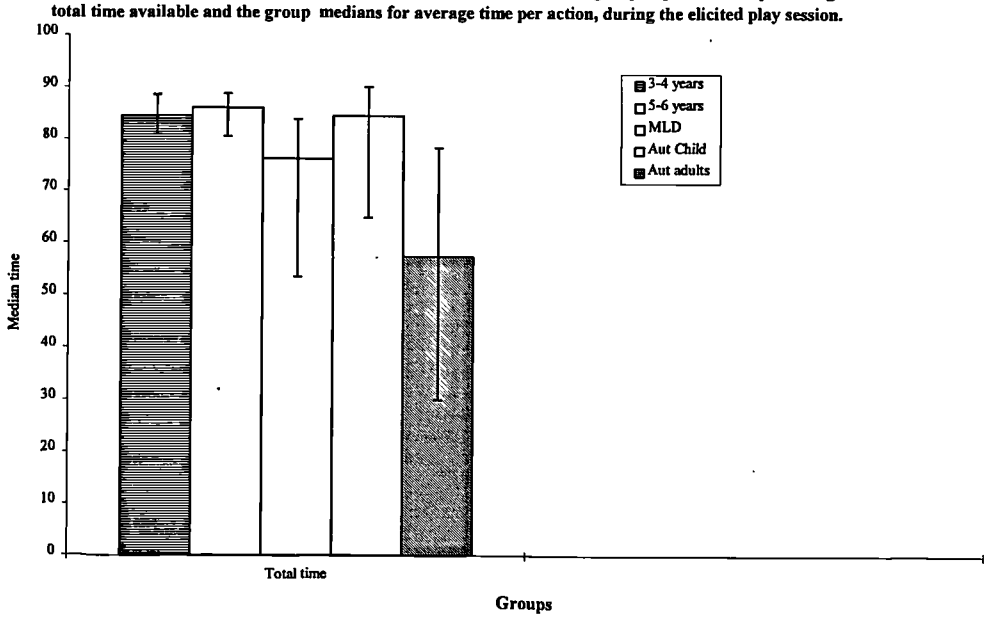


**Figure 7.9: Median time (and interquartile ranges) for each group, during elicited play, expressed as a percentage of *total* time played and averaged over four sets of objects - for manipulative, relational, functional and symbolic play.**

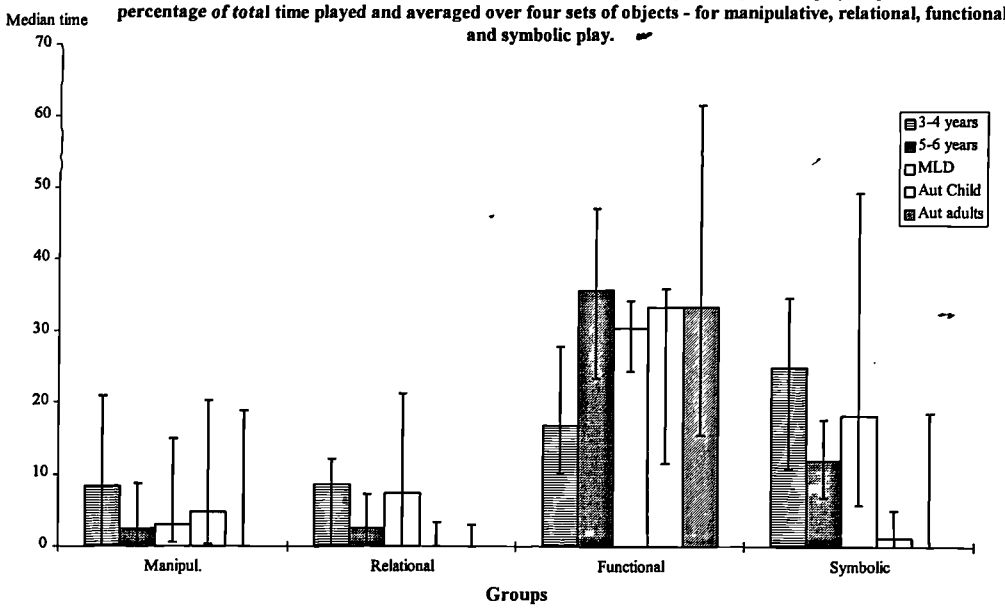
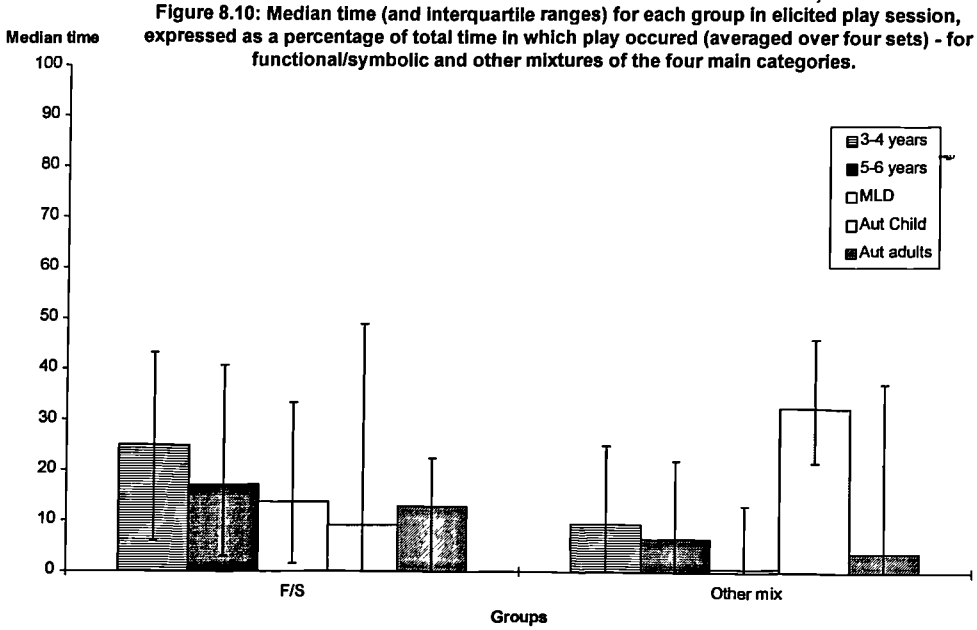



Figure 7.9 above and 7.10 below illustrate the results for each category of play in the elicited session. There were no group differences for manipulative and relational types of play. There were also no statistical group differences for functional play but there were for symbolic play. All the normal groups engaged in symbolic play at least 10% of the total time played. Both the MLD (n=10) and the 3-4 year olds spent more time in symbolic play than the autistic children (K-W=15.01 $p<0.01$; n=10). Although the adults had a lower group median than the autistic children, one adult spent a long time in symbolic activity. This may well have biased the statistical results. Figure 7.10 illustrates that all groups engaged in some functional/symbolic play and in other mixtures of play types but none of the groups differences were significant at 0.01 level. The autistic children showed more other play actions and spend more time in other play than the MLD group at 0.05 level (K-W = 9.79 and 10.9 respectively). The 3-4 year old children showed a slightly higher level of functional/symbolic play than the other groups but this was not significant.

When the collapsed autistic and non-autistic groups were compared, the differences were of a similar nature. The non-autistic children spent significantly more time in symbolic play, and produced significantly more symbolic actions than the autistic children (K-W=14.16 $p<0.01$; K-W=14.39 $p<0.001$). The time spent in other play was greater for the autistic than non-autistic groups but only at 0.05 level (K-W=6.42). The differences between the autistic and non-autistic groups on symbolic play remained when MA was controlled for (Number of actions: K-W =

9.0 p<0.01; Time spent: K-W=8.26 p<0.01), although the difference was reduced to only significant at 0.05 level when TROG was controlled (K-W = 6.42 p< 0.05 (number of actions); K-W = 5.25 p<0.05(time spent)).

Figure 8.10: Median time (and interquartile ranges) for each group in elicited play session, expressed as a percentage of total time in which play occured (averaged over four sets) - for functional/symbolic and other mixtures of the four main categories.




When the elicited results were compared to the warm-up and freeplay sessions some interesting results emerged. Most of these results can be found in Appendix 7.3 but the general finding was that there were no significant differences between sessions. Symbolic play, on the other hand, was interestingly significant. Over all children there was a highly significant difference between the elicited session and both the warm-up session (z = -3.69 p<0.01) and the second freeplay session (z = -4.37 p<0.0001). This was due to the tendency towards more symbolic play in the elicited session than the warm-up session by both the non-autistic children (z = -3.07 p<0.01) and the autistic children (z = -2.29 p<0.02). This, however, was a general deficit and could not be attributed to any one group. For the comparison between the elcited session and the second freeplay session the non-autistic subjects showed more play in the elicited session (z = -3.89, p<0.01) and this can be accounted for by both the 3-4 year old children (z = -2.39 p<0.02) and the 5-6 year old children (z = -2.76 p<0.01). Although the difference between these two sessions was not significant at the 0.02 level, it was significant at 0.05 level (z = -2.14, p<0.03) and this was accounted for mainly by the autistic children who showed more symbolic play in the elicited session (z = -2.37 p<0.02).

The instructed session:

Figure 6.11: Group medians and interquartile ranges for each group on each type of intruction, during the instructional session. This represents the average score, over four sets of instructions.

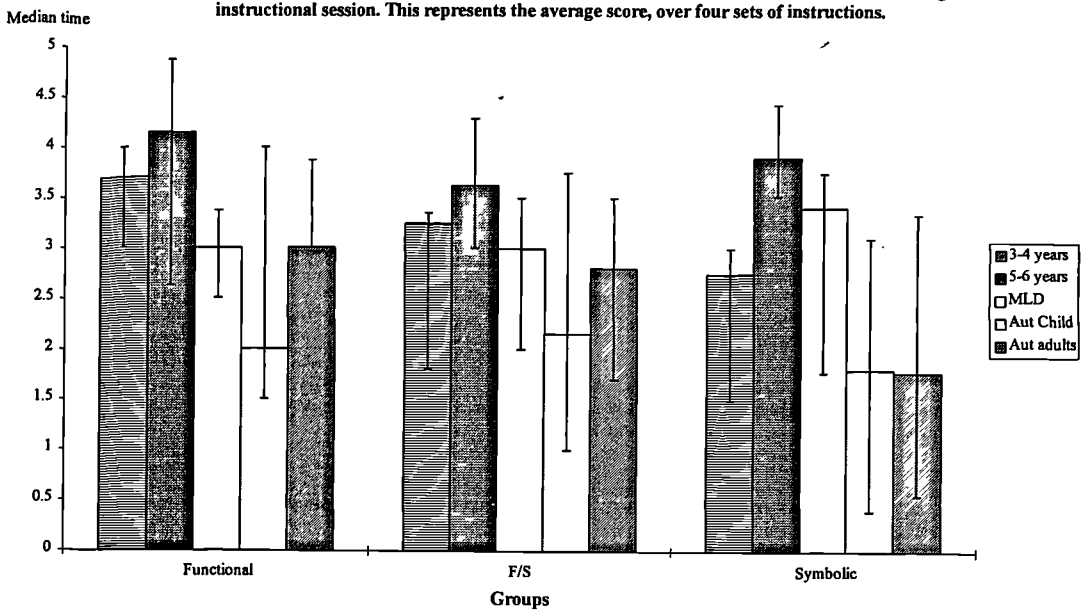



Figure 7.11 above, illustrates the results for the instructed sessions. Between groups the only significant difference at 0.01 level, however, did fall in the symbolic instruction category and this was a higher score for the 5-6 year olds than both the autistic children and adults (main effect K-W=15.41 $p<0.01$). This difference remained when the autistic/non-autistic comparison (since there were no differences between the two autistic groups nor between the three non-autistic groups) was made (main effect K-W=7.26 $p<0.01$). When MA was controlled for there was no difference (although only just - $p=0.056$) and controlling for TROG raw score reduced the difference to 0.05 level (K-W=4.73). For the autistic/non-autistic comparison, there was also a difference at the 0.05 level for functional/symbolic actions (K-W=4.0), which remained when the groups are matched for MA (K-W = 4.62) but disappeared when TROG raw score is controlled.

Third freeplay session:

As was explained in the introduction, there were quite a few of the older children and adults who did not take part in this phase of the experiment. However, of those who did, there were few group differences. The rest of the results on this section can be found in appendix 7.3.

**Summary of findings:**

Unlike the study by Lewis and Boucher (1988), this study found no deficit in functional play in autistic children and adults relative to controls. It was predicted that autistic groups would produce more manipulative or relational play? As far as the children were concerned they did not. In neither the freeplay nor the elicited conditions were there any differences in favour of autistic children for these two behaviours. In fact, non-autistic children showed more relational play than autistic children in some situations. The autistic adults did, however, show a tendency towards more manipulative play but this was not significant and it was only in the warm-up session - in the other sessions the adults did not produce much manipulative play.

The most important results with regard to this thesis are those on symbolic play. Autistic children and adults spent less time in symbolic play and produced fewer symbolic actions than non-autistic children in the elicited condition. In the freeplay conditions there were no diferences between autsitic individuals and controls on symbolic play. In these conditions there was a paucity of symbolic play for all groups, just as was found in the observational study (Chapter 2).

When *instructed* to engage in a symbolic action, the autistic children performed more poorly on symbolic instructions than the 5-6 year olds and in general the autistic individuals performed worse on symbolic instructions than non-autistic individuals. They also performed slighly worse on functional/symbolic instructions but this was not as significant as for symbolic instructions. These results, for the most part, agree with the findings of previous studies, although the evidence here is not as strong for a deficit universal in and specific to autism. High variablility in all groups may have been responsible for the lack of significant differences.

**Discussion:**

With regard to the mixtures of types of play, a problem was encountered. It appeared that the mixtures were of a different quality for some groups than they were for others. For example, if a mixture was coded for a 3-4 year old or 5-6 year old child then it was really a mixture of two or more types of behaviour, which usually occured so close together and on the same object that they were almost impossible to separate. For example, a 3-4 year old child would hold the hammer, turn it in his hands, look at it and then hammer the nail a couple of time and then look at the hammer again, turn it in hands and then hammer again. This would have been coded as manipulative/functional play. The autistic children, although they did produce this type of behaviour from time to time, also produced behaviours that were harder to code and therefore the mixtures category was used to code actions where the coder was uncertain about what the child was doing. For example, if the child lifted the spoon and stared distractedly at it then banged the upturned tin, was he just engaging in relational play or is he pretending the upturned tin is a drum? Because of this uncertainty this would be coded as relational/symbolic Although examples like this did occur in the normal groups, it was usually easier to judge whether the child was pretending or not in the normal groups. In their case mixed codes were more likely to be identifiable mixtures of two categories rather than a case of uncertainty between categories. Language was often an important deciding factor here.

So here again, as in the observational study, we find differences in quality, between the play of the normal children and the play of the autistic children. For the most part this experiment did manage to quantify some of the quality differences seen in the observational study, but quality differences still remain. Autism could be redefined as a disorder of quality of behaviour. Major categories of behaviours like functional and symbolic play are not necessarily absent in all autistic children and adults, they are just of a different quality to those we see in non-autistic children and adults.

The elicited condition, it had been hoped, would help to improve the quality of play in autistic children, by encouraging more symbolic play and reducing manipulative play, which is part of the autistic children's natural repertoire of obsessional behaviours. This was indeed what happened, although the effect for the

autistic children was smaller than had been hoped for. Manipulative play was less for all groups in the elicited condition, and the non-autistic children showed more of most other activities in the elicited condition than in the warm-up session. The only real difference for the autistic children was for symbolic play, although this was not quite significant. However, it is encouraging that there at least was a trend towards an improvement in the elicited condition. Perhaps autistic children should be encouraged to pretend play, even if they are older chronologically, in order to develop their imagination. Like imitation this behaviour can be elicited from them to a certain extent, and may well have been more successful if the experimenter had involved herself in the play more, thus providing occassion for imitation and interaction. This should be born in mind for future interventions.

However, what must also be born in mind is the fact that there are huge individual differences, not only for the autistic groups but also the non-autistic groups. Some of the autistic children were as keen to play and to involve the experimenter as some of the normal children. The converse was also true - some of the normal children showed the same lack of eagerness and level of distractions as some of the autistic children. Some of the autistic children spent as long in symbolic or functional/symbolic play as some of the normal children and some of the normal children spent as long in manipulative play as the autistic children and adults. These individual differences are important as it shows that some of the autistic individuals have the potential, at least on isolated abilities, to perform as well as non-autistic children. On the other hand, there may be some individuals who may not be able, even with interventions, to grasp a certain behaviour. As has so often been the case in the past, the spectrum of disorders seen in autistic children, and as a result the spectrum of reactions to interventions and therapies, is huge. This study tended to show that the lower the mental age on both BPVS and TROG, the longer the child played and the more time they spent in symbolic play. This reflects the fact those who were older did tend to have a higher MA and thus that the task was not age appropriate, for the most part. However, it may be that having a higher mental age in addition to exposure to normal, age appropriate behaviours in an elicited situation, may improve the situation of the autistic child. As with most interventions, the earlier it is made then the more successful it is likely to be.

**Implications for Rogers and Pennington's theory - The developmental trend.**

*Results.*

In order to examine the relationship between performance on the test and chronological and mental age, a Spearman's Rank Correlation was carried out for CA, MA and TROG score, over all children, and for the autistic only groups. Within the autistic groups there was a negative correlation between CA and the total time played in the elicited condition ($r = -0.497$ $p<0.05$; N=16) and between CA and the percentage of the objects reproduced in the second session, from the first session ($r = -0.502$ $p<0.05$; N=20). Over all the groups there were negative correlations between CA and BPVS and total time played in Session 2 and in the elicited session. There were correlations between the symbolic play produced in the elicited condition and TROG and a negative correlation with CA. The results of these correlation analyses can be found in Table 7.4 below.

Table 7.4: Results of Spearman's Rank Correlation tests for CA, MA and TROG raw score, 1) across all groups and 2) for autistic only groups. (* denotes significance at 0.05 level, ** at 0.01 level).

| Session | CA | MA | TROG |
|---|---|---|---|
| warm-up session 1) N=56 | Time spent in other mixtures r = - 0.402* Total time spent playing r = - 0.335 * | Time spent in other mixtures r = - 0.348 * | |
| 2) | | | |
| Session 2 1) N=52 | Time spent in other mixtures r=- 0.298 * Total time played r = - 0.345 * Time spent in functional/symbolic r = - 0.381 ** Time spent in manipulative play r = + 0.342 * | | |
| 2) N=16 | Objects reproduced from warm-up r = - 0.497 * | | |
| Elicited session 1) N=49 | Total time played r=-0.- 450 ** Time spent in symbolic play r = -0.329 * | Total time played r = - 0.329 * | Time spent in symbolic play r = - 0.368 * |
| 2) | Total time played | | |

| | | | |
|---|---|---|---|
| N=2 | r = - 0.502 * | | |

*Discussion*

It seems then that chronological age did adversely affect performance on this task, especially when symbolic play was examined. The older the child, the more self-conscious they appeared to be, and the more unnatural the situation seemed to them. The older the child, the less they played/used the objects and the more prompting they needed, the less symbolic play they produced and the more manipulative play they produced. The older the child the less likely they were to engage the experimenter in play. Even with the drama class scenario, it was observed that the oldest children were embarrassed to pretend. The autistic adults were much less self-conscious and most were eager to comply for the experimenter - responses were of two extremes - either they acted and played quite well, or they simply stared at objects and named them. This naming was also common in the oldest MLD children and in the autistic children. But the adults tended just to name, whereas the children tended to name and then to go on and at least manipulate the object or to use it functionally. Pretend play or other imaginative activity is not, in general, encouraged in older children and adults.

As was illustrated in Chapter 2 by the parental questionnaire, parents did view even their autistic children as too old to indulge in pretend play. Pretend play is not what is expected of them by teachers or by parents. At school the MLD children did have drama classes. Most of the adults did also, although not necessarily of the same nature as those attended by the MLD children. However, perhaps an alternative way to test these oldest children and adults would have been to have used the drama class scenario, with the whole group present, and presented the objects to each child/adult in the elicited and instructed conditions. The problem with this is immediately obvious - imitation. There will inevitably be a tendency for the children/adults to glance at their classmates for ideas and this would be very difficult to control for. Another idea would be to encourage them to make up stories to see how their imagination works.

From a theoretical point of view, these results do not present much support for Rogers and Pennington's (1991) theory. They predicted that it would be the young autistic children in whom a deficit in pretend play would be most noticeable. In this study it was the younger children who did produce pretend play, which ties in to

some extent with the normal developmental trend, obvious in the observational study in Chapter 2. Although the autistic adults did not produce much pretend play, neither did many of the older MLD children. In this way the deficit seen in the autistic children *was* more noticeable because chronologically they were compared to normal 3-6 year olds and younger children with learning disabilities, who did engage in more symbolic activity than the older children and adults. So indirectly there may be some evidence from this study for Rogers and Pennington's theory but this is by no means conclusive. Rogers and Pennington did not predict that symbolic play stood alone as a deficit but rather that it was part of a profile of deficits seen in young autistic children and adults. Rogers and Pennington predicted that young autistic children would show deficits in imitation, joint attention, pretend play and emtion sharing, while autistic adutls would show a profile of deficits in theory of mind, affect praxis and language pragmatics. So what about the relationship between imitation and pretend play and other abilities often absent in autism? This question is the topic of the next chapter.

# Chapter 8

## The relationships between imitation, play, emotion sharing and theory of mind - an evaluation of Rogers and Pennington's theory.

It is necessary once more to recall Rogers and Pennington's (1991) predictions for the profiles of deficits seen in autism, following their developmental model. They predicted that young autistic children would show a profile which consisted of deficits in imitation, joint attention, pretend play and emotion sharing. Autistic adults, on the other hand, would show deficits in theory of mind, affect praxis and language pragmatics, compared to non-autistic controls. We have already seen that young autistic children do indeed perform more poorly on elicited imitation tasks than older autistic children and adults (Chapters 3 and 6). We have also seen that there is a differentiation between elicited imitation and spontaneous imitation, the latter more likely to be engaged in by younger children than older children and adults, although the imitations may be less accurate (Chapters 4, 5 and 6). There was therefore some evidence that the development of imitation follows the same pattern in autism as in does in normal development, with the main deficit in imitation being for the young autistic children. As such there is some evidence for Rogers and Pennington's model.

Chapter 7 presented results for the ability to play and although some evidence for a normal developmental pattern was observed, in that the adults did not show less symbolic activity than the older children with learning disabilities, there was little direct evidence that it was the youngest autistic children who showed the most noticeable impairment in symbolic play. In order to examine the relationships proposed by Rogers and Pennington (1991) three additional experiments were conducted: experiment 1 tested for emotion recognition and sharing; experiment 2 tested visual perspective taking and joint attention; and experiment 3 tested for false-belief attribution. Since I was mainly interested in investigating the relationships between these abilities and imitation and pretend play, I shall only describe these experiments briefly here - the majority of the background literature for these studies can be found in Chapter 1 and the details of the experiments themselves can be found in Appendices 8.1 to 8.8.

### 1A) Experiment 1: emotion perception and sharing.

In 1986, Peter Hobson proposed that the problem in autism was one of intersubjective relations, which were mediated by emotions. He tested autistic children on emotion recognition tasks and he has continued this line of work for many years. In his first experiments he showed that autistic children have problems with recognising facial expressions of emotions, vocal expressions of emotions, gestural expressions and context-linked emotions, relative to non-autistic children. In later experiments, (Hobson, 1994) he tested emotion recognition in a much more subtle way than looking at pictures of faces and videos of contexts. Using points of light, attached to a person, dressed in black, with no face, he presented light images of this person acting in both mechanical and emotional contexts, to autistic individuals. These individuals could describe accurately what the person was doing but only in a mechanical way, whereas non-autistic controls produced emotional descriptions of the actions involving emotions. So for example, when the dots of light sat down and put his head in his hands, the non-autistic subjects would say that the person was sad or upset but the autistic subject would say the person was sitting down, slouched over/head in hands.

Hobson's results seemed to be convincing that autistic children have problems with recognising and describing emotionally relevant signals. However, there are several studies that have disputed these results, the most relevant being that by Prior et al. (1990). Prior et al. attempted to replicate Hobson's early work but failed to confirm his results. Baron-Cohen, Spitz and Cross (1993) looked at three emotions - happy, sad and surprised. They predicted that since happy and sad are simple emotions caused by situations, autistic children would not show deficits in these two. Surprise, however, is a "cognitive" emotion, caused by beliefs. It was here that Baron-Cohen et al. predicted that autistic children would show deficits. Baron-Cohen et al. point out that previous research found deficits in the cross modal matching of emotions to sounds, pictures etc. but that autistic children did not perform more poorly than controls, matched on verbal mental age, on simple facial emotion recognition tasks, which is exactly the findings of Prior et al. Baron-Cohen

et al's study did show that autistic children performed equally well on the happy and sad emotions as verbal MA matched non-autistic children. On surprise, however, they did perform worse. Thus, there is still some debate about whether autistic children are impaired in all emotion recognition tasks or just those requiring an understanding of belief and whether this impairment is specific to autism, universal in autism, or linked to mental age. The main aim of this experiment was to test emotion recognition and sharing and to examine any links between emotion recognition and imitation and Theory of mind as proposed by Rogers and Pennington (1991). This latter aspect will be dealt with at the end of this chapter. First of all, let us look at how the autistic children and adults features in this study performed on tasks of emotion recognition.

The tasks used in this experiment were based on those used by Hobson (1986a, 1986b, 1993; Hobson *et al.*, 1989) but also using some of the adaptations made by Prior *et al.* (1990). Unfortunately, due to the fact that this study traveled between 7 schools/centres, and facilities for testing the subjects were not optimal, it was impossible to use the exact tasks employed by Hobson, namely those involving video clips. The task was redesigned to be more portable, and also presentable to the oldest children and adults, as well as to the youngest children. Details of the tasks and equipment can be found in Appendices 8.1-8.5.

**Methods.**

Subjects

The subjects used were as for the previous chapters. One MLD subject could not be tested. Two extra 5-6 year olds were available for testing in this experiment. The number of subjects in each group were therefore as follows:

Table 7.1: Number of children in each experimental group.

| 3-4 years | 5-6 years | MLD | Autistic children | Autistic adults |
|---|---|---|---|---|
| 11 | 14 | 11 | 12 | 10 |

Procedure:

*Phase 1:* Recognition of facial emotions, using both a naming and showing procedure, was tested using 6 photographs of emotional expressions (plus one neutral expression photograph) taken from Eckman and Freisen (1975). The emotions were happy, sad, angry, frightened, surprised and disgusted. The pictures were presented first asking the child how the woman in the pictures (Carol) was feeling. Then they were presented again, naming each emotion and asking the child to point to the appropriate photo. The child was corrected on any wrong response after this second phase and then the photographs were presented one-by-one again, asking the child to name the emotion. Finally, all the pictures were displayed and the child asked once more to show the picture that went with the emotion spoken by the experimenter.

Coding and analysis: Coding was done by the experimenter at the time of the experiment on a prepared coding sheet. The experimenter also watched a video recording to confirm the first response. In order to pass this first phase the children had to score at least five on either the first naming procedure or on the first showing procedure. In order to proceed to the later phases of the test the children had to score at least five out of seven on either the second naming or showing procedures. This was relevant for the gestures and context phases. All children were put through the sounds procedure to see if they were any better at recognising sound mediated emotions than facial expressions of emotions.

*Phase 2: Sounds*: In this phase, the children were tested on their ability to match an emotionally relevant sound to one of the 6 emotional facial expressions. Twelve different sounds were played, two for each facial expression. There was no sound for the neutral photograph. The sounds were presented in a set order as detailed in appendix 8.2. The child could respond in one of three ways. Firstly, vocally, by stating verbally the emotional state of Carol. Secondly, they could point to a picture. If they pointed to the wrong picture but gave the right verbal response then this was noted as correct. Thirdly, they could simply give to the experimenter the picture that they thought matched the sound. In this case it was important to immediately replace

the photo on the table so that when the sound appeared again the choice was available for the child.

The result for each subject was a score out of twelve but a score out of six was also recorded for the first time the child heard each emotion. This was in case hearing each emotion twice confused the child and confounded their ability to recognise emotions by recognising human vocalisations.

*Phase 3: Gestures* - This was perhaps the most difficult phase of the test - it was certainly the most difficult to design. A picture (line-drawing) of a faceless body in a gestural position indicative of each emotion was presented to the children. All the photographs were on the table at this point and the child was instructed to match a face to the body to show how Carol was feeling. There were seven body pictures, each of which are featured in Appendix 8.3. A score of seven was the maximum but a child was said to have passed if they scored five or more on this phase.

*Phase 4: Context* : The children were first of all presented with 6 pictures of a faceless body which they had to match to a verbally narrated story. If the child was successful on five out of the six stories then they proceeded to the final stage and were once again presented with the six facial expressions, laid out on the table. The story pictures were presented to the child one by one and the child was asked to match the story to a face to show how Carol would feel in the story. They were told that they could change their decision at any time and it was the final arrangement of pictures and stories that was noted.

Data Analysis:

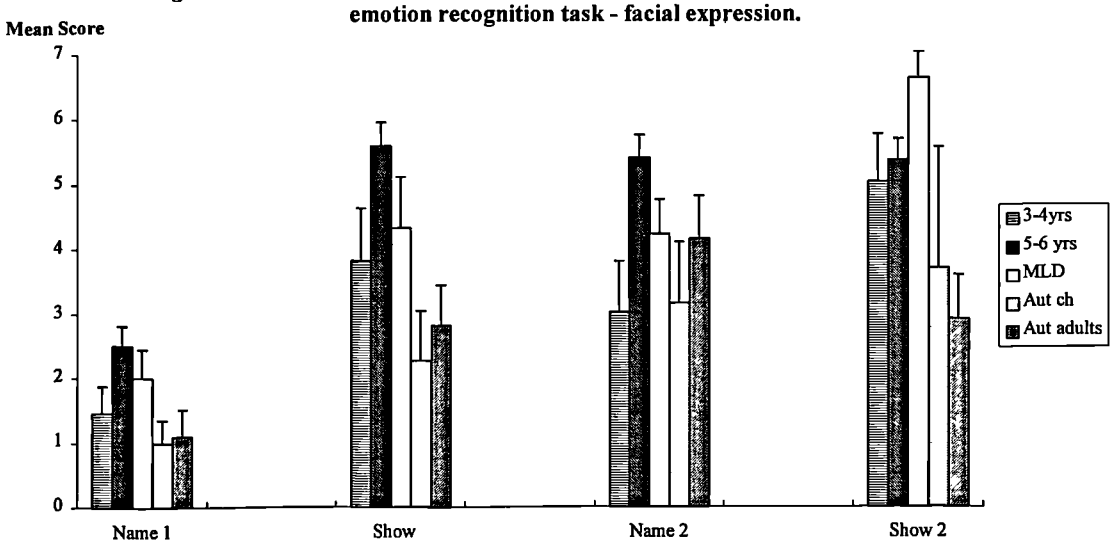
The mean scores of each group were compared using one-way ANOVAS and Newman-Keuls post-hoc tests, for each phase of the task. In addition, subgroups of the autistic and non-autistic groups were identically matched on MA (BPVS) (n=20) and the TROG raw score (n = 16) and matched within 12 months on CA (n=7) and then compared in the same manner as before. Correlations between CA, MA and TROG score and performance on each phase were also examined using a Pearson's product moment Correlation. Finally, to examine the number of subjects actually

passing each task, the scores were recoded as a one-zero data set, with a score greater than 5 being scored as a one. The results were then compared using a Chi-square to show how each group performed on each phase of the task.

**Results:**

The results can be found in detail in Appendix 8.5. I shall give only the most important results here. In the first phase of the experiment, recognition of facial expressions, it was found that all children performed relatively poorly when first asked to name the emotions, with no significant differences between groups. When asked to point to the appropriate emotional expressions, however, it was found that the 5-6 year old children showed a significantly better performance than the autistic children ($F=4.29$ $p<0.01$). Although not significant the other control groups also scored higher than both autistic groups. These results are illustrated in Figure 8.1 below.

**Figure 8.1: Mean scores and standard errors for each group on each phase of the first emotion recognition task - facial expression.**



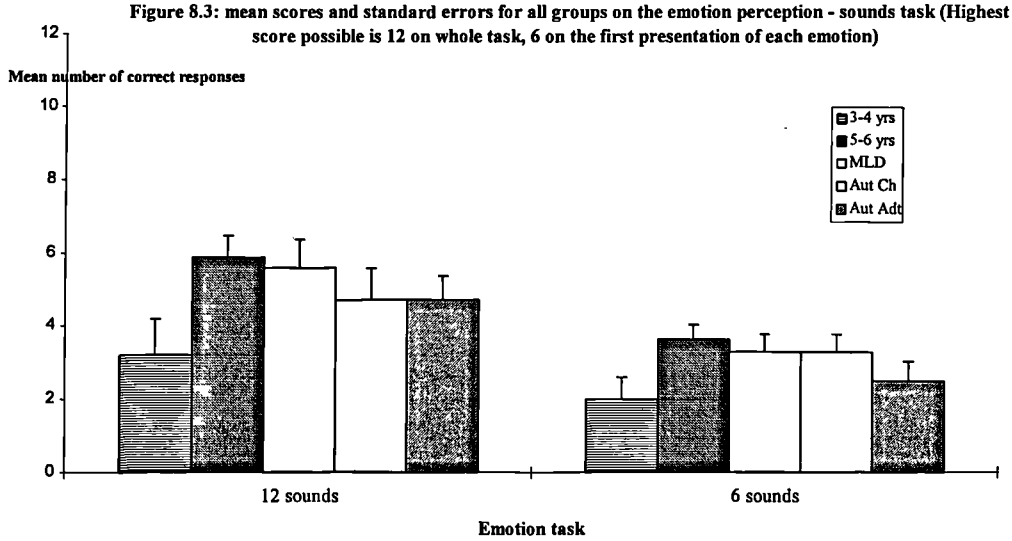

When the groups were collapsed into autistic versus non-autistic, the non-autistic group did better on naming than the autistic group ($F=7.34$ $p<0.01$). The non-autistic group also did significantly better than the autistic group on the showing procedure ($p<0.0001$). Even when MA and TROG score were controlled for the differences existed at $p<0.01$. There was a positive correlation between TROG score and performance on both these procedures for all children but not within the autistic

groups only. There was also a strong correlation between CA and performance on the showing procedure.

On the second naming and showing parts, the most noticeable result was that by the second showing part, the MLD children were showing significantly more recognition than the autistic adults ($F=3.65$ $p<0.05$). There was a general tendency for all control groups to have a higher score on the showing procedure than the autistic groups, although on the naming procedure there were few significant differences. On this the 3-4 year old normal children scored at a similar level to the autistic children and adults. When MA and TROG score were controlled for, the non-autistic groups showed more imitation than the autistic groups. However, controlling for CA did reduce the differences between the autistic and non-autistic group for both procedures. Further detailed comparisons can be found in Appendix 8.5.

In the second phase of the experiment - the matching of emotional sounds with emotional expressions, it was found that there were no group differences at 0.05 level. Across all children there was a correlation between TROG score and performance on this but not within the autistic groups. Even in the analysis of the first presentation of each sound, there were no differences between groups. Figure 8.3 below represents these results.

**Figure 8.3: mean scores and standard errors for all groups on the emotion perception - sounds task (Highest score possible is 12 on whole task, 6 on the first presentation of each emotion)**



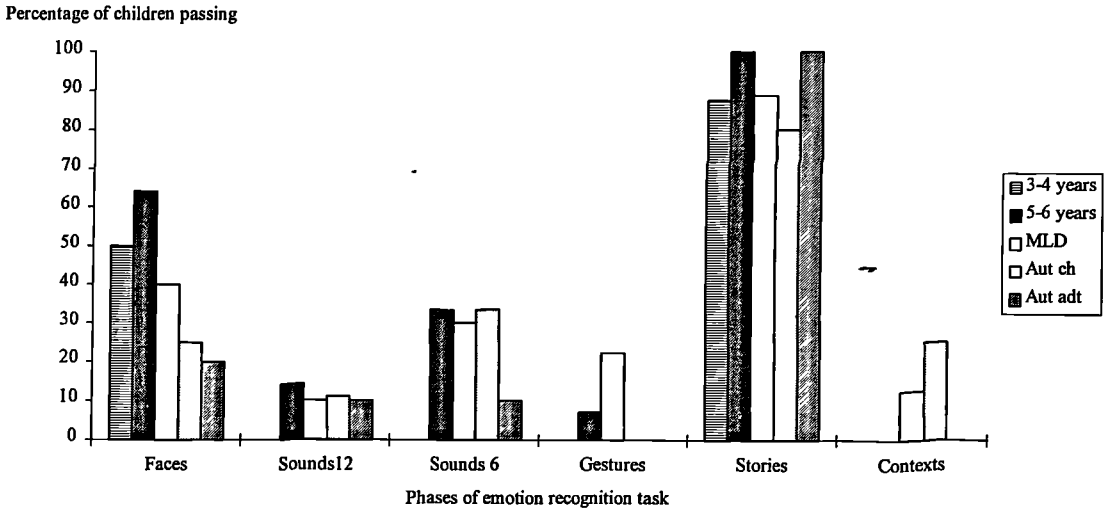
Phase 3 of the experiment involved testing for any differences in matching illustrations of gestures to emotional facial expressions. This proved to be very difficult for all groups of children and there were no differences between groups on this phase. The most important finding was that none of the autistic children, autistic adults or 3-4 year old children who proceeded to this stage, passed (i.e. scored 5 correct matches).

Finally, Stage 4 examined the ability to recognise specific emotions from a given context. This is a test of the ability to share emotions or at least to project what one would feel in the given situation to another person. All groups were good at matching the verbal story to a context picture, including the autistic children and adults. However, when matching emotions to the context pictures, the overall percentage of children passing was low in all groups. On actual score, the 5-6 year olds, MLD and autistic children scored better than the 3-4 year olds ($F=3.33$ $p<0.05$). However, these differences were obliterated when MA, CA and TROG score were controlled for in autistic/non-autistic comparisons. It must be remembered, however, that the numbers used in these comparisons were small. When the number of children passing (i.e. scoring at least 5 out of 6) was compared, only the autistic and MLD samples had any children passing this phase.

Summary of results:

Since only those who passed the initial facial expression phase were tested on the final two phases, raw frequencies of passing these cannot be directly compared. Therefore, Figure 8.4 summarises the *percentage* of children passing each phase of the test.

**Figure 8.5: Percentage of children in each group passing each phase of the emotion recognotion task.**




To summarise, fewer autistic children and adults were able to identify and recognise facial expressions of emotion than non-autistic children. Autistic children and adults did not improve their performance even after training. However, few significant differences were found between the autistic and non-autistic groups on other aspects of the tests. It seemed that those autistic children who could recognise facial expression of emotion could also match them to sounds, gestures and emotionally relevant contexts as well as non-autistic individuals. As is pointed out in some detail in Appendix 8.5, the methodology was restricted by the testing environment - it is possible that more children, in particular non-autistic children, may have passed if it had been possible to use video clips of gestures and stories rather than still pictures. Some interesting additional results can be found in Appendix 8.4 but perhaps what is most interesting is that some emotions seemed easier to recognise than others. As Baron-Cohen et al (1993) suggested, *happy* and *sad* seem to be slightly easier for autistic children and adults, while *surprised* seemed more difficult. No relationship with CA was found so we cannot say much about the development of emotion recognition and sharing. However, for the most part a higher mental age, at least as measured on the TROG, was correlated with a better performance at least with regard to the non-autistic children. On the other hand, even though the autistic adults had a slightly higher TROG score than the autistic children, this did not enable them to perform better on these tasks of emotion recognition and sharing. It seems that Rogers and Pennington (1991) (and Hobson,

1986;1993) were correct then, in that both autistic children and adults have problems with affective understanding, although from these results it is not possible to say how specific this is to autism, except for recognition of facial expressions.

**1B) Experiment 2 - Visual perspective taking and joint attention:**

Butterworth (1991) broke down joint attention into 3 levels - comprehension of gaze direction (which develops in normal infants between 6 and 18 months of age), comprehension of pointing (emerging at about 12 months) and production of pointing (which is evident, as an intentional gesture, around 13.5 months). Around 15 months a normal infant checks to see if the mother is attending before it points (Franco & Butterworth, 1988). Baron-Cohen (1991) reviews the literature of joint-attention behaviours in autism - there is some evidence that joint attention behaviours occur less frequently in autistic children (Mundy, Sigman, Ungerer and Sherman, 1986). In joint attention behaviours Baron-Cohen included "referential looking" (where the child looks at what the adult looks at, or tries to get the adult to look at something using the direction of their eye gaze) and gestures such as giving, showing and pointing. Studies by Hobson (1984), Baron-Cohen (1989), Leslie and Frith (1988), Tan and Harris (1991), Leekam et al. (1993; in press) have shown that autistic children can succeed on perspective-taking tasks, which require the child simply to say what the experimenter is looking at, with head and eye movements as the only clues. A recent study by Leekam, Baron-Cohen and Brown (1993) has shown that autistic children perform at the same level as controls on the visual perspective-taking task but failed the gaze-monitoring task, which measured the ability to spontaneously follow gaze direction. In a more recent paper (Baron-Cohen et al. (1994), which is dealt with in detail in Chapter 1) Baron-Cohen asserts the importance of eye direction following and joint attention, not only as precursors to a Theory of Mind ability, but as a possible fundamental basis on which a Theory of Mind is built.

A Level 1 and Level 2 Perspective-taking task (Flavell et al., 1981; see appendix 8.7 for the task used) was carried out during a pilot study, testing for the effect of visual perspective on the ability to imitate. Only four of the eleven autistic

children tested passed both levels, five failed both levels and 2 children could say what the experimenter could see but couldn't say if it was the right way up or upside down. On the other hand, all but one 5-6 year old passed both levels. There were only three 3-4 year olds who participated in both this pilot study on visual perspective-taking and in the present experiments, and of these three children, one child passed both parts, one child passed part 1 and failed part 2 and one child failed part 1 but passed part 2. Visual Perspective-taking will be examined in this study, while assessing joint attention abilities.

The results of the observational study in Chapter 2 hinted that joint attention was not altogether absent in the autistic group. It seemed that some autistic children would follow a point, usually with a verbalisation, of someone else to an object or event. But they themselves rarely tried to attract someone else's attention, unless it was to request the object or to show what they had done - usually to receive praise. In fact, this latter joint attention behaviour was one of the most common of the behaviours which were witnessed. This latter point is similar to other findings, for example, by Baron-Cohen (1989), that autistic children engage in protoimperative (i.e. to request) pointing but not protodeclarative (i.e. to share information) pointing. However, the apparent presence of a "passive" joint attention does not tie in so well with previous studies as mentioned above. In addition, it was often difficult to decide whether a child was following the gaze, or even the point of another person, or whether they were simply reacting to the vocalisation, which usually accompanied the point or gaze. It was also difficult to know if they were just interested in the object itself and happened to look at the object, not necessarily because the adult/ other person was looking at it.

Since joint attention is one of the social pragmatic deficits linked to imitation and Theory of Mind impairments in autism in Rogers and Pennington's model (1991) and plays an important role in many other theories of autism, specifically Baron-Cohen's latest proposals (1994), it was necessary to assess the joint attention capacities of the autistic children in this study. Rogers and Pennington (1991) predicted that it would be the younger autistic children in whom a deficit in joint attention would be most noticeable. Adults on the other hand should not be impaired relative to controls, based on Rogers and Pennington's model.

The present study aimed to examine both the spontaneous following of head and eye gaze and points and the ability of each child to take the perspective of another person in order to say what they are looking at. In addition, it has been shown that gaze behind the subject is harder for the subject to monitor than gaze to the side in normal children aged below 2 years (Butterworth and Cochran, 1980). Leekam et al. (in press) found that the gaze behind the subject condition was successfully monitored by some children in all groups - of the few autistic children who did pass the gaze-monitoring task, one of them successfully monitored gaze behind, but very few monitored gaze consistently across all conditions. It was decided that for this study, three conditions would be used for both perspective-taking and spontaneous joint attention (eye gaze and head direction monitoring) - gaze left of subject, gaze behind subject and point to the right of subject.

**Method:**

Subjects: The subjects for the present study were mostly those used for the emotion perception experiment and are described in detail in Appendix 8.6 (Table 8.3). There were 11 three-four year old and 13 five-six year old normal children, 11 children with Mild to moderate Learning Disabilities (mean CA:12;3, mean MA:5;11, and mean TROG score: 8.1), 9 autistic children (mean CA:12;1, mean MA:4;11, and mean TROG score: 6.2), and 10 autistic adults (mean CA:23;10, mean MA:7;0, and mean TROG score: 8.2).

Procedure: A scenario very similar to that described in Leekam et al (1993; in press) was used for this study. Once again details are given in Appendix 8.6. In brief, the experimenter, in the process of another session or dummy task,1) looked intently at a toy placed to one side of the child but with no verbal clues, except to call the child's name to gain their attention in the first place. The response of the child was recorded on video camera. Then the experimenter asked the child "What am I looking at?" and the response was recorded. 2) This was repeated for an object behind the child (i.e. both the silent stare and the verbal cue). 3) Finally, the experimenter pointed to an object to the other side of the child and after a pause

asked "what am I pointing at?". As far a possible the three trials were interspersed with other activities in the hope that it would lead to a more natural situation.

Coding and analysis:

The results were recorded on video tape and then coded by the principal observer using a check sheet of possible responses to each presentation. In order to analyse the results the child's responses were scored on a scale from 0 - 6 as shown in Table 8.4 (in Appendix 8.6). A Kruskal-Wallis analysis of variance for k-independent samples test was then used to test for group differences on each part of the task and for a total score on the task as a whole (out of 18). The total score was only calculated for the children who completed all aspects of the task - there were 3 MLD children and 5 autistic children/adults who, for one of many reasons, did not partake in all three components. Table 8.5 (in appendix 8.6) illustrates the number of children in each group taking part in each part of the experiment. This analysis was done for all five groups, for autistic vs. non-autistic children and for the sub-sets of the autistic and non-autistic groups matched on CA, TROG raw score and MA on BPVS (See Table 8.6 in Appendix 8.6). Pearson's Product Moment correlations were carried out for the performance on each part of the tasks, with CA, TROG and MA BPVS. Finally, the percentage of children in each group, scoring at least 5 out of six (i.e. following the gaze on the first response, before any verbalisations) was calculated and examined graphically.

**Results:**

The main analysis of the performance by the five groups showed no significant difference between the groups on any of the task components. These results are represented in Figure 8.6 below. On an analysis of overall score, between the five groups, there was a main group effect (K-W=12.46, $p<0.05$) - the MLD group showed significantly better scores than the autistic children. This result is illustrated in Figure 8.7.

Figure 8.6:Median Scores and Interquartile ranges for each group on the three phases of the joint attention task.

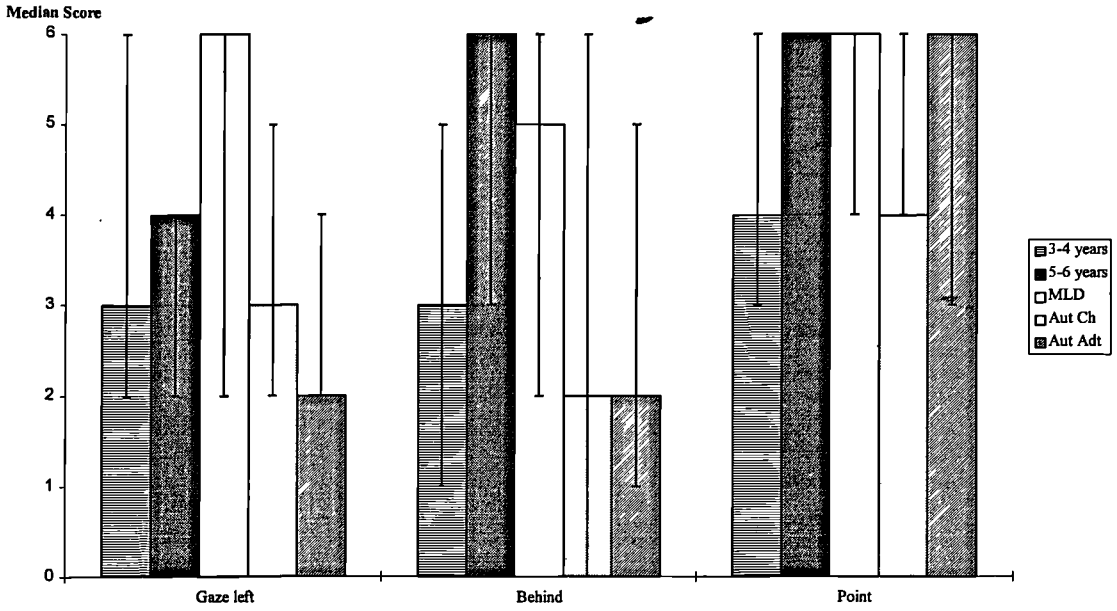
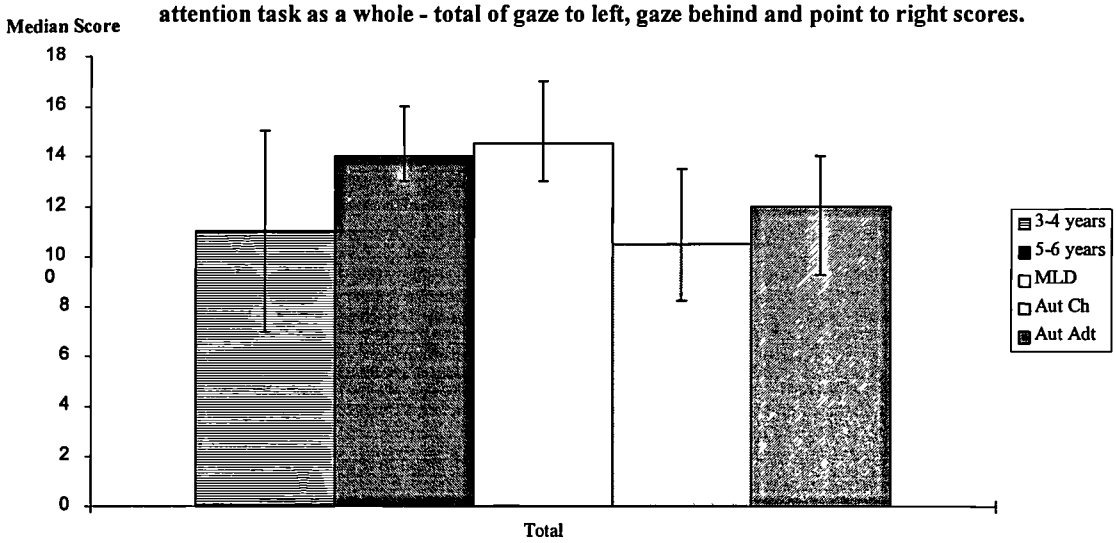



Figure 8.7: Median Scores and interquartile ranges for each group of subjects on the joint attention task as a whole - total of gaze to left, gaze behind and point to right scores.




When the groups were collapsed into an autistic and a non-autistic group, there were still no differences on each component of the task. On total score the non-autistic group did better than the autistic group (K-W=5.52 $p<0.05$) but this difference disappeared when MA and TROG score were controlled for. More details of these comparisons are given in Appendix 8.6 (Figures 8.8 and 8.9).

Finally, it was found that there was a lack of consistency across all groups, which ties in with what Leekam et al. (1993; in press) found. Although, as Figure 8.10 below illustrated, the same percentage of autistic children passed each phase of the task, the 33% was not the same children on each phase. This individual inconsistency is also represented by the percentage of children scoring 15 or more on the total score. One autistic child did acheive over 15 on the total but no autistic adults performed consistently well across all phases of the task. There was, however, higher consistency for the non-autistic groups although this was not as good as might have been expected from other studies.

Further analyses and observational results can be found in Appendix 8.6.

**Figure 8.10: Percentage of subjects in each group scoring five or more on the task components and 15 or more on total score, and thus showing a consistent tendency to follow the eye gaze or point, without prompting.**

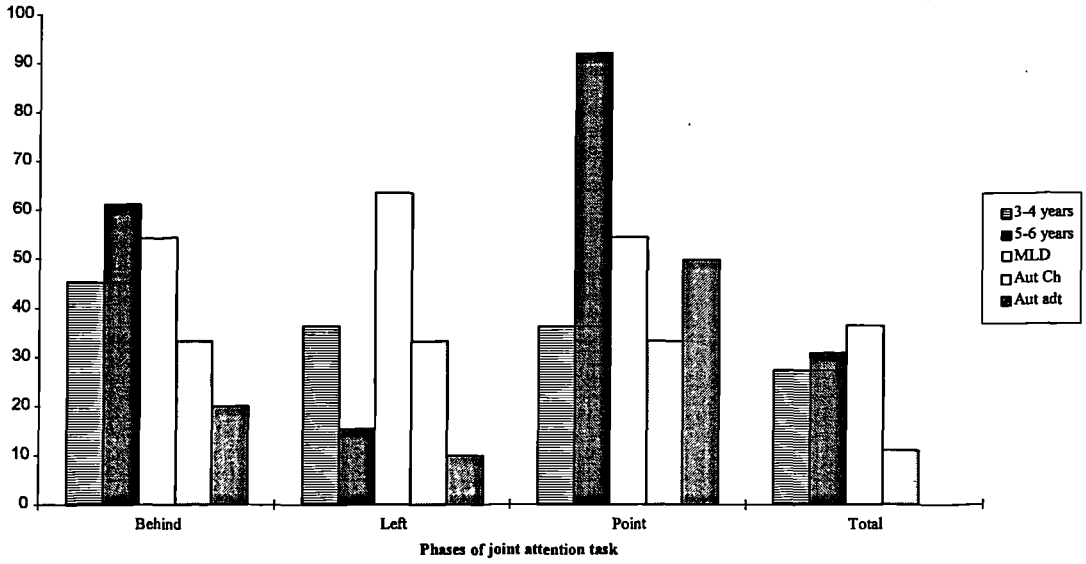
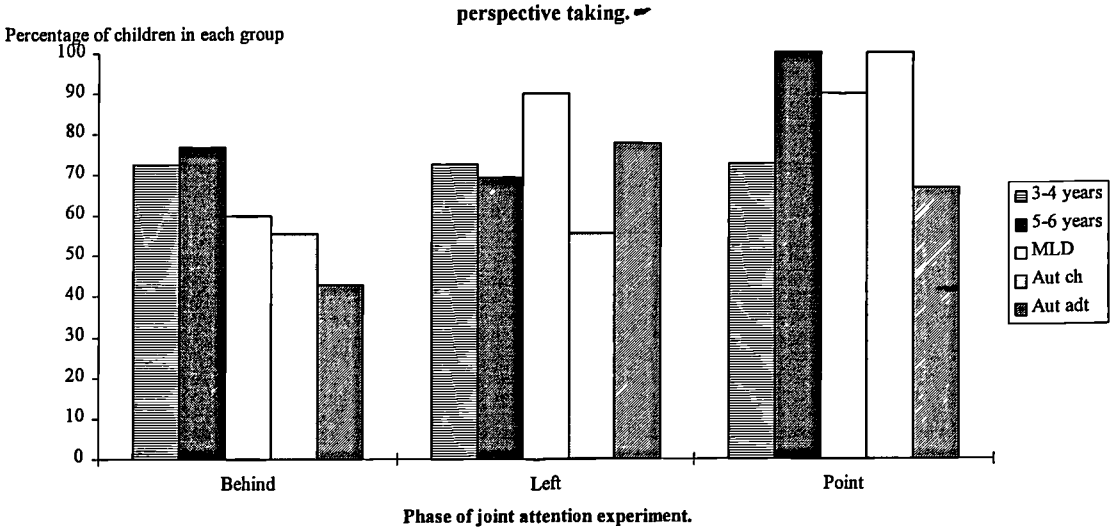


**Figure 8.11: Percentage of children in each group scoring, 2, 4 or 6 on each part of joint attention task. These scores represent a correct response to the question "What am I looking/pointing at?", thus illustrating visual perspective taking.**




Finally, to look a little at visual perspective-taking, as examined by this experiment, we can use Figure 8.11 above. This shows the percentage of children scoring 2, 4 or 6 on each component, and as such represents the percentage of children who correctly identify the object when asked "what am I looking/pointing at?"(See Table 8.4 for coding system). As is clearly evident a much higher percentage of children succeed on the visual perspective taking, than on the joint attention measure. The 3-4 year olds did equally well on all components - gaze left, behind and point. The 5-6 year olds did almost equally well on the gaze left and gaze behind conditions and all children passed on the point condition. The MLD children did equally well on look left and point and slightly worse on look behind, but still better than all other groups except the 5-6 year olds. The autistic children did equally well on the look behind and look left conditions, as was expected from the joint attention results, but all children passed the visual perspective on the point condition. Finally, the autistic adults performed well on look left, better than all except the MLD, but performed worst on the point and on look behind. In order to consider the implications of these results it is important to remember that the sample size for each group is relatively small, for example the 10% of the MLD children not scoring 2,4 or 6 represents just one child. However, it is clear, for example, that all the autistic children could correctly identify the experimenter's point of reference, when the point was used, but just over half of them could do it when just head and eye movements only were used.

**Summary of results**

From this study of joint attention we can say that both autistic children and adults tended to perform more poorly on joint attention tasks than non-autistic children, even those with learning disabilities. However, these differences were not significant on any of the phases of the task. The point phase did seem to be slightly easier for the autistic adults at least but again this was not significant. More autistic children and adults passed the visual perspective-taking tasks than the joint attention tasks, confirming what other people had found - that autistic individuals could identify another person's focus of visual attention when asked to. The lack of significant results for the joint attention means that I cannot confirm other findings that they are specifically impaired in taking another's perspective spontaneously. Perhaps, given the inconsistency of individual responses, larger numbers would produce a significant effect.

Finally, we cannot from these results offer much support for Rogers and Pennington's (1991) theory. Both autistic adults and children showed lower scores on joint attention but neither showed significantly lower scores than controls. Correlational analysis showed that there was no relationship between CA and score. The only positive correlation was between TROG raw score and performance on gaze behind, which is not surprising since this is thought to be the more difficult concept in joint attention, even for normal children.

It could be argued, however, that the autistic children used in this test were too old for Rogers and Pennington's predictions. Although the results were not analysed for this chapter, the very young autistic children were tested, or at least an attempt was made to test these children. It was found impossible, however, to get most of these children's attention in order to administer the test. This, of course, could be significant proof for an inability to engage in joint attention but at this point must remain speculation.

### 1C) Experiment 3: False-belief attribution

Most researchers in the field would agree that autistic children tend to have problems with false-belief and that false-belief is one of the last "Theory of Mind" abilities to develop. Understanding someone's false beliefs about a situation is considered the most difficult mental state for a child to understand and only appears in normal development after the age of four years. How specific to autism a problem with false-belief is and how universal, is still somewhat controversial. Baron-Cohen, Leslie and Frith (1985) found that 80 % of the autistic children in their sample failed a false-belief task (Sally/Anne Scenario, See Chapter 1 for more details). However, Prior et al. (1990) found that only 50% of the children in their sample failed the same task. Baron-Cohen (1989) examined the 20% of the children from the 1985 sample again, using a second order false-belief task and found that almost all the children now failed. He argued that failure on false-belief tasks was specific to autism and that children with learning difficulties and normal children over four years of age could reliably pass first order false-belief tasks. More details of experiments in this area are given in Chapter 1. Although it is normally children over four years who can pass this task, recent research has investigated ways of making the task easier, and thereby getting children younger than four years to pass this task (Eisenmajer & Prior, 1991; Parkin and Perner, 1993; see Wellman, 1993 for further examples). One has to ask if one can help autistic children in the same way. In order to truly investigate Rogers and Pennington's model, such a test of false-belief was necessary. This will also allow a profile of each child to be built up in the next chapter, to examine the links between mental state abilities, imitation, play and various measures of mental and chronological age. The present study, although mainly conducted to test if the subjects could attribute false-belief at all, attempted to make it as easy as possible for the children to pass, if the ability was present in the first place.

**Method.**

Subjects:

The same children in the 5-6 year old and MLD groups, autistic children and autistic adults were used as in the previous studies. Only three of the 3-4 year old children, were tested by the author for false-belief. The false-belief task was applied to subjects as part of another study, conducted with Faye Zobrist and Kristina Scheuffgen as part of their undergraduate study at the very beginning of the academic year, whereas the majority of the present study was conducted after Christmas. All but three of the 3-4 year olds in the first sample left the playgroup during that first term, or during the Christmas holidays. As a result, the 3-4 year olds will be mentioned, but a serious comparison cannot be made with such a small number. Table 8.7 in Appendix 8.8 illustrates the subjects used for this experiment. It must be remembered that although the mean age of the autistic children was above 4 years, half of the children had a mental age of less than 4 years on the BPVS and a score less than five on the TROG. Most of the autistic children and adults had been tested at least once before, usually on the Sally-Anne scenario, which was one reason why a slightly different storyline was used in this study (see below).

Procedure:

The normal children were originally tested first by Zobrist and Scheuffgen on a simple misleading package task. This is described in detail in Appendix 8.8.

Although ideally, all children should have been tested on the same false-belief task, it was felt that this scenario relied on being able and willing to speak the answer. Therefore, a different scenario was designed for the autistic children and adults. With these children a picture sequence story, based on the displaced object scenario of Wimmer and Perner (1983), was used. This gave the children the option of being able to point at the location, rather than speak the answer. It also meant that the whole story was available for the children's reference when the questions were being asked. It was hoped that this would act as a memory cue for the autistic children, so that they could not fail for reasons of poor memory recall. Two reality questions and two memory questions were asked during the task.

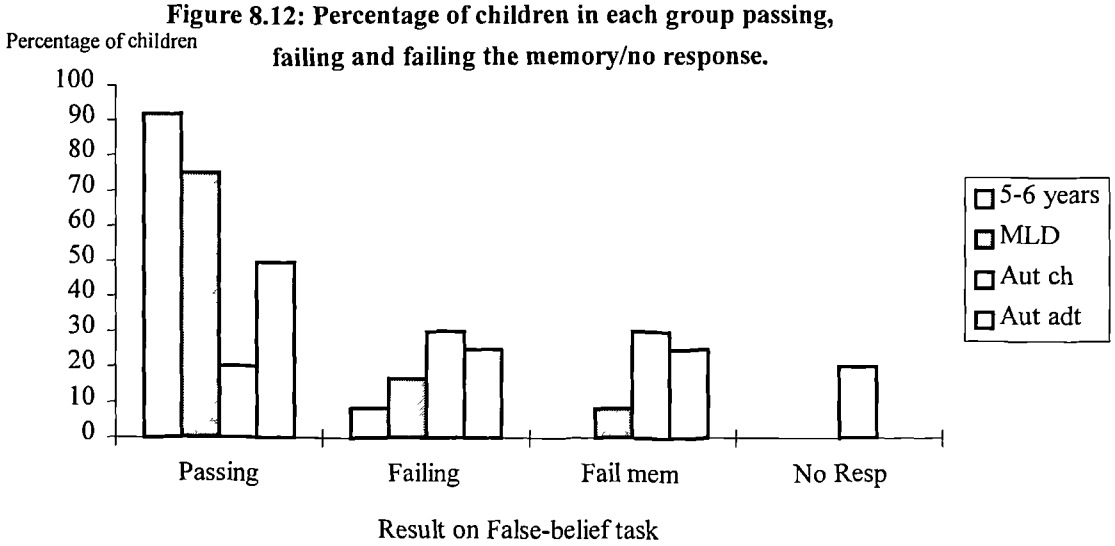
Coding and analysis: If the child named or pointed to the correct location in the story sequence or named 'coke' as the answer his friend would give as to the contents of the can, then they were scored as correctly answering the false-belief question. However, in order to pass the task, they also had to answer the reality and memory questions correctly on each occasion. If they failed the memory questions then they could not be coded as having failed false-belief, just failed to understand the task as a whole. The 3-4 year olds were not included in the Chi-Square analysis of the number passing, failing and not responding in all groups, due to their small sample size. They were, however, included in the analysis of the age of those who passed and those who failed, in both the autistic and non-autistic groups. This was analysed using an ANOVA, to compare the mean ages of the autistic subjects who passed and the autistic subjects who failed and the autistic subjects who did not respond to the false-belief question or failed the memory test. This was also done for the non-autistic groups and across all groups.

**Results:**

As can be seen from Figure 8.12 below, less than 20% of the autistic children (n=10) passed the false belief question. Of the 80% who failed, all children passed the reality questions but only three children failed the false-belief question and passed the memory questions. Two children gave the correct answer to the false-belief question but one failed the memory questions about where the mother put the bag when she was cleaning the floor and the other child pointed to several locations in quick succession on the same memory question. Two children could not be persuaded to answer the false-belief question and also answered one memory question wrong. One child failed the false-belief question and then refused to answer the memory questions. The autistic adults (n=8) did better, with 50% passing the false-belief question, two adults failing the false-belief questions but passing memory and two adults failing one or both the memory questions. One 5-6 year old child (out of n=12) failed the false-belief task and he passed the memory question. The MLD children (n=12) did well, with 2 children failing the false-belief question but passing memory and one child (MA 2;2) failing the memory questions. Of the

three 3-4 year olds, although not included in the analysis, two children passed the false-belief question and one child failed the false-belief but passed the memory questions.

**Figure 8.12: Percentage of children in each group passing, failing and failing the memory/no response.**




On the statistical analysis, there was an overall main group effect on a Chi-Square but this was only significant at 0.05 level ($X^2 = 17.39$, df 9). When the results were analysed on the basis of pass false-belief versus any other response, the 5-6 year old children showed significantly more passes than both the autistic children ($X^2 = 11.61$ $p<0.01$ df 1) and autistic adults ($X^2 = 4.4$ $p<0.05$ df 1). The MLD children also showed more than the autistic children ($X^2 = 6.6$ $p<0.05$ df1) but did not show significantly more passes than the autistic adults ($X^2 = 1.32$ $p>0.05$). When one discounted the children who failed the memory question or did not respond to the question and only compared the numbers of those passing and failing the false-belief question, only one significant difference emerged. Even at this level, the 5-6 year olds still showed significantly more passes and less failures than the autistic children ($X^2 = 5.23$ $p<0.05$).

To look at the developmental trend of false-belief and whether autistic children only failed because of a low verbal or chronological age a final analysis done. This compared the mental and chronological age of those children who passed the false-belief, failed the false-belief and failed the memory questions or did not respond at

all. Table 8.8 below summarises the results of this comparison. Basically there were few significant differences when the autistic groups and non-autistic groups were analysed separately, although the general trend for both the autistic and non-autistic groups, was a lower MA and TROG score for those children who failed the memory questions or did not respond at all. The autistic group also showed a lower CA for those who failed memory questions. Those who passed the memory questions but failed the false belief, also had a lower CA and lower TROG scores in the autistic group and also a lower MA in the non-autistic group. However, none of these difference were statistically significant on a one-way ANOVA. When both groups were clumped together there was a significant difference between the MA of the children passing and MA of the children failing memory. There was also a significant difference between the TROG score of the children passing and the TROG score of the children failing the memory questions or not responding ($F=3.18$ $p=0.05$) There was even a difference between the TROG of those failing false-belief but passing memory and those failing memory/not responding ($F=7.11$ $p<0.01$), with those failing memory questions or not responding, having a lower TROG score.

Table 9.2: ANOVA results and means for the comparison between the ages of the children who passed the false-belief, failed the false-belief and failed the memory questions. (A significant difference on the ANOVAs is denoted by * when significant at 0.05 level and ** when significant at 0.01 level).

| Measure of mental or chronological age. | ANOVA results | Mean Age of those who pass false belief | Mean Age of those who fail false-belief. | Mean age for those who fail memory questions |
|---|---|---|---|---|
| Overall children - CA | F=0.57 | 11.44 | 13.01 | 14.47 |
| - MA | F=3.18 * | 6.28 | 5.93 | 4.34 |
| - TROG | F=7.11 ** | 10 | 8.11 | 4.33 |
| Non-autistic children - CA | F=0.48 | 8.4 | 6.89 | 11.58 |
| - MA | F=2.79 | 6.21 | 5 | 2.17 |
| - TROG | F=2.13 | 10.42 | 9.25 | 2 |
| Autistic children - CA | F=1.88 | 22.55 | 17.90 | 14.83 |
| - MA | F=1.85 | 6.53 | 6.67 | 4.61 |
| - TROG | F=1.86 | 8.50 | 7.20 | 4.62 |

**Summary of false-belief results:**

Despite a few methodological problems due to the use of two different scenarios and a lack of 3-4 year old children, it is clear that most autistic children are impaired on false-belief attribution relative to non-autistic children. However, the children in this experiment who were of a younger mental age did not only fail false-belief questions but also failed the memory questions. As such we cannot draw as strong conclusions as have been drawn in previous studies (Baron-Cohen et al., 1985), although contradictory results were not found. Like Baron-Cohen et al.'s study, about 20% of the children were able to attribute false-belief in this experimental situation. For the autistic adults on the other hand, the percentage of those who passed was greater - at 50% of those tested. Fewer adults also failed the memory questions.

So what can we say from a theoretical viewpoint about these results? Because of the nature of this experiment we can only make speculations about this - Rogers and Pennington had predicted that deficits in theory of mind (which I tested here in the form of false-belief) would be most debilitating for older children and adults. Unfortunately, they do not specify what age they expected this difference to occur but since false-belief ability doesn't usually emerge in normal development until about 4 years, we might expect that this is the age where this ability really begins to play an important role in interpersonal relations. Most of the children in this study were over four years chronologically and about half of them were four years or above on verbal mental age. Relative to controls even those children who did not exceed this age showed problems with false-belief. In addition, even if autistic children and adults could attribute false-belief and thus use a theory of mind in an experimental situation most studies have found that they cannot put this ability into practice in everyday life. They still show deficits in the ability to deceive and understand deception, to make and understand jokes and teasing, and to show empathy and understanding of other mental states. Some evidence of this was seen in the Observational study in Chapter 2.

**2) The relationships between imitation, symbolic play and the ability to understand mental states, in the form of emotion, attention and false-belief.**

Rogers and Pennington (1991) predicted a profile of deficits for young autistic children of deficits in elicited imitation, joint attention, pretend play and emotion sharing. We have seen how young autistic children do indeed seem to be impaired in elicited imitation. They were also impaired to some degree in elicited pretend play, although no evidence was found for specific deficits in spontaneous pretend play. They were impaired in recognition of emotion in facial expressions and, although the difference was not significant, they showed lower joint attention skills than controls. The autistic adults on the other hand did not show impairments in symbolic play relative to age-matched controls nor in elicited imitation. They did have problems with emotion recognition and sharing, and they did have lower scores (although not significant) on the false-belief task. Fewer autistic adults used mental state language than age-related controls although this was not significant (See Chapter 2). In the experimental study there were no significant differences between the autistic adults and older controls, although the scores were lower for the most part. However, in the observational study both autistic children and adults showed significantly less joint attention than non-autistic controls. Rogers and Pennington had predicted that older autistic individuals would show a profile consisting of deficits in theory of mind, emotion recognition and sharing and language pragmatics. So then, apart from the results on joint attention, there seems to be some evidence for Rogers and Pennington's theory at a cruder, group level.

To truly examine Rogers and Pennington's theory it was necessary to look at the individual profiles. We have already seen that one of the most striking results from this thesis has been that there are huge individual differences for autistic subjects of all ages. I have attempted below to analyse any relationships between the abilities tested for both the children and adults. It was not possible to include the young autistic children in this analysis because they were not used for all the experiments. One must simply remember that most of them had lower scores than older autistic children and control children in almost every ability tested.

To investigate the relationship between first of all imitation and the other abilities, the score on the DAID, overall and again for each of the three categories, where some impairments were found (two-handed actions, meaningful/symbolic gestures and symbolic actions with objects) and the performance on the spontaneous production of symbolic play and manipulative/relational play during the observational study, was examined. This was done using a Spearman's Rank correlation, both with raw data and controlling for both MA and CA. It was conducted over all the autistic subjects - both children and adults. Secondly, the relationship between the DAID scores and performance on other tasks was examined using graphs plotted for each child (Figure 8.13 - 8.16) and Fisher tests conducted for both the autistic children and the autistic adults. Again the median score was used to classify subjects and those above and below the median score were compared on whether they passed or failed the other tasks. For visual perspective-taking, there were three parts. Parts 1 and 2 were the Flavell (1981) test, for which a simple pass/fail coding was available, and Part 3 was the response to the question used in the joint attention task (What am I looking at?). Part 3 also used a pass/fail measure but since the result was taken over two measures - look left and look behind - those who passed at least one of the measures were said to have passed, for the purposes of the Fisher test analysis. However, for the graphs, children who only passed one of the two measures are represented by a gray-filled point. Joint attention was coded in the same way as visual perspective-taking, Part 3. Whether they produced spontaneous symbolic play, was a simple yes/no coding and the results for the perception of emotions from facial expressions, was a simple pass/fail measure, where a pass equalled a score of at least 5 out of 7. Finally, false-belief was a little more difficult to code as three possible outcomes were possible - a pass, a fail and then a failed memory or no-response. Since, for the purpose of this comparison, I was really interested in only whether the child passed the false-belief, the latter two responses were combined as a fail.

Finally, a series of Fisher Exact tests were carried out between performance on the "theory of mind" tasks and the other imitation tasks - spontaneous imitation, the artificial fruit and order tasks and the deferred imitation task. This was done for both children and adults.

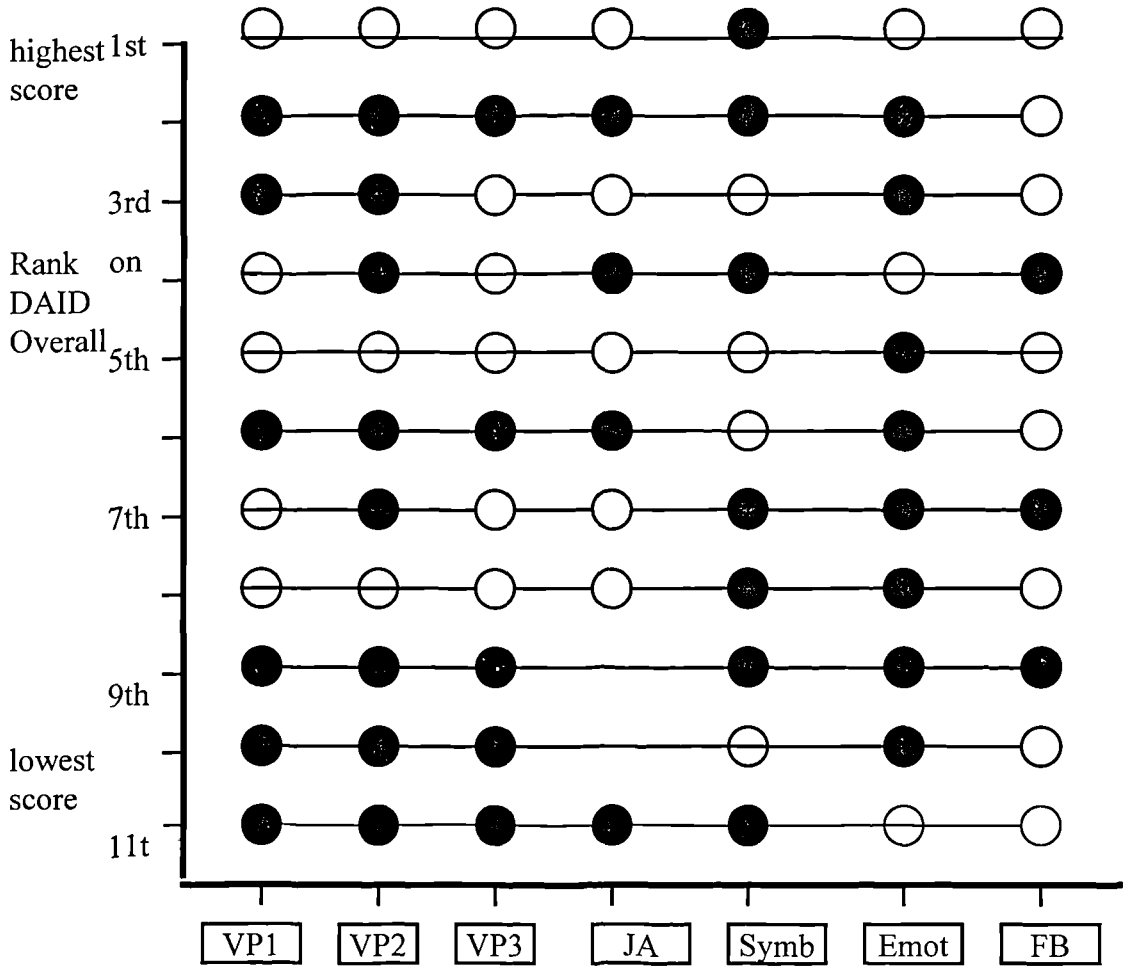
**Results:**

Firstly, to examine the link between the type of activity produced in a spontaneous and elicited play situation and the score on the various aspects of the DAID task, a Spearman's Rank correlation was carried out. It was found that there was a strong negative correlation between the amount of manipulative/relational play produced in the elicited situation and the overall score on the DAID ($r = -0.485$ $p<0.05$). Apart from this there were no other significant correlations. When MA and CA were controlled for in a partial correlation, the effect was still significant with a negative correlation ($r = -0.681$ $p<0.01$) between elicited manipulative behaviour and overall score on the DAID.

Secondly, Figures 8.13 to 8.16 below illustrate the relationship between the "Theory of Mind" tasks and the DAID scores. With regard to false-belief, it is difficult to say whether there is a trend or not since only two children passed. However, both these children did have an overall DAID score above the median for the group (Figure 8.13). The same is true for visual perspective-taking (part 3 - VP3 i.e. the response to the question "what am I looking at?" in the Joint attention task) However, neither of these trends are significant (Fisher test $p>0.05$). Visual perspective-taking, both parts 1 and 3 (VP1 and VP3), show a significant trend in the direction of positive interactions - those children who pass visual perspective-taking tend to score above the median score on both meaningful/symbolic actions (Figure 8.15) and symbolic-actions-with-objects (Figure 8.16 - $p<0.05$ for both VP1 and VP3 and meaningful/symbolic actions; $p<0.05$ for VP3 and symbolic-actions-with-objects; $p=0.06$ for VP1 and symbolic-actions-with- objects). There is also a trend for those who pass false-belief to score higher on symbolic-actions-with-objects but this is a not significant trend (Fisher test $p>0.05$).

Within the adult group, there are even fewer noticeable trends. There is a slight trend towards a relationship between joint attention and overall score and between meaningful/symbolic actions and both emotion recognition and false belief. However, none of these trends are significant ($p>0.05$ on Fisher test). None of the adults were tested on visual perspective-taking parts 1 and 2, only part 3.

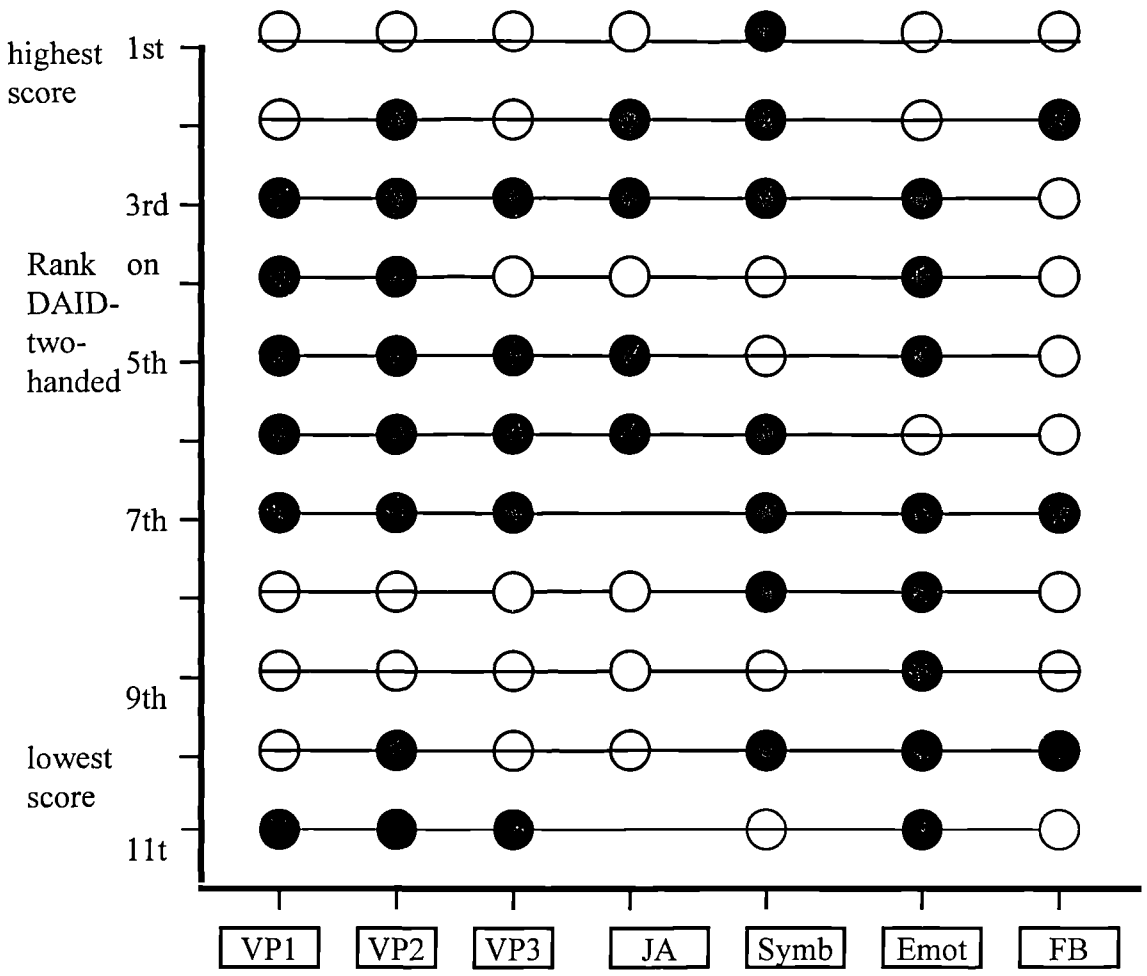
Figure 8.13: Graph to illustrate the relationship between overall score on DAID test and aspects of the "Theory of Mind Chain" of development for the autistic children (a solid point means the child failed on the task, an empty point means the child passed and a gray-filled point means the child failed one part but passed a second on a two part task, or on the false-belief task - failed the memory questions or didn't respond).




N.B. Key for Figures 8.13 to 8.16:

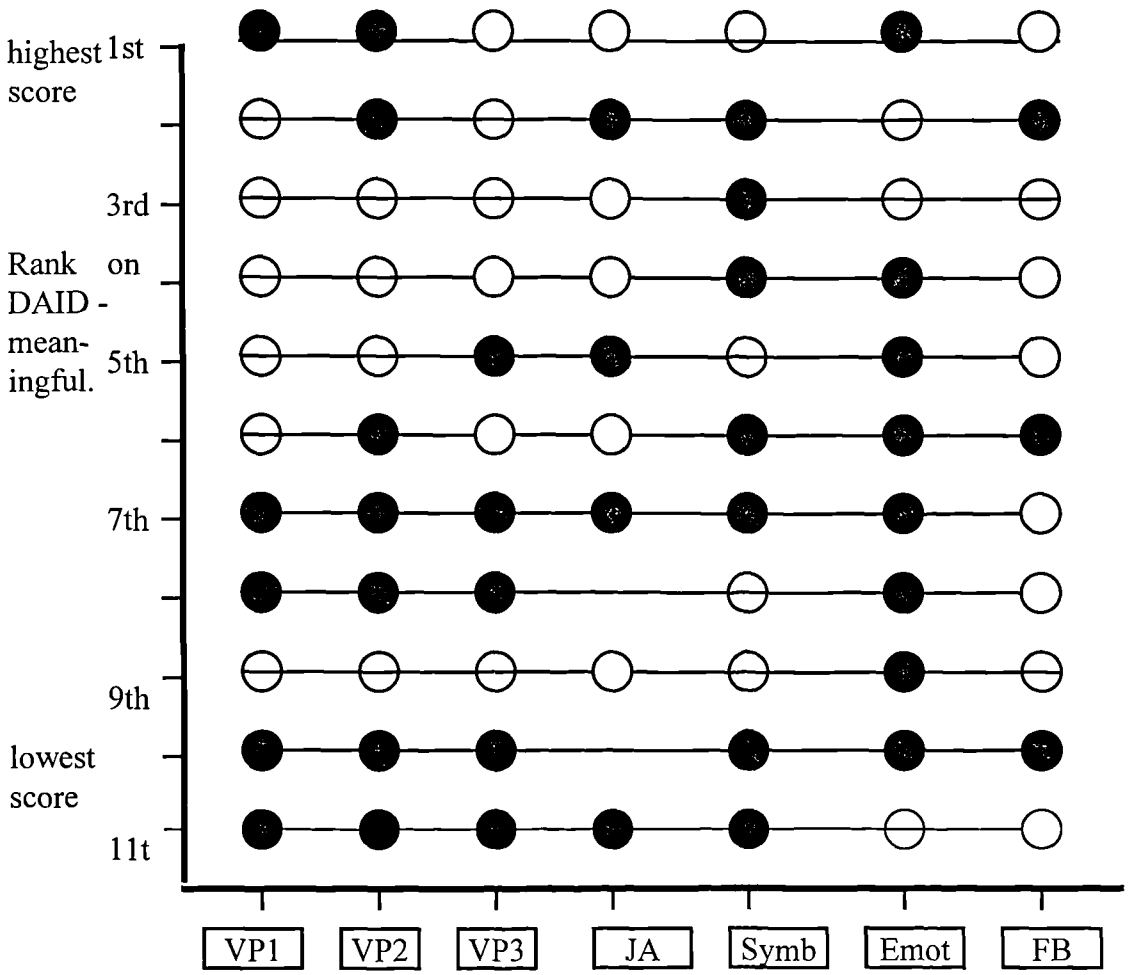
VP1= visual perspective taking, part 1 (Flavell, 1981); VP2 = part 2 of visual-perspective taking task (Flavell, 1981); VP3 = visual perspective task used in Chapter 8 along with Joint attention task (JA); Symb = showed symbolic play spontaneously during observational study; Emot = emotion perception task; FB = false-belief.

Figure 8.14: Graph to illustrate the relationship for the autistic children between score on two-handed actions on the DAID task and aspects of the "Theory of Mind Chain" of development (a solid point means the child failed on the task, an empty point means the child passed and a gray-filled point means the child failed one part but passed a second on a two part task, or on the false-belief task - failed the memory questions or didn't respond).



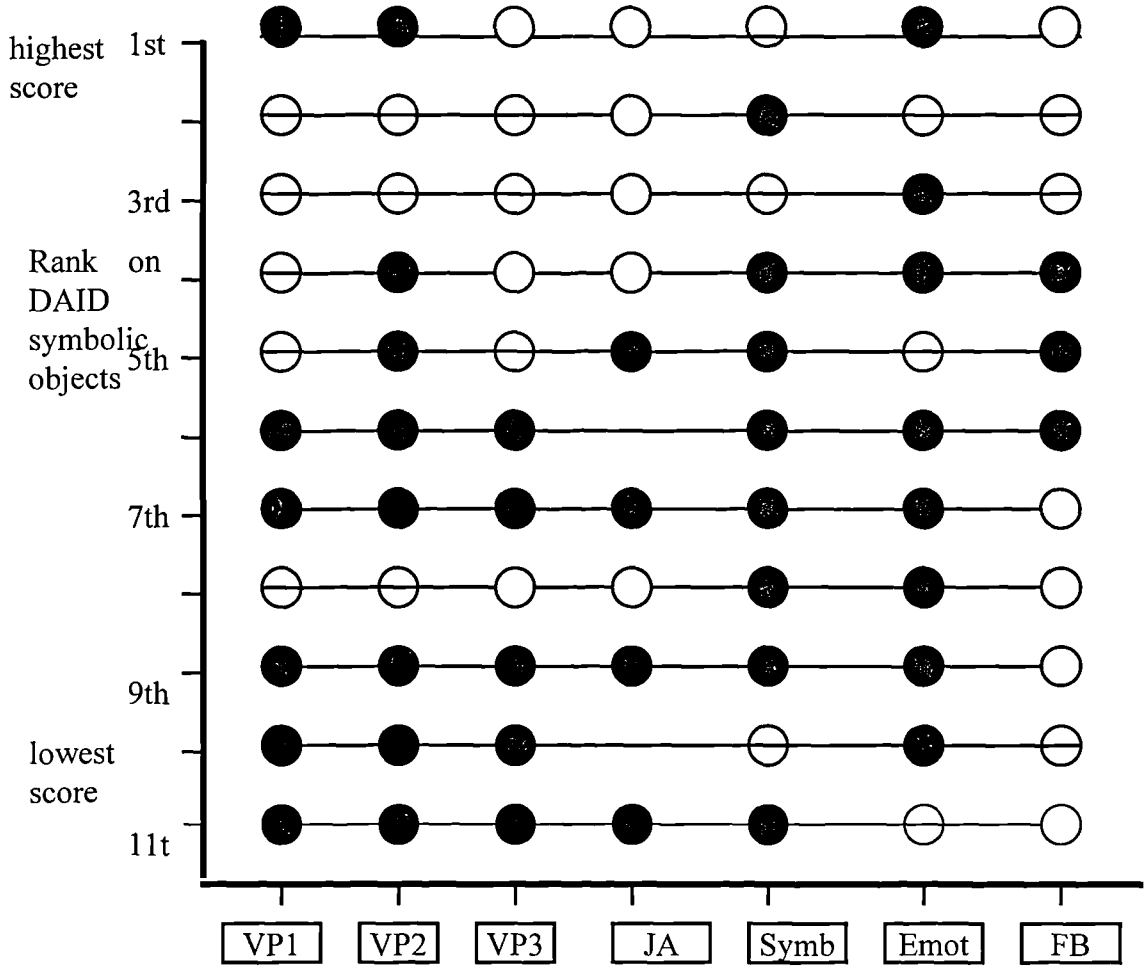

N.B. Children ranked 5 and 6 had the same score on the DAID, two-handed actions.

Figure 8.15: Graph to illustrate the relationship for the autistic children between the score for meaningful/symbolic actions on the DAID task and aspects of the "Theory of Mind Chain" of development (a solid point means the child failed on the task, an empty point means the child passed and a gray-filled point means the child failed one part but passed a second on a two part task, or on the false-belief task - failed the memory questions or didn't respond).




N.B. Children ranked 5, 6 and 7 all had the same score on DAID meaningful/symbolic actions.

Figure 8.16: Graph to illustrate the relationship for the autistic children between ranked score on symbolic actions with objects from the DAID task and aspects of the "Theory of Mind Chain" of development (a solid point means the child failed on the task, an empty point means the child passed and a gray-filled point means the child failed one part but passed a second on a two part task, or on the false-belief task - failed the memory questions or didn't respond).




N.B. Children ranked 6 and 7 both had the same score on DAID symbolic actions with objects.

The final analysis involved a comparison of imitation on the deferred and spontaneous tasks and performance on the "Theory of Mind" tasks. This was done for the adults and children combined. There were no significant relationships on a series of Fisher tests between performance on imitation tasks such as deferred imitation, spontaneous imitation and performance on the artificial fruit task, and performance on the various "theory of mind" tasks - joint attention, visual perspective taking, emotion perception and false-belief tasks.

To look briefly at just the "Theory of Mind" (ToM) abilities themselves, it would be reasonable to expect that there might be a relationship between performance on false-belief tasks and on other, lower "theory of mind" abilities such as visual perspective-taking and joint attention, as Baron-Cohen (1994) would predict. However, on a final set of Fisher tests, none of the ToM abilities were significantly related to any other (ToM) ability ($p>0.05$ on all tests).

**Overall Discussion:**

It was hoped that the analysis in the second part of this chapter might throw some light on the development of autism at an individual level and in particular which behaviours and deficits occurred together in at least the majority of autistic children. This would have allowed some stronger conclusions to have been drawn regarding Rogers and Pennington's model of autism. Unfortunately, the picture we still have on the individual level is one of a mixture of behaviours that normally coincide or precede/follow each other in normal development, occurring in autism in no reliable pattern and rarely resembling the pattern seen in normal development. Some children show one ability while unable to show a different, developmentally easier ability. Even abilities such as those in the "theory of mind" chain, which occur in a certain order in normal children, do not seem to occur in that order in the children examined in this study. It does not seem to be the case, that if impaired in visual-perspective taking, for example, the child must also be impaired in joint attention, pretend play and false-belief. However, a few factors must be born in mind when considering these results. Firstly, the group of subjects being compared was relatively small. To examine the *development* of autism, larger samples of autistic

individuals must be used. Many of the trends witnessed in this study may have been significant with larger sample sizes. Secondly, when tested on one behaviour, subjects may have just been having a bad day and if tested another day would have passed. To remedy this, a longitudinal study is needed. Thirdly, the tasks which are generally used to test for some of these behaviours may not be age-appropriate - this might account for a lack of consistency across tasks.

One pattern did seem to emerge, however, and that was that the ability to take another's visual perspective seems to be linked to the ability to imitate, in the elicited situation. This has important implications for the results found in Chapter 3 - actions which appeared to require a more complicated transformation of perspective such as two-handed actions or those requiring of a symbolic nature, gave autistic subjects the most difficulty. The connection with visual perspective-taking was strongest for actions that required some symbolic activity. Performance on visual perspective-taking was good for those children who did well on the meaningful/symbolic gestures and the symbolic-actions-with-objects.

Visual perspective-taking and joint attention have been proposed as precursors to a "Theory of Mind" (Baron-Cohen, 1994) and as such do come before false-belief in the developmental chain. Although the two children who did pass the false-belief task also tended to pass the other tests, there were no significant links between the different aspects of the "theory of mind" chain. It cannot be said that if autistic children produce visual false-belief, then they can automatically pass joint attention, symbolic play and emotion recognition tasks.

Although on the level of individual profiles the relationships between the abilities tested did not seem to resemble the pattern seen in normal development, the picture was a little different at the group level analysis. We saw that in Chapter 6, the pattern of development of both elicited imitation and spontaneous imitation followed very closely the pattern seen in normal development (Piaget, 1951; Rogers and Pennington, 1991; Nadel and Camaioni, 1993). Similar results were also found for symbolic play (Chapters 2 and 7). As such there does some seem to be some evidence that at least some abilities follow a pattern similar to normal development. Of course, it may have been that if more children had been used in the profile analysis and if the study had been longitudinal in nature as Rogers and Pennington

suggested, more of a developmental pattern may have emerged at the detailed analysis level.

The main aim of this chapter was to examine the relationships between imitation, pretend play and emotion sharing and theory of mind abilities as suggested by Rogers and Pennington (1991). Although I have not found much support for the profile suggested by Rogers and Pennington's theory at the level of detailed analysis, on a broad, more crude level, some evidence is available. We have over the last 7 chapters seen evidence that some deficits may be more important at an earlier stage in development such as imitation and pretend play while other abilities are debilitating for older children and adults such as theory of mind deficits and emotion recognition and sharing deficits. In addition we have seen that some abilities do develop with age, following a normal developmental pattern. I will discuss the implications of this in the final chapter which follows.

# Chapter 9

# General Discussion and Conclusions.

**Summary of findings:**

1) Imitation:

As was seen in Chapters 3, 4 and 5, no general deficit in imitation was found for *older* autistic children and adults. However, certain aspects of imitation were impaired. Autistic children were worse on imitation involving some symbolic capacity and produced more partial imitations on certain actions that have been described here as possibly requiring a more complicated reversal of perspective or mental rotation, particularily those gestures using two hands. The young autistic children, on the other hand, did have more problems with all types of imitation. From a theoretical viewpoint, these results were consistent with Rogers and Pennington's (1991) prediction that it would be the young autistic children who would show most problems with elicited imitation, with older children and adults not impaired relative to controls. The development of elicited imitation seemed to follow the pattern seen in normal development with novel actions and symbolic actions being more difficult (Piaget, 1951). On spontaneous imitation, a normal developmental pattern was also observed, with the younger of the autistic children being more likely to imitate spontaneously (Nadel and Camaioni, 1993). However, autistic children did produce less evidence of spontaneous imitation, although not significantly so. Autistic adults also produced less spontaneous imitation, as did non-autistic children with learning disabilities. However, for the most part their lack of spontaneous imitation was not because they *could not* imitate, except perhaps for the very young autistic children, but perhaps because it was either not an age appropriate behaviour or because they did not want to use imitation spontaneously because of it's social complexity.

With respect to previous literature, the results of the Do-As-I-Do experiment confirmed some previous findings of no general deficit in gestural or procedural imitation (Charman and Baron-Cohen, 1994; Morgan et al, 1990). The deficit in symbolic imitation replicated previous findings by Hammes and Langdell (1981),

Curcio and Piserchia (1978), Stone et al (1990), and Heimann et al. (1992). The impairment in selective two-handed gestures such as grasp thumb and T-signs, replicated findings by Ohta (1987). The finding that autistic children tend to produce partial imitations such as reversals of the hand position in an action or using a body part as the object when imitating a symbolic action, provides support for the idea that imitation might be more difficult when the mental rotation of the visual perspective is more difficult, whether due to a theory of mind deficit (Whiten 1992) or a perception and information processing deficit (Smith and Bryson (1994).

The experiments on deferred imitation and spontaneous use of imitation in a problem-solving task, added a new dimension to existing research, since neither of these tasks have been used with autistic subjects before. Although some autistic children did imitate in these conditions and differences were rarely significant, fewer imitated than in the non-autistic groups. It was also found that on the problem-solving task, where both imitation and emulation of a model were possible solutions to opening an artificial fruit, autistic children did show some signs of imitation. However, once again the level of imitation in the autistic children was not as marked as in the non-autistic children. More of the younger autistic children and adults on this test of spontaneous imitation, tended to emulate the aim of the model actions, rather than imitate the methods demonstrated. As regards sequence level imitation (Whiten and Custance, in press; see also Byrne, 1994, 1995) quite a high percentage of children in all groups followed the same sequence as the model in opening the box. However, slightly more autistic subjects and young normal children did not stick to the sequence than children in the older non-autistic groups. Although the group differences found in this study were not significant, this method should prove a useful tool for assessing whether human and non-human subjects use imitation in the *impersonation* sense (Wood, 1989; Byrne, 1994), use program-level imitation (i.e. imitation of the sequence of the complete act, without necessarily slavishly copying the exact methods used in achieving each subgoal as in Byrne (1994)), or simply emulate the final goal to get their reward.

2) Play, joint attention, emotion recognition and "theory of mind".

In order to further investigate Rogers and Pennington's theory, abilities other than imitation were examined. The observational study indicated that autistic subjects preferred to engage in manipulative and relational behaviours much more than controls. Functional behaviour did not differ from controls and although autistic children showed less pretend play than 3-4 year old children, there were no differences relative to older controls. This, of course, may not be surprising considering that normal children engage less and less in pretend play as they get older. The ability is present but it may not be considered age appropriate. The experimental study established a deficit in pretend play for autistic children relative to non-autistic children, but it also demonstrated that pretend play could be elicited and instructed from autistic subjects. It was noticeable that the autistic adults did not differ much from the MLD children or in fact the older children. This ties in with Rogers and Pennington's predictions that it would be the youngest autistic children for whom the deficit in pretend play would be most noticeable. Whether older children or adults do or do not develop the ability to produce pretend play when asked, is irrelevant here. What is important is that they do not differ spontaneously from older non-autistic children and adults - any deficit in pretend play is less handicapping and less noticeable in older autistic children and adults as Rogers and Pennington predicted.

The other abilities investigated involved understanding of mental states of varying developmental difficulty. In previous studies, autistic children had been found to be capable of visual perspective-taking while being impaired on joint attention (Baron-Cohen et al., 1992; Leekam et al., 1993 and in press; Hobson, 1984; and Tan and Harris, 1991). Chapter 8 (Experiment 1B) presented similar results for the autistic subjects used in this study. There were no significant differences between autistic and control groups on visual-perspective-taking, although the autistic children did respond correctly slightly less often than control groups. Joint attention was, however, slightly impaired in both autistic groups, relative to older controls, although the difference was not significant. Unlike other studies, the 3-4 year old children did not perform significantly better than autistic children. In fact, these two groups demonstrated very similar levels of abilities in almost every category

examined in this thesis. Spontaneous following of pointing was as impaired in the autistic children as head/eye gaze direction, although the point did make visual-perspective taking much easier for all groups. Finally, as in other experiments there were a small number of autistic children and adults who passed one or two parts of the task but who did not pass consistently. Rogers and Pennington predicted that it would be the young autistic children who would show most impairment in joint attention. This study however, found that autistic children and adults were relatively equally impaired in spontaneous joint attention as observed in Chapter 2 and neither groups showed significantly lower scores during the experimental scenario (Chapter 8), although the scores did tend to be lower.

Rogers and Pennington also predicted that both autistic children and adults would show problems with affect. The study on emotion recognition reported in Chapter 8 found that autistic subjects were indeed worse than controls at recognising facial expressions of emotion, replicating previous work particularly by Hobson (1986a and 1986b). There were no significant differences on perception of gestures and contexts but as suggested in Chapter 7, this is probably because so few autistic children actually proceeded to the gestures and context stages of the experiment, due to the criterion used. This study also illustrated that some emotions were harder or less mastered by autistic individuals. *Happy* and *sad*, probably the first two emotions mastered by the developing infant, were more often correctly identified by autistic children and adults than emotions such as *frightened, surprised, angry* and *disgusted*. Baron-Cohen et al. (1993) proposed that emotions such as *happy* and *sad* are "simple emotions" and emotions such as *surprise* require some mental state understanding of the beliefs of other people. However, *surprise* was not the only emotion to be less easily identified. In fact, autistic subjects found *fear* and *anger*, just as hard to recognise as *surprise*. Baron-Cohen et al. (1993) would probably argue that recognition of these emotions requires only a simple understanding of the situation, but I have proposed in Chapter 8 that these other emotions also require an understanding, in an everyday situation, of the mental *attitudes* of another person (Hobson, 1993). This may not be equivalent to an understanding of higher mental states such as belief or knowledge, but an understanding of what the other person likes or dislikes or finds funny or annoying is necessary to appreciate why another

person should be happy, sad, frightened, angry or disgusted. Thus all emotions, even *happy* and *sad*, require an understanding of other people and the ability to relate to other people in order to understand how they are feeling. I propose that most autistic children are impaired in emotion perception but that this ability remains intact in a few exceptions. However, on further investigation we may find that, like Theory of Mind abilities, the ability to correctly identify emotions from facial expressions does not necessarily mean that the child has better interpersonal relations or can engage in empathy with others.

Finally, Rogers and Pennington predicted that older autistic children and adults would be impaired on "theory of mind" abilities relative to controls. This ability was tested using a false-belief paradigm. Autistic children in this study conformed to expectations of false-belief capacity in that 20 % of the children tested passed. This figure replicated the results of Baron-Cohen, Leslie and Frith (1985) and other follow-up studies. The figure is lower than that found by Prior et al (1990) but a greater number of the autistic adults, who had a slightly higher verbal mental age than the autistic children, passed - almost 50% passed the false-belief task. This was still less than control children of the same mental age and lower than results on higher-functioning individuals with autism (Bowler, 1992; Tager-Flusberg and Sullivan, 1994).

From a naturalistic viewpoint, autistic subjects showed less sophisticated use of mental state language, less joint attention and less sophisticated examples of mental state understanding (Chapter 2) than seen in some of the non-autistic controls. However, due to difficulties in the observational situation and to the generally low frequency of such behaviours for all groups, few of these naturalistic deficits could be said to be specific to autism except for the deficit in joint attention.

3) Relationships between imitation and other abilities studies - is there evidence for Rogers and Pennington's model.

Chapter 8 showed that, at the crude level of group analysis, the profiles offered by Rogers and Pennington (1991) seem to have found some support in this thesis. However, in an in-depth analysis (using individual profiles) of the links between imitation, play, joint attention, emotion recognition and sharing and theory of mind

as proposed by Rogers and Pennington (1991) little evidence was found for any such relationships. Chapter 6 pointed out that a normal developmental pattern was in evidence in autism and that there was some consistency across imitation tasks, in that if autistic children showed spontaneous imitation during the observational study, they tended to show imitation on the artificial fruit task. However, few links were found between the various other abilities except visual perspective taking and imitation. On an individual level no consistency across "theory of mind" tasks were found as might have been expected from Baron-Cohen's (1994) theory. The same inconsistency was found within tasks such as the joint attention tasks. This inconsistency is a feature of autism. We cannot generalise that if autistic children pass a developmentally more difficult task that they will necessarily pass an easier task, even if the group results illustrated a normal developmental pattern and therefore we cannot generalise from group results to individuals. It is important to bear this in mind when developing interventions.

**Summary of Implications for Rogers and Pennington's theory.**

As was concluded in Chapter 8, this thesis does seem to provide at a crude level some evidence for the Intersubjectivity Theory of Rogers and Pennington (1991). As Rogers and Pennington predicted there was no general deficit in elicited imitation by *older* autistic children and adults relative to controls. The younger autistic children did, however, have problems with elicited imitation. Unfortunately, due to problems of language differences and a lack of motivation in these children, we cannot say for definite that these young autistic children could not imitate. Older autistic children were impaired to some degree on specific types of actions such as pantomimic/fully symbolic tasks, and some of them also had problems with symbolic actions with objects, producing partial imitations such as using body parts as objects or closed gestures. Two-handed actions also produced lower scores, although the differences were rarely significant, except for the young autistic children. This was expected in that autistic children have problems with symbolic play but also in that these types of imitation are some of the latest manifestations seen in normal development (Piaget, 1962). These actions may also need a more advanced mental rotation or information processing capacity, which may develop

with age but takes longer than imitation of simple, one-handed actions and actions with objects. Further for Rogers and Pennington's theory came from the fact that autistic development followed the same pattern as normal development for imitation and play, despite the inconsistency seen at the individual level.

It was stated in Chapter 1 that Rogers and Pennington's theory is very difficult to test and despite the evidence seen in this thesis, I still maintain that this is the case. This thesis was a mixture of observational and experimental data and also a mixture of spontaneous and elicited situations. But then Rogers and Pennington (1991) drew their evidence for their model from a mixture of spontaneous and elicited studies. While they referred mainly to elicited imitation, they referred to joint attention, pretend play, emotion sharing and theory of mind at a spontaneous level. As we saw there was quite some distinction between spontaneous and elicited imitation (Chapter 6) and also that just because a person passes a false-belief task does not mean they use a theory of mind in their everyday life (Chapter 1, 2 and 8).

This leads me to conclude that the only way that could possibly put Rogers and Pennington's theory to the test is to do an observational study of a longitudinal nature from birth. As any one researching this area will know this is an extremely difficult thing to achieve, ideal as it may be. The main problem is the delay in diagnosing autism coupled with the fact that less than 4 in every 10,000 children are diagnosed autistic.

Rogers and Pennington's theory is difficult to really test for another reason - how can one really test whether the underlying deficit is an impairment in the formation and coordination of specific self/other representations (Rogers and Pennington, 1991) or an impairment in primary intersubjectivity and the ability to interact affectively with others (Hobson, 1993)? Both theories would predict very similar deficits at the primary behavioural level. Even a longitudinal study would find it difficult to differentiate between underlying deficits. What can be said is that there is some evidence for impairments in intersubjective relations being at the bottom of the deficits seen in autism but that these impairments manifest themselves in different ways at different stages of development, perhaps along the lines suggested by Rogers and Pennington (1991).

Finally, in Chapter 1 I mentioned having reservations about Rogers and Pennington's theory because they did not define imitation or mention the different types/manifestations of imitation. We have seen that there is a need to take into account different types and manifestations of imitation such as those proposed by Piaget (1962). Not only do they illustrate particular problems faced by even older autistic children but they also make clear the developmental pattern of imitation, which is very similar in autism as in normal development. In order to have a true understanding of imitation and the role it plays in autism it was essential to investigate imitation comprehensively (Smith and Bryson, 1994) by looking at the different types of imitation or the imitation of different types of actions (symbolic/non-symbolic; objects/body movements; one-handed/two-handed) to identify were specifically problems lay.

Yet at the same time as bearing in mind the different manifestations of imitation, it is necessary to have a *unitary* definition by which to judge the inclination to imitate and the accuracy of the imitation. Of course, at different stages in development imitation is combined with other abilities to varying degrees. I think mainly here of the ability to process the visual information one receives, to hold a representation in the memory and to reproduce this representation when required. In a spontaneous situation one cannot distinguish one ability from the other - they all combine to produce imitation. Therefore, I maintain that the definition chosen for this thesis, combined with the effective scoring system employed, is a useful one for judging whether a child imitates or not, across many different manifestations of the ability to imitate., and the accuracy with which they imitate. This allows the development of imitation to be followed through childhood into adulthood.

Despite the difficulties of testing a model such as that proposed by Rogers and Pennington (1991), I would venture to conclude that their model has some merit in emphasising the developmental nature of autism. However, another study using the younger age group, is essential to establish with conviction whether imitation is at a mental age-appropriate level, or more impaired in the younger autistic child. If the latter is the case then the intersubjectivity theories, particularly those of Rogers and Pennington (1991) and Hobson (1993), may well have some bearing on

understanding the development of autism. As recent studies have shown (Klin et al., 1992; Restall & Magill-Evans, 1993), autistic children do have problems with early social abilities - impairments that emerge long before impairments in joint attention and symbolic play become predictors of autism at 18 months (Baron-Cohen et al. 1992).

One final criticism that I made of Rogers and Pennington's model of autism stands for all the existing theories - they only deal with several aspects of the disorder. Recently researchers such as Hobson (1993) and Frith (1992) have made explicit how complicated autism really is. Following on from this, I would speculate that autism is much too complicated for one primary "cognitive" deficit to explain. Although Hobson (1993) offers us a more developmental account of how a problem with interpersonal relatedness contributes to later deficits in autism such as pretend play and understanding mental states, he still proposes one primary deficit as an explanation of all social impairments, as in the Triad of Impairments (Wing and Gould, 1979). The format will be very similar to that used by Rogers and Pennington (1991) and will represent very closely Hobon's (1993) theory. In doing this I will also draw on proposals by Baron-Cohen et al. (1985) and Frith (1992). The theoretical speculations below are intended as just that - *speculation* in the hope that they will give rise to more research into autism. They are based on, and in fact are a summary of the results of this thesis, combined with my understanding of the theories of other researchers, and are assisted by the intuition that comes from working with the same autistic children (and their teachers and carers) on a one-to-one basis over a period of three years. This, I am sure, clinical psychologists, teachers and researchers can appreciate from their own experience.

My speculations (illustrated in Figure 9.1) very much follow the same lines as those put forward by Rogers and Pennington (1991) that inspired this thesis in the first place, namely that autism is a *developmental* disorder and must be treated as such in any explanatory hypothesis of this disorder. Perhaps the most important finding of this thesis has been to demonstrate just how much people with autism do develop, even without using a longitudinal study. I propose that there are several primary deficits, which, as in Rogers and Pennington's theory, exist along a developmental continuum and interact to produce the triad of impairments and the

behavioural impairments by which we recognise autism. However, by incorporating several other theories, I hope to explain some of the deficits which are not part of the Triad of Impairments. Rogers and Pennington proposed that older autistic individuals would show problems with executive function tasks alongside the deficits proposed by their model. Like Frith (1992) I suggest that multiple mediating factors must be considered in order to explain how autism develops and how some children show certain abilities while most autistic children do not.

In summary, I propose that problems with intersubjectivity (as described by Hobson (1993) of which a problem with specific self-other transformation (Rogers and Pennington; 1991) is but one aspect) are most important in *infancy*. Later, after 18 months, a deficit in mentalising (operating a Theory of Mind or mindreading) may become more important, possibly even the primary deficit. This may be a result of a problem in intersubjective relations as Hobson would propose or it could be that this ability develops independently (as Frith and Leslie would propose). In addition to these problems, a problem with executive function (Ozonoff & McEvoy, 1994; Ozonoff, Pennington and Rogers, 1991; Ozonoff et al. 1994) which develops independently of the other deficits proposed may be important in affecting non-social deficits in autism, such as perseveration, stereotypic, obsessive behaviour and an inability to pay attention to more than one thing at a time. These three deficits, found on the primary deficit level of Figure 9.1, combine to produce the three main diagnostic criteria - impairments in social interaction, impairments in communication, both verbal and non-verbal, and a restricted repertoire of activities and interests. Which of the final behavioural deficits within each diagnostic category emerge depends on at what stage in the biological development the problems began (Aiken, 1991). This in turn affects the point along the developmental continuum of each of the primary deficits impairments first are noticed, which in turn dictates which of the behaviours on the final level are impaired and which remain intact. This later level of the model is also affected by the amount of mental retardation that accompanies autism and the development of certain abilities and deficits may depend on the age, IQ, experience and education of each child.

On this later level of deficits, impairments may interact to cause other impairments. So, for example, with impoverished social interaction skills, pretend

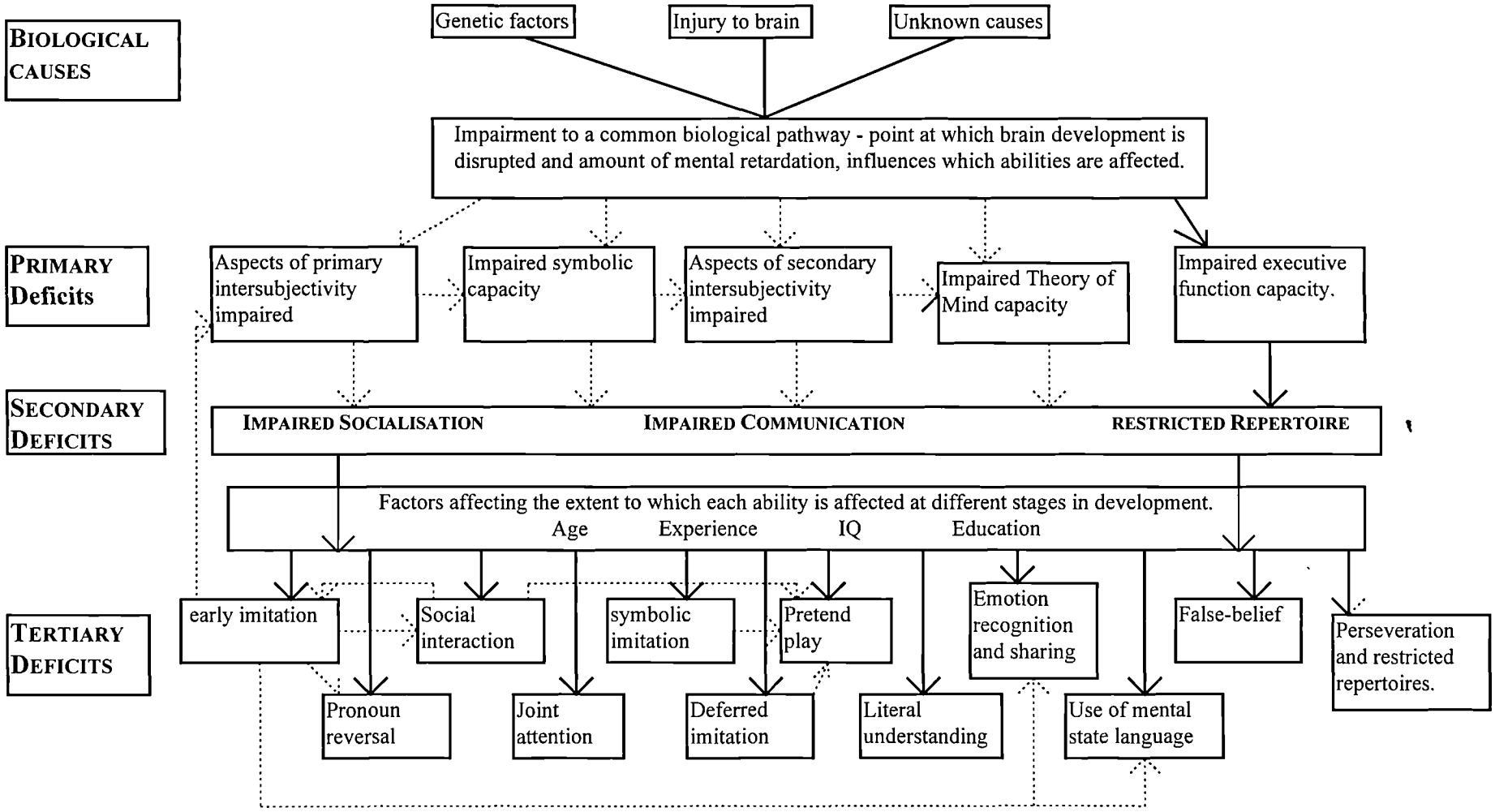
play may be affected (Hobson, 1993). Pretend play may also be affected by a lack of deferred and symbolic imitation (Piaget, 1962). These possible connections are represented in Figure 11.1 by dotted lines. The links between primary intersubjectivity, symbolic capacity, secondary intersubjectivity and Theory of Mind abilities are those links proposed by Hobson (1993). If early imitation is impaired this would have important consequences for the learning of language and pronoun proficiency in particular (Tomasello et al., 1993; see Chapter 1). There could also be a feedback loop from early imitation through to social interaction back to primary intersubjectivity, in the establishment of which mother-infant imitation may play an important role (Trevarthen, 1979; Meltzoff and Gopnik, 1993).

It should also be pointed out that by including joint attention, emotion perception and pretend play on the lowest level, I am not suggesting that they do not play an important role in the development of Theory of Mind. In fact, Hobson included these abilities at various stages in the development of secondary intersubjectivity, so that they thus affect the development of Theory of Mind as Leslie (1987) and Baron-Cohen (1994) suggest. I have included these behaviours explicitly on the tertiary level because they can and have been tested directly; as such they can be regarded as behavioural deficits. Another way of looking at this issue would be to provide further feedback loops from the tertiary deficits to the primary deficits. So that although not having the ability to share the visual attention of another person may arise through problems with primary intersubjectivity (Hobson, 1993), these problems in joint attention may affect the development of later primary deficits.

Below I have attempted to summarise these speculations, using a scheme based on those of Frith (1992) and Rogers and Pennington (1991). One must remember that this is simply a summary of the findings of this thesis, previous theories and how I propose they could be integrated to better explain autism. The model presented below, like the theory of Hobson, still needs a very important source of evidence to be researched - a longitudinal study of a large population studied right from birth with tests of imitation, social interaction and adaptation, eye gaze monitoring, mutual eye gaze, joint attention behaviours and play behaviours, given at intervals in development until autism is established. If evidence can be

found of abnormal social development right from birth, then the importance of an intersubjectivity account of autism in the early most-formative years, would be very difficult to argue against. Until such times as such a longitudinal study is conducted, the deficits first at work in autism can remain only speculative.

Figure 9.1: Summary of proposed merging of existing theories to best explain the findings of this thesis. Solid arrows represent generally accepted links; dotted arrows represent links proposed but not yet universally accepted by researchers.



**Implications for future research and intervention.**

Future research:

I have already mentioned the need for an extensive longitudinal study, of the type first done by Wing et al in the 1970s and followed up by Shah in the 1980s. However, instead of taking children with learning disabilities and establishing which behaviours occur together in autism, it is essential to take a large sample of children and follow them from birth and at much more frequent intervals than every 10 years. Since the prevalence of autism in the general population is so low, this would mean exceedingly large sample sizes. However, one could adopt the strategy used by Baron-Cohen et al. (1992) and target the expected siblings of autistic children or families were autism is present in the family history. Following such children would, as already suggested, provide evidence for or against early problems in social domains. However, although the first five years will probably be the most influential, a continuation of this longitudinal study would be essential to a full understanding of the development of this disorder and the degrees of environmental influence on which behaviours the children can learn or develop later, even if absent in early childhood.

Aside from the idea of the longitudinal study, there are many other possible experiments that lead from this thesis, either to complement and supplement the present findings or to clarify those findings that through methodological problems or inherent difficulties in subject recruitment were not as clear as one might have hoped.

In the present study, there were problems with recruitment of subjects with learning disabilities who did not have autism and this affected the ability to work with groups matched on mental age or IQ. It was regrettable that due to unforeseen circumstances, the autistic children in this study were not tested for non-verbal mental age. There was also a problem inherent in working with children from a different culture and language (French), even as a secondary project, as straightforward comparisons could not be made. Some of the very young autistic group were too young to motivate for most of the tasks. This, of course, was a

methodological problem that most researchers face when trying to conduct experiments with children of this mental age.

A methodological problem which occurred again and again in this work, from the observational study through to the elicited imitation study, concerned interpretation of pretend/symbolic activity, especially in the autistic groups, where language does not aid interpretation. This problem was discussed in Chapters 2 and 3. An experiment to clarify whether autistic children are really capable of symbolic imitation would involve testing children's abilities to imitate a model's actions using a substitute object, instead of the real object.

To investigate the extent of a mental rotation deficit, a series of actions with which autistic children have shown difficulty in this study, such as grasping the thumb and t-signs, could be presented to several subgroups of autistic children and adults, varying the numbers of presentations and the length of presentations, with a baseline measure of one presentation of approximately 2 seconds as in this study. This would help to identify which factor - more time to study and attempt a reproduction or more repetitions of the action - would help the autistic individual most to make that mental rotation as quickly as possible, which in itself could be essential in developing the use of imitation in education.

Educational and home interventions:

This leads on to a strand of study that has been proposed and tested with limited samples on a short term basis - the use of imitation as an intervention strategy. As was shown in studies by Dawson & Adams (1984) and Dawson & Galpert (1990) (see Chapter 1), imitation of the child by an adult can help to increase mutual eye gaze and social interaction with the imitator. Tryon and Keane (1986) showed that being allowed to watch the play of other children, and being allowed to imitate that play, increased appropriate play and social behaviours and decreased inappropriate, stereotypic behaviours. Although the effect of imitation sessions on the social interaction of autistic children was not systematically assessed in the present study, it was noted in Chapter 3 that most of the autistic children in this study engaged willingly in this session and seemed to enjoy it. The experimenter felt that this session provided the best opportunity for normal social interaction with

these children. Nadel (in press) has suggested that the most effective strategy for using imitation as an intervention for autism would be to alternate imitation of the children with elicited imitation by the child. She has piloted this work with a few autistic children and did indeed find that social interaction improved in quality as well as quantity (Nadel & Peze, 1992). An intervention of this type introduced at a very early stage in development, i.e. as soon as social interaction was found to be abnormal, could be very important. Meltzoff & Gopnik (1993) suggested that early imitation plays an important role in the development of Theory of Mind. So such an intervention might also help, either directly or indirectly via improved intersubjective relatedness, later developing abilities such as an understanding of mental states. It should be easy to train parents in the methods and could be used effectively as an informal as well as a formal intervention. However, more research is needed to work out the details of such an intervention, before it can be offered to parents as a way of improving the prognosis for their child.

The present study, like previous studies such as Lewis and Boucher (1988), demonstrated that autistic children can produce more pretend play and, sometimes, more functional play in an elicited or structured environment than they do spontaneously. It also showed that the frequency of manipulative behaviours decreases in an elicited or structured environment. Other researchers have offered an assessment of *play* and *imitation* as a useful diagnosis tool (Stone et al. 1990), while Restall and Magill-Evans (1993) not only proposed that play is a useful tool to evaluate the interpersonal skills of preschool autistic children, but also that play can be used to develop these skills. Atlas (1990) proposed that play can be a useful tool in both the diagnosis of and intervention in disorders such as autism. It may be that a combination of play and imitation, or imitation in a playful setting, might constitute a very effective intervention programme that could be used both at home and in educationally based therapy sessions, usually on a one-to-one basis.

In addition to the suggestions above, there are many other areas which need to be addressed, with regard to autism. In the course of writing this thesis I found myself asking several questions. What affects how autistic children develop? How big a role does the type of school attended have? Can we establish that one type of

schooling i.e. autistic special school, is better for an autistic child showing certain characteristics than a second type of school, say, the mixed environment of a special education class? Are there cultural differences in autism and how is it treated in different cultures? There has not been much research on cultural differences, although a study comparing English and French autistic adults and adolescents showed few differences between the two on cognitive, social and theory of mind behaviours (Fombonne et al., 1994). Studies on autism in Japan have shown that performance on certain tasks, for example, false-belief tasks, for example, seem to be similar (Naito, Komatsu and Fuke (1994). Further cross-cultural studies would help to develop interventions, as well as our understanding of environmental effects on autistic development.

Finally, I have to ask one question that may be the true key to developing an affective intervention for autism - what is it that allows some children to develop the ability, for example, to pass false-belief tasks and tasks of emotion perception, yet doesn't allow these abilities to be used spontaneously? Would autistic children be more inclined to spontaneously use the abilities that may be present, if they were "trained" at an early stage to follow a point and eye gaze, to show toys, to point to objects, using a much more rigorous, deliberate training than normal children receive, along with interventions to improve their social interaction skills? These wide-ranging questions I leave to future research.

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# Appendix 2.1:

**Category Definitions:**

Play/spontaneous activity:

This general category included any of the behaviours in the following subcategories. The general defining characteristic is that the actions, with objects or without, with other people or solitary, were spontaneous. Because a group of adults and older children were observed at school, this category did not have to be play in the accepted sense of the word (i.e. involving diversion or recreation e.g. games of mastery, games with rules, and games of make-believe and fantasy, to use Piaget's classification (Penguin Dictionary of Psychology) - this was the case for the youngest children of course), but could also be used of any spontaneous activity (see Functional play, for an example).

G - General/Gross motor play/activity.

Any play/activity which consists of movement and does not fall into any specific category. This could be, for example, running around, jumping or skipping. In gym class movement was recorded here but was marked with "ns" when done in response to the teachers instructions, to show that it was not spontaneous. Only spontaneously movement of this sort was included in the results.

M - Manipulative play/activity:

Holding, turning, examining or "fiddling" with a toy, object or body part, e.g. pencil or hair.

R - Relational play/activity:

Combining two objects/toys in some way that is not functional. This category can include combining an object and a body part, e.g. tapping pencil on ear or chin, tapping a building block on the table, or hitting together two pieces of a puzzle.

F - Functional play/activity:

Using a toy or object in a manner consistent with the conventional function. This can include puzzles, painting, using a hammer to hammer in nails, beating a musical instrument, building with blocks or Lego. Also included in this category, and especially important when observing the older autistic subjects, is any activity which is appropriate, for example, getting on with work without having to be prompted, reminded, or helped by the teachers or other members of the class. Other schoolwork was noted but with an "ns" - not spontaneous.

Symbolic play:

Originally two categories of symbolic play were used (although for the final results these were collapsed back into one category of symbolic activity).

S - Fully Symbolic play/activity:

Any incident in which an object is used as something else (substitution play) or the child acts as if an absent object was there. This can be for example, using a banana as a telephone, making dolls talk (i.e. animating inanimate objects). Also included was making noises and acting like something else, for example acting like a dog and shooting others using fingers as a gun, or falling down dead when shot. Thus following Leslie (1985) pretend play occurs when there is evidence that:

1) The subject is using an object as if it were another object - deviant reference; or

2) The subject is attributing properties to an object which it doesn't have - deviant truth; or

3) The subject is referring to absent objects as if they were present - deviant existence.

I - Intermediate play:

This category included incidences of play which fell between functional and fully symbolic: any imaginative play where objects were used in the conventional manner but elaborated by language and other behaviour, usually social contact. Examples of behaviour placed in this category may include: playing Mummies and Daddies, shop, cops and robbers etc. Also included were examples such as making tea and giving it to another person using appropriate objects or talking on the telephone.

[Note: This category was adhered to for the school time observations but in the analysis it was included in Symbolic play. This may cause problems for some researchers in this area, for whom this would still be functional play. However, formally such acts meet the criteria for symbolic play, above: they are just conventional and therefore raise unavoidable ambiguities about the extent to which the child recognises its activity as pretence. It was felt that this was still a type of pretend play. i.e. when talking on the phone, the child is pretending that someone is speaking. When playing mummies and daddies, the children are pretending to be something they are not. To make and give a cup of tea, the child often pretends that the empty cup has something in it. The identification of this category was often helped by the language used by the children. This in itself proved troublesome in the autistic groups since few of the children possessed this sophisticated language. This is also true of fully symbolic play. Given the low frequency of both I and S, the two were combined. ].

Social Interaction: - Interaction with others, initiated by subject. May be verbal or touching; can be affectionate, aggressive, fighting, asking for help, asking a question, or simply sharing a piece of information.

Adt - with adult.

Peer - with child.

Evidence of a Theory of Mind (ToM) Abiltiy:

This Category was defined as any behaviour falling into any one of the following categories, and implying a possible understanding of the mental states of others and acting accordingly. Some of the following categories are viewed as precursors to a full Theory of Mind as is in evidence in success on false-belief tasks.

MSL - Mental State Language:

Use of words either referring to self or to others such as "think", "know", "believe", "feel", "want", "like", "happy", "sad".

JA - Joint Attention:

1) where the subject follows the point, gaze etc. of another person.

2) Subject uses gaze, pointing or words to draw someone else's attention to something but not for the purpose of requesting the object. This included actions such as showing.

E - Empathy:

The understanding of the emotions of another person. Can be seen most clearly in comforting someone else, getting upset because someone else is upset or acting happy because someone else is happy.

UMS - Use of mental state understanding:

Other actions indicating some understanding of the intentions or other mental states of another person. Examples include, helping someone (for example, by supplying the knowledge needed to answer a question), lying, making a joke, laughing at a joke, being deceptive, teasing etc.

Imitation:

Within the realm of child development, few researchers offer a definition of imitation. It is in the animal literature where we find imitation defined but in a rather narrow and restrictive way (See Whiten and Ham, 1991; Tomasello et al., 1994). In order to understand spontaneous imitation in children, especially autistic children, it is necessary to have a broader definition to work with. If imitation involves the ability to mindread, as suggested in Whiten & Ham, 1991, then a narrow definition is needed to rule out mimicry and other forms of social learning other than imitation. However, if imitation does not necessarily involve mindreading but simply the ability to make and transform self-other distinctions (Roger and Pennington, 1991), then a broader definition suffices. In previous research in the human development area, for example Meltzoff and Moore, 1989, the reproduction of actions was not perfect to begin with but improved with practice and the authors concluded that imitation had taken place.

In work by Nadel (See Nadel and Camioni, 1993 for review), toddlers were scored as imitating their play-mate if they picked up and held the same toy; this usually included using the toy in the same way as the other child. For this study, being partly observational in nature, it was decided to take a broader definition - one that could conceivably include mimicry, which does not involve any understanding of mental states but, at the same time, narrow enough to rule out other phenomena such as stimulus enhancement. Therefore the definition of imitation which was adopted for this study was as follows: *Imitation occurs when the child reproduces to a some extent the actions or vocalisations of another child or adult.* This reproduction does not have to be perfect but it should be clear that the child has not performed the action by him/herself, without reference to another person. This was established by noting that the child looked at the other child before or while performing the action. In addition the action should contain at least some of the elements seen in the model's actions, to rule out simple stimulus enhancement and here again the child should make some sort of reference to the model, usually eye gaze. To give one example of making this distinction - if a child approaches an object having watched another child play with it and then picks up the object and sits down quietly on his own, with no further reference to the model, and produces actions on the object that are not similar to the model's use of the object (except where the object dictates a certain use, for example, a hammer, nail and board invites the child to hammer the nail in), this would be stimulus enhancement, not imitation.

VI - vocal imitation of both speech sounds (Words, sentences etc.) and non-speech sounds (e.g. laugh, yawn, hiccough, cough, sigh). Includes echolalia.
w/e - vocal imitation without echolalia, which is defined as "the compulsive and apparently senseless repetition of a word or phrase just spoken by another person". (Penguin dictionary of Psychology). Echolalia is discarded from the evidence of imitation since it is a product of the disorder of autism and not a sign of normality.

B/G - Body or gestural imitation:
Imitation of body actions or gestures, including facial expressions.

AONS- non-symbolic actions with objects:

Imitation of actions with objects without pretence, including manipulative, relational or functional as described above. e.g. hits drum with stick, jumps over block.

AOS - imitation of symbolic actions with object:

As for symbolic play, but three categories of symbolic activity were noted here: 1) all objects present but still some pretence involved.(as in intermediate play), e.g. stirs spoon in an empty cup and then says "here is your tea". 2) One or more objects present but pretending another object is also present - e.g. stirs imaginary spoon in a real cup. 3) All objects imagined.

## Appendix 2.2

**Questionnaire given to the parents and care staff of the autistic children.**

QUESTIONNAIRE (Completed by *Parent/*Care Staff) * *please delete where appropriate*

Date:

Name of Child:
Age:

*Parents only answer questions A - C*

A. Has your child been diagnosed with autism? Yes/No

Year of Diagnosis? -------

B. Where was your child before coming to Struan House?

C. When were you first concrened about your child's development? *(age of child)* -------

**********

Question 1 *(N= never, S= sometimes, O= often)*

| | N | S | O |
|---|---|---|---|
| Does this child interact with other children? | l--------- | l--------- | l |
| Does this child interact with other adults? | l--------- | l--------- | l |
| Does he/she ever initiate this contact? | l--------- | l--------- | l |
| What is the nature of this contact? | | | |
| Is it: affectionate? *(eg hugging)* | l--------- | l--------- | l |
| fighting? | l--------- | l--------- | l |
| Rough and tumble play? | l--------- | l--------- | l |

Any other *(please specify)*

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Question 2

Does this child have any obsessional behaviours? Yes/No*
can you desribe these? *(they may be past or present but please specify)*

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Is there anything in the environment to which he/she reacts strangely?
*(eg specific noises)* Yes/No*

Please give details

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N S O
Does this child throw temper tantrums? l--------l--------l

Can you give an example of why this occurs? (or when)

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Question 3

How would you describe this child's language ability? N S O
Is it: articulate? l--------l--------l
meaningful? l--------l--------l
repetitive? l--------l--------l
imitative? l--------l--------l

:absent vocally but can communicate in other ways. Yes/No*
*(please give details)*

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N S O
Does he/she have a problem with comprehension? l--------l--------l

interpretation? l--------l--------l

Please give an example of both these problems

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N S O
Does he/she ever tell stories? l--------l--------l

What sort of stories? Can you please give a recent example?

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| | N | S | O |
|---|---|---|---|
| Does this child ever reverse pronouns? *(eg uses 'you' when he/she means 'I' or 'me')* | l--------- | l--------- | l |

Any other details about this child's language ability?

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Question 4

To your knowledge does this child ever have hallucinations? Yes/No*

If yes, what sort?

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Question 5

Have you ever seen this child imitating/copying the actions or behaviour of another person? Yes/No*

Was this: vocal imitation? -------
imitation of body movements or gestures? -------
imitation of facial expression? -------
imitation of an action with an object? -------
*(tick where appropriate)*

Can you give me some recent examples - perhaps from the past week/weekend?

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Question 6

Have you ever seen this child teases someone else? Yes/No
Example:

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How does this child react to being teased?

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Question 7

Have you ever seen this child be deceptive in any way?
(eg to get what they want) Yes/No

Example:

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| | | | Examples: |
|---|---|---|---|
| Do they ever: | tell lies | Yes/No | ---<br>---<br>--- |
| | play tricks | Yes/No | ---<br>---<br>--- |
| | make jokes | Yes/No | ---<br>---<br>--- |
| | laugh at a joke | Yes/No | ---<br>---<br>--- |
| | comfort someone | Yes/No | ---<br>---<br>--- |
| | get upset because someone else is upset | Yes/No | ---<br>---<br>--- |

*(if necessary, continue on a separate sheet of paper overleaf).*

Question 8

| | N | S | O |
|---|---|---|---|
| Does this child ever request an object by pointing to it? | l--------- | l--------- | l |
| Does he/she point to an object just to draw your attention to it? | l--------- | l--------- | l |
| Does he/she look at an object when you point to it? | l--------- | l--------- | l |

Question 9

Does this child ever use words or language that shows any understanding of what goes on in their own or someone else's head? For example does this child use any of the following words? *(please tick appropriate boxes and give an example, if possible)*

| | | Examples |
|---|---|---|
| Like/Love | ------- | ---------- |
| | | ---------- |
| Want | ------- | ---------- |
| | | ---------- |
| See | ------- | ---------- |
| | | ---------- |
| Need | ------- | ---------- |
| | | ---------- |
| Feel | ------- | ---------- |
| | | ---------- |
| Happy | ------- | ---------- |
| | | ---------- |
| Sad | ------- | ---------- |
| | | ---------- |
| True | ------- | ---------- |
| | | ---------- |
| Lie | ------- | ---------- |
| | | ---------- |
| Know | ------- | ---------- |
| | | ---------- |
| Remember | ------- | ---------- |
| | | ---------- |
| Think | ------- | ---------- |
| | | ---------- |
| Mean/meant | ------- | ---------- |
| | | ---------- |
| Believe | ------- | ---------- |
| | | ---------- |

Question 10

What opportunity does this child get to play either on his/her own or with others?

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What sort of toys/games are available to him/her?

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Which of the above does this child play with most often?

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Does he/she play in any of the following way?

| | N | S | O |
|---|---|---|---|
| A: manipulating one object/toy. | l--------- | l--------- | l |
| is this very repetitive or stereotyped? | l--------- | l--------- | l |
| B: using two objects together, but not appropriately. eg lining up toys in a repetitive, routine or unmeaningful manner, <u>or</u> banging toys/ objects together | l--------- | l--------- | l |
| C: using objects as they are supposed to be used. eg using a toy telephone as a telephone, pouring a cup of tea from a teapot or using building blocks to build appropriate things. | l--------- | l--------- | l |

Can you give an example of this type of play?

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| | | N | S | O |
|---|---|---|---|---|
| D: pretend play, | | | | |
| eg 1, | 'mummies and daddies' | l--------- | l--------- | l |
| | 'shop' | l--------- | l--------- | l |
| | 'doctors and nurses' | l--------- | l--------- | l |
| | 'dressing up' | l--------- | l--------- | l |
| | 'fighting games', eg 'cowboys and indians' | l--------- | l--------- | l |
| eg 2, | using an object as something else - a banana as a telephone | l--------- | l--------- | l |

Please give exapmles if possible

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Has this child ever been 'taught' play behaviours? Yes/No

Please give details

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*THANK YOU FOR YOUR HELP*

## Appendix 2.3:

Examples of each subcategory of behaviour as observed in three of the subject groups - the 5-6 year old children, the autistic children and the children with learning difficulties.

| Behaviour | autistic children | 5-6 year olds | MLD children |
|---|---|---|---|
| General motor play | 1)skipping from one end of the room to the other, across diagonals, repeating the same pattern of movement. 2)rocking in the chair or on the floor. All examples are usually obsessive and/or repetitive. | Usually incorporated into other types of play, especially symbolic play-acting as horses, pretending to fly etc. See below for a full example. Also could be seen in brief bursts as fidgeting in the line while waiting to see the teacher. | Usually in play but also fidgeting and pacing around the room. When the later, the behaviour doesn't last for very long - less than the autistic children and slightly more than the normal 5-6 year old children. |
| Manipulative play | Mostly just manipulating objects or body parts - e.g. hair. Usually very obsessive and without any exploratory function. Often repetitive and lasts for a relatively long time (usually more that one minute. e.g. fiddling with thread, not looking at it. | Manipulating objects such as pencil, while working - child often seems to be either thinking about work or distracted. Never lasts very long. | Manipulating sticks, pencils etc. Shaking, biting etc., usually when working and again doesn't last very long. |
| Relational play | E.g. Putting blocks in neat rows, banging pencils and other objects on table. Mostly very obsessional. Can last quite a long time if teacher doesn't stop it. | Can also be tapping pencil on hand or cheek, usually while working and often when thinking about an answer. | Tapping animals together while playing - not using objects functionally. Can last quite a long time but usually playful and not obsessional. |

| | | | |
|---|---|---|---|
| Functional play | Drawing with chalk on a blackboard. Usually involves continuing work which they have been given at start of class, often matching work or jigsaws. | Building castles from bricks, doing puzzles, playing games, using toys as they were designed to be used. - cars, dolls, etc. Also included continuing work on their own. | Mostly involved doing school work, colouring, writing. Usually set by teachers at beginning of class but the children carried on without any prompting. Some toy play was also in evidence. |
| Symbolic play | Very few examples, usually involved toys such as dolls so coding was ambiguous due to a lack of language. An example is quoted in depth below. | See anecdotes below for an example. Usually involved substitution pretence and also role-taking games, such as shop, or house. | Role-playing games with self taking both parts. Some language elaborated the pretence. Pretending to smoke pencil as cigarette. |
| Social Interaction with adults. | Mostly verbal, to ask a question, to get help with work etc. Sometime information was shared just for the sake of sharing information, but this was usually seen in the most able children. Sometimes wanted a cuddle, one boy was rather obsessed by having contact with the adults around him. A few of the most able children would also engage in limited eye contact and smile or at least return the smile of the teacher or observer. | Mostly asking for help with work but also sharing information with the teacher, in a very appropriate way. Sometimes affectionate, sometimes teasing. Eye contact and affect sharing with observer was common. | Asking questions, sometimes sharing information. Often eye contact and affect sharing was observed. |
| Social interaction with Peers. | Very little observed - mostly verbal contact, e.g. requesting them to not shake the table, or to do something. A few examples of physical contact, usually passive, were observed. Rarely aggressive or retaliatory. | Very much verbal - but discussing all sorts of topics. Usually while playing. Sometimes contact was physical, for example in some games such as tig. Sometimes aggressive but usually friendly. | Mostly verbal and very often while playing. Sometimes aggressive, especially in the younger children. But most of the fighting was play-fighting. |

| | | | |
|---|---|---|---|
| Mental state language. | Usually, very idiomatic use of words and only ever heard to be self-referencing. "I think so", "I don't know", "I thought she was good yesterday". Words used: think, know, love, like, want. | Words used: need, think, want, like, hate, know, remember. Usually used in a self-referencing manner - other referencing may need to be elicited but a few spontaneous examples were observed. One example - "he (Teddy) thinks he's under arrest, 'cos he's got his hands up." | Words used: know, like, scared, want, hate, think, need. As for other groups, mostly idiomatic phrases but again a few examples of other referencing was observed. - "Mum and dad thought he had dome something bad." |
| Joint attention. | Showing work to teacher or observer. Some following of a point, usually accompanied with "look!". A few examples of pointing, usually when naming something. Sometimes watches what another child is doing after looking at the child's face, although this is sometimes ambiguous. Not very frequent. | Showing, pointing, following a point were all used to different degrees. The children constantly monitored what each other were looking at and often they followed the gaze of the observer to other children. Working together was very common, so that both children were attending to the same object, page etc. | Pointing to attract attention to something. Pointing at pictures while a story is read, working together on map work and discussing their work. Following pointing and gaze with no clues was also observed, as was showing work and objects to other children and adults. |
| Empathy | None observed | During pretend play, one child reacts empathetically to the story of another child - being happy for each other when the phone call brings good news etc. Also when one child is hurt or crying, an other child usually tries to comfort or at least get the teachers attention | None observed |

| | | | |
|---|---|---|---|
| Use of mental state understanding. | Helping each other, one boy only, by giving the answer to a question or telling them how to do the task. Apologising for things that should not be done was common in one boy, but it often became very annoying since he said sorry so often, even when told it was all right. Laughs at jokes, but usually only the unsubtle, slapstick kind. Mostly very ambiguous examples which could very easily be explained by a Theory of Behaviour rather than a Theory of mind. Several examples are quoted in detail in Appendix 2.4 | Use of sarcasm, teasing, making jokes and laughing at even subtle jokes. Cheating in games, in order to win was quite common, when the teacher wasn't watching. Lying, deception etc. were all observed. A few examples are quoted in Appendix 2.4 below. | Understanding lying and deception in stories, enjoying teasing, teasing others, laughing at jokes appropriately, hiding/deception. For example, one boy, who was not suppose to use an eraser in class, would use it while hiding the fact from the teacher, first checking to see if the teacher was watching him. |
| Vocal imitation | Mostly echolalia, although sometimes observed in the learning situation, for example where one boy repeats what the teacher says to get the pronunciation right. Other words are often copied but not in an echolalic fashion. One boy also mimicked the teachers words and tone of voice and also imitated commentators, presenters, advertisements etc. form the T.V. | Not observed very frequently. Some repetition of what playmate has said to another child, for emphasis. | Few examples recorded. |

| | | | |
|---|---|---|---|
| Body/gestural imitation | Gym class at school as well as music class was most conducive to imitation but most of this was elicited by the teachers. In the second study, there was one example of an imitative sequence between two boys. which is described below. | Mostly observed in gym class, copying teacher before told to do it and copying the actions of other children both functionally and as a means to misbehaving in class. One boy, that with the youngest MA, copied a lot in gym class. No imitation was seen in the playtime study. | Seen in classes such as music, gym and drama, some of which was elicited and some was spontaneous. One example, is when the teacher would say "show me how you wake up" and the children would proceed to copy the teacher, although this was not the purpose of the exercise. |
| Non-symbolic object imitation | Few examples. Sometimes in music class some of the children would imitate the teachers demonstrations before told to do so. This however, may be just a problem with turn-taking more than an example of imitation. | Some of the children would copy each others use of toys during play. One example is quoted in Appendix 2.4 - the sequence of play between the two girls. Another example is how one boy would copy the way others were taking their turn in a board game. | None observed. |
| Symbolic object imitation | none observed | Not seen very often but one or two examples can be found in play sequence described in Appendix 2.4. | None observed. |

## Appendix 2.4

**Case Records:**

The following specific records come from the observational study or were passed on by the teachers and parents in the questionnaires. These examples are selected to illustrate particularly the most advanced cases considered for categories of specific interest, notably pretence, imitation, and ToM. As already noted, these can be especially difficult to interpret.

1) For autistic children:

1) Child I (CA 15,7; MA 6,8.) was asked (in Gym class) to run as if catching a taxi - he did so by running and waving arms appropriately and with an appropriate expression on his face. This is taken as an example of role playing and therefore pretence. All the other children just ran around the room. In the same class, this boy was told to get on all fours and lower head, like "a cat at cream" by the teacher. He did this but elaborated it by using his tongue as if licking the cream out of the bowl.

2) Child A-M (CA.15,4; MA.8,3) : quite often laughed at jokes but only very obvious, or slapstick-type humour. For example, the Teacher said "Child A1 sounds as if she is about to lay an egg" and A-M laughed.

A-M tended also to seem very moody, and she would say "I am in a bad mood today" and would act accordingly, e.g. huffing and shouting at others, and refusing to do what she is asked to do. However, this was mostly overacted and her teacher felt that a lot of this moody behaviour was picked up from her sisters. She seemed to just decide that day that she was going to be in a good or a bad mood.

3) One younger boy, A2 (CA.9,2; MA.2,2), had very limited understanding and language. But the teachers report that he sometimes seemed to understand when someone else was “being silly”. For example, one of the assistants pointed to the bin and said to A2 "Is that a chair". He laughed and said "no" quite emphatically.

4) Child C (CA.9,1; MA. 4) had been encouraged to play with dolls quite a lot and this was what she did in her free play time. But this playing with dolls and teddies became her obsession. Her play did sometimes involve symbolic activity or at least imaginative play - e.g. making the dolls talk, hug, walk in and out of the house, kick a ball around - but is at the same time very limited. Often she would stare at the doll, making noises, fiddling with the doll's dress for a large part of the play time and had to be prompted to do something different. If restarted on play she would elaborate but only very slightly. For example, she was engrossed in manipulating the dolls dress and one of the teachers prompted her to making the dolls talk. She sat two dolls opposite each other and pretended to make them talk, while C. watched. The teacher then left C. and C. continued the talking to some extent (although it was nonsensical, since C has very little spoken language) and then made the two dolls hug and kiss each other.

Another incident involving Child C and one of the boys in the class, serves to illustrate that spontaneous vocal imitation occurs at least to some extent. One child screamed, the other copied, and it got louder each time. This could be argued to be echolalia but the observer was convinced that there was something more here than just echolalia since it continued until the teacher stopped it and appeared to be an interaction between these two children, and they seemed to be enjoying it.

5) Child S (CA.7,11; MA 3,2) was one of the youngest children at the school and was not one of the subjects in this project but he is worth mentioning. His ability to imitate at least vocally seems to be intact, although it can become obsessional or annoying, and is reinforced by laughter from another person. One example, is where the classroom assistant, had a bad cough and was coughing at lunch time. S. picked up on this and coughed at intervals for the rest of the day.

6) Child G (CA.7,2; MA. 3,2) also tended to pick up the habits of the other children, especially if one of them is away for a while - he annoyed the teachers in the same way as the absent classmate would do! This behaviour was not done in the presence of the other child. One of the teachers commented, "We don't miss A3 much when G. is around - it seems as if he is still here"!

7) A4 (CA.12,3; MA 5;4) had a tin that contained several small toys and sometimes at play time he was allowed to play with the small plastic animals that he had in there. This play was usually fighting, and he made the appropriate noises when doing this.

In one example he had a gorilla and a parrot, which he called monsters, and which he made fight each other, with all the appropriate noises. When asked to tidy up he begins to do so and asks the observer to stroke the gorilla's head and say "goodbye" before he puts it away in the tin. The request was made verbally but accompanied by showing that he wanted the observer to stroke the animal's head.

An example which could possibly be seen as a mixture of pretence and teasing, was when he was asked to lie down which he didn't really want to do. He began to pretend to snore quite loudly, which made the adults in the class laugh. He continued it. When he got told off, he began to snore even more loudly, seemingly to annoy staff.

8) Child D (CA.11,10; MA.3,7) provides us with an example of a type of deception which most of the children engage in at some point, reported by one of the teachers. One day D. came to school complaining of a terrible earache and asked to be taken to the doctor's. He continued asking until one of the staff questioned him about why he wanted to go to the doctors since he had no other symptoms. Eventually he admitted that he wanted to go to the Doctors so that he could read the magazines in the waiting room. Magazines and catalogues were one of his obsessions!

9) Child A3 (CA.14; MA. 7,2) was a T.V and video addict - it was his obsession and his islet of ability. He would impersonate quite accurately celebrities such as Tommy Cooper, Mavis form Coronation Street, Prince Charles and many more. He sometimes mimicked staff when asked to do a chore which he didn't want to do. The staff gave an example of how he was given a police walkie-talkie for a few minutes, used it appropriately and made up a story pretending he was a policeman making an emergency call. He also impersonated Michael Jackson's voice and style of dance movements. He showed some symbolic ability when, for example, he used a hair brush as a microphone, when impersonating a singer.

Child A3 also provided the example of deception which was discussed in the main part of this paper.

11)According to her parents Child M (CA.15,1; MA.4) is like A3 in that she seems to have a talent for mimicking pop stars and she imitates their use of the microphone. She accepts teasing but gets very violent if her Mum is teased. Her parents noted that M was very affected by sad music or sad stories and would get upset. She would comfort little children and mother them, but never did this with dolls. She would cry readily if a T.V. character was obviously upset or depressed. But she did not seem to understand when her Mum and Dad, for example, were playfully fighting and she attacked her Dad in these situations.

12) In the second observational study, a sequence of behaviour between two autistic boys was observed. It was initiated mostly by one older boy who wanted to play with the younger child. The first child, A.Y. (CA.9,8; MA.2,2) approached the second child, S. (CA.7,11; MA.3;2), who was playing with the Lego. AY proceeded to cuddle and engage S in rough and tumble play, but which from time to time included some glimpses of symbolic behaviour and imitation, both vocal and with objects. For example, AY took a piece of Lego and appeared to pretend to eat it. Then he picked up a bit and put it up to the mouth of S, who proceeded to briefly "eat" it and then put it back to the mouth of AY. Also AY tried constantly to get S to copy the noises he made (mostly non-speech sounds). When S came even close to copying the noise AY laughed and seemed very pleased and tried it again. This continued for 15 minutes.

2) For the 5-6 year old children:

(Although the following example focuses on one child, the behaviour of the other children in interaction with her is also of interest. In this example, which lasted approximately 15 minutes, we can identify general motor play, symbolic play, functional play, interaction with peers, understanding mental states in the form of teasing and possibly seen in the sarcasm used by M. There is also imitation of actions with objects and body/gestural actions. The most interesting thing is how each behaviour links to another and flows naturally in the course of the children's play. This

variety and yet uniformity of behaviour was typical of play sequences in the normal children but was rarely seen in the autistic children.)

"M. (CA 5,4; MA 5,4) was playing with her best friend, C. They both had small toy ponies. They were talking to each other. M. said "Pretend we are princesses. Pretend this is my pony." She made horse noises, then skipped and "flew" around the garden to the castle which some of the boys had built from bricks. She wanted to play in the castle as a princess but then changed her mind and ran back and "flew" back to C. "Why don't we make a nest for us" she said. So they left the horses on a rock and went to collect grass cuttings. They carry the grass back to the rock where they make nests for the ponies. They pretended to fly around. A boy, J. stopped M taking grass out of the barrow he was pushing. "We need grass" she says. She skipped off to find some elsewhere. They collected some and returned to nests. She pretended to fly around the garden again. "We are flying horses" she said and then told C. to get more grass. "We are going to have to go all over the place looking for more nests." M took some grass off C., who grabbed it back. "I really do need it for my horse" M complained.....Another child, B, came along and destroyed their grass house. M yelled at B, who was laughing. "We don't like it!" she shouted. C. said "It's not funny!". "It's not funny!" repeated M. She chased B until he dropped the grass then said sarcastically, "Thanks B.....B you are being a pain, a very big pain." She tried to take some grass off J but he wouldn't let her. "We need it " she pleaded. They continued to play and rebuild nests. As B passes, M adds "Thanks B, thanks a lot! That was very helpful of you!".....In the queue for a drink, they continued to play with horses. M copied what Christina does with the horse - they both stroke the horses hair- and then tied it up in a bow."

An example of understanding mental states is quoted in the discussion.

3) For the children with learning difficulties:

(These examples come from both the observational study and less formal observations in the classroom.)

1) One morning while the children were telling each other their news from the night before, one young boy, A (CA. 11,7; MA.2,2). begins to "copy" everything the other boys are doing. The teacher chooses to ignore this. Most of the imitations are of body/gestural movements, and include imitation of postures, hand movements and noises such as coughs. Another boy, J (CA.10,9; MA.8;11), leads A on, giving him things to copy but then pretending he is sitting still and quiet once the teacher looks in his direction.

2) In one of the older children with learning difficulties, S (CA.14,8; MA. 5,4), some examples of symbolic activity is observed in drama class. He pretends to be the Penguin out of "Batman", smoking a stick as a cigar. He also pretends to drive the batmobile, using furniture as the car. Pretends to slide down pole and runs and jumps as if batman. Drives Batcopter etc. The same boy used to also enjoy playing with the telephone. He would phone and listen and on one occasion he pretended he was phoning for a job. Listens and gets ready to take down a message.

# Appendix 3.1

Lists of tasks in the imitation battery (the actions in parentheses, are the fifteen actions not included in the analysis):

| Session 1 | Session 2 |
|---|---|
| Puff out cheeks [7] | Shut eyes very tight |
| Finger wiggle [7] | Interlinked fingers [7] |
| Mouth pull [7] | Lip wobble [7] |
| Cough | Yawn |
| ("Look!") | "Oh dear" (doll falls off chair) |
| Make and look through spy hole [7] | Roll paper in ball and flick [7] |
| Sad face | (Grin) |
| Use cup as hat [2] | Drink from brick as cup |
| All fingers touching [7] | Peek-a-boo [7] |
| "Moo!" with cow | "Baa!" with sheep |
| Jump twice [7] | Sway foot to foot [7] |
| Build two brick tower [2] | Hold small wooden block then drop it [2] |
| Ok sign | Thumbs up sign |
| (Pretend to eat blocks as fruit ) | (Park car in garage) |
| "Beep! beep!" with car | ("hello, how are you today" with doll) |
| Draw line on paper | String three beads together |
| Touch ear 7 | Touch back of head [7] |
| Stirs soup in bowl (no spoon) [1] | Pours from imaginary teapot into cup [1] |
| Extend both arms & touch nose [1] | Pat top of head [7] |
| Give doll a drink from cup [1] | (Brush dolls hair [3]) |
| Loud sigh | Giggle |
| Pours from empty pot into imag. cup [1] | (Stirs soup in imaginary bowl [1]) |
| Pat stomach [7] | Grasp foot [7] |
| Tap pencil on table | Bang spoons together [5] |
| Turn like balerina | Turn round shuffling [7] |

| | |
|---|---|
| Wave goodbye[2] | Move as if brushing teeth |
| March | Pulling imaginary rope |
| Switch on torch and point to wall | Play musical instrument |
| Sit down and rock back and forth | (Sway, turn and jump). |
| Saw piece of wood (no saw) | Hammer nail into wood (no hammer) |
| Throw ball into box | (Throw beanbag in air and catch it) |
| T-sign (1) [6] | T-sign (2) [6] |
| Protrude tongue | Lip-smacking |
| (Stirs soup in imaginary bowl, no spoon 1) | (Pour tea from imag.pot to imag.cup 1) |
| Mouth pop | Look up |
| (Turn clock hands to time) | Build pyramid of blocks 3 |
| Pour tea with wrong object | Stir soup with wrong object |
| Move like combing hair | move like drinking from glass |
| Hammer nail into wood [1] | (Saw piece of wood [1]) |
| Two finger clapping [7] | Grab thumb [7] |
| Look through tube as telescope | Roll paper - straw for coke bottle |
| (Flap arms and jump [7]) | Hug self [7] |
| Stir spoon in cup [2 & 3] | (Feed soup to doll [1]) |
| Roll hands [7] | Touch index fingers [7] |
| Extend hinged object then return flat [4] | Press play button with nose |
| Hide behind cushion & go "boo!" | Doll shouts "help!" |
| (Car noise as drive car along) | doll goes down slide "weeee!" |

<u>Items included to control for motivational problems:</u>

1. Switch on torch and point to wall
2. Turn clock hands to time
3. Draw line on paper
4. Tap pencil on table
5. Play musical instrument
6. Feed doll
7. Brush dolls hair
8. Build a pyramid of blocks
9. Turn like a ballerina
10. Sit down and rock back and forth
11. String three beads together.

All these items were decided on, on the basis of observational studies, and something which is seen as motivational for all the children and some of the adults is included here.

Sources in literature:

Most of the actions in the battery are self-explanatory, however there are a few which need careful definition and these shall be described below. Those from other studies are coded as follows (This applies to the above list)

[1] In Hames and Langdell (1981)

[2] In Heimann *et al.* (1992)

[3] In Stone *et al.* (1990)

4 In Charman and Baron-Cohen (under review)

[5] In DeMyer *et al.* (1972)

6 In Ohta (1997)

7 In Custance (1994)

Definitions:

Puff out cheeks: Lips shut and cheeks filled with air

Finger wiggle : The hand is held with palm facing away from body and fingers curled sequentially and straightened.

Mouth pull: Both hands are formed in fists with index finger extended. The index fingers are hooked inside corners of mouth and pull edges of mouth wider.

Lip wobble: Lips are protruded, the right hand forms a fist with index finger extended and places lengthways on lips and then moved up and down causing lips to smack against each other

Spy hole : a piece of paper is folded in half and a semi-circle is torn out of middle of edge. Paper is unfolded and the hole looked through.

Roll in ball and flick: piece of paper is rolled up into a ball, placed on palm of left hand and then the right index finger and thumb is used to flick ball off palm.

All fingers touching: The hands are held apart, palms facing each other and fingers bent so that their tips face each other and are splayed apart. The hands are then brought together until the tips of all equivalent fingers are touching.

Peek-a-boo: The hands are held flat up in front of the face, small finger to small finger with palms facing towards body. They hands are moved apart to reveal face and then brought together again.

Jump : Standing upright, the hands held against the side of the body, the experimenter jumps twice off the ground.

Foot to foot: Standing upright, each foot is lifted alternatively from the ground, producing a swaying motion.

OK sign - index finger of right hand and thumb are joined to make a circle. other three fingers are extended straight upwards.

Thumbs up sign - Four fingers make a fist with thumb touching fingers as hand is moved towards body and then thumb is extended upwards as hand is moved to point away from body.

Touch ear: the tip of right index finger touches ear.

Touch back of head: Flat of right hand is placed on back of head.

Pat top of head: the flat of right hand is place on head and then moved in patting action.

Pat stomach: Flat of right hand used to pat stomach.

Grasp foot: right hand reaches to left foot while sitting and grasps it.

Turn round (shuffling): Standing upright, the hands held against the sides of body, the demonstrator turns through 180 degrees using small jerky steps.

Turn round (like ballerina): Demonstrator turns round on tip toes with arms in the air.

March: Knees are lifted high and arms swung alternatively.

Pulling imaginary rope: Demonstrator moves hands, which are making partial fists (as if holding rope), in a downwards movement in front of body, using alternative hands. This is done 3 times.

Play musical instrument: a xylephone is beaten in a six note rhythm, descending in pitch.

Sit down & rock: Demonstrator sits down cross-legged on floor and then rocks gently back and forth three times.

Sway, jump and turn: demonstrator sways from foot to foot twice, then turns 45 degrees while jumping once.

Protrude tongue: tongue is pointed and pushed out of mouth.

Lip-smacking: mouth is opened and closed 3 times with the lips smacking against each other.

Mouth pop: The right hand is made into a fist with the index finger extended and the palm facing away from body. The end of the index finger is placed against the inside of the left cheek. The lips are closed around the finger which is kept straight and then jerked, from the wrist, out of the mouth to make a popping noise.

Look up: Head is tipped upwards firmly and slowly.

Two finger clapping: Left hand is held palm up, with the fingers together. The right hand is held in fist, except with the index finger and next one, extended. These are used to clap the left palm.

Grab thumb: Left hand was held in a fist with thumb extended sideways (palm away from body). The right hand then forms a fist around the thumb.

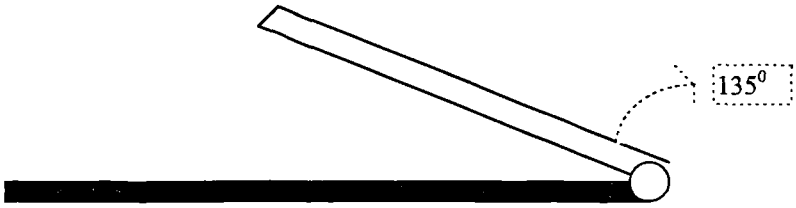
Flap arms and jump: Standing upright the arms a raised and waved up and down as if imitating a bird. Arms are waved three times and then the demonstrator jumps at the same time as waving arms a fourth time.

Hug self: Kneeling on one knee, the arms are crossed over one another in front of the body, grasping the opposite arm. The body is then twisted from side to side from the waist, causing the body to rock.

Roll hands: Hands are held as fists, sideways to the body, with one in front of the body. They are then quickly circulated around one another.

Touch index fingers: The hands are held about a foot apart, index fingers of both hands extended and pointing to each other. The hands are then moved together until the index fingers touch.

Extend and flatten hinge: An L-shape hinge, made of a flat rectangular base and a wooden flap, is unfolded to its maximum angle (135 degrees) and then returned to the flat position, using the index finger of one hand to lift the hinge and the palm of the same hand to knock it down again.




"Oh dear!": this is said as dolly falls off her chair.

"Look!" : This is said while pointing to an object in the room.

Drink from brick (as if cup): A brick is held in the hand as you would a glass and raised to the lips, which are open. One swallow occurs and brick is lowered.

Pretend to eat blocks as apple: Block is picked up in one hand and raised to mouth. Demonstrator pretends to bit and then chew fruit.

Park car in garage: Cardboard box with top opening in placed on side. A car is pushed along ground into box and then the flaps of box are closed over - as doors of garage.

Look through telescope - a tube from wrapping paper is raised to the eye, and the room is scanned, with the other eye closed.

Make straw and drink from bottle: A piece of paper is taken an rolled quite thinly, to the dimensions of a drinking straw. One end is then place in an empty coke bottle and the other end in the mouth.

"Weee!" : This is said having built a slide from three blocks and a piece of card and small doll if pushed down the slide. - important bit is the verbal imitation in this action although actually imitating some of the actions will also be noted.

Turn clock hands to time: Clock hands say 12.00 when the clock is picked up. The demonstrator uses the index finger of one hand to move the hour hand to 4 and the other index finger to keep the minute hand at twelve.

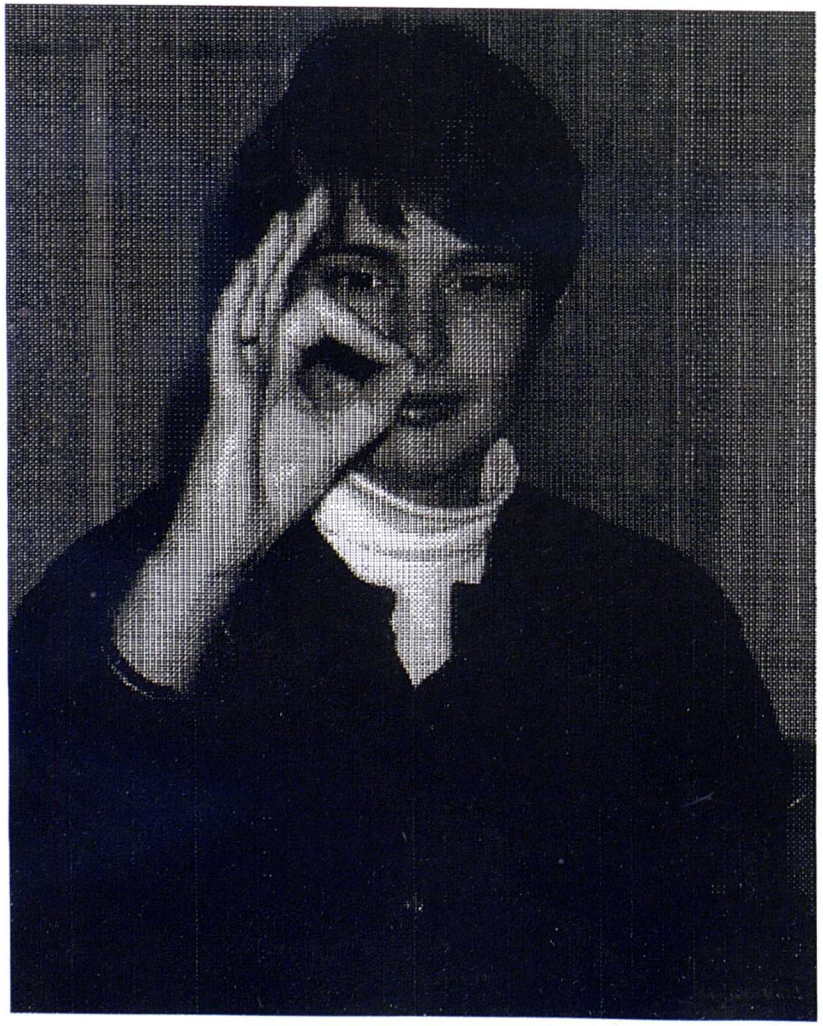
T-signs (1): Left hand is held in front of body, palm facing towards body. Right hand is held placed at right angles to left hand, fingers touching palm of left hand, with right hand nearest to the body.

T-signs (2): Left hand is held sideways so that fingers are pointing away from body. Right hand is placed at right angles to left hand, palm facing towards body, fingers touching palm of left hand.

Some of objects used in the Do-As-I-Do experiment (Photograph also included the artificial fruit (Chapter 4)and the drawer object used for testing deferred imitation (Chapter 5))

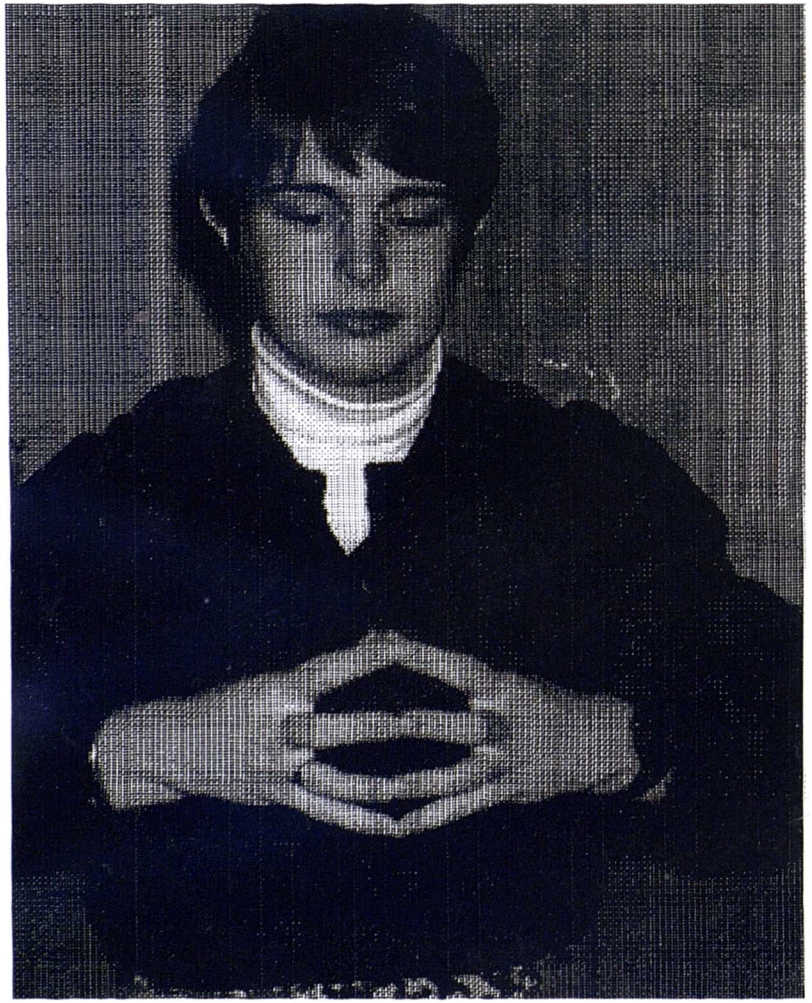
# Appendix 3.2

## Photographs of actions used in the Do-As-I-Do task.



Okay Sign

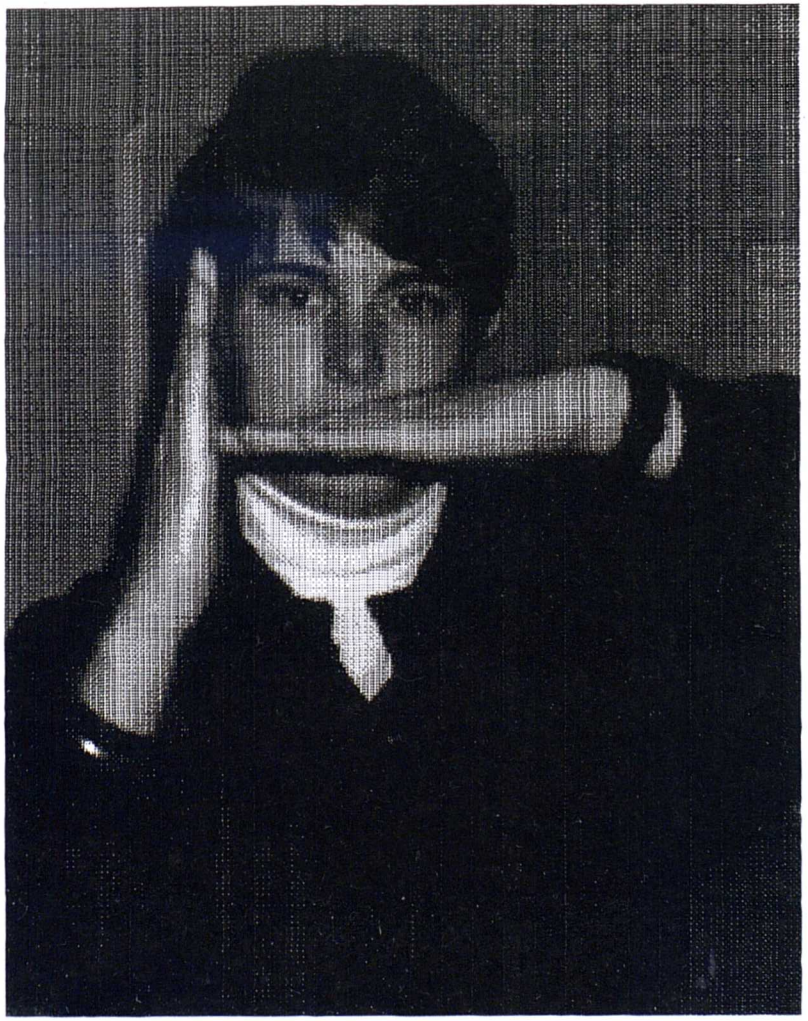
Lip Wobble



All-fingers touching

T-Sign (T)

Grasp Thumb



T-sign (|--)

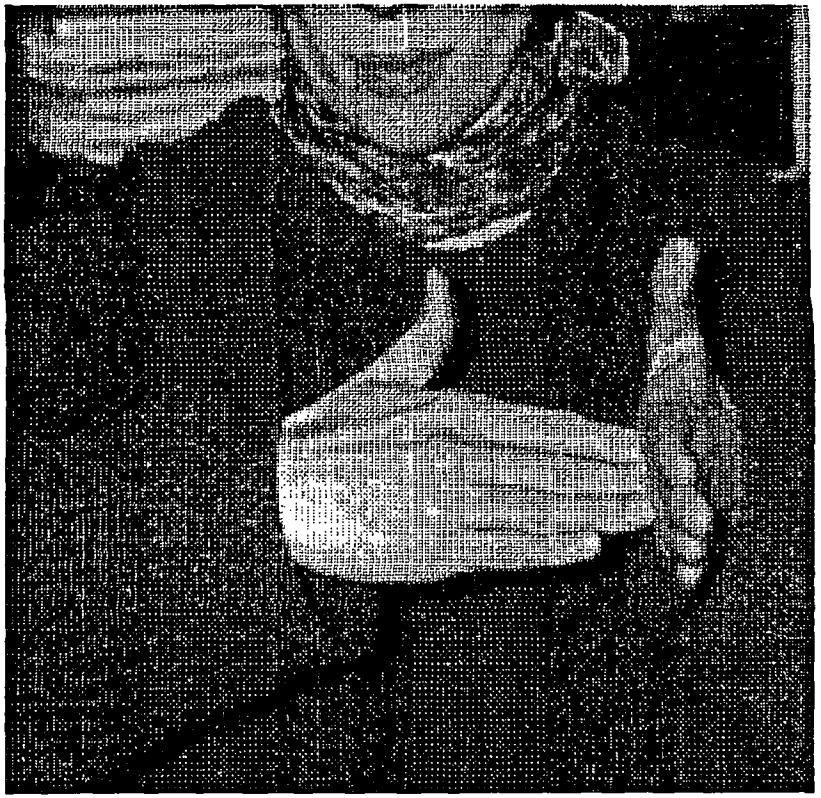
## Appendix 3.3

**Photographs of some of the responses seen for grasp thumb, Peekaboo and T-sign actions, illustrating reversals of actions.**

Grasp Thumb - two handed reversal

Grasp Thumb - one-handed reversal

Reversed hands response to Peekaboo



Altered Orientation of T-sign.

# Appendix 3.4

## Further results on the imitation individual actions.

Table 3.4: Mean percentage of total responses on which each group scored, 6,5,4,3,2 and 1, over all actions and for three categories of actions of special theoretical interest - symbolic actions with objects, meaninful/symbolic actions and two-handed actions.

| Category | Scored 6 | Scored 5 | Scored 4 | Scored 3 | Scored 2 | Scored 1 | Group |
|---|---|---|---|---|---|---|---|
| **Overall** | 41.27 | 27.54 | 13.54 | 6.00 | 3.27 | 7.72 | **3-4 years** |
| | 78.83 | 14.21 | 5.75 | 0.67 | 0.08 | 0.17 | **5-6 years** |
| | 67.43 | 20.64 | 8.09 | 2.54 | 0 | 0.91 | **MLD** |
| | 14.33 | 10.67 | 12.17 | 9.5 | 15.83 | 36.17 | **Yng Aut** |
| | 53.09 | 20.36 | 14.73 | 6.73 | 2.8 | 2.81 | **Aut Ch** |
| | 62.4 | 24.30 | 9.00 | 3.00 | 0.70 | 0.40 | **Aut Adt** |
| **Sym obj.** | 25 | 39.65 | 16.79 | 6.19 | 8.21 | 4.17 | **3-4 years** |
| | 65.66 | 23.16 | 11.18 | 0 | 0 | 0 | **5-6 years** |
| | 59.89 | 27.81 | 9.74 | 2.60 | 0 | 0 | **MLD** |
| | 15 | 10.00 | 20 | 5 | 25 | 25 | **Yng Aut** |
| | 37.23 | 18.30 | 29.65 | 2.31 | 6.58 | 5.95 | **Aut Ch** |
| | 48.4 | 36.44 | 9.3 | 2.78 | 3.10 | 0 | **Aut Adt** |
| **M/S** | 38.48 | 16.67 | 26.67 | 6.06 | 0 | 12.12 | **3-4 years** |
| | 73.06 | 20.42 | 6.53 | 0 | 0 | 0 | **5-6 years** |
| | 67.27 | 11.67 | 10.15 | 10.91 | 0 | 0 | **MLD** |
| | 14.58 | 0 | 12.50 | 6.25 | 18.75 | 47.92 | **Yng Aut** |
| | 30.61 | 21.52 | 41.82 | 3.03 | 0 | 3.03 | **Aut Ch** |
| | 60.67 | 17.67 | 18.00 | 3.67 | 0 | 0 | **Aut Adt** |
| **Two-hand** | 43.80 | 26.10 | 15.15 | 5.37 | 1.58 | 7.99 | **3-4 years** |
| | 86.55 | 9.16 | 4.29 | 0 | 0 | 0 | **5-6 years** |
| | 71.69 | 19.63 | 7.85 | 0.83 | 0 | 0 | **MLD** |
| | 10.9 | 8.89 | 12.78 | 4.05 | 0 | 57.38 | **Yng Aut** |
| | 57.58 | 17.36 | 17.22 | 7.85 | 0 | 0 | **Aut Ch** |
| | 71.52 | 18.94 | 7.80 | 1.74 | 0 | 0 | **Aut Adt** |

**Figure 3.7: Median Scores and Interquartile ranges for four actions within the Two-handed actions category - All fingers touching, T-sign, peekaboo and grasp thumb.**

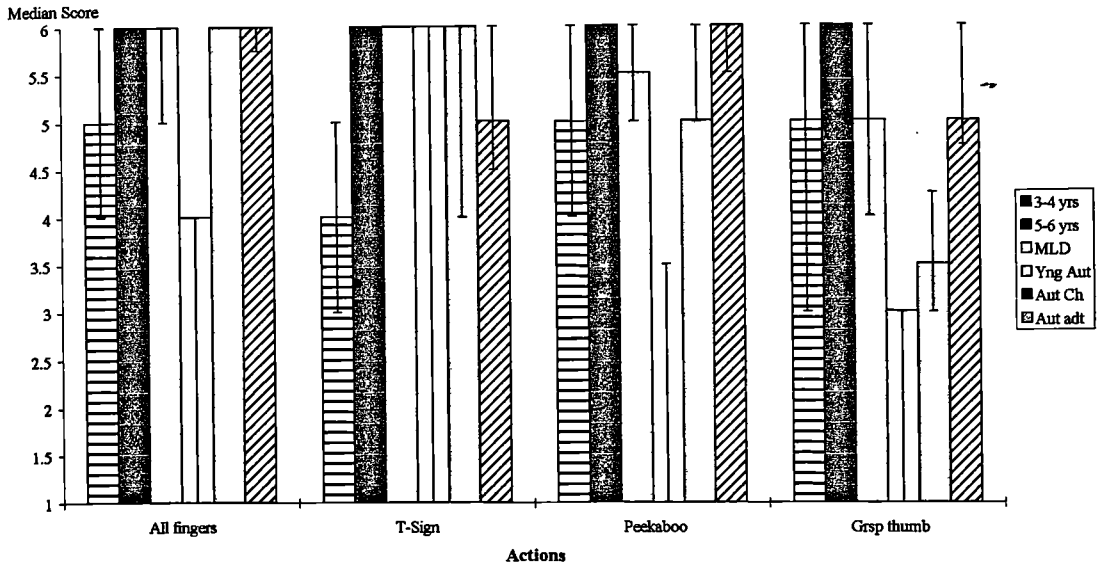



**Figure 3.8: Median Scores and interquartile ranges for four actions within the category of meaningful/symbolic actions - thumbs up, clean teeth, rope pull, brush hair.**

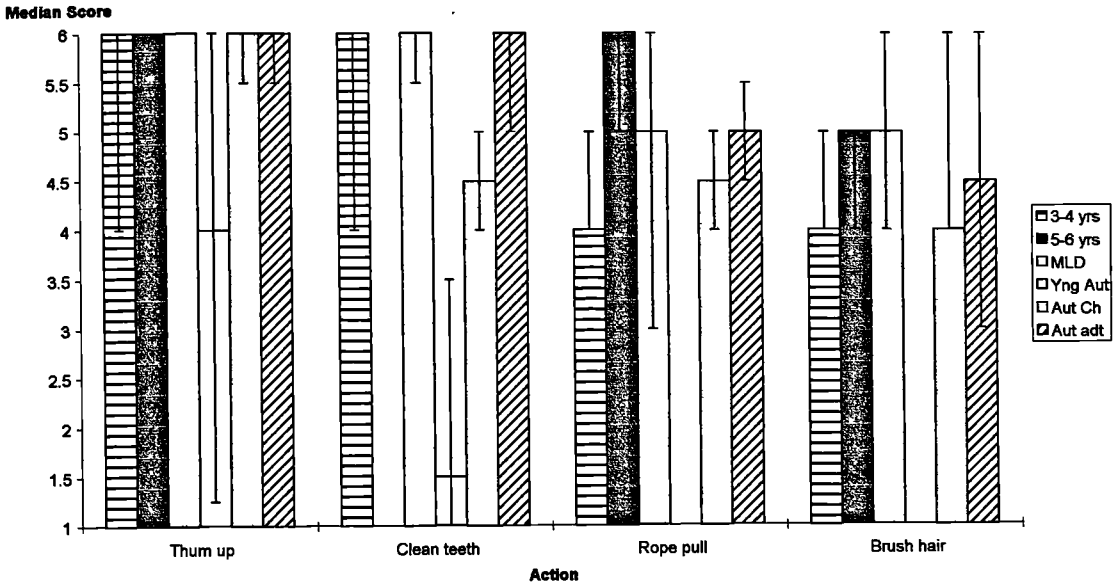
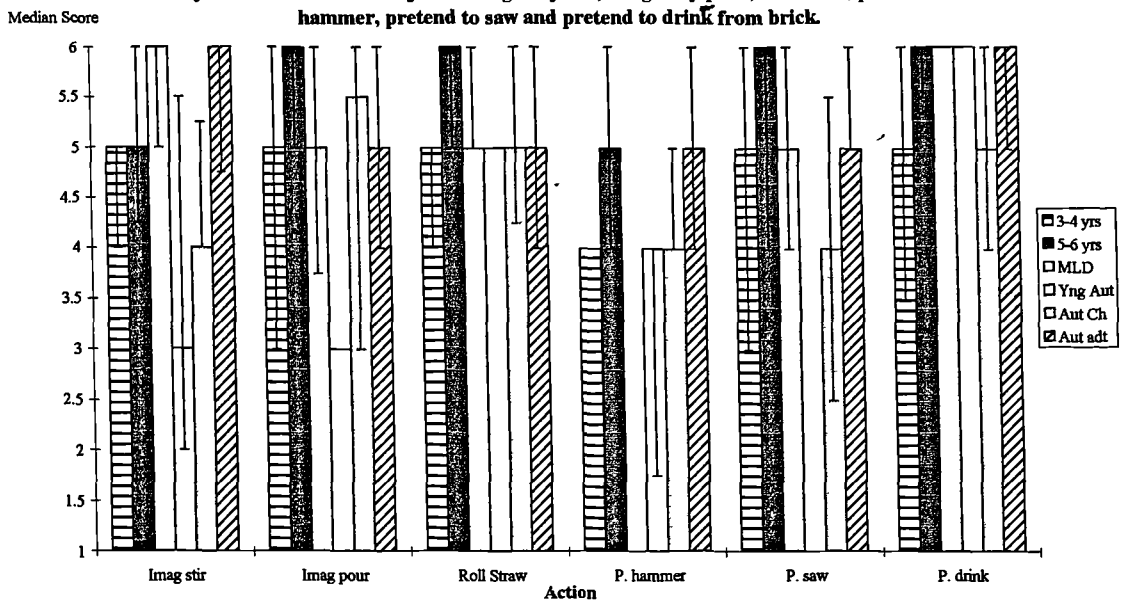


**Figure 3.9:Median Scores and Interqartile ranges for each group on six actions from the category of symbolic actions with objects - imaginary stir, imaginary pour, roll straw, pretend to hammer, pretend to saw and pretend to drink from brick.**




The action "grasp thumb" produced a significant difference between the 5-6 year olds and the autistic children. This is one of several actions where the most common mistakes were a *reversal* of either one hand or two hands. Examples of these reversals are described in Table 3.2 and are illustrated in photographs in Appendix 3.3. The other actions were Peekaboo and the two T-signs. Although all groups produced the same type of errors, the autistic children tended to do it more. However, as the results show, there was a significant difference only for grasp thumb and it is only the 5-6 year olds who show more than the autistic children. These actions are part of the category of two handed gestures.

If we compare the CA- and MA- matched subgroups (See Table 3.8 below for subgroups used) on just the actions within the three categories mentioned above, we find that when matched on CA the non-autistic group did significantly better on 1) T-sign (T) (K-W=4.70, p=0.03), 2) Okay sign (K-W= 5.55 p=0.018), 3) Mime brush teeth (K-W=7.2, p=0.007), 4) Mime rope pull (K-W=4.33, p=0.04), 5) Use tube as telescope (K-W=4.2 p=0.04) and 6) stir imaginary spoon in bowl (K-W=4.72 p=0.03). When matched on TROG there were no significant differences and, when matched on MA (BPVS), there was only one significant difference and that was on Grasp thumb (K-W=6.03, p=0.014).

Table 3.8: Medians and interquartile ranges for the autistic and non-autistic subgroups matched on CA, MA BPVS and TROG raw score, on those actions within the categories of two-handed actions (BGHH), meaningful/symbolic gestures (BGMS) and symbolic actions with objects (AOS), for which there was a significant difference.

| Category | Action | CA Autistic | CA non-Aut | MA Autistic | MA non-Aut | TROG Autistic | TROG non-aut |
|---|---|---|---|---|---|---|---|
| **BGHH** | T-sign (T) | 5 (4.75->6) | 6 (6) | 6 (5->6) | 6 (4->6) | 5 (3.25->5.75) | 6 (4->6) |
| | grasp thumb | 4 (3->6) | 6 (4->6) | 4.5 (3->5) | 6 (4.75->6) | 6 (5->6) | 6 (5->6) |
| **BGSM** | Okay | 4 (4->5) | 6 (5->6) | 5 (4->6) | 5.5 (4->6) | 5 (4->6) | 6 (5->6) |
| | Brush teeth | 5 (4->5) | 6 (6) | 5 (4->6) | 6 (5->6) | 5 (4->6) | 6 (5.5->6) |
| | Rope pull | 4 (4->5) | 6 (5->6) | 5 (4->6) | 5 (4.5->6) | 5 (4->5.5) | 5 (5->6) |
| **AOS** | Telescope | 5 (5->5) | 6 (5->6) | 5 (5->6) | 5 (5->6) | 5 (5->6) | 6 (5->6) |
| | Image stir - spoon. | 4 (4->5) | 6 (5->6) | 5 (4->6) | 5 (4->6) | 5 (4->6) | 5.5 (5->6) |

To verify these results, a second type of analysis was carried out on the individual categories. When each of the 78 actions was recoded using a strict definition of imitation (the child had to score 6 to be said to be imitating), a chi-square analysis showed a high tendency for imitation across all groups, i.e. significantly more children succeeded than failed. For 25 actions all groups exceded this criterion ($p<0.01$). For 6 actions, all children imitated below this criterion (i.e for

these actions more subjects failed than succeeded: these were Finger Wiggle, Mime Rope Pull, Mime combing hair, Roll and Flick, Operate Hinged flap and Pretend to hammer - these actions were scored very stringently, in that, for example the correct finger had to be used to score a 6 on the hinged flap and rolling and flicking a piece of paper was a difficult action for most of the children in all groups).

However, when a slightly less stringent definition of imitation was taken, so that the child could be said to have imitated if they scored a six or a five, then these differences were eradicated. Almost all children in all groups could imitate at this level. A large number of post-hoc tests would be required to analyse this comprehensively and would not tell us much more than the Kruskal-Wallis analysis already reported above. Instead chi-square posthoc analysis will be reported just for those actions which on the Kruskal-Wallis analysis were significant at 0.05 but not at 0.01 level. There were 12 of these actions from a mixture of categories and these results are presented for all groups in Table 3.9 below.

Table 3.9 Summary of chi-square analyses on those actions significant at 0.05 level on the Kruskal-Wallis analysis but not at the 0.01 level. The analyses were performed at three levels: (1) Imitation = Score of 6, (2) Imitation = Score of 5 or 6, and (3) Imitation = Score of anything between 3 and 6. (* denotes chi-square significance of 0.01, ** denoted significance of 0.001; N/S = not significant)

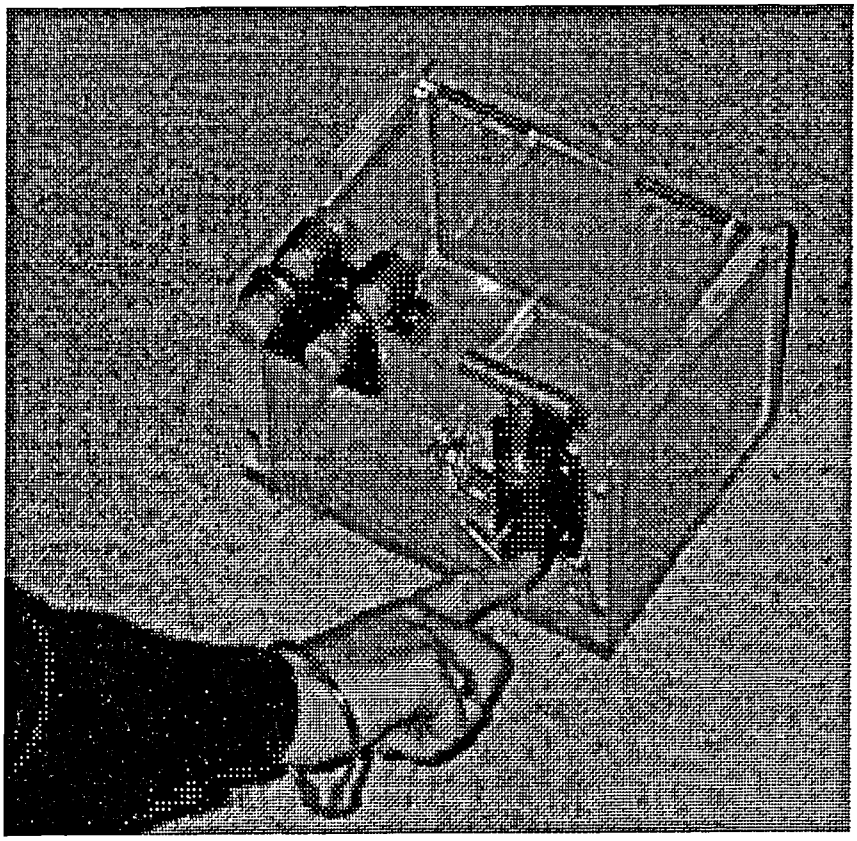
| Action | Level 1 (Score 6) | Level 2 (Score 5 or 6) | Level 3 (Score 3-6) |
|---|---|---|---|
| **"Oh dear!"** | 5-6>3-4 ** | 5-6 > 3-4 * | N/S |
| **"Hello, how are you? "** | MLD > autistic * | N/S | N/S |
| **Cough** | 5-6 > 3-4 yr old *<br>MLD > 3-4 *<br>Aut > 3-4 ** | N/S<br>N/S<br>N/S | N/S<br>N/S<br>N/S |
| **All fingers touching** | 5-6 > 3-4 yr old *<br>5-6 > young aut **<br>Aut > 3-4 *<br>Aut > young aut ** | 5-6 > 3-4 *<br>5-6 > young aut *<br>N/S<br>Aut >young aut ** | N/S<br>N/S<br>Aut>young aut * |
| **Grasp foot** | N/S at 0.01 | N/S | N/S |
| **Jump** | 5-6 > 3-4 *<br>5-6 > young aut * | N/S<br>N/S | N/S<br>N/S |
| **Okay sign** | 5-6 > 3-4 **<br>MLD > 3-4 * | 5-6 > 3-4 **<br>MLD>3-4 * | N/S<br>N/S |
| **Draw line on paper** | 5-6 > 3-4 *<br>MLD > 3-4 **<br>MLD >young aut *<br>Aut > 3-4 **<br>Adults > 3-4 **<br>Adults>young aut * | N/S | N/S |
| **Bang Spoons** | 5-6 > 3-4 **<br>5-6 > young aut *<br>Aut > 3-4 * | N/S | N/S |
| **Play xylophone** | 5-6 > 3-4 ** | N/S | N/S |
| **Ball to box** | 5-6 > young aut **<br>Adt > young aut **<br>3-4 > young aut *<br>Aut > young aut * | N/S<br>Adt>young aut **<br>N/S<br>Aut>young aut ** | N/S<br>Adt>young aut *<br>N/S<br>Aut>young aut * |
| **Stir Imag spoon** | 5-6 > 3-4 *<br>MLD > 3-4 ** | N/S | N/S |

...

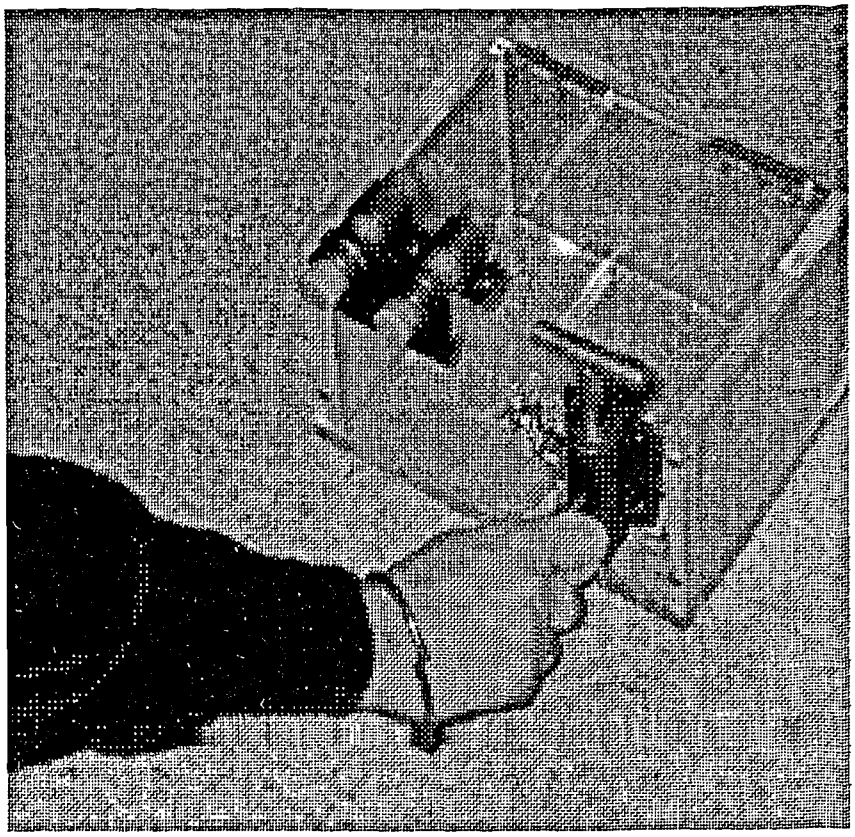
For the most part, then, reducing the pass level for imitation wipes out the group differences or at least reduces the significance level. On none of these actions do the autistic children or adults perform worse than any of the control groups. In fact, the two older autistic groups often perform significantly better on many tasks than both the 3-4 year olds and the young autistic children. This analysis therefore supports the results from the Kruskal-Wallis tests in that the older autistic children and adults do not show deficits on imitation of most actions even at a lower significance level of 0.05.

# Appendix 4.1

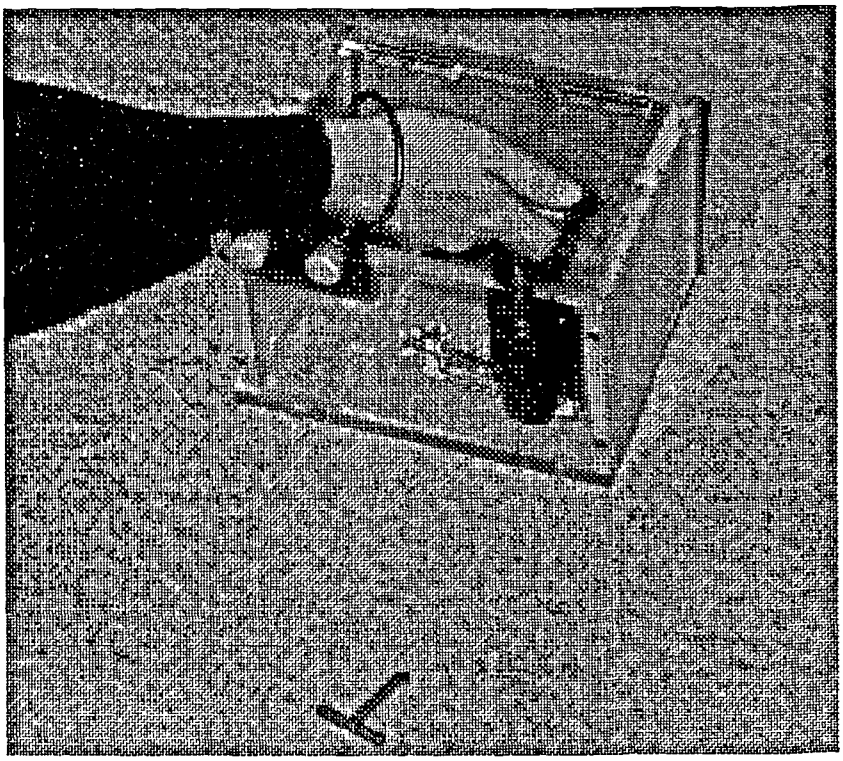
**1) Each of the two possible actions on each of the component of the plastic fruit, as modelled by the experimenter.**



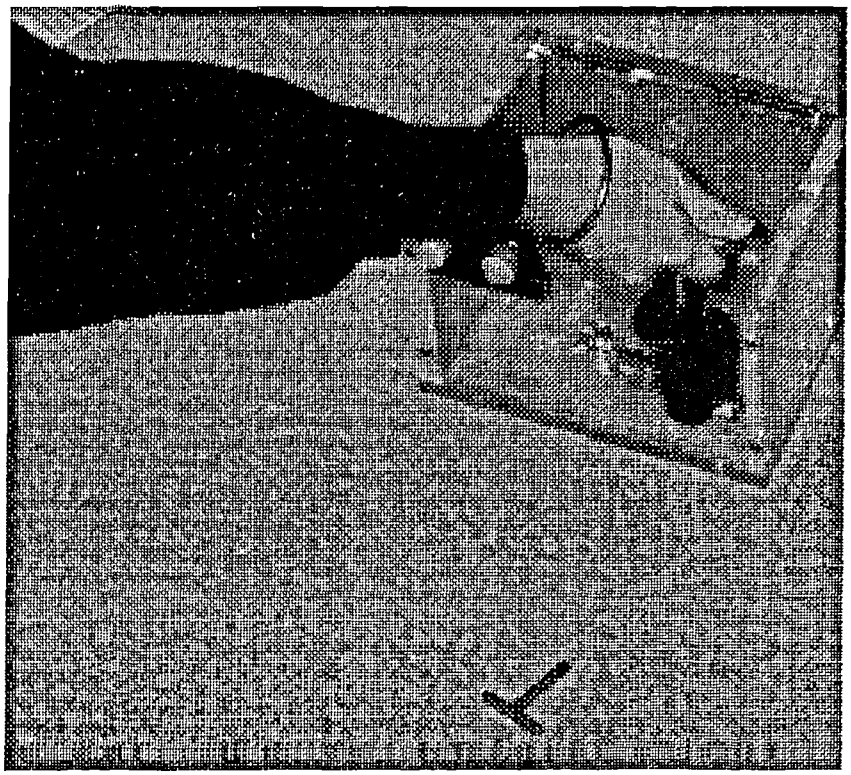
Spinning the pin



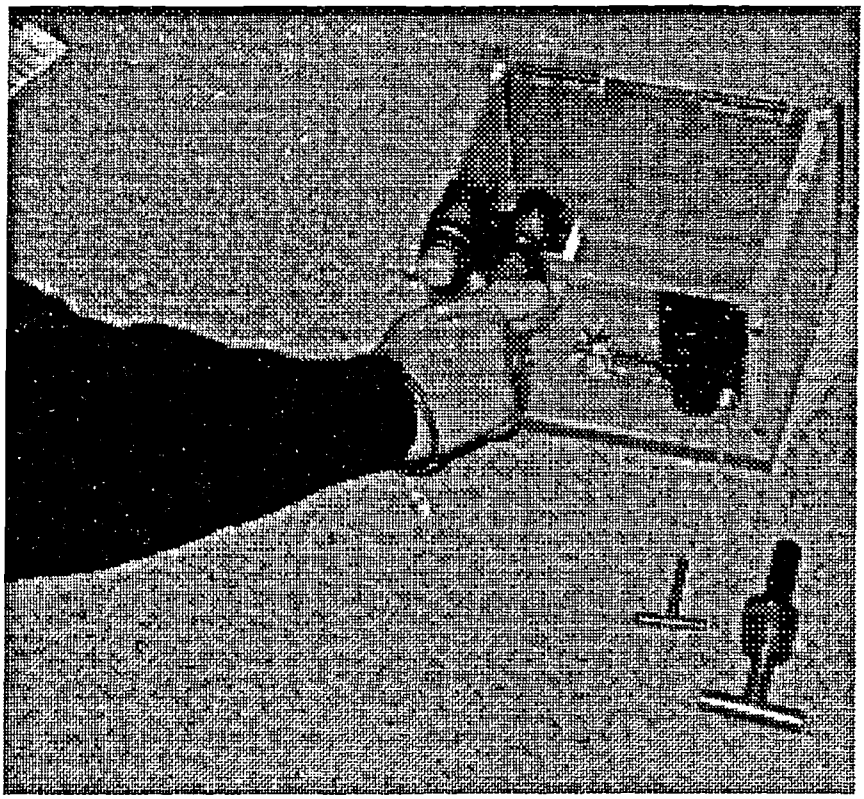
Turning the pin



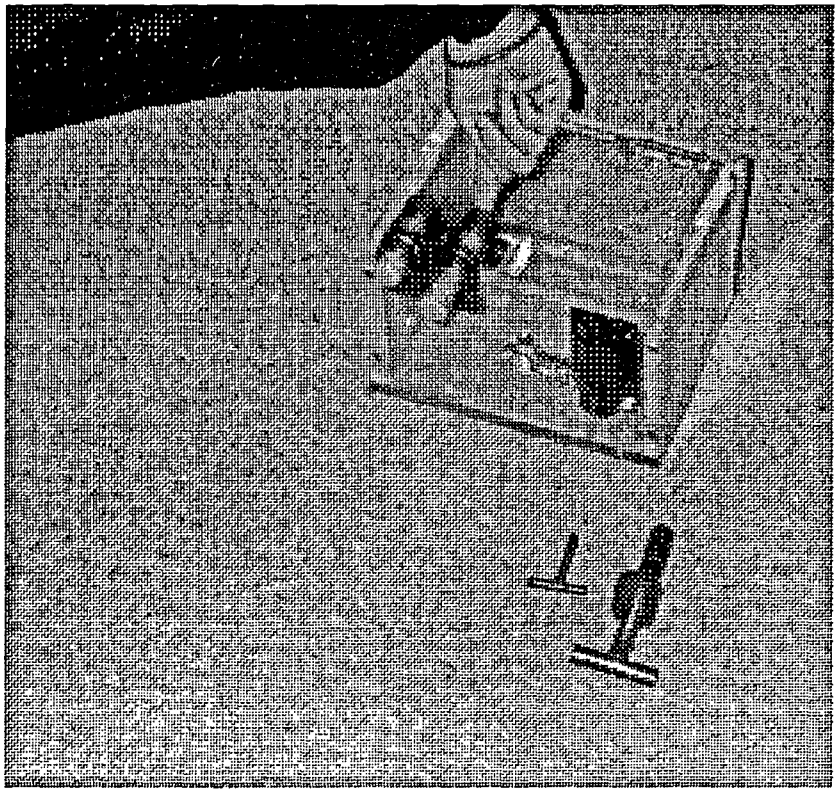
Pulling the handle



Turning handle 180° and pulling out



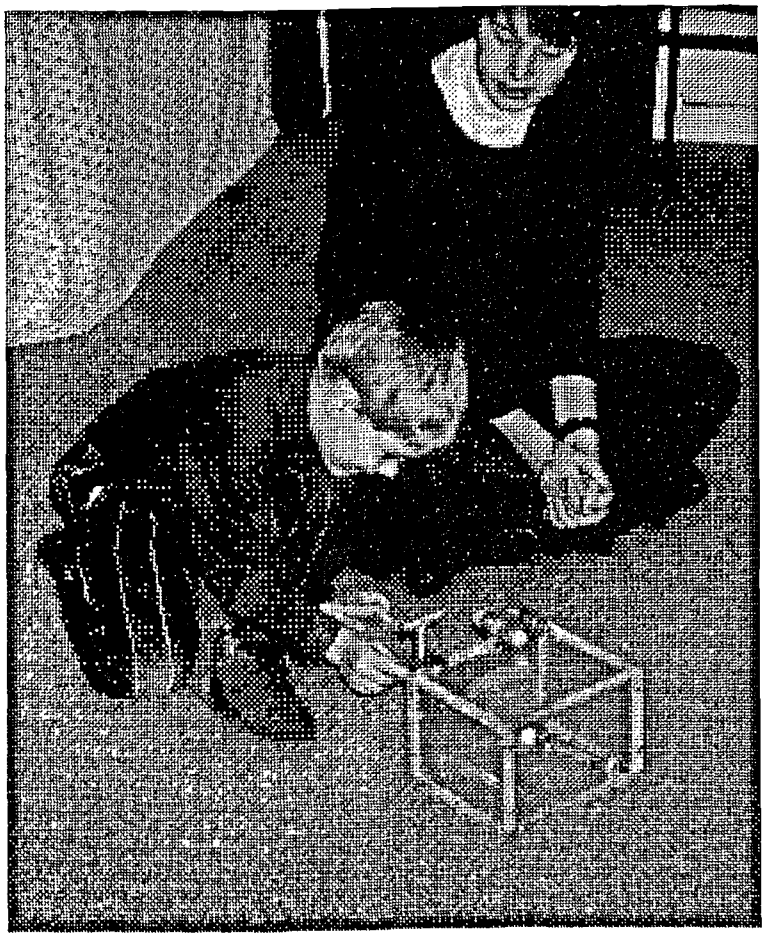
Twisting bolts



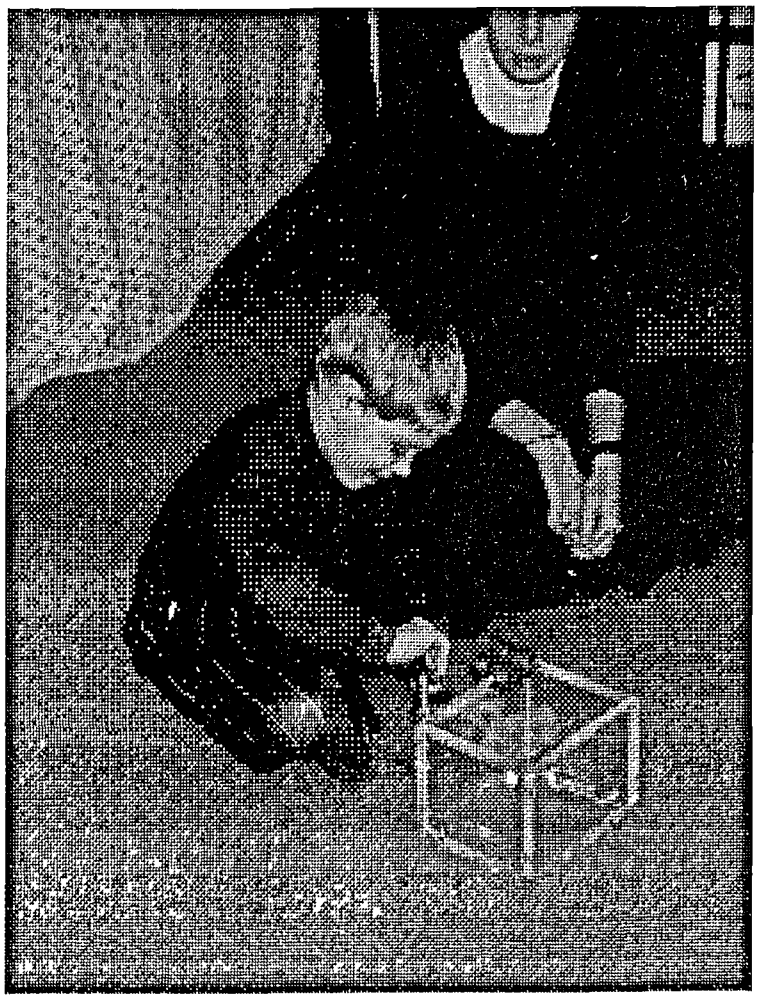
Poking bolts

## Appendix 4.2

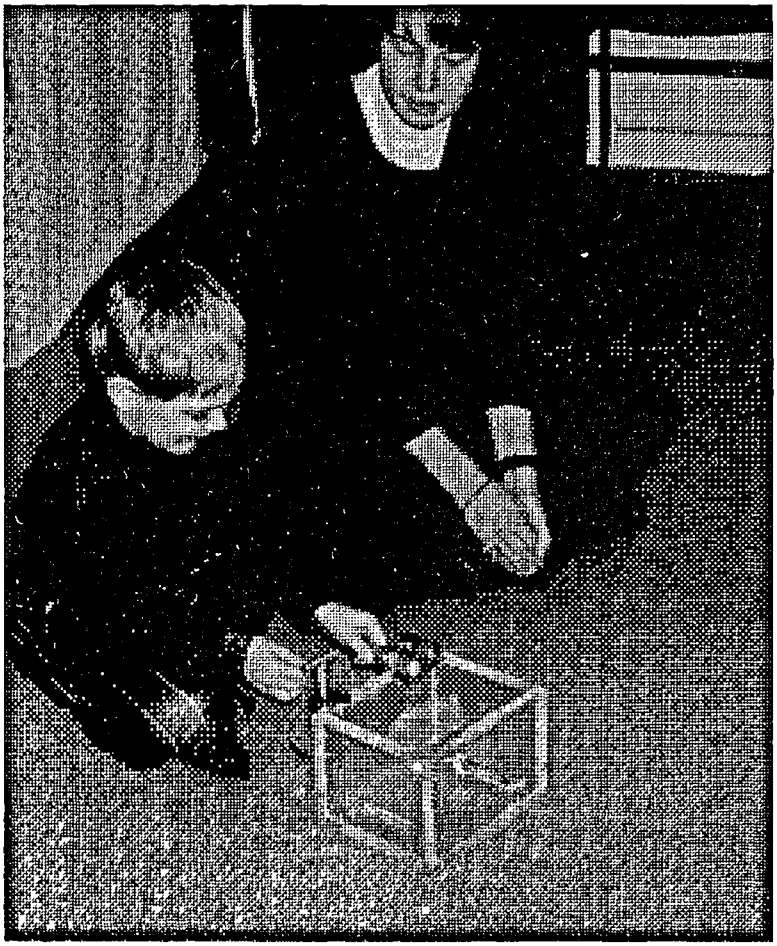
**2) The box being opened by a normal 3-4 year old boy, who was shown spin, turn and twist method.**



Spinning the pin



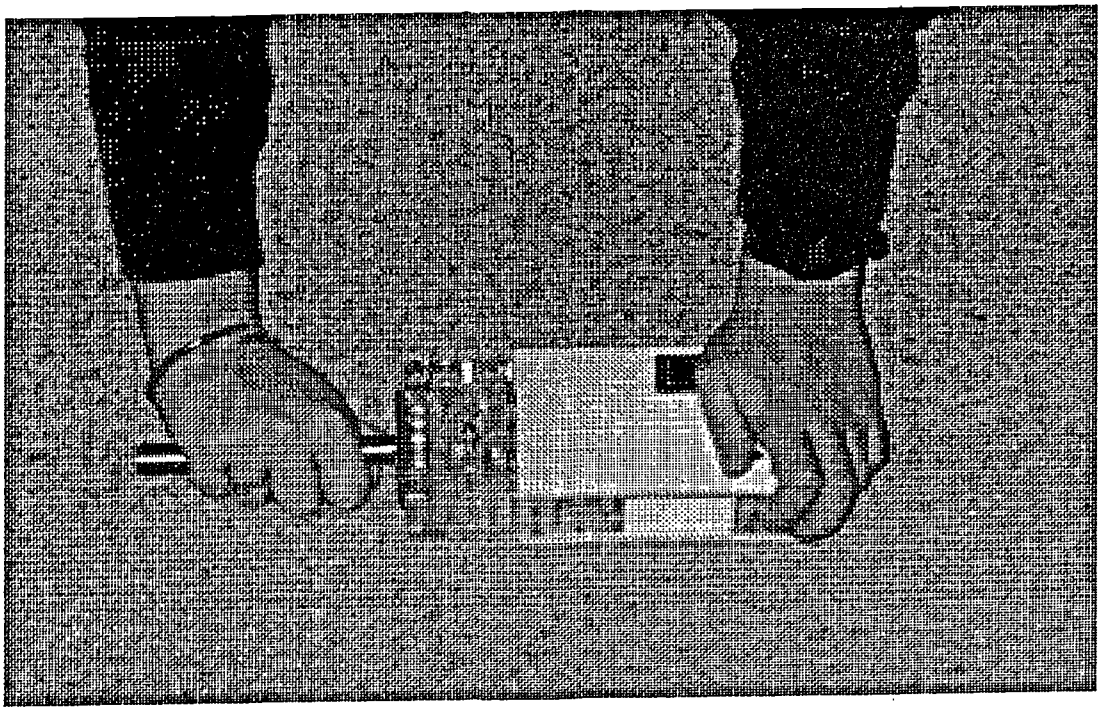
Turning the handle



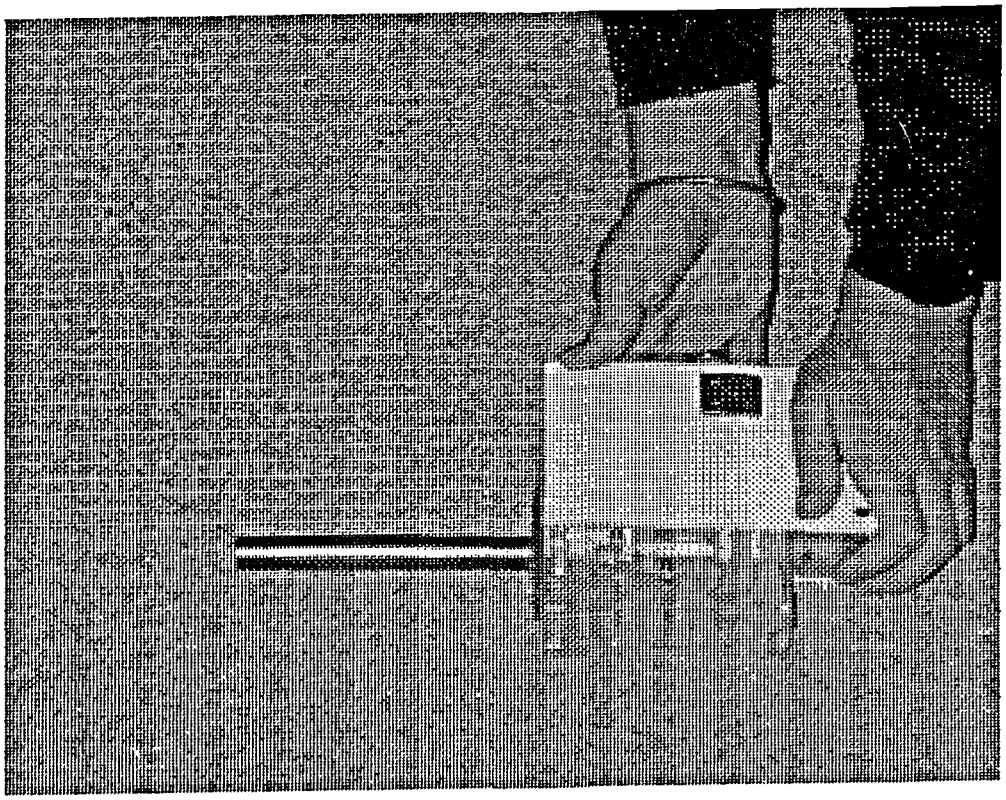
Twisting the bolts.

# Appendix 5.1.

Photographs of each of the two actions on the drawer - 1) Wiggle and Pull



2) Push to Side



# Appendix 7.1

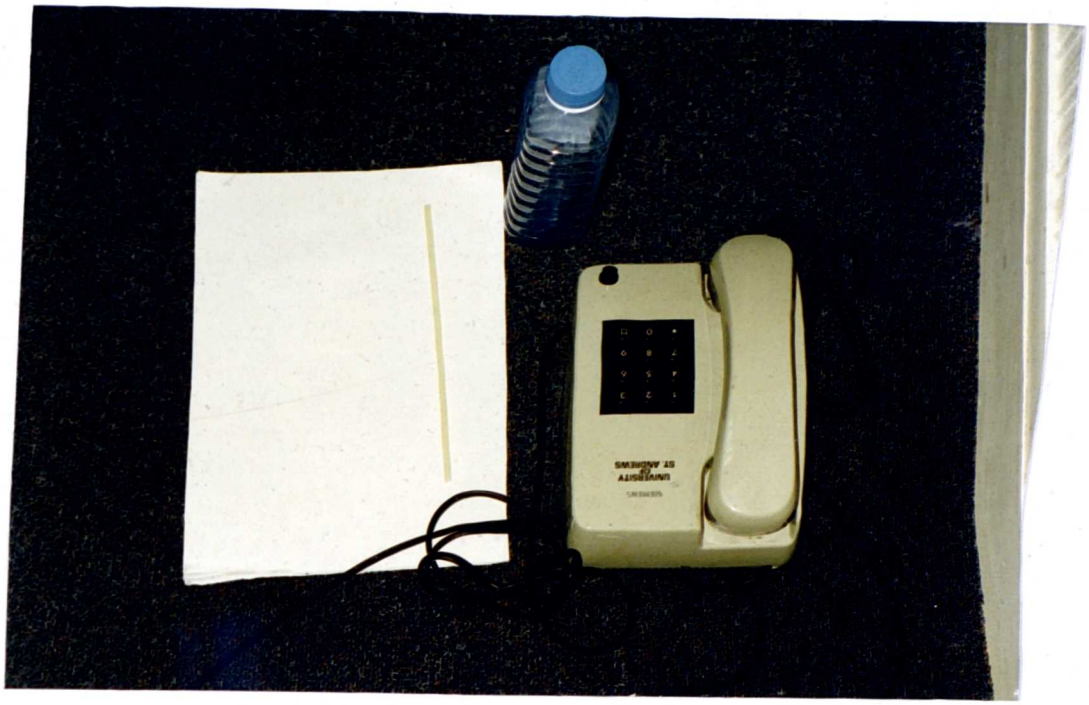
List of objects to be used and the instructions to be given to the children (This depends what the children produce in the preceding conditions. However, at least one instruction per set of objects will be given to all children) S = predominantly symbolic activity, F = predominantly functional activity, F/S = both interpretations are possible:

| | |
|---|---|
| Set 1: car,<br>shoebox,<br>piece of card<br>wooden block<br>Roadway<br>Petrol pump | Can you show me:<br>how to park the car in the garage (S)<br>how the car goes up the ramp (S)<br>how the car drives along the road (F)<br>how the car fills up with petrol. (F) |
| Set 2: toy animals<br>blocks<br>fence<br>box<br>straws and string<br>Tree | the dog chases the horse (F/S)<br>The horse jumps the hedge/wall (F/S)<br>the lions sleep in their cage (S)<br>the monkey swings in the trees (F/S) |
| Set 3:<br>doll<br>toy saucepan<br>basin<br>spoon<br>sponge cubes<br>tin box with lid | how dolly eats her dinner off a plate(F/S)<br>how dolly washes her face (F/S)<br>how dolly plays the drum (S)<br>how dolly stirs the soup in the saucepan. (F) |
| Set 4: paper<br>straw<br>telephone<br>Empty coke bottle | how you answer the telephone (F)<br>and write down a message for me. (S)<br>how to drink from the bottle with a straw (F)<br>how you pour me a drink of coke (S) |

1) Objects for Set 1
(piece of card missing)

2) Objects for Set 2

3) *Objects for Set 3*




4) *Objects for Set 4*

# Appendix 7.2

List of objects and instructions for the adults and older children:

| | |
|---|---|
| | You are an actor/actress - these are your props - Show me how..... |
| Set 1: paper | You would paint a picture if you were an artist (F/S) |
| paintbrush | |
| plate | you would throw a frisbee for your dog to catch. (S) |
| doll | |
| cloth | you would wash the dishes. (F/S) |
| squeezy bottle | you would wash the baby's face (F/S) |
| basin | |
| Set 2: hairbrush | you act as a singer on stage and use your microphone(S) |
| tape recorder | you would make the tape deck work (F) |
| cassette | how you play the xylephone in the band(F) |
| musical instrument | how the conductor conducts the orchestra.(S) |
| straw | |
| Set 3: scarf | you act an old lady (F/S) |
| hairbrush | How you look through your telescope, is you were a sailor (S) |
| ball | |
| stick | you would signal for help if you were a sailor (F/S) |
| frying pan | you would play tennis.(S) |
| Set 6: frying pan | how you would be a chef and cook me dinner (F/S) |
| coke bottle | |
| blocks | how you would drink coke on a picnic (F) |
| straws | how you pour me a drink of coke (F) |
| spoon | how you clean up the spilt coke. (F/S) |
| cup and saucer | (Experimenter having pretended to spill coke). |
| toilet roll tube | |
| sponge pieces | |
| tin box with lid | |

# Appendix 7.3
# Other results from the play experiment.

In addition to the results presented in the main part of Chapter 7, the following data was also collected.

a) Number of actions per minute.

b) Number of objects per minute.

c) Time per object.

d) Time per action.

e) Percentage of total number of actions, accounted for by each type of action - manipulative, relational etc.

Is there a novelty effect?

In order to examine the effects of the children being allowed to familiarise themselves with the objects and situation and any novelty effect that might exist, it was essential to compare the play produced by the groups in the first two sessions. When all children were included, there was significantly more functional play in the second session than in the warm-up session (Wilcoxin, $z = -2{,}64$ $p<0.01$). This pattern was reflected in the results for the 5-6 year old children who also showed more functional play in the second session than the warm-up session ($z = -2.37$, $p<0.02$). When the collapsed autistic and non-autistic groups were compared, there was only one difference that was significant and that was for the non-autistic children, who produced less manipulative play during the second session than they had during the warm-up session ($z = -2.98$, $p<0.01$). This can be accounted for by the results when each individual group was examined - the 3-4 year olds and 5-6 year olds showed less manipultive play in the second session than they did in the first session ($z =-2.24$, $p<0.02$ and $z = -2.37$, $p<0.02$ respectively). The 5-6 year olds also played for a higher percentage of the total time available during the second session compared to the first ($z = -2.37$, $p<0.02$). Finally, the autistic children also played for a higher percentage of the total time available, during the second session, when compared to the warm-up session ($z = -2.7$, $p<0.01$).

Further measures of the quality of play.

**Figure 7.5: Objects used in both freeplay sessions by each group, expressed as a percentage of the total number of objects used in the second freeplay session. The percentage values here represent the medians for each group (and interquartile ranges).**

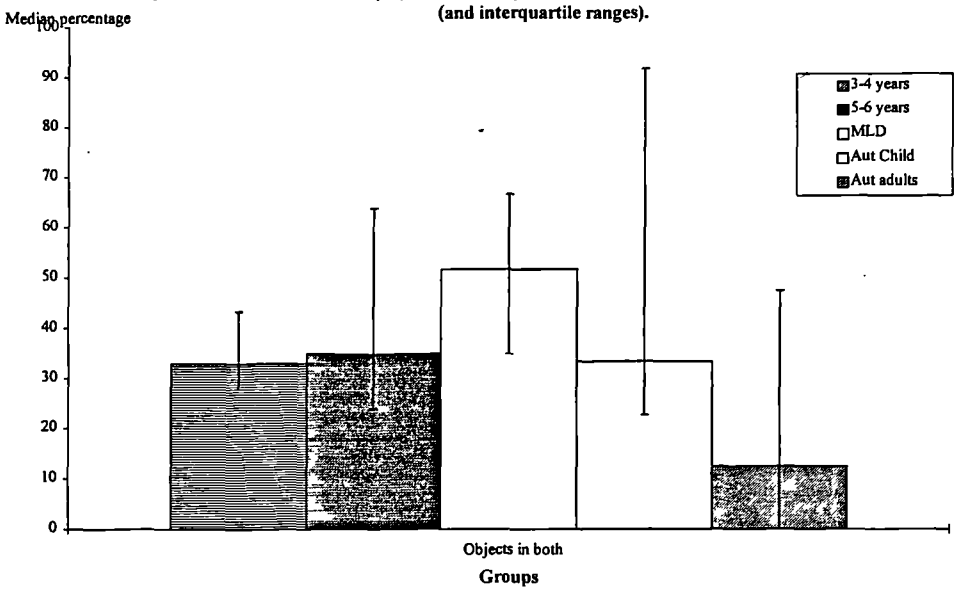



Figure 7.5 illustrates the percentage of objects used in second freeplay session that were also used in the first freeplay session. The percentages were not very high for all groups, and when tested using a Kruskall-Wallis, the only significant difference was between the clumped autistic and non-autistic groups and only at the 0.05 level - the non-autistic children showed more repetition of objects than the autistic children (K-W=4.82 $p<0.05$). The MLD showed a slightly higher tendency for repetition of this nature, but no significant differences were found.

Figure 7.6: Median number of objects and actions per minute and interquartile ranges for the warm-up and second freeplay sessions.

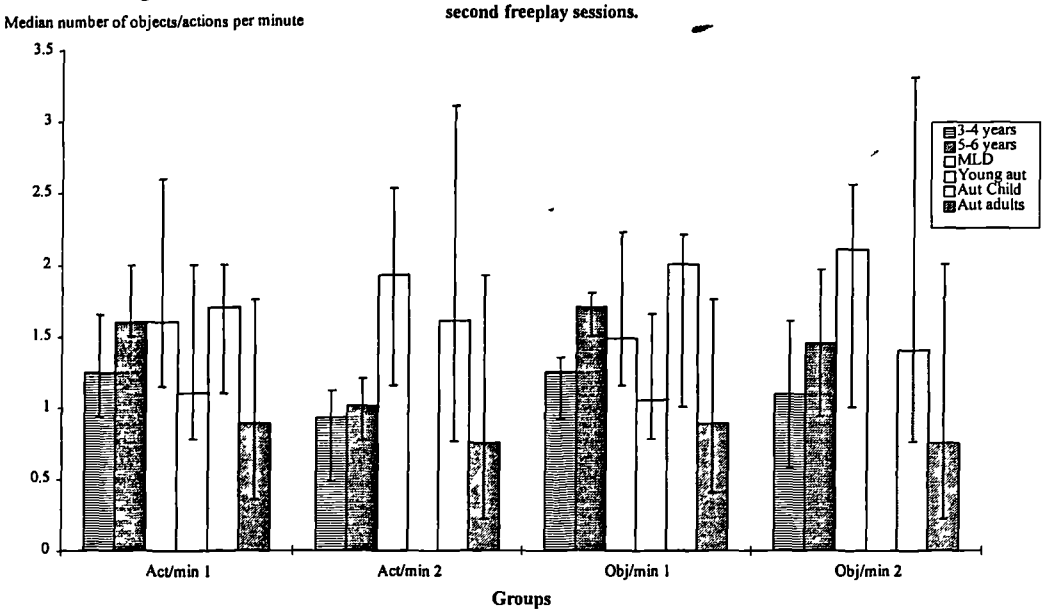
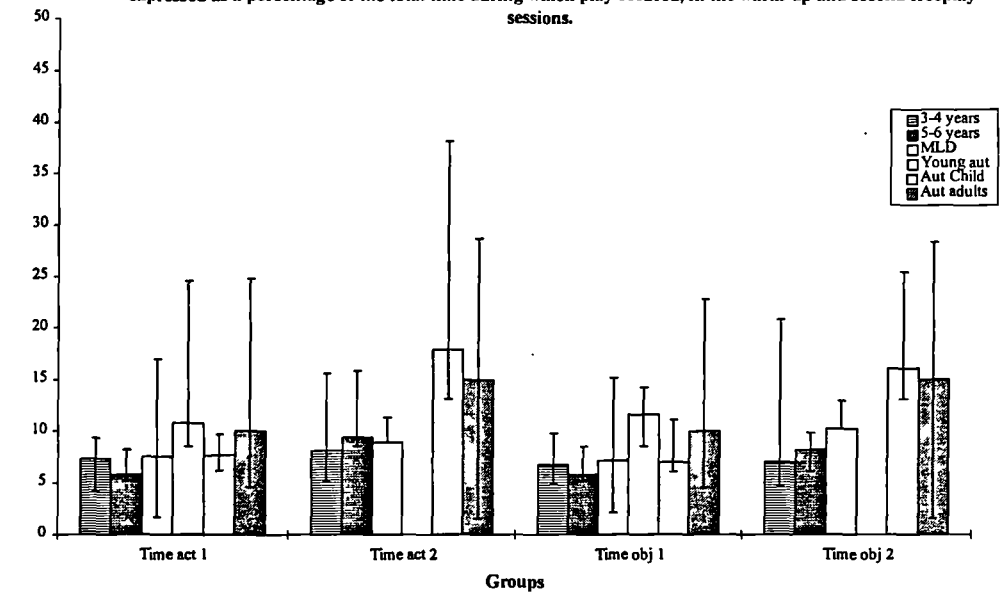



Figure 6.7: Group medians (and interquartile ranges) for the average time spent on each action and each object, expressed as a percentage of the total time during which play occured, in the warm-up and second freeplay sessions.




A comparison of the number of actions and objects used,and the time spent on each action or object, was carried out to provide another index of the quality of the play being engaged in. Figures 7.6 and 7.7 illustrate these results. All groups performed fairly similarily on each measure. Although not significant for the warm-up session, the time spent on each action and object was less for the non-autistic groups than for the autistic groups. On the second freeplay, the autistic children spent longer on each object than the 5-6 year old children, although only at the 0.05 level (K-W=11.04). The clumped autistic group also spent longer on both objects and actions

than the non-autistic group (K-W = 8.20 $p<0.01$ and K-W = 7.94 $p<0.01$ repectively). When MA and TROG score were controlled for, these differences still remained at the 0.05 level.

Additional results from the elicited session:

It is interesting to compare the performance on the types of play to those produced in the warm-up and freeplay sessions. Firstly, the percentage of total time engaged in play - when all children were used in the comparison there was a significant difference between the elicted session and the warm-up session, with the children playing for a higher percentage of time in the elicited session than in the freeplay session (Wilcoxin $z = -2.87$, $p<0.01$). This pattern is echoed when the comparison is carried out for the autistic children alone ($z = -3.51$ $p<0.0001$). This can be accounted for by both the autistic children and the autistic adults, who both played for a higher percentage of the time available during the elicited than they had during the first freeplay session.

When manipulative play was examined across all children there was significantly less manipulative play in the elicited session than in the first freeplay session ($z = -2.71$ $p<0.01$) and this can be explained by the non-autistic children's tendency in this direction ($z = -2.4$ $p<0.02$). This in itself is attributable mainly to the 5-6 year old children ($z = -2.37$ $p<0.02$). Functional play did not show any significant difference between elicited play and either of the freeplay sessions and the same was true of functional/symbolic behaviour.

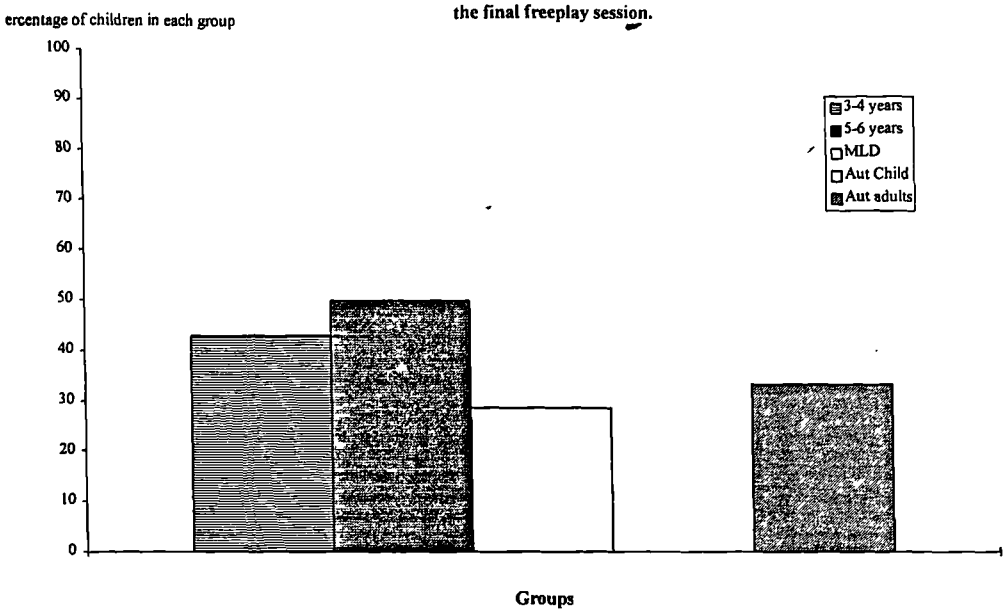
So to summarise these results - is there a novelty effect? Yes, there does seem to be a novelty effect for both autistic and non-autistic groups. Overall there was significantly more manipulative play produced on the first, warm-up session than on the second freeplay and the elicited conditions. There was also more symbolic play and functional/symbolic play on the elicited situation than on the preceding sessions, but this effect was stronger for the non-autistic groups than for the autistic groups. What was significant was that the autistic children played for a longer time on the second session than the first, warm-up session. There was also a slight tendency towards less functional play on the second freeplay session than the first.

Third Freeplay Session:

There was only one significant difference at all and that was at the 0.05 level, between the autistic group and the non-autistic group on the amount of time spent on each object, which was longer for the autistic than non-autistic group (K-W=6.28 $p<0.05$). This difference remained when the children were matched on MA and TROG raw score. This ties in with the observation that most of the oldest children and the autistic children only played with one object in this session, or did one action (and they often did this until the experimenter stopped them). They usually chose an object that they had seemed to enjoy using before, or that they had shown an interest in during the freeplay sessions.

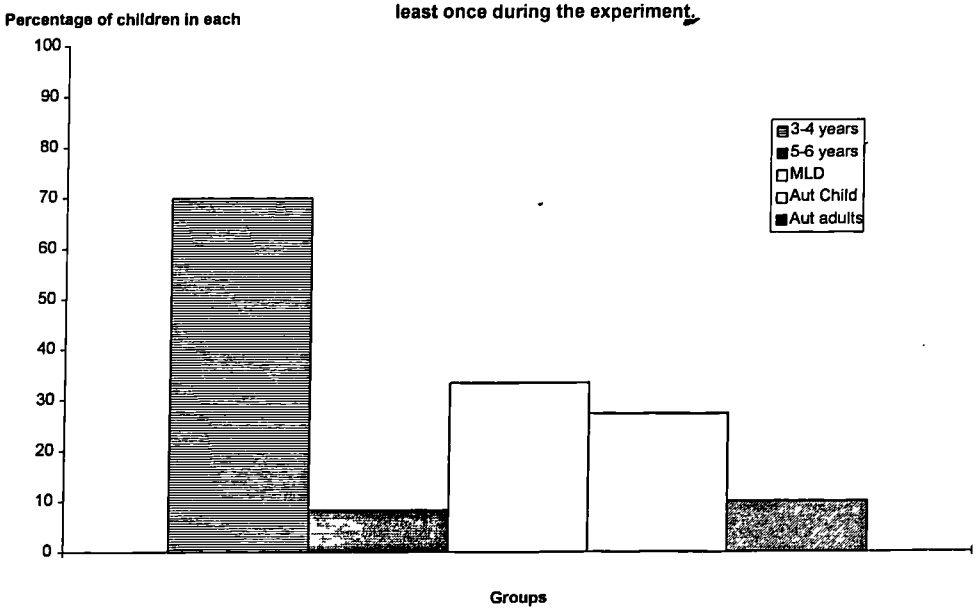
It was thought that it would be interesting to look at whether one group more than another reproduced actions seen, or ressembling those seen, in the instructed/elicited sessions. Considering all children there was no significant difference between the number of children who did and and the number who didn't reproduce any actions from the session before. Within the autistic groups fewer autistic subjects reproduced actions from previous sessions than did not ($X^2 = 4.45$ $p<0.05$). There were no other group differences. When the comparison was carried out between groups there were no significant group differences at all. Figure 7.12 illustrates these results.

**Figure 7.12: Percentage of children in each group producing actions from the elicited and instructed sessions in the final freeplay session.**



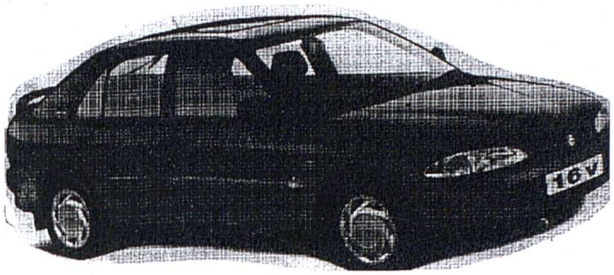

Finally, Figure 7.13 illustrates the percentage of children in each group who involved the experimenter in their play, other than talking to her or showing an object. As can be seen, the 3-4 year olds involve the experimenter in their play, most often, although the autistic children did so more than might be expected. On a Fisher Exact test, the difference between the 3-4 year old group and the 5-6 year old was shown to be significant ($p<0.01$) as was the difference between the 3-4 year old group and the autistic adults ($p<0.01$). The differences between the 3-4 year olds and the MLD children and the autistic children were not significant at the 0.05 level.

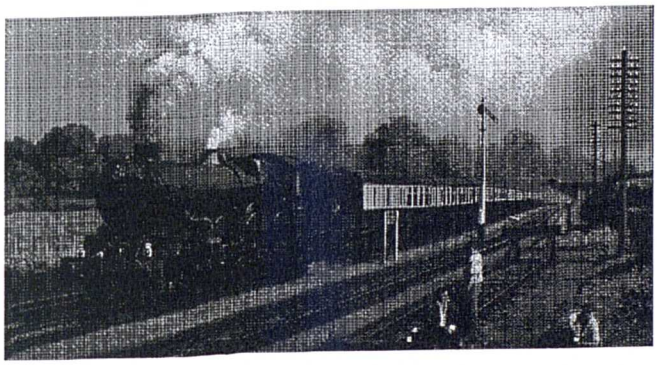
**Figure 7.13: Percentage of children in each group who involved the experimenter in their play at least once during the experiment.**

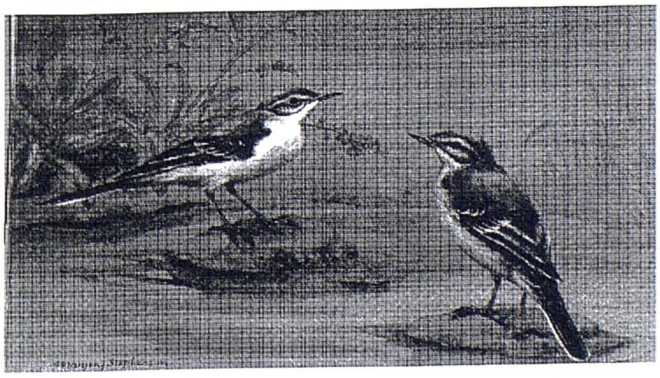


# Appendix 8.1

1) Pictures used as control stimuli.







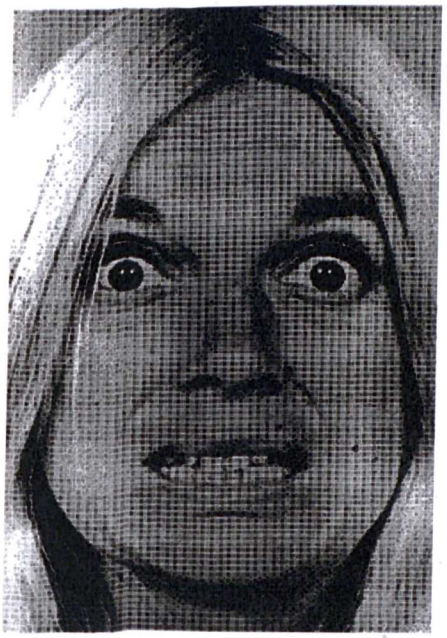
2) Photographs of Facial Expressions, taken from Eckman and Friesen (1975) as used in Phase 1 of emotion perception experiment.

NEUTRAL


HAPPY

SAD

ANGRY



FRIGHTENED


SURPRISED


DISGUSTED

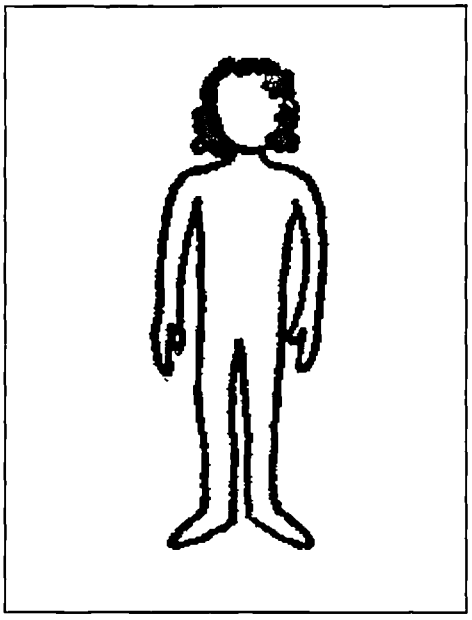
# Appendix 8.2

Sounds used to test recognition of emotion. These were recorded by an adult female completely unknown to all subjects and were presented in the order shown below.

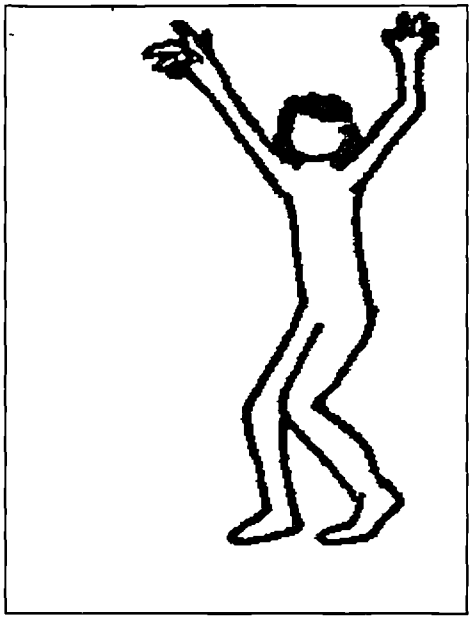
| Sound | Emotion |
|---|---|
| 1) laugh | Happy |
| 2) crying | Sad |
| 3) trembling sound | Frightened |
| 4) angry grunt | Angry |
| 5) "yuck!" | Disgusted |
| 6) whistle | Happy |
| 7) "ooh!" | Surprised |
| 8) angry mumbling | Angry |
| 9) sigh | Sad |
| 10) "wow!" | Surprised |
| 11) "eueueugh!" | Disgusted |
| 12) scream | Frightened. |

## Appendix 8.3

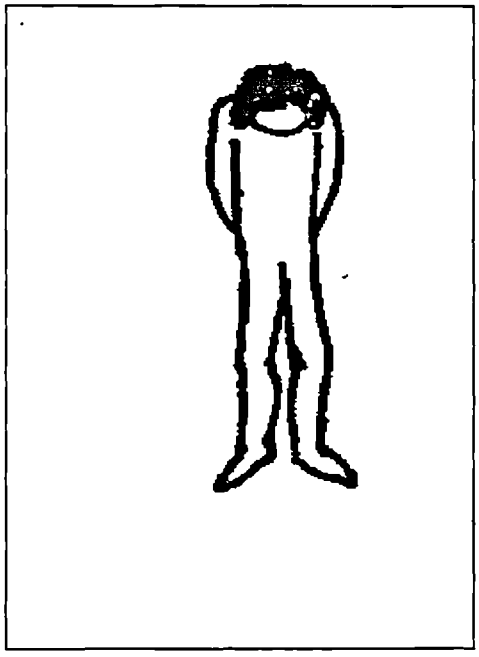
Pictures of gestures used to test understanding of gestural clues to emotions.



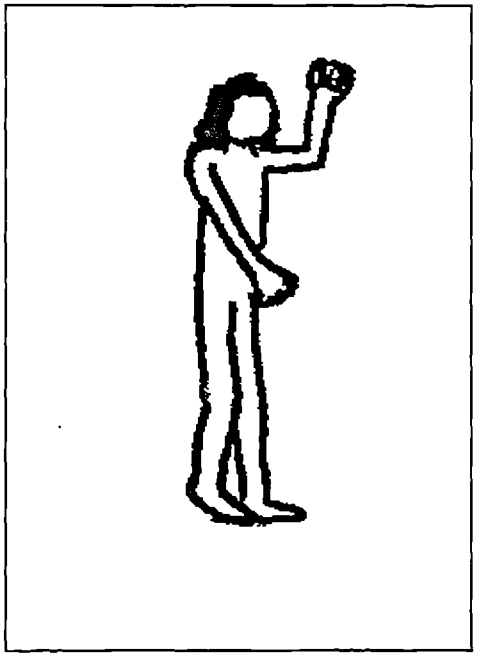
NEUTRAL



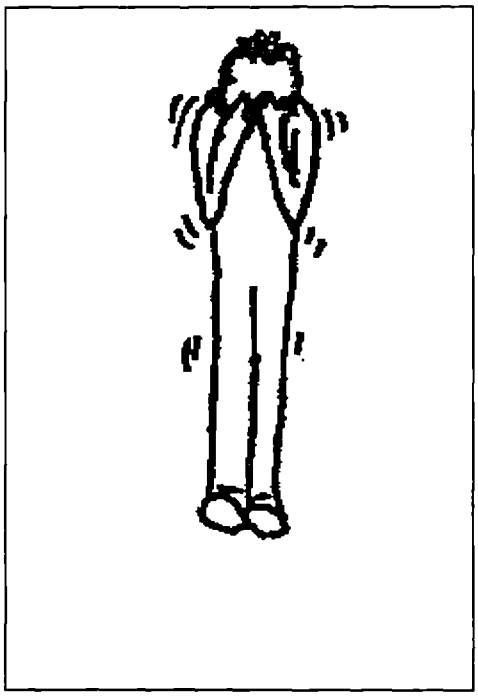
HAPPY



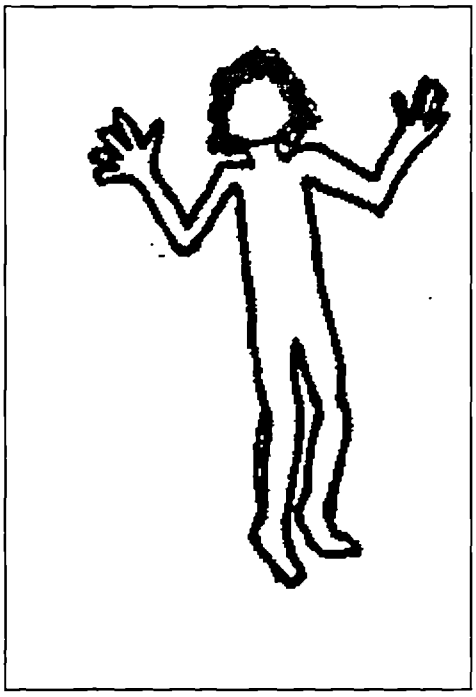
SAD



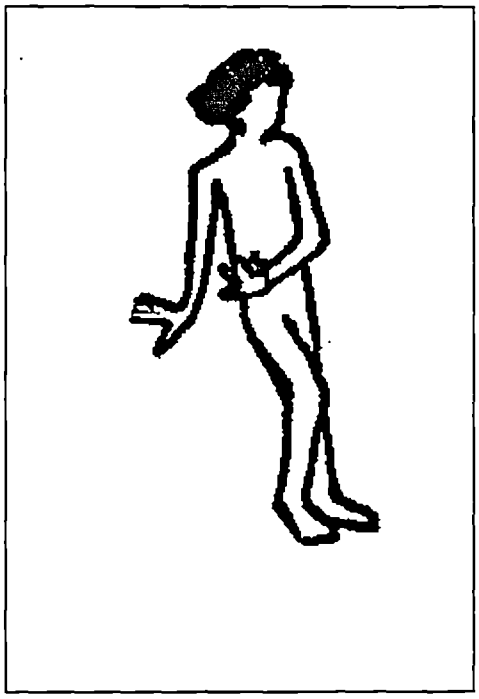
ANGRY



FRIGHTENED



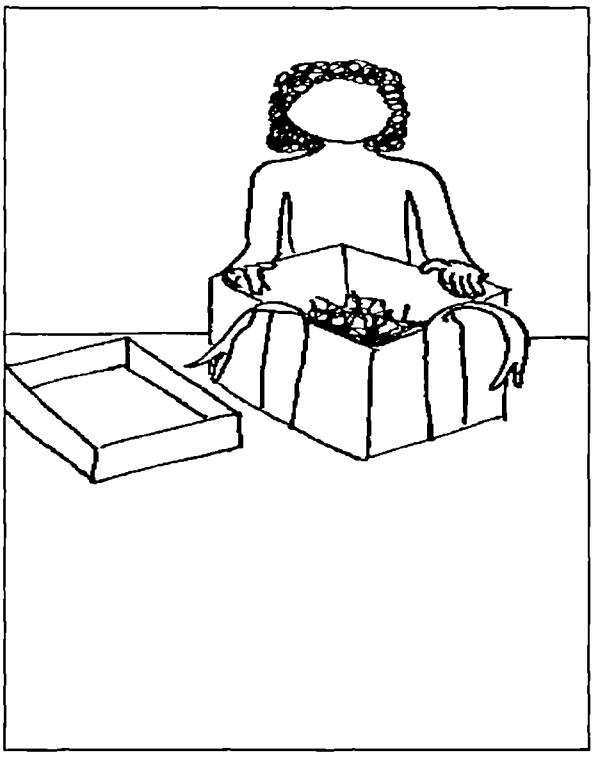
SURPRISED



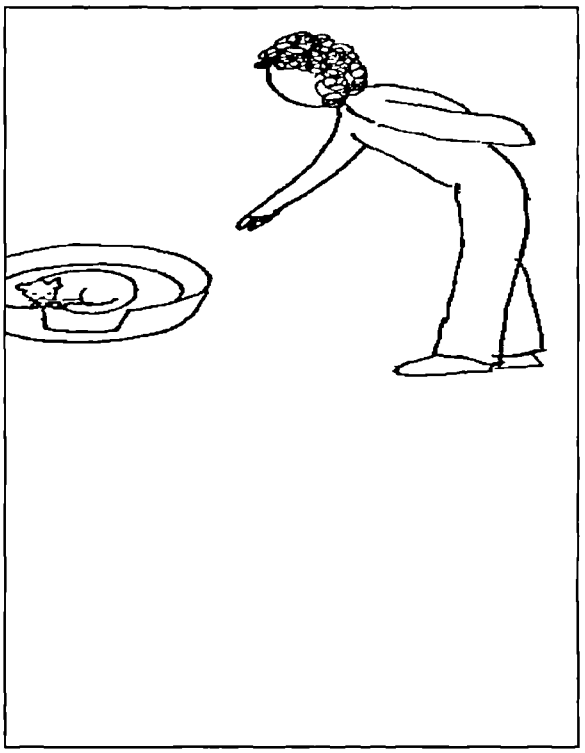
DISGUSTED

# Appendix 8.4

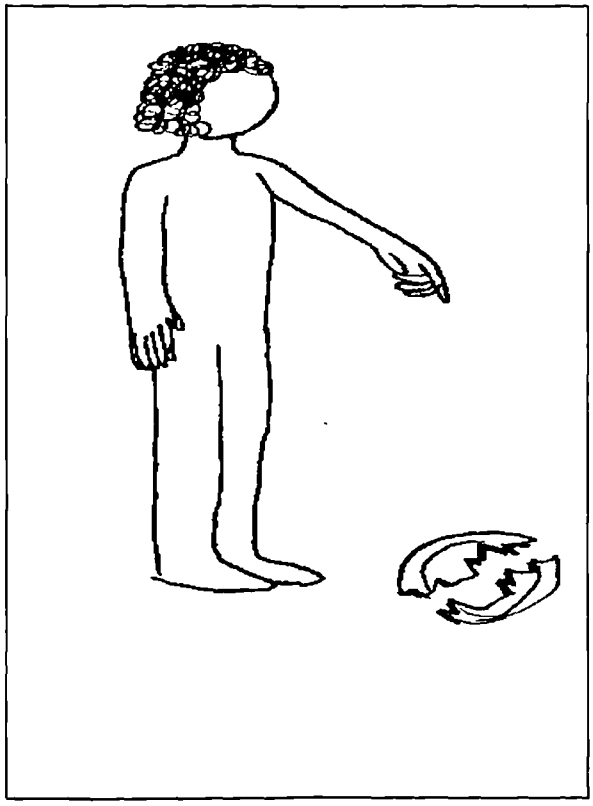
Pictures and stories used for each of the emotions in the context condition and the order used to counterbalance the presentations.



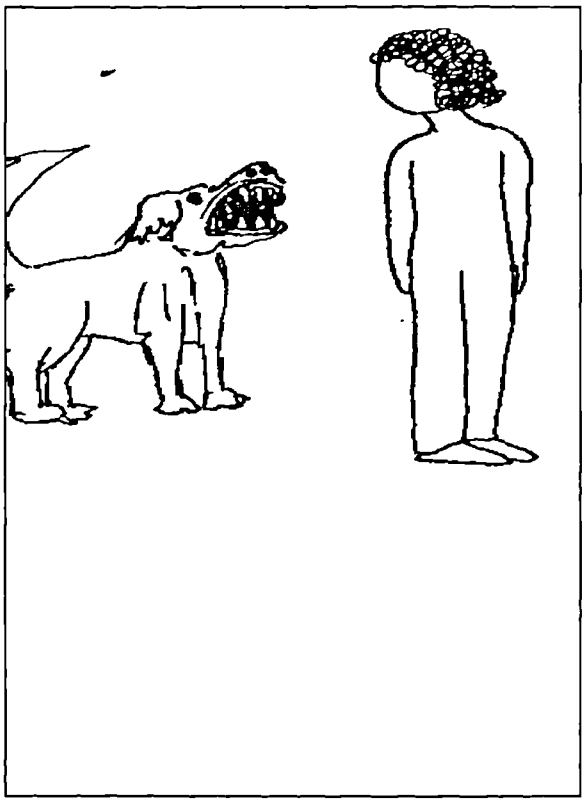
HAPPY



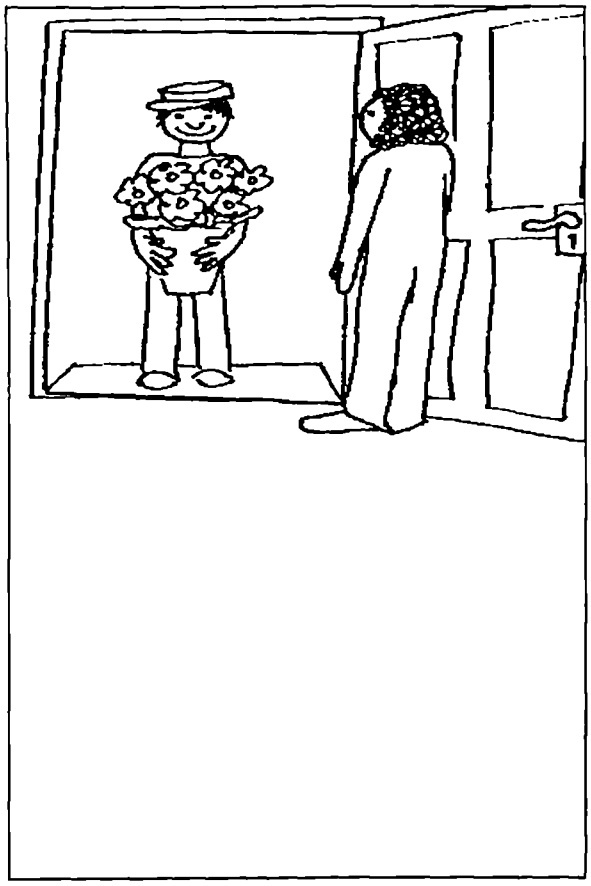
SAD



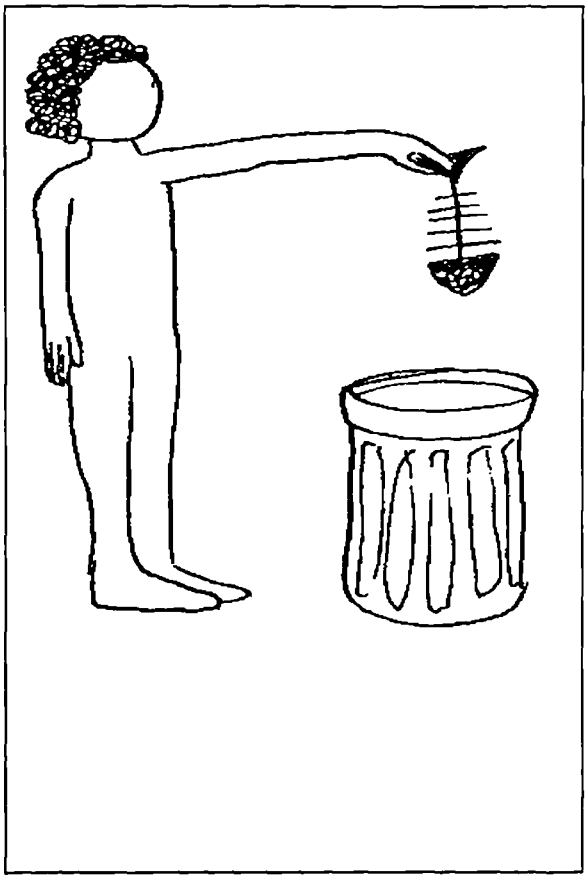
ANGRY



FRIGHTENED



SURPRISED



DISGUSTED

**Stories:**

Happy: It is Christmas time and Carol is opening her presents - this is her biggest one.

Angry: Carol is in the living room. She hears a crashing sound in the kitchen. She run's into the kitchen and sees one of her best plates broken on the floor.

Sad: Carol's cat is sick - she is going to have to call the vet.

Disgusted: Carol smells a horrible smell in the kitchen bin. It is an old fish. She takes it outside and puts it in the big bin outside.

Fearful: Carol is walking down the street. She looks around and sees a huge dog with very sharp teeth.

Surprised: Today is Carol's birthday. She hear's the doorbell ring. When she answers the door there is a man with a big bunch of flowers for her.

Order used for counterbalancing:

| Child 1 & 7 | Child 2 & 8 | Child 3 & 9 |
|---|---|---|
| happy | angry | disgusted |
| angry | happy | surprised |
| sad | disgusted | happy |
| disgusted | fearful | angry |
| fearful | surprised | sad |
| surprised | sad | fearful |

| Child 4 & 10 | Child 5 & 11 | Child 6 & 12 |
| --- | --- | --- |
| surprised | sad | fearful |
| fearful | disgusted | sad |
| angry | fearful | surprised |
| sad | surprised | happy |
| disgusted | happy | angry |
| happy | angry | disgusted |

# Appendix 8.5
## Further details of emotion recognition and sharing experiment.

Details of equipment and procedure.

1) Changes from Hobson's original experiments.

Instead of line drawings of faces based on Ekman & Friesen (1975), as was used by Hobson and Prior et al., the photographs themselves were used to test for recognition of emotions from facial expression. Instead of using video-tape sequences to test for the understanding of gestures and contexts as affecting emotions, handdrawn pictures were used. To test for how sounds are used to recognise emotions, an audiotape of non-speech sounds was used - as in Hobson's studies. These sounds were recorded by a female, completely unknown to any of the subjects. A training sequence with four non-face pictures was used as a control test and to train the children in the experimental set-up. This was done for the picture naming, sound naming and context questions. The objects used for the training were a car, train, dog and bird and were simply pictures of each cut out of a magazine and clued on a piece of card.

2) Procedure

*Phase 1:* Control: The children were presented one at a time with the four control pictures and asked to name the object in the picture. If they correctly named at least three out of four, then the experimenter proceded to the experimental situation.

Experimental: The subjects were presented with 6 photographs portraying facial expressions of emotion - fear, anger, happiness, sadnes, surprise, and disgust. One face of neutral expression was also included (The photos can be seen in Appendix 8.1). The children were introduced to the girl in the photos as Carol and they were asked to say how Carol was feeling in the photograph (Naming procedure). The photographs were presented one by one to the child, The previous one was pushed aside but left in sight of the child. If the children seemed confused by the question, they were asked again. If they still made no reponse then they were prompted on the first photograph with suggestions - Is she happy, sad, angry? The response for this photograph was not counted as valid. At the end of this first presentation, all the photographs were laid out in front of the child and the child was

asked to point to the photo where Carol was happy, sad, angry etc (Showing procedure). Once each emotion has been responded to, the child is made aware of their mistakes and trained to the correct response for each photo. The Naming procedure was then repeated, followed by the showing procedure if necessary to obtain at least 5 correct answers.

Coding and analysis: The children's performance was noted on a prepared check-sheet by the experimenter. The whole process was also recorded on video and the experimenter then watched the video to confirm her first coding of the children's responses. Unfortunately, due to technical problems the quality of the videos (light often reflected off the photographs, making it difficult to tell which one was which) was not good enough to test for interobserver reliability - it was necessary to observe the actual sesssion and the video in order to code. However, this was not felt to be a serious problem since the scoring system was very objective.

In order to pass the first phase the children had to score at least five on either the first naming procedure or on the first showing procedure. In order to procede to the later phases of the test the children had to score at least five out of seven on either the second naming or showing procedures. This was relevant for the gestures and context phases. All children were put through the sounds procedure to see if they were any better at recognising sound mediated emotions than facial expressions of emotions.

*Phase 2: Sounds*: All the photographs and the control pictures were laid out in front of the child and they were instructed to listen to the sounds that the experimenter would play and then show which picture went with the sound. The four control sounds were played first and then those pictures were taken away, to leave seven pictures. The instruction was reiterated - the child was to tell the experimenter how Carol was feeling on the tape by showing the photograph that matched the sound.

Twelve different sounds were played, two for each facial expression. There was no sound for the neutral photograph. The subjects were informed that most of the photographs had two sounds but one photograph didn't have any sounds.The sounds were presented in a set order as detailed in appendix 8.2. The child could respond in one of three ways. Firstly, vocally, by stating verbally the emotional state of Carol.

Secondly, they could point to a picture. If they pointed to the wrong picture but gave the right verbal response then this was noted as correct. Thirdly, they could simply give to the experimenter the picture that they thought matched the sound. In this case it was important to immediately replace the photo on the table so that when the sound appeared again the choice was available for the child.

The result for each subject was a score out of twelve but a score out of six was also recorded for the first time the child heard each emotion. This was in case hearing each emotion twice confused the child and confounded their ability to recognise emotions by recognising human vocalisations.

*Phase 3: Gestures* - This was perhaps the most difficult phase of the test, it was certainly the most difficult to design. A picture (line-drawing) of a faceless body in a gestural position indicative of each emotion was presented to the children. All the photographs were on the table at this point and the child was instructed to match a face to the body to show how Carol was feeling. There were seven body pictures, each of which are featured in Appendix 8.3. A score of seven was the maximum but a child was said to have passed if they scored five or more on this phase.

*Phase 4: Context* - The child was first presented with each of the control pictures again and then a picture of a nest, garage, basket and station were given to the child one at a time and they were asked to match the new pictures to one of the control pictures. Again they had to score at least three out of four to be said to have passed the control condition. The child was then presented with six pictures featuring a faceless body in a simple situation and six stories were read to the child, one at a time, and the child was asked to match the story to one of the pictures. The stories and pictures used can be found in Appendix 8.4. If the child was successful on five out of the six stories then they proceded to the final stage and were once again presented with the six facial expressions, laid out on the table. The story pictures were presented to the child one by one and the child was asked to match the story to a face to show how Carol would feel in the story. They were told that they could change their decision at any time and it was the final arrangement of pictures and stories that was noted.

Results:

Facial expression (All results for this phase are represented in Figures 8.1 and 8.2 below):

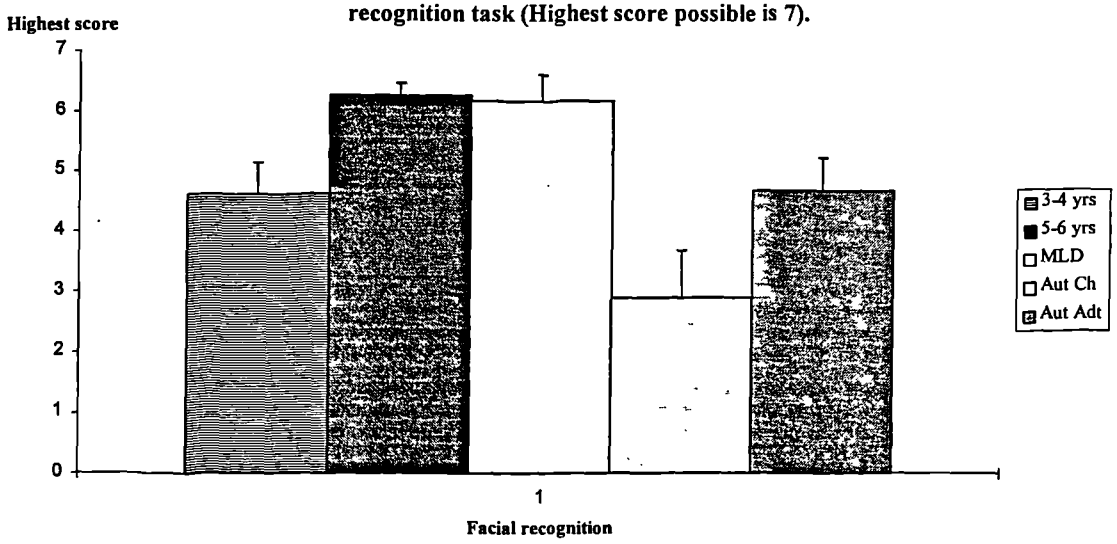
1) On the first presentation of the photographs, when the children were asked to say how Carol was feeling, all the children performed relatively poorly and there were no significant group differences on the ANOVA. There was a strong correlation between TROG and performance on this phase ($p<0.001$) over all children but not within the autistic group. When the three non-autistic groups and the two autistic groups were collapsed into one autistic and one non-autistic group, there was a significant difference between them on an ANOVA, with $p<0.01$ $F=7.34$, with the non-autistic subjects performing on average better than the autistic subjects on this phase. The percentage of children in each group passing this phase is represented in Figure 8.5 below and Table 8.2 illustrates the results on the chi-square for each group, representing the phases where significantly more children passed than failed and visa versa.

2) When the children were asked to point to the face that goes with the emotion as spoken by the experimenter, a group difference emerged, with the 5-6 year old group showing a better performance than the autistic groups ($F=4.29$, $p<0.01$). This difference was accentuated by collapsing the groups into autistic and non-autistic groups ($p<0.001$). When MA and TROG was controlled for, the differences still existed at 0.01 level. The small sample of autistic and MLD children matched on CA, did not show a significant difference, but this sample was much smaller than the samples matched on MA and TROG. Across all children there was a correlation between TROG and performance on this phase and also between CA and performance, at 0.001 level and 0.05 level respectively.

Overall, the percentage of children passing this second phase was as expected by the ANOVA results, highest for the 5-6 year olds and lowest for the autistic groups. These results are represented in Figure 8.5 and Table 8.2 below.

3) The final two parts of this phase served to train the children to a level of competence in recognising the photographs, adequate to allow them to display a understanding of other types of emotion perception, if they existed. On the second naming procedure the 5-6 year olds showed better performance than the 3-4 year olds ($F=2.65$ $p<0.05$) and on the second showing procedure the MLD children perform better than the autistic adults ($F=3.65$ $p<0.05$). When a subset of autistic subjects and a subset of non-autistic subjects were matched on MA BPVS and TROG the non-autistic subjects did better than the autistic subjects ($F=12.37$ $p<0.01$) and this could not be explained by either MA ($F=6.64$ $p<0.05$) or TROG raw score ($F=10.01$ $p<0.01$). Controling for CA did, however, wipe out the difference, but this was a very small sample. There was also no correlation between any of the age related measures and performance on either of the final parts of this phase. It is the children who pass these final stages that contribute to the results of the gestures and context phases. The exact numbers of children, as well as the percentages of each group, progressing to the final phases are shown on Figure 8.5.

**Figure 8.2: Mean highest scores and standard errors for all groups on the facial emotion recognition task (Highest score possible is 7).**




4) The highest scores over the four parts of this phase are a general indication of the failure of the younger children in all groups to recognise facial expressions, even with a chance to learn. The autistic children also showed poorer performance overall ($F=6.69$ $p<0.001$) than all the normal groups, even the 3-4 year olds. Since there were no differences between the two autistic groups nor the three non-autistic groups it was again feasible to compare the collapsed autistic and non-autistic groups. The

differences described above remained with the non-autistic children scoring higher than the autistic children ($F=14.15$ $p<0.001$). When CA ($F=4.78$), MA ($F=8.54$) and TROG score ($F=5.15$) were controlled for, this significant difference remained at 0.05 level. There were correlations between both TROG score ($r= 0.62$ $p<0.0001$) and BPVS MA ($r = 0.27$ $p<0.05$) and the high scores of all children. No correlation with CA existed. Within the autistic groups there was also a correlation between BPVS and High scores ($r = 0.46$ $p<0.05$).

Table 8.2: Chi-square results for each group on each phase of the emotion recognition task and ANOVA results for autistic/non-autistic groups, unmatched and matched on CA, MA (BPVS) and TROG raw score.

| | Chi Square results for number passing/failing (*=sig. at 0.05, **=sig.at 0.01, ***=sig at 0.001) | | | | | ANOVA results | Autistic/non-autistic matched on: | | |
|---|---|---|---|---|---|---|---|---|---|
| Phase of task | 3-4 year olds | 5-6 year olds | MLD | Autistic children | Autistic adults | Aut/non autistic | CA [b] | MA (BPVS) | TROG raw score |
| Face1 | All fail | fail>pass. $X^2$=10.29 ** | all fail | all fail | All fail | nonaut> aut F=7.34 ** | not sig | not sig. | nonaut> aut F=4.85* |
| Face2 | not sig. | not sig. | not sig. | not sig. | not sig. | nonaut> aut F=12.43 *** | not sig. | nonaut > aut F=8.04 ** | nonaut> aut F=6.92 ** |
| Face3 | not sig. | not sig [a] | not sig. | not sig. | not sig. | not sig | not sig | not sig. | not sig. |
| Face4 | not sig. | all pass | all pass | not sig. | fail>pass $X^2$= 5.44 * | nonaut> aut F=12.37 ** | not sig | nonaut > aut F=6.64 * | nonaut> aut F=10.09 ** |
| High Score | not sig. | all pass | pass>fail $X^2$=4.45 * | not sig. | not sig. | | nonaut>aut F=4.7 * | nonaut > aut F=8.54 ** | nonaut> aut F=5.15* |
| Sound - 12 | fail>pass $X^2$=5.4 * | not sig. | not sig. | fail>pass $X^2$=5.4 * | fail>pass $X^2$= 6.44 * | not sig. | not sig. | not sig. | not sig. |
| Sound - 6 | all fail | not sig | not sig | not sig | fail>pass $X^2$ =5.44 * | not sig. | not sig. | not sig. | not sig. |
| Gestures | all fail | fail>pass $X^2$=10.29 ** | not sig. | all fail | all fail | not sig. | not sig | not sig. | not sig. |
| Contexts a) | pass>fail $X^2$=4.5 * | all pass | pass>fail $X^2$=5.44 * | not sig. | all pass | not sig | not sig. | not sig. | not sig. |
| Contexts b) | all fail | all fail | fail>pass $X^2$=4.5 * | not sig. | all fail | not sig | not sig. | not sig. | not sig. |

[a] Although not significant here ($X^2$ =3.77 p=0.052) , the 5-6 year olds did show more passes than failures.

[b] This comparison was only possible with a small sample of children from the MLD and autistic children groups (n=7 in each group).

Sounds:

Figure 8.3 illustrates the results from this phase of the task. When results over all twelve sounds were considered there were no group differences at 0.05 level, neither on the autistic/non-autistic comparison nor on the five group comparison. When matched on CA, MA and TROG score there were still no differences between autistic and non-autistic children. From the chi-square test it is seen that none of the groups scored more passes than fails, although the MLD and 5-6 year old groups both showed no significant differences between the numbers of pass and fail. The autistic groups and the 3-4 year olds all produced signifcantly more fails than passes (at 0.05 level). See Table 8.2. There was a correlation between TROG score and performance on this task across all groups ($r = 0.39$ $p<0.01$) but not within the autistic groups.

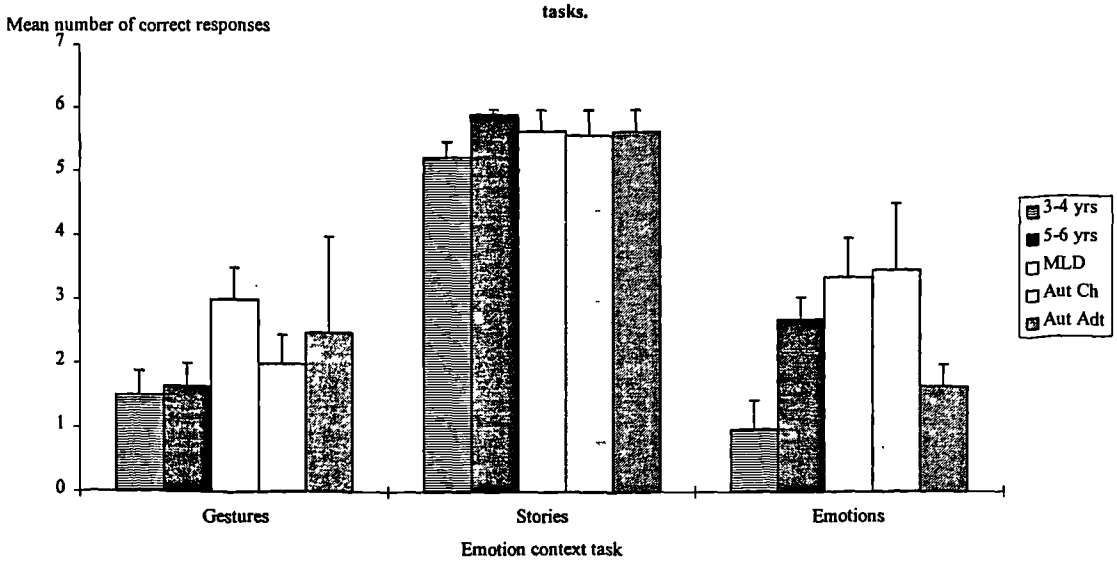
In retrospect, it was decided that perhaps on the second presentation of the emotions, some of the children could have been confused as to which photo to choose, having already chosen most photos once. So an analysis of the data taken from the first presentation of each emotion was conducted. There were now no significant differences between groups on any comparison and no correlation with any of the measures of mental or chronological age. In fact, the autistic group no longer showed significantly more failures than passes on this task although the autistic adults continued to do so. What is interesting is that taking just the first presentation, actually decreased some of the children's performance in the 3-4 year old group, so that all children in this group now failed the task.

Gestures:

(Figure 8.4 represents the mean results for this phase and Figure 8.5 illustrates the mean percentage of children passing this phase). In this phase none of the autistic children or adults and none of the 3-4 year olds passed (i.e. scored more than 5 out of 7). In the five to six year old group, significantly more children failed than passed (chi-square=10.29 $p<0.01$). In the MLD group there was no significant difference

between the number passing and the number failing but the tendency was towards more failures than passes (Table 8.2). On the ANOVA there were no group differences but there was a correlation between performance and both MA on BPVS and TROG score. When the autistic/non-autistic comparison was made there was no significant difference between the two groups and this remained the case when CA, MA and TROG score were controlled for.

**Figure 8.4: Mean scores (out of 7) and standard errors for all groups on the emotion perception - context tasks.**




Contexts (See Figures 8.4 and 8.5 and Table 8.2):

1) Stories: Overall there were no group differences for this, either across five groups or on the autistic/non-autistic comparison. More than 80% of the children in all groups, who got this far, passed this part of the task and proceded to the emotionally relevant condition. All children irrespective of age, did well on this task.

2) Emotions: Here, like for the gestures condition, the overall percentage of children passing was low for all groups. In the 3-4 year old, 5-6 year old and autistic adult groups all children failed. The MLD group showed more failures than passes

(chi-square=4.5 $p<0.05$) and the autistic group actually showed no significant difference between passes and failures. (N.B. Pass equals a score of 5 or more out of 6).

When the actual scores were compared, the 5-6 year olds, MLD and autistic children all performed better than the 3-4 year olds, with the autistic adults somewhere inbetween ($F=3.33$ $p<0.05$). There were correlations between performance and both BPVS MA ($r=0.57$ $p<0.001$) and TROG ($r=0.47$ $p<0.01$) score. When the autistic and non-autistic groups were matched on CA, MA and TROG score there were no significant differences between the two groups, as Table 8.2 suggests.

Additional results:

Recognition of facial expression:

Of the autistic children and adults who did score on the facial expression recognition, the emotions of happy and sad, seemed to be the most often correctly identified. Angry and surprised also appeared regularily in the correct answers on this phase. In response to the first request to tell me how Carol was feeling, many of the autistic children and adults and some of the MLD children said "fine". One autistic boy said "sick" (this was one of his obsessions - feeling "sick"). When these children and adults were asked "how are you today" or "how are you feeling today?" their stock answer was "fine". Perhaps it was the response they have been taught to use in association with the word "feeling".

Matching of sounds to facial expressions:

Although the difference was not tested statistically, the autistic children did seem to score higher on the sounds phase than on the facial expression phase, at least when their response to the first presentation of each emotion. Some of those who did not score at all on the facial expression phase, did score, allbeit not very high, on the sounds tasks. This, of course, could have been by chance. There was a tendency for some children in all groups, but especially the 3-4 year olds and the autistic children to appear to be simply randomly matching the pictures to the sounds. Sometimes they just pointed to them in the order they appeared on the table and sometimes they

simply pointed to a photo without really looking at it. It was to rule out the possiblility that they were performing quite well by chance, that led to the adoption of such a high pass rate as the criterion for success for each phase of the task.

Finally, it is interesting to note that the autistic children, loved this part of the experiment. In later experiments the children requested to see "that girl" again, the one "who made the funny noises". At the end of the experiment itself, quite a few of the children, especially the more able children, wanted to listen to the sounds again. They found some of the sounds very amusing, even if they didn't recognise the emotional context.

Contexts:

Almost all the children who proceded this far, accurately and reliably matched the verbal stories to the pictures, in the first part of this phase. This showed that they understood the language necessary to describe the pictures in mechanical terms. However, on the second part, most children did poorly on matching an emotion to the story pictures. The 3-4 year olds had the poorest performance and the autistic adults were not far behind them. The autistic children, MLD children and 5-6 year olds all did significantly better than the 3-4 year olds, although none of these groups showed more passes than failures. This may have been due to the tendency of the 5-6 year olds, MLD children and some of the autistic children to mix up the pictures for happy and surprised which in itself is not suprising, due to the concurrent nature of the two emotions. Getting both these wrong would have left the child with a score of 4 out of 5, which was not a pass. The poor results from the 3-4 year old group may be explained by the correlation between mental age on BPVS and performance and also between performance and TROG raw score, since the 3-4 year olds had the lowest score on both measures. This does not, however, explain the poor results of the autistic adults, none of whom performed above chance. Memory may have been a problem for both the 3-4 year olds and the autistic adults and this could have been catered for by retesting and retraining each subject on the facial recognition task before progressing to each stage. This would, however, have made the whole experiment too long for the youngest and least able children and adults, whose attention was hard enough to hold as it was. Again the problem may have been ruled

out by using videos as Hobson (1986) did, or by training the child to speak the emotion rather than poitning at the photograph. To have a higher sample of autistic children and adults progressing to this phase, the subjects should have been trained to a criterion of five correct identifications of photographs.

General Discussion:

There are a few pieces of observational data, not detailed elsewhere, worth mentioning. Firstly, the youngest autistic children tended to produce much echolalia of the instructions. Also when the experimenter would, for example, wave her hand over the pictures to draw the child's attention to them, while giving the instructions, some of the autistic children copied this movement. It took a lot of effort to draw some of the children's attention to the task at hand. Secondly, on the sounds phase, quite a few of the children named some of the easier sounds for example, crying and laughing, but could not match this to a facial expression of sad or happy.

As suggested in the context results, quite a few children in all groups mixed up surprise and happy emotions. This also happened in the sounds phase, where a few children identifies the surprised sounds as happy, or sometimes as frightened, both understandable enough. Baron-Cohen et al (1993) note that the most common mistake made by the subjects with autism when sorting pictures in the Surprise category, was to put the picture into the Happy file. As Baron-Cohen suggested Happy and Sad are well recognised by most children in all groups, in each phase of the experiment (except Gestures). And as mentioned earlier fewer autistic subjects correctly identified the surprised face in the first part of phase 1 (in both naming and showing procedures), than identified all the other faces. All the other emotions could be labeled as simple emotions, in Baron-Cohen's terms, i.e. that they only require an understanding of the situation not the person's beliefs, but in some circumstances these simple emotions can still be ambigous. For example, fear is an emotion that depends on the individual - what frightens one child, might not frighten another - so the child's response may be based on a personal experience. At least a sense that the other person's feelings may not be the same as the self's is necessary to correctly

understand the emotion. Surprise, however, does require an understanding of the beliefs of the person, in a the natural context. However, in this experiment, the child did not need to know what Carol was believing to identify the facial expression. It could be argued, however, that since surprise normally requires understanding of beliefs, in order to attribute surprise, it is not an emotion autistic children will understand if they come across it in everyday life. Happy and Sad may be drilled into children from an early age, and are probably the first two emotions all children learn to recognise and name. To actually surprise someone requires the knowledge of what the other person believes about the situation. Autistic children have not been observed to play tricks of this nature, to surprise someone else.

Overall, then, it seems that the autistic groups in this sample did seem to have problems recognising emotions when asked to do so from facial expressions. They were better at simple emotions, such as Happy and Sad, than they were on Theory of mind dependent emotions such as Surprise. This, however, was not tested statistically and is only based on observational and descriptive data. The autistic groups did not learn as quickly as the other non-autistic groups, in that their highest scores were significantly less than all the non-autistic groups. They were slightly better at matching sounds to facial expressions but not significantly so. For those children who passed the first phase and proceded to the gestures and context phases, they seemed to do well. They certainly did not do statistically worse than their non-autistic mental age matched counter-parts. Those who did get this far tended to be those of a higher MA. One autistic girl passed Phase one, scored well on the sounds, did quite well on the gestures and then passed both the context phases. In fact, while she was matching the stories to the pictures she told the experimenter how the person in the story was feeling, without prompting to do so. Yet there were adults with a higher mental age than this child who did not pass the first phase, never mind the last phases. Performance over all children was often linked with score on TROG, although within the autistic group a higher TROG score only improved performance on the overall high score in the facial expression phase and the emotion assignment in the context phase. This backs up the idea that it is the children with the higher verbal MA's that pass the first part and progress to the latter phases. Thus I would suggest that there

may be a possible link between verbal MA and performance on these emotion recognition tasks. However, this suggestion has to remain speculative, until the experiment can be performed using better controls especially for memory problems, and better equipment and facilities.

# Appendix 8.6

## Further details on the joint attention experiment

**Method:**

Subjects:

The subjects used were drawn from the samples described in Chapter 2. They were the same as for the emotion recognition task described in Chapter 7, although several children did not complete this task due to many different factors. One autistic girl, for example, had a sight problem which allowed her to be tested using pictures and objects close-up but not things at a distance. Another autistic boy refused to come for the play session, during which he was to be tested. One other autistic boy's video session was lost due to a technical problem, as was one for one of the MLD children. However, this MLD child was replaced by another child of a very similar chronological and mental age. This left the numbers in each group as follows:

Table 8.3: Number of children in each group who took part in the joint attention experiment.

| Group --> | 3-4 year olds | 5-6 year olds | MLD children | autistic children | autistic adults |
|---|---|---|---|---|---|
| number in group | 11 | 13 | 11 | 9 | 10 |
| Mean CA | 3;4 | 5;4 | 12;3 | 12;1 | 23;10 |
| Mean MA on BPVS | 3;4 | 6;0 | 5;11 | 4;11 | 7;0 |
| Mean TROG score | 5 (n=5) | 11.5 | 8.1 | 6.2 | 8.2 |

Procedure:

A scenario very similar to that used in Leekam *et al.*' s (1993; in press) study was used in this experiment. The experimenter, in the process of another task (usually the emotion recognition or warm-up freeplay sessions) looked intently, turning both eyes and head, at an object placed at a specific point to the left of the child as the experimenter sat, but with no verbal clues. The reaction of the child was recorded on camera. The experimenter then asked " what am I looking at?". Secondly, the process was repeated for an object behind the child. Finally, at a later stage in the dummy or other task, the experimenter pointed at an object to the right hand side of the child. After a short pause the experimenter asked the child "What am I pointing at?" and the response was recorded on video. How the child interpreted the point, was evident from the child's response. If the child looked at the object then back to the experimenter and said something like "it is a plane" then they were interpreting the gesture as protodeclarative. If they got up and brought the object to the experimenter then they saw the point as protoimperative. If, however, they reached for the object and then played with it and didn't give it to the experimenter, then this could imply a protodeclarative interpretation. The reaction to the "what is it?" question served to confirm that the child was looking at the right object and in doing so tested for visual perspective taking. It was predicted that the autistic children, on the basis of previous research, might respond more with protoimperative interpretations, than protodeclarative, if they responded at all.

For some children, due to constrictions in the testing rooms, the point was to the experimenter's left and the gaze to the right, but this was seen as unimportant when analysing the results. As far as possible there was always a gap of another activity between each phase. This was an attempt to make the whole scenario more natural. The task was presented in the order described above - look left, look behind and point to right. The presentations were not counterbalanced because it was felt that three different presentations, separated by another task, would not be enough to show a learning effect that might compromise the results, especially since each child was only given the task once. Where possible the experimenter waited until the child looked at her and then looked away to the object. But with some of the children, especially the

autistic children, it was necessary to call the child's name to gain their attention before looking away.

Table 8.4: The scoring system used to code the response by each child a) to the gaze and b) to the point.

| Score | a) Gaze | b) point |
|---|---|---|
| 6 | Child follows gaze and answers correctly on "what" question. | Child follows point and names object. (No verbal prompt needed). |
| 5 | Child follows gaze but answers question incorrectly. | Child follows point and picks up object (No verbal prompt needed) |
| 4 | Child moves head slightly and answers question correctly. | Child follows point and then on prompt names or gives object. |
| 3 | Child moves head slightly but answers incorrectly | Child follows point but does not name or give object on prompt. |
| 2 | No response to gaze only but looks and answers question correctly. | No response at first but responds correctly to prompt. |
| 1 | No response to gaze only; looks but answers incorrectly in response to question. | No response to point and answers incorrectly on prompt. |
| 0 | No response either to gaze or to question. | No response to either point or to prompt question. |

Table 8.5 Number of children included in each group for each part of the experiment.

| Group | Began experiment | Gaze behind | Gaze left | Point | Total score |
|---|---|---|---|---|---|
| 3-4 years | 11 | 11 | 11 | 11 | 11 |
| 5-6 years | 13 | 13 | 13 | 13 | 13 |
| MLD | 11 | 10 | 10 | 10 | 8 |
| Autistic ch | 9 | 9 | 9 | 8 | 8 |
| Autistic adt. | 10 | 7 | 9 | 9 | 6 |

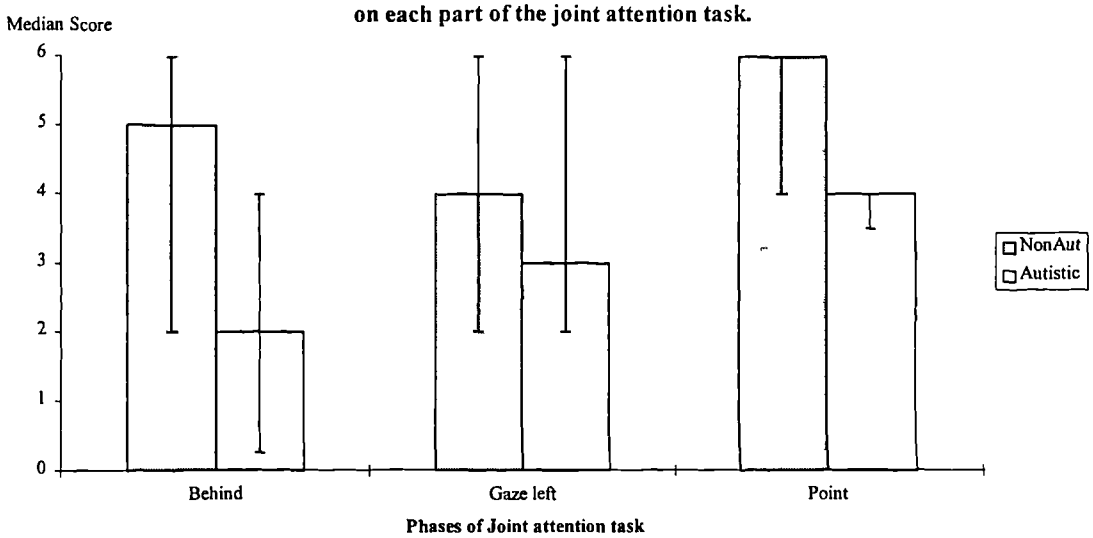
Table 8.6: Mean MA on BPVS and TROG raw scores for the autistic and non-autistic groups as matched on these measures.

| Group | number matched on MA BPVS | number matched on TROG | Mean MA on BPVS | Mean TROG raw score |
|---|---|---|---|---|
| autistic | 15 | 14 | 5;4 | 7.1 |
| non-autistic | 15 | 14 | 5;4 | 7.2 |

Inter-observer reliability was tested using a sample of children from the autistic children, autistic adults, 3-4 year old and 5-6 year old groups. This sample was coded by an independent naive observer, who was trained to apply the coding system, to the video sessions. A Pearson's product moment correlation was calculated, giving an r value of 0.874 $p<0.0001$.

**Results:**

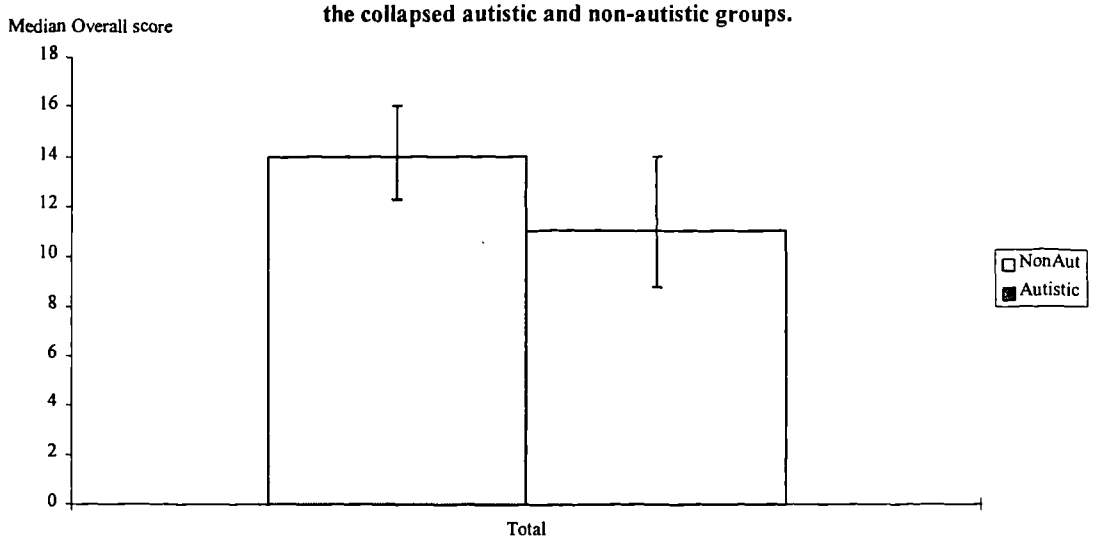
**Figure 8.8: Median Scores and interquartile ranges for the autistic and non-autistic groups on each part of the joint attention task.**



When the ANOVA (Kruskal-Wallis) was done for the autistic/non-autistic comparison (See Figures 8.8 and 8.9) there were no differences for the component parts of the task but there was a difference on overall score (K-W=5.52 $p<0.05$), with the non-autistic children scoring higher overall than the autistic subjects. However, this difference disappeared when a sample of the children were matched on MA BPVS (K-W=3.4, $p=0.07$) and on TROG raw score (K-W=2.53 $p=0.112$), suggesting that there may be a link between MA and performance on joint attention tasks. Unfortunately it was only possible to match a small sample of twelve children (six autistic and six non-autistic) on MA BPVS for total score and 18 children (9 in each group) on TROG raw score. This was due to the fact that of the children who were matched on these measures, there were five autistic children and three non-autistic children, who did not complete the whole task.

On the correlation analysis, only one comparison emerged significant at 0.05 level and that was for TROG and the score for "gaze behind" across all five groups ($r = 0.33$), but no correlation within the autistic groups only.

**Figure 8.9: Median scores and interquartile ranges for the overall joint attention score for the collapsed autistic and non-autistic groups.**




Figures 8.10 and 8.11, illustrate the more interesting aspects of the non-significant results. If we look at the number of subjects, scoring at least five out of six, we can see that on each component part the same percentage of the autistic children (33.3%) shows evidence of spontaneous joint attention (Figure 8.10). This extreme

consistency cannot be explained by the same children responding well on each part - only one child (MA 3;2) scored 6 on two out of the three parts, the gaze left and point. There were, however, children who scored high on gaze behind but low on gaze left and point. So the apparant consistency of the groups results really was inconsistency on an individual level and this was reflected in the percentage of children scoring 15 on the total score measure. The 3-4 year old children also showed a consistency between the component tasks of the experiment. This time the same children did tend to perform well on at least two out of the three components. Again this was reflected in a higher percentage of children scoring 15 or over on total score. More autistic adults showed evidence of joint attention in response to the point but because they performed so poorly on the other aspects of joint attention, none of the adults showed a consistency in their total score. A higher percentage of 5-6 year olds showed joint attention on the gaze behind and point tasks, than the other groups, and yet they show the second lowest, after the autistic adults, percentage on the gaze left. Possible explanations of this result, tied in to explanations of overall low scores in the non-autistic groups, are offered in the discussion. Finally, in respect to Figure 8.10, the MLD children showed the most consistently high scores, as seen by the total score figures, with 50% of children scoring 15 or more overall. Fifty percent is still a very low figure for non-autistic children, on a behaviour normal toddlers and younger can be shown to understand. Again, explanations for this will be offered in the discussions. To look a little more at the group differences on overall score and each phase of the task, a series of Fisher test were carried on the number of those who passed in each group compared to the number of those who failed. There were no group differences on overall score found, and none on gaze behind. On gaze left no differences were significant at 0.01 level, but at the 0.05 level the MLD children showed better joint attention on this phase than both the autistic adults ($p=0.04$) and 5-6 year old children ($p=0.03$). On the point condition, the 5-6 year old children showed more spontaneous joint attention than the autistic children ($p=0.01$) and the 3-4 year olds ($p=0.006$).

Observational points:

It was thought that how the children interpreted the point or eye gaze, i.e. whether protoimperative or protodeclarative, would be decipherable from the results. And from the results it seems that all children/adults in all groups interpreted the point as protodeclarative. Only two children, one in the 3-4 year old group and one in the 5-6 year old group, left their seats to approach the object at which the experimenter was pointing. However, they did not bring the object back to the experimenter but named it in response to the "what" questions. Three of the autistic children reached and took the object in response to the gaze behind and verbal prompt. They played with it but did not give it to the experimenter. So the gaze and prompt just serve to attract the child's attention to the object, not as any form of request. However, due to the situation the autistic children were tested in they were closest to the object placed behind them and most of the children could reach back and take the object without leaving their seat. None of the children did this for the objects that were further away. The results here tie in with the observational study results (Chapter 2), which showed that some autistic children quite commonly engaged in showing things to other people and in following other people's attention to an object or event, especially when a point was used. Here, although the non-autistic children performed slighly better than the autistic children, on the joint attention task this difference was not significant.

Some of the children, mostly the normal children, replied to the question by pointing at the object, rather than naming it. This was not seen in the autistic groups - if they did not answer verbally, then they did not respond in any other way, other than to look at the object. Sometimes the children from all groups named the object wrongly but were looking in the correct place. Instead they named the object immediately behind, for example, the wall or the door. This was taken as a correct response, as was a response such as "clock" or "musical thing" for the tambourine, if they didn't know the correct term, or "parrot", which was the picture on the tambourine.

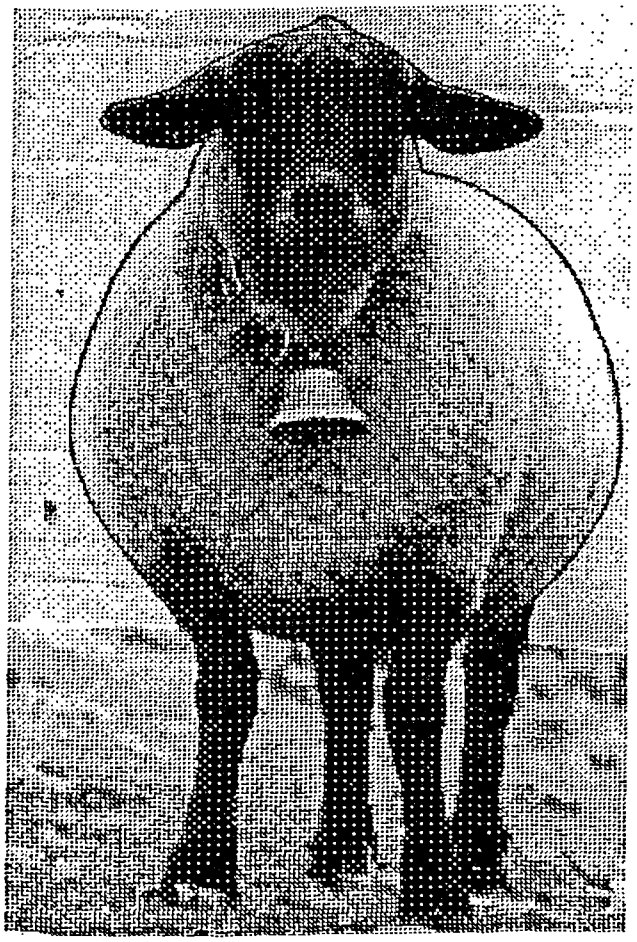
This point leads on to an aspect which may bias the result in any such experiment - a problem with language may lead the autistic and youngest children to look but not answer, because they simply don't know what the object is called. However, it was evident in this study that most of the children could make some sort of verbal answer that could be easily associated with the object. In all groups it

seemed that for the most part, if they didn't name one object then they didn't name any objects, even those with an "easy" name such as "teddy". In future experiments this could easily be controlled for at the end of the experiment by asking the child to name each of the objects while the experimenter gives them to the child.

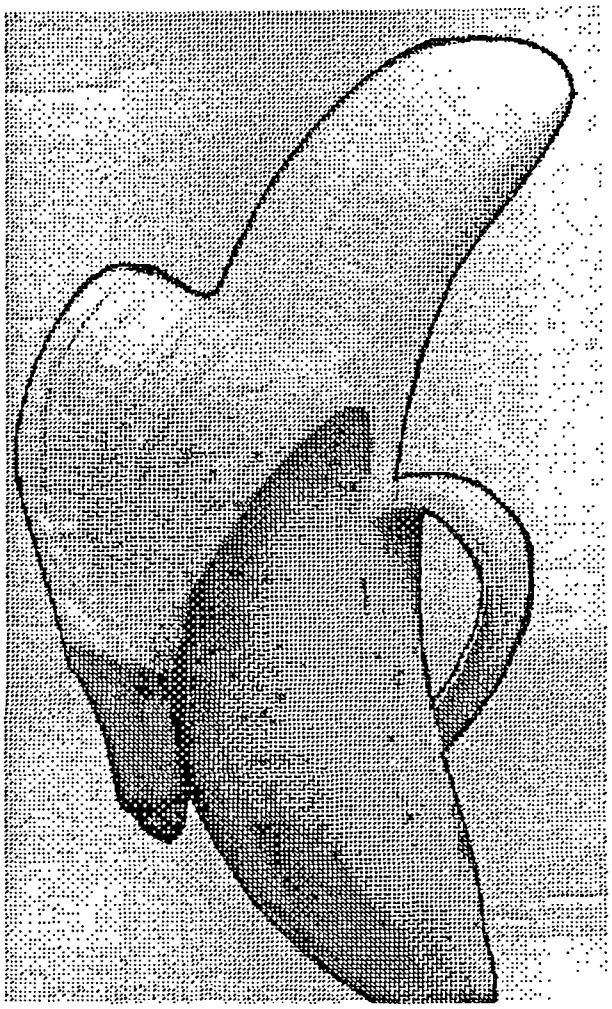
# Appendix 8.7:

Pictures used for Visual Perspective taking task (Level 1 and Level 2) - Flavell et al. (1981)

1)"What can you see?"



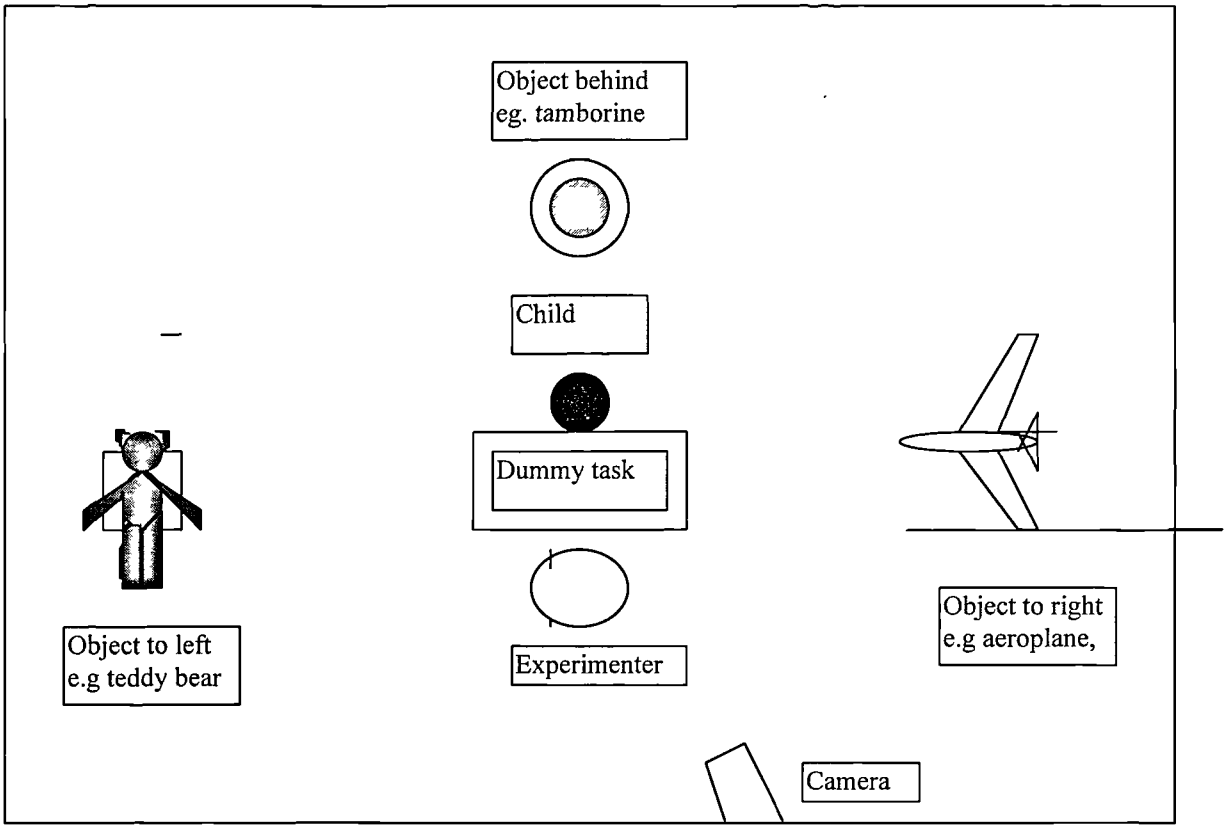
2)"What can I see?"



3) Can I see the sheep upsidedown or the right way round? (Card placed flat on table with sheep facing upwards)

N.B for the older MLD children pictures of a sports car and a computer were used instead.

Experimental set up for joint attention and visual perspective experiment.



# Appendix 8.8

## Further details on false-belief experiment.

Subjects:

Table 8.7. Numbers of children/adults in each group and mean mental age in years and months on the BPVS and mean TROG raw score (plus standard deviations and ranges).

| | 5-6 year olds | MLD children | Autistic children | Autistic adults | 3-4 year olds |
|---|---|---|---|---|---|
| Number in each group | 12 | 12 | 10 | 8 | 3 |
| Mean MA on BPVS | 5;11<br>(1;2)<br>(3;7->7;9) | 6;3<br>(2;7)<br>(2;2->8;11) | 4;7<br>(1;10)<br>(2;2 ->8;3) | 7;4<br>(1;11)<br>(5;4 ->10;2) | 4;2<br>(0;6)<br>(3;7->4;5) |
| Mean TROG score | 11.5<br>(3.6)<br>(5->17) | 9<br>(4.6)<br>(2->17) | 5.3<br>(3.47)<br>(1->11) | 8.75<br>(3.69)<br>(4->14) | 7<br>(4)<br>(3->11) |
| CA | 5;4<br>(0;5)<br>(4;7->5;11) | 12;6<br>(3;0)<br>(8;6->16;4) | 13;0<br>(3;2)<br>(7;7->16;4) | 25;8<br>(4;10)<br>(19;5->33,11) | 3;6<br>(0;2)<br>(3.3->3.7) |

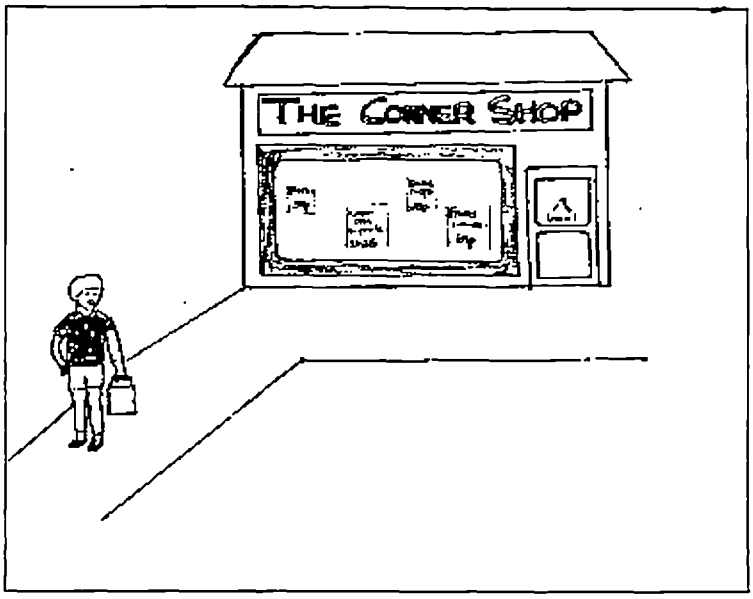
Procedure:

The misleading package scenario involved the experimenter holding up a coke can and asking the child "What do you think is in here?". Once the child had said coke then a glass was produced and water was poured from the can into the glass. The child was then asked "What is it?". If they did not immediately say 'water' - some of the children said juice or fizzy drink, or coke - they were allowed to taste the water, or were prompted until they said "water". They were asked the reality question "So what is in the can?" and the memory question "What did you say was in the can when I first showed it to you?". The water was then poured back into the can and any spillage

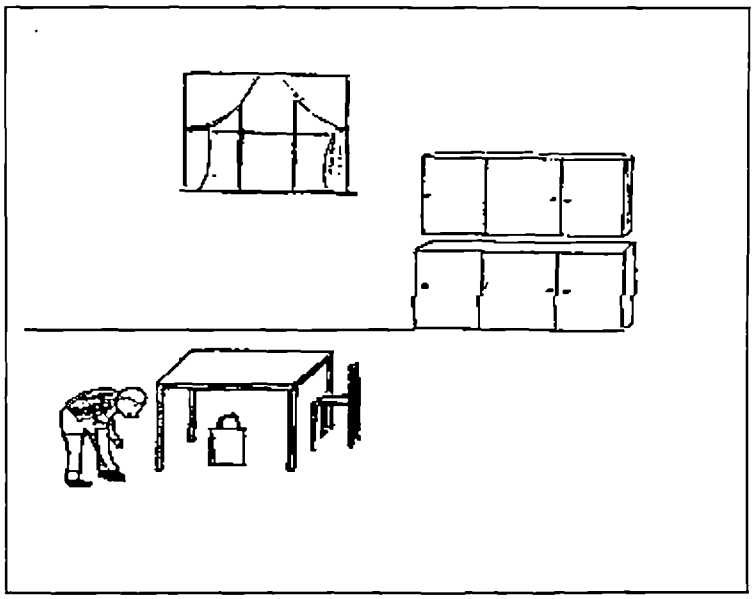
wiped up and the child was asked "If Jack (or another child who had not yet been in the room) comes into the room and I hold up the can to him, what will he say is in the can?". The child was then asked the second reality/memory questions "What is really in the can?".

A different scenario was used for the autistic children and adults, using a picture sequence story as described below and illustrated in the pictures. The story involved a young boy called Peter, who on his way home from school one day, stopped at the corner shop and bought something to eat. He carried it home and left it under the table in the kitchen while he went out to play football. At this point the child was asked "Where did Peter put his bag of food?". If the child did not respond, he or she was urged to point to or show the place. The story continued with Peter's Mum coming in to clean the kitchen floor and in order to do so she moves Peter's bag to the cupboard. The second reality question was then asked - "Where has Peter's mum put the bag of food?" Finally, Peter is getting hungry so he comes in from the garden to get his food. The child was then asked the false-belief question - "Where will Peter first look for his bag of food when he comes into the kitchen?" Again the child was prompted to show the position if no verbal response was given. The word FIRST was included in the false-belief question for both tasks in an attempt to improve the autistic children's performance, as a study by Eisenmajer and Prior (1991) suggested it would. The child was then asked the two memory questions "Where did Peter leave his food when he came home from the shop?" and "Where did his Mum move it to when she was cleaning the floor?".

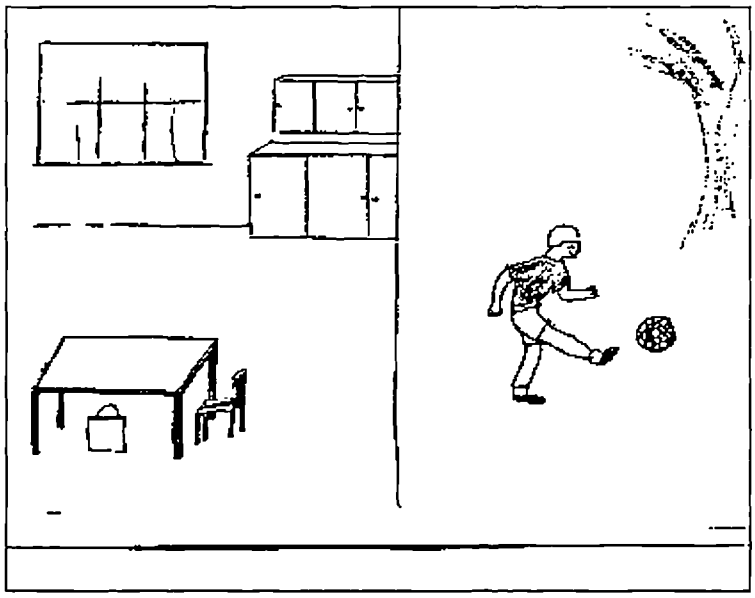
Picture story used with autistic children and adults to test false-belief.



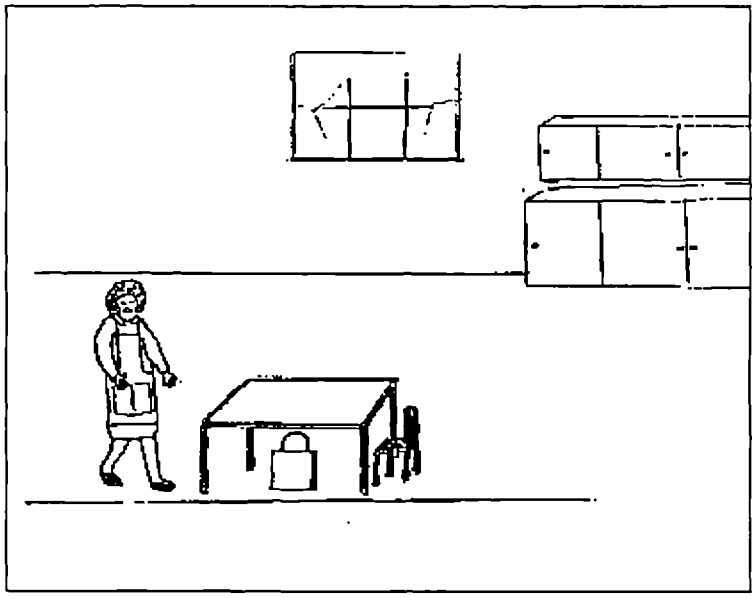

Here is Johnny on his way home from school. He has just been to the little shop to buy some food for a snack. He has bought crisps and a Mars bar and a can of coke.



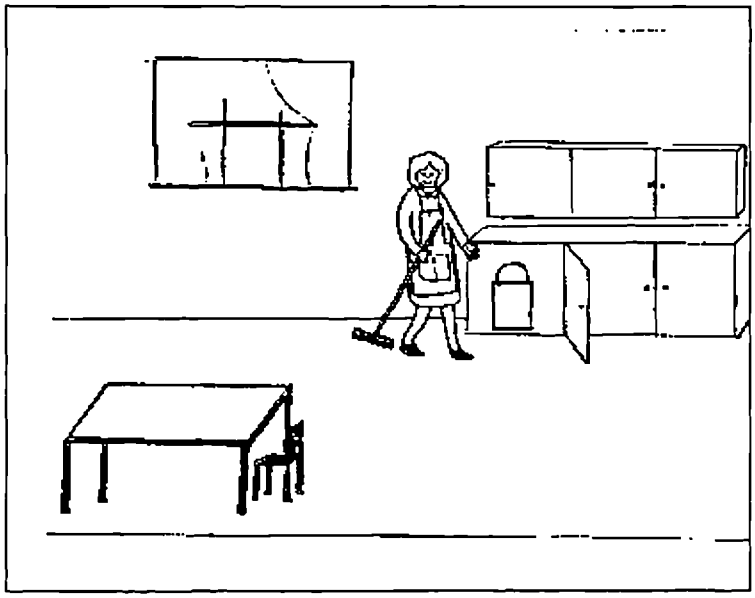
Now here is Johnny at home, in the kitchen. He decides that he will have his snack later, after he has played football. He puts his bag of food under the table in the kitchen.
Where has Johnny left his bag of food?



And here is Johnny outside, playing football.

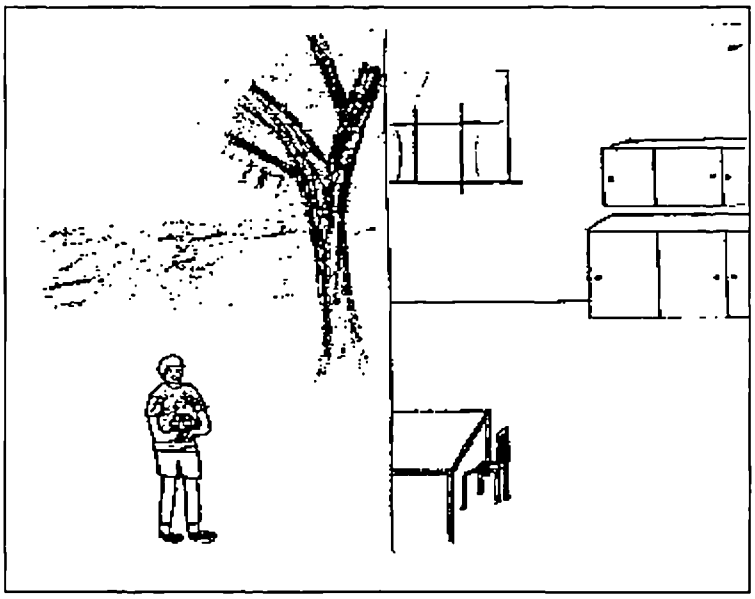


While Johnny is out playing, his mother comes into the kitchen. She is tidying the house.



She wants to clean the kitchen floor so she moves Johnny's bag of food and puts it in the cupboard.

So where is Johnny's bag of food now?
Where did he leave it when he came home from school?



Here is Johnny again. Now he is hungry and he decided to come inside to have his snack.

When Johnny comes into the kitchen, where will he first look for his bag of food?

Where is it really/ where did his mum put it?

Where did Johnny put it when he first came home from school

Additional Results:

When a simple autistic/non-autistic comparison is made the difference between the number of passes and failures only reaches significance when the non-reponses and failed memory responses are taken into account ($X^2 = 10.90$ $p<0.01$). Because of the high number of memory failures in the autistic group in was decided to look at this in more detail. The autistic groups combined showed more memory failures and no responses than the non-autistic groups combined ($X^2 = 8.41$ $p<0.01$). The autistic children also showed more no reponses and memory failures than both the 5-6 year olds ($X^2 = 7.76$ $p<0.01$) and the MLD children ($X^2 = 4.77$ $p<0.05$). There was no difference between the autistic adults and control groups.

To look at the pattern of passes and failures within each group, a second series of chi-square analyses was carried out. The autistic children showed significantly more failures plus no responses/memory failures than passes ($X^2 = 4.45$ $p<0.05$) but there were no significant differences between failures, passes and no response/memory failures. The autistic adults showed no differences between the number of adults pasing, failing false-belief and failing memory. The 5-6 year olds showed more passes than fails and there were no children who failed the memory

questions ($X^2$ = 8.33 $p<0.01$). Finally, the MLD children did not show significantly more passes than other responses but did show more passes than failures ($X^2$ =10.74 $p<0.01$) and more passes than no responses/ memory failures ($X^2$ = 8.4 $p<0.01$).