

THE UNIVERSITY OF HULL

**A PSYCHOLOGICAL INVESTIGATION OF
AUTISTIC SPECTRUM DISORDERS : IMPLICATIONS FOR THE
CONCEPT OF ASPERGER SYNDROME**

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Abstract

Asperger Syndrome was first described in 1944. Because of its similar presentation with autism it was subsumed under autistic spectrum disorders about 35 years later. The present study re-assessed Asperger's original article and identified specific differences between the two conditions leading to the hypothesis that Asperger Syndrome was different from autism. This was examined in four areas: cognitive profiles, cognitive styles, language and motor skills. A test battery of 11 standardised and non-standardised tests was used to examine the hypothesis. Medical consultants classified 50 participants, from 5 to 10 years of age, with autistic features on the basis of both the DSM-IV criteria for autism and Asperger Syndrome and, separately, Gillberg and Gillberg's (1989) criteria. The results showed very low agreement for either with consultants' overall diagnostic impressions, indicating poor validity of these three diagnostic instruments, which consequently did not allow allocation of participants into groups of autism and Asperger Syndrome.

The classification was finally based on parental ratings using the *Childhood Autism Rating Scale* (CARS), which showed a higher agreement with consultants' overall diagnoses. Schopler (1985), one of its authors, recommended that individuals with Asperger Syndrome should be subsumed under "mild autism", and this classification was adopted here. Eighteen non-symptomatic controls matched on age and sex were tested on the non-standardised tests. Significant differences between experimental and control groups were found in all four areas. The experimental group displayed a cognitive style characterised by rigid field-independent information processing in the areas of intellectual abilities, perception, language and motor skills. Differences between "mild" and "severe autism" were statistically not significant. This may have been due to mild presentation of autistic features in the whole sample, ambiguity of classification or other reasons. However the profiles of traits and abnormalities in both groups were not as would be anticipated from an all-inclusive concept of autism with varying degrees of severity but were more in accord with Asperger's suggestion that there are qualitative differences between autism and Asperger Syndrome.

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To my parents and my sister Sibylle.

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INTRODUCTION

In recent years, autobiographical accounts (Williams 1993, Schäfer 1997, O'Neill 1999) of people who have emerged from their so-called "autistic" world have challenged the text book views of autism. Rather than suffering from a life long debilitating condition, O'Neill (1999) writes "my goal is to show that autism can be seen as a truly beautiful event" (page 13). Her internal world appears rich but very different from the one that most people share. Autistic people describe themselves as experiencing the world in a different way, which can be extremely frustrating and confusing, particularly in social situations.

This is expressed in a poem by Dianne Mear (in Attwood, 1998, page 42):

Humans are the most illogical race

Nothing they say

Nothing they do

Makes any sense

Oh, why can't humans be logical?

It is interesting that from Dianne's point of view, the human race shows a deficit in logical thinking. Researchers in the field of autism argue from the opposite point of view (see chapter 2.1) claiming that autistic people show cognitive impairments.

However, what is perceived as a deficit from a particular perspective, whether it is called normal or impaired may turn out to be enriching and widening for the individual and for society as a whole.

It is hoped that the outcome of this study will contribute to a better understanding and a clearer identification of conditions, which present with autistic features. The author has met many children exhibiting these features who have gone through a troublesome and traumatic childhood, bullied and ostracised by their peers and little understood by their bewildered families. An early diagnosis is important in order to give them adequate support so that they are able to develop their individual potential and find their place in society.

1. HISTORICAL OVERVIEW

1.1 BLEULER AND KANNER

The term “autism” was first introduced by E. Bleuler (1916), a Swiss psychiatrist. In his work with psychotic adult patients, he observed specific cognitive processes characterised by visionary, dream like thoughts, with impulsive, undisciplined, illogical thinking. These thought disorders indicated in Bleuler’s view a loosening of associations causing the personality to disintegrate and eventually lose touch with reality. The term “autism” described the process of withdrawal from reality and detachment from the social world. Bleuler did not understand autism as a separate psychiatric condition but used it to describe the detachment in psychotic disorders.

Leo Kanner (1943), an American child psychiatrist, contributed an article to a symposium on the topic of children’s abilities to form affective relationships with people. He was struck by the unusual presentation of a group of 11 children, assessed by

his team, whose condition differed markedly from any other condition known so far. Despite their individual differences, they showed a number of common characteristics:

- The inability to relate to people and situations from birth. Kanner called this “extreme autistic aloneness”. Young children would not show anticipatory postural preparations before being picked up. Older children did not seem to acknowledge other people but rather regarded them as objects.
- Most children of his group acquired the ability to speak at an appropriate age but failed to develop the communicative function of language. Their language consisted mainly of naming nouns, identifying objects, recognising colours and counting all of which Kanner did not regard as communication skills. Kanner felt that in their ability to communicate, the “verbal” children did not differ from mute ones. He also observed echolalia and literality, which Kanner did not regard as disturbances of communication skills.
- The majority of his children had problems with feeding from very early on. They ate very little food at all and were either colicky babies or vomited frequently. These difficulties seemed to abate on their own within the first year. Kanner interpreted the intake of food as an intrusion into the child’s world.
- A strong negative response to loud noises. However, if the child controlled the noise, the aversive reaction was absent. Here again, Kanner felt that an independent noise was an intrusion into the child’s aloneness.

- An anxious obsessive desire for sameness, which implied a strong resistance to change. Repetitive, monotonous behaviour and a limitation of spontaneous activities were frequently observed. The child found it easier to relate to objects as their appearance or position did not change without the interference of a person.

- Although their lack of co-operation did not allow formal assessment, Kanner held the notion that his children had good intellectual abilities. In the past, they would have been diagnosed as feeble minded or schizophrenic. But their good vocabulary, excellent memory and rote memory, as well as an amazing ability to recollect complete patterns and sequences indicated in Kanner's view a good intellectual potential. It is important to note that all children of his cohort did well on the *Seguin Form Board*.

- The physical examinations showed nothing unusual. Five children had relatively large heads. Some were clumsy in their gross motor performance but skilful in their fine motor co-ordination. The EEG's only showed unusual brain activity in one of the children.

- The children came from highly intelligent families. Kanner found a high degree of obsessionality in their family backgrounds. He also noticed that the parents of his children were not emotionally warmhearted people but rather cold and formal in their relationships. Kanner wondered how much this had contributed to the children's difficulties, which he thought, were mainly innate.

Despite remarkable similarities with childhood schizophrenia Kanner found that the children of his cohort were different. They showed “autistic aloneness” from birth, implying an innate rather than a degenerative development. The fact that his children were able to establish a relationship to objects but not to people indicated in Kanner’s view a specific and not a general difficulty and was therefore different from schizophrenia. Kanner understood the repetitive and obsessive behaviour of his children as an attempt to preserve sameness and predictability in their own world. He also observed that the lack of reciprocal social interaction did not change with age although older children seemed to emerge out of their solitude, becoming more communicative and approachable to reasoning.

Kanner concluded that the difficulties of these children were different from schizophrenia. They suffered from a condition not described previously, at the core of which was the disability to form relationships with other people. Kanner called it “autistic disturbances of affective contact” which was also the title of his article.

1.2 RUTTER AND WING

After Kanner’s pioneering work other clinicians identified children with this condition (Darr and Warden, 1951, Vaillant, 1962). The term infantile autism became widely accepted. Although Kanner’s description of the syndrome was clear, its manifestations varied widely, which complicated the diagnostic process. Especially the differential diagnosis from psychotic conditions and primary attachment disorders was difficult. It was unclear whether different diagnostic labels such as schizoid personality disorder, schizotypal personality disorder or childhood psychosis were associated with separate

clinical conditions as they all included autistic features. The boundaries seemed to be unclear.

A group of children with the psychiatric label of schizoid personality disorder attracted the interest of Wolff and Barlow (1979). The characteristic features included solitariness, lack of empathy, abnormal sensitivity, rigidity and metaphorical use of language. Wolff and Barlow felt that there were some similarities with autism although the full presentation of autism was not present. In their study, they assessed autistic, schizoid and non-symptomatic children with a variety of cognitive, language and memory tests. The results suggested that the performance of the schizoid group was intermediate between the autistic and the control group. In their presentation these children seemed to resemble the ones which Asperger (1944) labeled as “autistic psychopaths”. However, Wolff and Barlow did not relate their findings to Asperger’s results.

In a longitudinal study on children with schizoid personality disorder, Wolff and Church (1980) reported that the five core characteristics (as above) typical for this group had predictive value. Wolff and McGuire (1995) explored sex differences in children diagnosed as schizoid and confirmed a much higher prevalence in boys (4.6:1). In their distinguishing features, the gender groups did not differ. However, the authors also found that schizoid girls exhibited significantly more anti-social behaviours than boys did during childhood and also in adult life. In her later publications Wolff (1995, 1997) stressed the striking similarities between schizoid personality disorder and Asperger syndrome and introduced the term “loners” to describe this group of people. She also

identified management strategies and special educational provisions to support their development.

Rutter (1978a) documented the confusion regarding the diagnosis of conditions with autistic features after Kanner published his article. Based on his own research he suggested to reduce the core criteria to four to strengthen the diagnostic procedure:

- early onset of the condition(before the age of three years)
- severe impairment of reciprocal social interactions
- severe abnormality in the development of communication
- restricted, repetitive and stereotypical patterns of behaviour, interests and activities

Rutter conceded that his suggestion did not resolve the confusion regarding subgroups, which showed some but not all features of autism. Despite some criticism (Volkmar et al., 1986) Rutter's criteria have been widely adopted and formed the basis for the third edition of the DSM-III (American Psychiatric Association, 1980) and the revised edition DSM-III-R (American Psychiatric Association, 1987).

A year after Rutter, Wing and Gould (1979) carried out an epidemiological study in the former London borough of Camberwell. Their aim was to develop a reliable classification system for autistic disorders.

They identified all children who had features of autism or any other syndromes within what was called "childhood psychosis" and children who showed strange or bizarre behaviours, regardless of their levels of intelligence. Children with an IQ below 50 who did not show autistic features were included as a comparison group. The participants came from special schools and from mainstream schools. The analysis of the data was

aimed to identify specific patterns of impairments and behaviours in order to find clusters of subgroups. One small group of children was easily identified; they showed the full picture of autism as described by Kanner. However, the majority of children did not fit Kanner's description. The variation in their presentation made it difficult to assign these children to any named syndrome. However, further analysis of the data revealed that the whole cohort could be divided into two groups: one group of children who were interested in and enjoyed social interactions at a level which was appropriate for their mental age, and a second group who showed a general lack of interest in other people irrespective of their mental age. Gould and Wing also observed that a lack of reciprocal social interactions was always accompanied by poor linguistic skills and a poor development of imaginative and pretend play. They concluded that these three criteria were central to autistic disorders and its various manifestations.

All children of their cohort exhibited these core criteria which Wing and Gould called the "Triad of Social Impairments". They found that the triad could occur in children of all levels of intelligence, in children with classic autism as well as those with other conditions within the field of childhood psychosis. Even children described as odd, strange or bizarre fulfilled the criteria of the triad and could be subsumed under this category according to Wing (1979). As a result, the range of manifestations labeled as "autistic" varied greatly from very severe to very mild "almost shading into normality". (Wing 1989), and could be visualised on a continuum. Wing (1988) called it the "Autistic Spectrum", on which all autistic conditions could be located.

By introducing the triad of social impairments and the autistic spectrum, Wing and Gould were broadening the concept of autism in order to clarify the diagnostic process.

Although this concept was widely accepted, it has also attracted some criticism (Szatmari et al., 1989, Szatmari et al., 1990, Ozonoff et al., 1991, Brook and Bowler, 1992, Gillberg, 1998). However, Wing and Gould's findings and conclusions were taken into consideration by the American Psychiatric Association (1980), who in their third edition of the Diagnostic and Statistical Manual, introduced the clinical term "pervasive developmental disorders" (PDD) to describe disorders characterised by the triad of social impairments. The new label PDD provoked a discussion regarding its usefulness (Happé and Frith, 1991, Gillberg, 1991) but it remained the category for autistic spectrum disorders. The World Health Organisation (WHO) has also accepted this label and in their recent editions, both diagnostic manuals use this term as denomination for all autistic spectrum disorders.

It is not surprising that 58 years after Kanner published his article, the diagnosis of this condition can still pose a challenge to the clinician. The child with so called "classic autism" is picked up nowadays fairly early (Baron-Cohen et al., 1992) but the child with an incomplete or mild presentation of the triad is often not identified. Despite recent advances, e.g. *Theory of Mind* (Baron-Cohen et al., 1985) and a plethora of research findings in this field, our understanding has remained limited. One of the most advanced diagnostic protocols, the ADI-R (Autistic Diagnostic Interview-Revised, Lord et al., 1994) is able to diagnose autism reliably but fails to give a satisfactory success rate for the identification of individuals on the mild end of the autistic spectrum or other conditions with autistic features (Cox et al., 1999).

1.3 ASPERGER

At the beginning of the 1980's, a different syndrome became more known to researchers in the field of autism. It was originally introduced by Asperger (1944), who called it "autistic psychopathy in childhood". Asperger, a Viennese paediatrician, published his work, which was his second doctoral thesis, in war stricken occupied Austria, and was not aware of Kanner's research, which was printed only several months before his own. The timing and the fact that it was written in German were probably the reasons why his article did not attract much interest amongst English speaking scientists for more than 36 years. Wing (1981a) conducted a literature search and found only seven articles written in English regarding the "autistic psychopathy in childhood" before 1981.

In his paper Asperger (1944) drew on his extensive clinical experience to describe a specific type. He illustrated this with the detailed case histories of four boys who showed similarities with the children described by Kanner. However Asperger always maintained that the type he identified was different from Kanner's. Van Krevelen (1971) supported this notion. In his paper he compared Asperger's observations with Kanner's and was intrigued by the later onset of autistic psychopathy. He also suggested that it was a genetic trait, mainly carried by males, whereas autism developed if this trait was combined with brain damage. He noticed that in Kanner's type autism, children's motor skills were advanced when compared with speech development. All children showed poor eye contact. Wing's (1981a) influential paper made Asperger's concept more accessible to English speaking researchers. She suggested to use the term "Asperger Syndrome" instead of "Autistic Psychopathy in Childhood" as the English usage of "psychopathy" was different from the German one and could create wrong impressions

and misunderstandings. Wing gave a brief account of Asperger's (1944) work and discussed the overlap with autism and schizoid personality disorder.

She noticed that all the features, which characterised Asperger Syndrome, could also be found in the normal population in varying degrees, confirming Asperger's view of a personality trait being the underlying cause for the difficulties of his cohort. However, she also felt that a distinct pathology rather than a personality disorder seemed to be a more appropriate explanation for the unusual and odd behaviours:

"The reasons for personality disorders are so obscure, that classifying Asperger's syndrome under this heading does not lead to any testable hypotheses concerning cause, clinical phenomena, pathology or management. A more limited, but more productive, view of the problem is to consider it as a consequence of impairment of certain aspects of cognitive and social development." (Wing, 1981a, page 123)

She therefore concluded that Asperger Syndrome should be included into a wider group of conditions characterised by the triad of impairments. After 1981, the term Asperger Syndrome was widely used in the English literature and until today it generally carries the connotation that Wing (1981a) gave to it in her article as being at the mild end of autism (National Autistic Society, 1999).

Schopler (1985) suggested that the term Asperger Syndrome should not be used at all to reduce "diagnostic confusion" (page 359) and suggested to subsume all autistic-like conditions under the term autism. Other authors held the opposite view (Green, 1990, Volkmar et al., 1998). However, it appeared that in the absence of an English translation

researchers in this field have developed a different picture of Asperger Syndrome, which seemed to carry his name but did not reflect his ideas. This variation of the type originally described by Asperger has now found entry into the most authoritative and internationally recognised diagnostic manuals, the ICD-10 (World Health Organisation, 1992) and the DSM-IV (American Psychiatric Association, 1994).

The diagnostic criteria for autism and Asperger Syndrome in both manuals are almost identical. They are mainly based on the triad of social impairments (Wing and Gould, 1979). The differentiating features are the absence of a general delay or retardation in language or in cognitive development in Asperger Syndrome. ICD-10 also includes marked clumsiness in its criteria for Asperger Syndrome. Green (1990) discussed in his article the differences between autism and Asperger Syndrome. Although there was no significant evidence, which distinguished between the conditions, he felt that individuals with Asperger Syndrome presented different criteria, which justified a different category.

Miller and Ozonoff (1997) highlighted this discrepancy in a recent paper and asked provocatively “did Asperger’s cases have Asperger’s disorder?” They came to the conclusion that the boys described in Asperger’s (1944) paper would not be diagnosed with Asperger Syndrome according to the present diagnostic criteria. It seemed as if the drive for a unifying diagnostic model in this area of research neglected the comprehensive analysis of observable data.

Several attempts have been made to develop clearer diagnostic criteria. Gillberg and Gillberg (1989) used their own list of criteria for Asperger Syndrome in their

epidemiological study. It consisted of six main symptoms based on papers of Asperger (1944), Van Krevelen (1979) and Wing (1981). However, the authors did not explore its discriminative value regarding autism and Asperger Syndrome.

In a later genealogical study, Gillberg (1991) found that the people of his cohort diagnosed with Asperger Syndrome had at least one close relative with this condition or with Asperger traits. He also noticed that in comparison with autism it was very uncommon that parents of autistic children were also autistic. Gillberg therefore concluded that there must be a closer hereditary link in Asperger Syndrome. He also suggested that motor functions could be a possible discriminator between Asperger Syndrome and autism.

Szatmari et al., (1989) attempted to establish reliable diagnostic criteria for Asperger Syndrome. They compared a group of 28 children diagnosed with this condition with a group of psychiatric outpatients using a structured interview for parents, and the *Vineland Adaptive Behavior Scales*. The results indicated significant differences regarding a range of social impairments. On the basis of their findings, the authors developed a list of new criteria for Asperger Syndrome. Its validity in comparison with autism was not examined.

Almost 50 years after Asperger (1944) published his article Frith (1991) produced an English translation. Admittedly the original was written in a lengthy, sometimes convoluted, old fashioned style which made a word for word translation almost impossible. However, Frith's suggestion in a footnote to replace the term "autistic psychopathy" by "autism" and thereby "bring it into line with current terminology"

(page 37) seemed to indicate a bias towards her own model of autism (Frith, 1989). The present author agrees with Wolff (1995), who felt that “her (*Frith's*) interpretations, however, of what Asperger really meant (especially her belief that his emphasis on the children's giftedness may have been misplaced) may not finally prove to be correct” (page 20).

In her translation Frith (1991) has omitted the first seven pages of Asperger's article, dismissing them as a “general and somewhat discursive introduction” (page 37). However, the present author felt that they were important as they illustrated Asperger's struggle to find diagnostic categories, which described the children of his cohort in a comprehensive and holistic way. Asperger discussed three different psychiatric typologies of his time and criticised their limitations:

“If one keeps to a well established typology, then one fails to identify and correctly evaluate such traits, which perhaps are essential and give a person the characteristic and individual features, but are by themselves not represented in the typology” (Asperger, 1944, page 79, translated by the present author).

He felt that the whole personality could not be explained by the simple sum of its individual traits. He compared the concept of personality to a living organism where “each one of its traits is related to others receiving from them a certain tinge and in turn is influencing all others”. (page 79, translated by the present author). To illustrate his ideas he looked at intelligence as one of the main characteristics of a person. Asperger felt a single score had only limited value and suggested that an assessment of intellectual abilities should also include for example the style of working, range of

interests, spontaneity, affect, rapport, fantasy, originality and other characteristics to describe the full intellectual potential of a person. In the same way, Asperger saw the ability to relate to people as being embedded into the whole personality. How else could the contradiction in the autistic psychopath be understood who could show fond attachment to an animal or object but extreme unkindness and even “cruelty” towards close relatives?

Asperger warned that the use of any specific typology would result in the loss of the essential features of a person. His aim was to understand the individual as a whole and to develop a remedial system of education and behaviour modification, in German called “Heilpädagogik”, to give the individual an opportunity to reach his potential. This treatment was delivered by a team of committed professionals from health and education and was described as being very successful (Frith, 1991).

These introductory thoughts by Asperger (1944) describe clearly his theoretical position. He did not deliver a list of characteristic deficits and shortcomings of the autistic psychopath but attempted to understand his difficulties and unusual behaviour as part of the whole personality. Asperger felt that the autistic psychopath experienced the world in a different way, which has now been supported by autobiographical accounts (Williams, 1993, O’Neill, 1999).

Sacks (1995) explored this notion in his interview with Temple Grandin, a well-known American scientist suffering from autism. Grandin compared her auditory perception in childhood with “helpless microphones transmitting everything, irrespective of relevance, at full overwhelming volume”, (Sacks, 1995, page 242). “Much of the time, I

feel like an anthropologist on Mars” (ibid., page 248). Grandin described her own autism as a result of her visual thought processes and felt that all autistic people were visual thinkers.

Asperger’s (1944) article is too lengthy to be replicated here. The interested reader is referred to Frith’s (1991) translation. The intention is instead to focus on Asperger’s summary of his detailed observations of four boys aged between six and eleven years. Despite their varying presentation Asperger felt that they showed a number of typical features, which he placed under six different headings, the contents of which are summarised below:

(1) Physical and expressive characteristics

- Young children lose the undifferentiated baby-like appearance early and develop early mature facial features.
- Abnormality of gaze: the eyes are rarely focusing on an object or a person. The gaze is more vague. However, the child appears surprisingly well informed about the visual environment as it assimilates visual information through the peripheral visual field.
- Poor expression of gesture and mime. Difficulties to express and understand affect or emotions through language.
- Unusual, unnatural voice production: it can sound low and distant, or like a German upper class accent, or shrill, inappropriately loud, monotonous, or over modulated.
- Language is not directed to an interlocutor but almost as if spoken into an empty space.

(2) “Autistic intelligence”

- Asperger felt that autistic intelligence is characterised by a spontaneous production of own ideas, and at the same time an inability to learn from other people.
- The environment is experienced in a different way. This can be verbally expressed by neologisms and an unusual use of verbal expressions.
- Early development of special interests mainly in the field of sciences and mathematics.
- Mature understanding of objects of art. Children are not only able to describe what is portrayed but also show an understanding of the expressed emotions and mood (in contrast to their deficit in reading emotions in other humans).
- An accurate and mature observation of people is often present. e.g. an awareness of other people’s shortcomings. Asperger called it “psychopathic clarity of vision” (translated by Frith, 1991).
- At school, learning difficulties are common: “someone who only follows his own impulses and responds little to demands of the environment can show a high degree of originality but will fail to learn” (Asperger, 1944, page 118, translated by the present author). “ The obsession to use the own self invented method hinders the child to learn the mathematical procedure taught by the teacher” (ibid., page 119, translated by the present author).
- Specific difficulties with attention. The child shows good concentration when following his* own pursuits. When confronted by demands of the environment, there is little inclination to pay any attention at all.
- Intelligence tests reveal high scores in abstract and logical thinking.

(* The majority of people suffering from Asperger Syndrome or autism are of male gender. Therefore the male singular personal pronoun “he” is used throughout the present study.)

(3) Social behaviour

- Significant difficulties in interacting with other people. Children sometimes show what appears as calculated aggression towards members of the family. Asperger called it “autistic maliciousness” (translated by the present author). The child is often isolated.
- Children follow their own impulses, unconcerned by expectations of the environment. To avoid conflicts, parents often do not interfere.
- Lack of awareness of interpersonal distance; he may approach strangers with familiarity.

(4) Drive, affect, sensory perception and emotionality

- Interest in sexuality is variable: majority shows intense interest expressed in masturbation or exhibitionism and inappropriate advances.
- Oversensitive responses to certain tastes, touches or sounds. For example, a sound may be tolerated or even ignored in a certain situation but may cause an extreme response in a different context.
- Lack of respect for another person. Asperger felt that disobedience did not indicate deliberate insolence but instead expressed a lack of understanding of the other person.

- Symbolic or pretend play is not present. Objects are often carried around like a “fetish”. (Asperger). The child will show a severe temper tantrum if parted from the object.
- Personal skills like washing, toileting and dressing are neglected. Children can be messy eaters.
- Lack of humour, although enjoyment of puns. These can consist of simple word reversals or a play with similar sounding words, sometimes sharply formulated witty remarks. In this area, they are often highly skilled and creative.
- Strong feelings of homesickness, Asperger wondered whether the obsessive need for sameness in their environment and routines at home were the reasons for this strong reaction.
- Asperger felt it could be misleading to presume that these children showed a lack or poverty of emotionality. He described it as a qualitatively difference experience of being. Compared with non-symptomatic people it can be described as a disharmony of emotions and surprising contradictions, causing difficulties in conforming.

(5) Genetical and biological factors

- Asperger assessed more than 200 children over a period of ten years, who showed the characteristics of the autistic psychopath in varying degrees. In all cases, where it was possible to meet the parents or other relatives, Asperger found “psychopathic” traits in relatives. The majority of children had fathers who had academic, intellectual occupations often occupying high positions.

- Asperger did not find a single girl in his cohort who showed the full picture of autistic psychopathy. He mentioned two cases where preceding encephalitis had caused similar symptoms.
- “The autistic psychopath is an extreme variant of the male intelligence, of the male character” (Asperger, 1944, page 129, translated by the present author). Asperger held the notion that generally speaking girls learn better than boys do. They were more interested in concrete practical things, whereas logical thinking, abstract thinking and concept formation was the domain of boys. “The ability of abstract thinking is so far advanced that the relationship to the concrete, to people and to objects has almost been lost, and the adaptation to demands of the environment is only present to a very low degree” (ibid., pages 129 and 130, translated by the present author).
- In Asperger’s group, autistic psychopaths were most often single children. Asperger was aware that this could be seen as the reason for their unusual behaviours. However, he found that very young children showed already the characteristic symptoms. Also the fact that autistic children who grew up with non-symptomatic siblings did not differ in their development and peculiarities from the “autistic psychopath” who grew up as a single child, supported, in Asperger’s view, his idea of an inherent factor.
- Asperger also considered the possibility that his client group showed early signs of schizophrenia. However, he could not find a deterioration in their development; on the contrary, Asperger felt that older children were able to adapt better to the demands of everyday life. If there was change in these children it was an improvement.

(6) Social aspects and prognosis

The above described summary of the difficulties of the autistic psychopath may give the impression that the social integration of a person diagnosed with autistic psychopathy is very difficult if not impossible. However, Asperger found that this was only true in the minority of cases, when low intelligence was paired with autistic traits. The majority was able to achieve good work performance resulting in social integration. “Their unswerving determination and penetrating intellectual powers, part of their spontaneous and original mental activity, their narrowness and single mindedness, as manifested in their special interests, can be immensely valuable and can lead to outstanding achievements in their chosen areas”. (Asperger 1944, translated by Frith, 1991). Asperger frequently found amongst adults with autistic psychopathy professionals such as mathematicians, engineers, chemists, civil servants and musicians.

Conclusion

Asperger’s detailed observations describe a type that has similarities with Kanner’s autism, but also shows significant differences. Even in later papers, Asperger (1968, 1979) always stressed that the two conditions were “basically different types”. He did not see the autistic psychopath as a person with deficits, but, on the contrary, as a specially gifted individual who had the ability to experience the world in a different way. Visual, auditory and tactile information was not being processed in the way most people do. Verbal understanding and cognition seemed to function on a different level. Abstract thinking, logical thinking and concept formation were highly developed. Asperger regarded these specific traits as great assets of a person and for society in

general, and concluded that the autistic psychopath was a person with an enormous potential.

In order to clarify the distinguishing features of Asperger's autistic psychopath from other developmental disorders the present author has condensed the previously described list of typical features. Asperger (1944) stressed that the narrowing down of features would result in a loss of essential information. However this further reduction of criteria was carried out to clarify the differences from other developmental disorders and not to derive criteria for diagnostic purposes.

Summary of criteria of the autistic psychopath based on Asperger (1944):

- pervasiveness, all areas of the personality are affected
- specific features can be detected from the second year of life and show constancy over time
- variability of individual features can be great; Asperger introduced the concept of a continuum
- features are inherited
- related to gender, predominantly male sufferers
- inability to learn instinctually (by observation), difficulties in learning basic life skills and adapting behaviour to social requirements, but a creative potential
- different processing of visual information; visual information is assimilated faster, predominant use of peripheral vision
- highly developed abstract thinking
- clumsiness especially with regards to gross motor skills
- specific difficulties with attention
- good expressive language but difficulties with verbal understanding

These criteria seem to describe a type different from the one characterised by the triad of impairments. In the table below autism and Asperger Syndrome are compared on the basis of the triad of impairments.

Table 1: Comparison of autism and Asperger Syndrome

<u>Autism</u> (as defined by the triad of social impairments, Wing and Gould, 1979)	<u>Asperger Syndrome</u> (as described by Asperger, 1944, translations by the present author)
Severe impairment of social reciprocal interactions	<p>“These children show a surprisingly good understanding of their teacher’s personality.” (page 93)</p> <p>“Here there are numerous genuine relationships, an understanding of reciprocity and a genuine educational potential if specific methods are provided.” (page 96)</p>
Severe impairment of speech and language abilities	<p>“Especially the intellectually more able children have a particularly creative relationship with their own language expressing their original experiences and observations in a verbally original way.” (page 115)</p>
Lack of imaginative and pretend play, presence of obsessionality and routines.	<p>“Young autistic children often show stereotypic activities, sometimes the simplest movement stereotypes for example rocking.” (page 122)</p> <p>“Instead of using toys e.g. blocks appropriately, they line them up or sort them by colour, shape or size or by some other, incomprehensible, rule.” (page 122)</p>

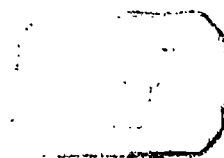
This comparison suggested that Asperger (1944) described a group of children who seemed to be different from the ones characterised by the triad of impairments. However current theories place Asperger Syndrome on the autistic spectrum (Wing and Gould, 1979, Wing, 1981a, National Autistic Society, 1999). It seemed as if Asperger’s original observations have only sketchily influenced clinical theory and research.

His central idea that people with Asperger Syndrome have special abilities and therefore need specific educational support in order to develop their full potential has only found limited entry into treatment plans and educational curricula.

In the Camberwell Study Wing and Gould (1979) found that their entire research population could be divided into two groups with regards to their interests in social activities (see chapter 1.2). The authors focussed on the group of children who showed a general lack of social interests and subsequently identified the triad of social impairments as cardinal features of this group (Wing, 1989). However, Asperger (1944) did not mention a general lack of social interests when describing his cohort but found instead an inappropriate and inapt social behaviour which, he felt, as a consequence had often led to social withdrawal and isolation.

The question arises whether Asperger was describing a different group of children. It seems as if his participants were similar to the group identified by Wing and Gould (1979) who showed an interest in social interactions but did not present the complete triad of impairments. From the present author's clinical experience it is not uncommon that children with Asperger Syndrome do not present the complete triad.

It has also frequently been found that children with Asperger Syndrome express a strong wish to socialise with their peers but are at a loss at how this can be achieved. These specific verbal difficulties have been identified as 'semantic-pragmatic' problems (see chapter 2.3). These observations in combination with Asperger's findings lead to the hypothesis that not a lack of social interest but a different processing of sensory information is the main characteristic of a person with Asperger Syndrome. The present study intends to explore this hypothesis in four different areas and to test for differences between Asperger Syndrome and autism.



2. RESEARCH AREAS

2.1 COGNITIVE PROFILES

Kanner (1943) claimed that people with autism had a good intellectual potential. Although he did not carry out any formal assessments, he based his assumption on the presence of good expressive language, excellent memory and high performance on form boards. However, research in the 1960s and 1970s indicated that the majority of autistic children were functioning well below average according to conventional intelligence tests (Wassing, 1965, Lockyer and Rutter, 1970, DeMeyer et al., 1974). Assessments also indicated an uneven profile of abilities with generally low scores in verbal subtests but average or above average results in performance/practical tasks.

Lotter (1966) assessed a group of 32 autistic children with a battery of cognitive tests and found that 22 had an IQ of lower than 55.

Hermelin and O'Connor (1970) investigated the learning and problem solving strategies in 27 children diagnosed with autism. 25 had IQ's below 80, with the majority showing an IQ of under 60. The assessments included a range of different visual, verbal and tactile tasks. Regarding the processing of visual information, the authors found a shorter visual inspection time in autistic children when compared with controls. The experimental group also showed a faster adaptation to light at the cortical level. These findings suggested a better processing of visual information in autistic children. In their motor responses, this group tended to persist in giving the same responses and showed a delay in adapting to a new task. Regarding their short-term auditory memory functions, autistic children were as good as or better than, non-symptomatic controls in

memorising meaningless verbal information. However, when meaningful verbal material was introduced, their results were significantly lower, indicating a profound lack of encoding information meaningfully. The authors concluded that autism was associated with basic cognitive deficits, different from mental retardation. This outcome was supported by a later study by Tager-Flusberg (1991).

Bartak et al. (1975) conducted a comprehensive study of autistic children. They collected information regarding milestones, intelligence, language, reading skills and social behaviours. The outcome of the intellectual assessments confirmed the pattern of average performance skills but significantly lower verbal abilities. The authors also found that autistic children differed markedly from the language-impaired controls: comprehension difficulties were more severe, an impairment of “inner language” was common and language in general was less used in a social context. Especially the last two criteria differentiated well between the autistic group and the language impaired one. The authors concluded that a language deficit was not a sufficient cause of autism.

Maltz (1981) suspected a strong influence of verbal comprehension abilities on the outcome of intellectual assessments. He therefore used in his study a non-verbal test, an adaptation of the *Leiter Scale* (Arthur, 1969). The visually presented test items consisted of geometrical shapes and patterns, which had to be matched according to two principles, representing different cognitive processes. The concrete discrimination test used features such as size, colour or shape to indicate similarity between a group of different objects, whereas the formal discrimination tasks used abstract concepts (e.g. same class or category). The results suggested that autistic children were significantly better than mentally retarded and normal controls (matched on mental age) on concrete

discrimination tasks but not on formal discriminations. The results confirmed specific cognitive deficits and strengths regardless of verbal comprehension abilities.

A similar result was published by Shah and Holmes (1985) who assessed a group of autistic children with the *Leiter Scale* (Leiter, 1980). They found a high correlation between *Leiter IQ* and *Performance IQ* (PIQ) of the *Wechsler Scales*. This was not surprising, as both tests required good visual perception and visuo-spatial abilities. However, the low correlation between *Leiter IQ* and *Verbal IQ* (VIQ) suggested in their opinion that the tests were assessing two different cognitive abilities.

Rumsey and Hamburger (1988) found in their group of autistic adults significant deficits in both verbal and non-verbal problem solving tasks which did not confirm the characteristic pattern of abilities typical of autism. They used the *Wisconsin Card Sorting Test* (Heaton, 1981) to assess non-verbal skills. This test is particularly sensitive to frontal lobe dysfunction. The low performance of the autistic group indicated, in the author's view, that impairments found in autism are more likely to be related to frontal lobe dysfunction.

Ozonoff et al. (1991a) investigated the frontal lobe hypothesis further. Their group of high functioning autistic people between the ages of 8 and 20 was compared with non-symptomatic controls on a number of measures. The autistic group showed significant deficits in executive functions and emotion perception, which was not present in the control group. It was concluded that poor planning and organisational abilities were a primary deficit in autism. On the basis of this study Ozonoff et al. formulated the executive functions hypothesis which claims to differentiate autism and Asperger

Syndrome on the basis of executive functions variables. These findings were confirmed by later studies (Hughes et al., 1999).

In a second study Ozonoff et al. (1991b) found confirmation for their hypothesis and also found evidence for a significantly higher VIQ in Asperger Syndrome when compared with autism.

Lincoln et al. (1988) assessed in two studies autistic individuals and compared their test results with controls. The VIQ of the autistic group was significantly lower than the PIQ. The profile showed a trough in *Comprehension* and *Similarities* but a peak in *Block Design* and *Object Assembly*. The best discriminator between the autistic group and the controls was the subtest *Comprehension*. A principal component analysis of the *Wechsler* scores for the autistic group resulted in three factors:

Factor 1: all verbal tests

Factor 2: *Block Design*, *Object Assembly* and *Coding*

Factor 3: *Picture Arrangement* and *Picture Completion*.

The typical autistic profile, which was found by other researchers, was only partially confirmed. The authors speculated that each factor was likely to be representative of various aspects of brain functioning rather than a specific one. Poor results in tasks represented by factor 1, did not, in the author's view, suggest a defect but a serious mismatch of abilities within the individual.

In their longitudinal study Szatmari et al. (1989) monitored 16 high functioning autistic people (IQ between 68 and 110) over a period of 11 – 27 years after they had been diagnosed with autism. *Wechsler* results were not reported but it was said that autistic

individuals did not confirm the pattern of unimpaired non-verbal skills and delayed verbal ones. The results also suggested that the severity of early behaviour difficulties in autistic children was a poor predictor for problems in later life, whereas the early performance in non-verbal problem solving tasks was a better prognostic indicator. The authors concluded that high functioning children with good non-verbal skills could be expected to improve to a substantial degree.

A year later Szatmari et al. (1990) published another study, which compared the performance of individuals with autism, Asperger Syndrome and outpatient controls on different neuro-psychological measures. The *Wechsler* results of both experimental groups showed the typical pattern of abilities but the groups did not differ significantly from each other. However, the authors failed to comment on a significant difference in the subtest *Similarities*. Here the results differentiated well between all three subgroups with the Asperger Syndrome group located on the intermediate rank. In their discussion, the authors concluded that a lack of flexibility and generalisation in both the autistic and the Asperger Syndrome group was evident throughout the assessment. This deficit is associated with frontal lobe dysfunction, which Szatmari et al. regarded as a core feature of autism.

The presence of superior visuo-perceptual abilities in autistic children prompted Shah and Frith (1983) to investigate their performance on the *Embedded Figures Test* (Witkin et al., 1971). The autistic group scored higher than the non-autistic controls. The authors discussed the possibility of different problem solving strategies and explored this further in a later study (Shah and Frith, 1993). They used the *Block Design* task of the *Wechsler Scales* and assessed the effect of visual segmentation on the performance.

Their results confirmed significantly higher scores in autistic children than in non-symptomatic controls. The authors concluded that the advanced ability was mainly due to the ability to visually segment the master pattern into its components. When all groups received prompts regarding segmentation, the performance of the groups did not differ any more. This supported in their view the central coherence theory formulated by Frith (1989). It postulates that people normally show a tendency to organise information into a meaningful whole. Different aspects and observations are connected with each other. However, autistic individuals seem to process information in a “piece meal style” (Happé, 1994) by rigidly focusing on details thereby losing the perception of the whole. In visuo-perceptual tasks like the *Embedded Figures Test* or *Block Design*, this strategy is advantageous because the person is less likely to be distracted by the visual perception of the whole figure. The actual deficit or weakness in the ability to create central coherence has, in this example, turned into a strength (Frith, 1989). Shah and Frith (1993) suggested that the central coherence hypothesis (Frith, 1989) may be one possible explanation for the uneven cognitive profile of autistic people and also made a reference to the concept of cognitive styles (see chapter 2.2) which took a different perspective.

Jarrold and Russell (1997) examined counting abilities in autism. The participants of their experiment were asked to count a number of black dots as fast as they could. The individual elements on the stimulus cards were presented in two conditions, at random order and in a geometrical pattern. Compared with children who had moderate learning difficulties and normal controls the group of autistic children were counting each single element of a stimulus card rather than using the perception of the whole and thus demonstrated an analytical rather than a global strategy to complete the task confirming the central coherence hypothesis.

An unusual experimental design was used by Fein et al. (1985). In order to avoid the bias inherent in the diagnostic process when forming experimental groups, they collected data from an unselected group of children within the wide category of Pervasive Developmental Disorders. In a post-hoc cluster analysis they identified eight subgroups. Three of the groups had peaks in performance test (50% of the population), two groups showed peaks in verbal tests. Two groups exhibited a more complex pattern and one group did not show a significant pattern. All but one group had relatively low scores in short term memory, which was attributed to poor attention skills. The authors demonstrated that without using conventional diagnostic criteria autistic subgroups with specific profiles were confirmed.

Ohta (1987) studied the performance of high functioning autistic children on cognitive tests. The result supported previous findings of significantly higher PIQ than VIQ in the *Wechsler Scales*. However, Ohta also found marked difficulties of autistic children in abstracting, conceptualising and sequencing visual and auditory information.

Happé (1994) examined *Wechsler* profiles of two groups of autistic children: the members of one group had successfully passed *Theory of Mind* (TOM) tasks whereas the other participants had failed on these tests. The *Theory of Mind* (Baron-Cohen et al., 1985) attempts to explain behavioural and cognitive deficits in autistic individuals by proposing a specific impairment in meta-representational abilities. This was initially explored with tasks regarding false belief and deception. The results indicated an inability in autistic children to infer the mental states of other people. The theory can partially predict low *Wechsler* scores in *Comprehension* and *Picture Arrangement*.

In her study Happé (1994) confirmed the characteristic profile of peaks and troughs present in both groups. She also found that poor performance on the *Comprehension*

subtest was associated with failing the TOM tasks. An error analysis favoured in Happé's view the explanation that low scores in *Comprehension* were due to a lack of "mentalising" rather than "language limitations". However, it remained unclear how Happé differentiated between these two abilities. Especially, receptive language skills involve similar cognitive functions as are required for the successful completion of TOM tasks. She also wondered whether the assumptions of conventional intelligence testing, e.g. the concept of intelligence testing in general, and the estimation of intelligence quotients from subtests, could be applied to autistic individuals and was calling for different experimental designs.

Bowler (1992) examined the *Theory of Mind*. He selected fifteen young adults with Asperger Syndrome. The diagnostic criteria were based on Wing (1981a). The results indicated that individuals with Asperger Syndrome were capable of solving second order belief tasks. This was later confirmed by Stone et al. (1998). Bowler concluded that these tasks could be used to discriminate between high-functioning autism (HFA) and Asperger Syndrome. He confirmed people with Asperger Syndrome were able to develop an understanding of other people's thoughts and emotions. He called for a revision of the notion that autistic individuals show a lack of awareness of other people's mental states. He supported the theory of an autistic spectrum and explored the possibility that Asperger Syndrome was a subgroup of the autistic spectrum.

Siegel et al. (1996) found in their literature review on IQ profiles in autism frequently a pattern of high PIQ and lower VIQ. The fact that not all studies showed this pattern indicated in the author's view, a lack of universality of the concept of autism. However, the profile of subtest scores had been more consistent with high scores in *Digit Span* and *Block Design* but poor results in *Comprehension* and *Picture Arrangement* or

Coding. In their own study, Siegel et al. assessed a large sample of high functioning autistic children and adults with autism. The results did not confirm the pattern of high PIQ and low VIQ. The authors concluded that this specific pattern was dependent on general ability levels and expected it to be more common in low functioning individuals. The typical pattern of subtest scores was, however, replicated, although there was considerable individual variability. Siegel et al. felt “there is no evidence that any particular IQ level or pattern is incompatible with a diagnosis of autism” (page 403) and gave a caution regarding the use of *Wechsler* scores in the diagnosis of autism.

Ehlers et al. (1997) evaluated the validity of *Wechsler* results as discriminator between autism, Asperger Syndrome and attention deficit. They included Gillberg and Gillberg’s (1989) concept of *DAMP* (deficits in attention, motor control and perception) which seemed to overlap with autistic disorders and attention deficit/hyperactivity disorder (*ADHD*). The group with Asperger Syndrome showed good verbal abilities but poor visuo-perceptual skills whereas the autistic group developed a tendency towards the opposite pattern. The profile of the *DAMP* group revealed poor performance in *Coding* and *Arithmetic*. As only a minority of individuals showed the typical profile of a particular group, Ehlers et al. concluded that the discriminating value of *Wechsler* subtest scores was poor but saw autism and Asperger Syndrome principally as separate entities. Individuals with autism and Asperger Syndrome differed on general IQ level and verbal ability, which, in the author’s view, questioned the validity of the concept of an autistic spectrum. Nass and Gutman (1997) found in their cohort of children with Asperger Syndrome exceptional verbal abilities but deficits in visuo-perceptual functions and motor skills which, they felt was different from the typical autistic presentation.

Manjiviona and Prior (1999) came to the opposite conclusion in their most recent study. They assessed children with autism and Asperger Syndrome on a variety of neuro-psychological measures. The two groups differed significantly in their *Full-Scale Wechsler* scores, which the authors felt was mainly due to better verbal abilities in the Asperger group. However, as there was no significant difference between the groups on a range of other neuro-psychological tests, the authors felt that the significant *Wechsler* results may have falsely enhanced the differences between Asperger Syndrome and autism. They interpreted the significant scores as representing quantitative rather than qualitative aspects of autism. They were confirmed in their views by the typical pattern of peaks and troughs found in both groups. In their conclusions, the authors discussed the limitations of research in this field in the absence of clear diagnostic criteria and conceded the possibility that as a result of this some children of their cohort could have been incorrectly diagnosed. However, the authors felt that their findings supported the concept of an autistic spectrum.

Early neuro-psychological assessments of autistic people (Lockyer and Rutter, 1970, Hermelin and O'Connor, 1970) gave rise to the hypothesis that autism was caused by cognitive deficits, which were the result of brain dysfunction (Rickaby et al., 1991). Although the majority of children showed below average intellectual abilities, they could be successfully differentiated from children with learning difficulties by their specific pattern of cognitive abilities. The most frequently used test to assess cognitive abilities is the *Wechsler Intelligence Scale* (Wechsler, 1977). Its 12 subtests are divided into six verbal and six performance tests which assess different areas of functioning. The visuo-perceptual and visuo-spatial tasks reflect processing strategies thought to be located in the right hemisphere, verbal abilities are attributed to the left brain hemisphere and have frequently found to be low in autism.

Dawson (1983) used subtests of the *Halstead-Reitan Test Battery* (Reitan, 1969) to compare a group of autistic children with two control groups: one consisted of children with bilateral or diffuse brain damage and the other of mentally retarded children. The results showed left hemisphere deficits in the autistic groups but not in the controls. Dawson discussed the possibility of right hemisphere compensation in the presence of left hemisphere dysfunction. She quoted Prior and Bradshaw (1979) and Dawson (1982) who found that autistic individuals favour the processing of visual and verbal information in the right hemisphere of the brain.

Voeller (1986) investigated a group of 15 children from 5 to 13 years of age who showed evidence of a right hemisphere lesion or dysfunction as supported by neurological examinations of CAT scans (Computer Axial Tomography). These children were previously not diagnosed as autistic but were referred for behavioural disturbances and learning difficulties. Voeller recorded their developmental histories and assessed the children on intellectual abilities, literacy and numeracy skills. She found in 64% of her cases a significantly higher mean VIQ than PIQ. 93% of her children were extremely distractible and displayed marked problems in their attention. Despite their good verbal abilities they had difficulties in socialising with peers and were often unable to maintain friendships. They were described as “being on a different wavelength”. Unusual prosody and poor eye contact was also common. The test results indicated better verbal than visuo-spatial abilities and higher scores in literacy skills than in numeracy skills. Difficulties in recognising the emotional state of others were also present. Although Voeller did not relate her findings to research in the field of autism, the similarities between the children of her cohort and the ones described by

Asperger (1944) were striking and gave indirect support for the hypothesis of right-hemisphere dysfunction in autism, in contrast to Hoffman and Prior (1982).

McKelvey et al. (1995) used modern electronic imaging techniques in their investigations of three adolescents diagnosed with Asperger Syndrome. From each participant three different scans were taken *computerised tomography (CT)*, *magnetic resonance imaging (MRI)* and *single photo emission computerised tomography (SPECT)*. The *SPECT* imaging technique indicated right hemisphere abnormalities in all three individuals. Abnormalities of the cerebellum were also present which, the authors felt, was consistent with previous findings of autistic people (Cook, 1990). Although the findings supported the hypothesis of a right hemisphere dysfunction in Asperger Syndrome, the lack of an autistic control group left the question unanswered whether individuals with autism show similar or different neuro-anatomic features.

Conclusion

The literature review of relevant research papers over the last 25 years shows little consistency of outcome. On the contrary, conflicting results were frequently published. This appears to be due to a number of reasons:

- There has been little agreement on diagnostic criteria, which has resulted in different diagnostic concepts. The author has found eleven different lists of criteria: Kanner (1943), Rutter (1978 a), ICD-9 (1978), Wolff and Barlow (1979), Wing and Gould (1979), DSM-III (1980), Tantam (1988), Gillberg and Gillberg (1989), Szatmari et al. (1989), ICD-10 (1992), DSM-IV (1994).

Aitken (1991) gave an overview of changes of diagnostic criteria in autistic spectrum disorders.

- Although many researchers recruited individuals with so-called "high functioning" autism (HFA), there are, at present, no explicit diagnostic criteria for this group (Gillberg, 1998).
- Earlier studies did not differentiate between autism and Asperger Syndrome, which resulted in heterogeneous experimental groups.
- Experimental groups frequently covered a wide age range. Both Kanner (1943) and Asperger (1944) pointed out that the severity of symptoms could change significantly with age. However, even in more recent studies (Ehlers et al., 1997, Manjiviona and Prior, 1999) children and adolescents were allocated into the same groups.
- Inappropriate experimental designs. Happé (1994) called in question the adequacy of conventional test assumptions and interpretations of results when comparing autistic individuals with non-symptomatic controls.
- Lack of operationalisation of diagnostic criteria (Szatmari et al., 1994).
- The trend of seeking a unifying framework (Schopler, 1985) has resulted in the loss of essential information of specific conditions.

It was surprising that despite these contradictions a typical pattern of subtest scores was frequently confirmed. Table 2 lists the *Wechsler* results (scaled scores) of eight studies described earlier, reporting on 13 different groups of individuals with autism or Asperger Syndrome. On the performance side 12/13 studies showed a peak in *Block Design*. *Picture Arrangement* was the lowest score in 7/13 studies and *Picture Completion* in 6/13. The verbal subtests did not indicate a distinct peak. In 6/13 studies *Digit Span* was the highest score closely followed by *Similarities* with 5/13. The lowest scaled scores, obtained in *Comprehension*, occurred in 8/14 studies. These results seemed to indicate a typical pattern of peaks and troughs in the assessment of autistic children:

- high scores in *Block Design*, *Similarities* and *Digit Span*
- low scores in *Picture Arrangement*, *Picture Completion* and *Comprehension*

However, some researchers found evidence of different profiles in autism and Asperger Syndrome (Szatmari et al., 1989, Ozonoff et al., 1991b, Ehlers et al., 1997) which was mainly based on high scores in *Similarities* found in Asperger Syndrome. Their findings supported Asperger's (1944) view that the uneven profile of abilities in his cohort was explained by the presence of superior functions in abstract and logical thinking.

Research findings regarding brain functioning in autism have supported the idea of a neuro-biological basis of this condition (Gillberg, 1990, Lincoln et al., 1998). However, test results were not consistent and did not produce conclusive evidence for the presence of hemispheric dominance in autism and Asperger Syndrome. Significant areas, which could explain poor functioning in individuals with autism or Asperger Syndrome, were

identified e.g. frontal lobe, temporal lobe, the limbic system and the cerebellum. However, due to a lack of clear diagnostic criteria in this field research results were often ambiguous.

The objective of the present study is to find out whether a particular profile of intellectual abilities can be confirmed in this cohort and whether it is different in individuals with autism and ones with Asperger Syndrome. It is also intended to examine Asperger's (1944) notion that the individuals he assessed showed superior abilities in abstract thinking and logical thinking and to establish whether this criterion differentiates between autism and Asperger Syndrome.

Table 2: *Wechsler* subtest scores of eight research studies carried out between 1975 and 1999

	YEAR	N	AGE RANGE	INFO	SIMIL	ARITH	VOC	COMP	DIGIT	PICT		BLOCK	OBJECT
										SPAN	COMP		
BARTAK et al.	1975	9	5-10	4.80	3.80	5.60	4.10	2.70	7.20	9.80	7.80	12.40	10.00
WOLFF and BARLOW	1979	8	5;10 - 15;10	8.75	9.50	7.88	8.25	5.75	9.38	10.00	7.75	10.63	9.00
RUMSEY and HAMBURGER	1988	10	18-39	11.50	11.50	10.50	9.80	7.00	13.00	9.50	8.50	15.00	10.80
LINCOLN et al. 1.	1988	33	8;6-29;2	5.66	5.15	5.69	3.96	3.42	7.42	7.09	6.54	10.27	8.75
2.	1988	13	8-12	3.69	4.28	4.38	1.92	1.38	5.23	7.69	4.69	10.15	9.84
SZATMARI et al. AU	1990	17	7-32	7.66	6.76	7.72	7.75	6.88	8.59	7.36	7.57	8.14	7.81
AS	1990	26	8-18	7.93	8.50	7.66	8.14	6.13	8.41	7.69	8.44	8.92	8.14
SIEGEL et al. 1.	1996	45	6;0-16;6	10.69	10.58	9.27	9.02	7.47	9.61	9.33	9.33	11.33	10.22
2.	1996	36	16;1-51;11	9.03	8.50	8.78	8.28	7.25	9.22	7.44	8.33	9.17	8.72
EHLERS et al. AU	1997	40	6;1-15;8	7.30	8.20	5.60	6.80	6.30	7.80	8.00	5.90	9.10	6.90
AS	1997	40	5;3-15;0	12.00	12.30	9.50	12.0	11.20	10.40	10.60	9.40	10.50	8.30
MANJIVIONA AU	1999	21	7;0;15;0	9.80	9.90	6.80	7.60	7.20	7.40	7.70	8.60	10.20	9.80
PRIOR AS	1999	35	6;0-17;0	11.40	11.10	9.30	9.40	9.50	7.70	9.00	10.60	12.60	10.60

(AU = autism, AS = Asperger Syndrome)

2.2. COGNITIVE STYLES

Independent of research in the field of autism Witkin et al. (in Witkin and Goodenough, 1981) explored specific areas of visual orientation in the late 1940's. They analysed response patterns in visual distraction tasks. In the so-called "*Rod and Frame Test*" individuals were asked to position a straight bar, which could be rotated like a propeller into an exact vertical position. A moveable rectangular frame around this bar and also different geometrical patterns behind it were used to distract the visual perception and render the task more difficult. The outcome suggested that people follow preferred ways of integrating conflicting information in the task of locating the upright. The experimental design was varied to include different postures and also by rotating the room in which the experiment took place. The performance in all three tasks depended mainly on two perceptual processes:

The visual perception regarding the field of the experimental task and the direction of gravitation perceived was mainly depending on vestibular, tactile and kinaesthetic senses. The results suggested that some individuals were more susceptible to distraction than others. Witkin et al. (in Witkin and Goodenough, 1981) named these different responses "field dependent" and "field independent" strategies. They also found that these different ways of processing sensory information especially in the *Rod and Frame Test* were related to the gender: male adults tended to be more field independent than females.

Further studies of these response patterns suggested that they were part of a broader dimension involving general cognitive as well as perceptual abilities. Witkin (1950)

examined the field dependence-independence dimension in relation to the *Embedded Figures Test* (Witkin, 1971). This test requires the individual to find specific geometrical shapes in a complex pattern, which is constructed of elements depicting the simple shapes. It was found that a field independent strategy was associated with better scores in the *Embedded Figures Test*. The dimensions of this concept were further broadened by research involving social and personal attitudes and judgements. The results indicated that people who were functioning in a more field-independent mode were less likely to utilise external sources of information when making decisions in ambiguous social scenarios (in Witkin and Goodenough, 1981). Individuals who were more field-dependent showed a stronger orientation towards other people and demonstrated better interpersonal competencies.

The concept of field dependence-independence seemed to be part of a wider concept which Witkin called “*Cognitive Styles*” (Witkin, 1964). He assumed that the cognitive style of an individual was present within all areas of functioning that it was pervasive. It was a specific, individual way of responding and experiencing the world. It was also evident to Witkin that although a person’s abilities changed over time, the cognitive style remained the same. Witkin and Goodenough (1981) felt that biological factors could play a major role in its development and speculated on the influence of hormones during brain maturation.

Witkin (1964) did not apply his theory to individuals with autism or Asperger Syndrome. However, the similarities between his concept and Asperger’s (1944) were striking. Both researchers found:

- specific styles of processing sensory information
- pervasiveness of styles
- constancy over time
- styles were related to gender

The question arises whether individuals with Asperger Syndrome can be described as generally functioning in a specific cognitive style which is characterised by field independent processing of information. The social as well as non-social deficits and assets of people with Asperger Syndrome could be explained within this theory. For example, children with Asperger Syndrome often develop a special interest in a particular area but show minimal interest in more general age appropriate topics. The specific knowledge in their area of interest is often far beyond the level of that of the ordinary peer. They are keen to join their peers but do not know how this can be accomplished. The child with Asperger Syndrome finds it much easier to socialise with children younger than his age, who happily follow his lead. Likewise conversations with adults are more successful. The Asperger child can baffle the adult by his detailed information on a specific topic, which sometimes is interpreted as maturity.

Shah and Frith (1983) compared the performance of autistic children with normal and mildly retarded non-autistic controls on the *Children's Embedded Figures Test* (Witkin et al., 1971). The authors did not differentiate between autism and Asperger Syndrome. They selected their cohort on the basis of DSM-III criteria (APA, 1980). The outcome indicated that the autism group performed significantly better than both control groups. Autistic individuals were searching for the hidden figure "by means of a cut out shape" whereas the control groups used a purely visual search strategy. The authors concluded that individuals with autism have poor visualisation skills and found it difficult "to

mentally manipulate, rotate, twist or invert a pictorially presented object.” They used a different strategy by searching with a visual template in mind, which was a more effective strategy in this specific task. Shah and Frith made a reference to Witkin’s theory but interpreted the outcome of their study with the *Central Coherence Theory* (Frith, 1989).

In their later study Shah and Frith (1993) could confirm their previous findings: autistic individuals showed a better performance in a modified *Block Design* task when compared with non-symptomatic and mentally retarded controls. However when the control groups received visual prompts the difference between groups was no longer significant. The authors felt that the superior performance could not be explained by superior general spatial abilities but mainly by the ability to perceive the parts of an object rather than the whole.

Happé (1996) used six well-known optical illusions to examine the *Central Coherence Theory* in autistic individuals. She found that the effect of the illusion depended mainly on the perception of the visual stimulus as a whole. Autistic individuals who were more able to focus on the parts of a visual stimulus were less likely to succumb to the illusion than normal controls and children with learning disabilities who made the expected errors in their judgements. However in a second trial visual prompts were introduced. The parts of the illusion that had to be compared (e.g. the two parallel lines in the *Müller-Lyer Illusion*) were highlighted by brightly coloured plastic material which stood up about 4mm from the surface of the stimulus card. The results indicated no significant differences between the autistic group and the control groups, which confirmed the *Central Coherence Theory*. Happé did not relate her findings to the theory of cognitive styles. She felt that the significant lack of visual integration in autistic individuals might

account for reports of fragmented perception in people with autism. In more recent publications Happé (1999a, 1999b) discussed different problem solving strategies in autism within the context of cognitive styles. She hypothesised the cognitive style as being a normally distributed characteristic with strong and weak central coherence at opposite ends and called for further research especially in verbal tasks to find evidence for this position.

Asperger (1944) was surprised by the prevalence of males suffering from autistic psychopathy, which suggested to him the presence of an underlying trait. Later the research of Witkin and Goodenough (1985) indicated that a field-independent style of functioning was more common in males. Further research in the field of Asperger Syndrome and autism confirmed a strong preponderance of male sufferers.

Kanner (1954) found a male:female ratio of 4:1. Epidemiological studies have shown that this ratio can vary significantly depending on the level of intelligence. Lotter (1966) assessed several retarded children with autism and found a ratio of 1.4:1. A Swedish study by Gillberg (1989) confirmed a much higher ratio of 10:1 in children with Asperger Syndrome who had average IQs. Wing (1981b) referring to the Camberwell study reported a ratio of 14.2:1 for individuals with an IQ of 50+. She noticed that generally fewer girls exhibited the triad of impairment but those who did, were found to be more profoundly retarded. She speculated that the varying sex ratios could indicate a hereditary causation in males but in females the genetic predisposition was combined with severe brain damage.

However Kopp and Gillberg (1992) raised the question whether females with high functioning autism presented with different behaviours than males and were therefore

under-represented. They assessed a group of six girls between the ages of six and ten years with severe social and communication impairments. Although the autistic symptoms were more pronounced when they were younger a diagnosis of autism was dismissed by experts in the field. The authors found that females with high functioning autism presented less aggressive behaviours and showed more often a lack of initiative, which did conceal autistic symptoms so that they frequently received the non-specific diagnosis of learning disability. The authors concluded that the autism phenotype might be different in females when compared with males.

Conclusion

Asperger (1944) has found different cognitive strategies in his cohort e.g. solving mathematical tasks, visuo-perceptual tasks and also specific verbal tasks, which resembled a field independent style of functioning. Research studies regarding problem solving strategies in autism and related disorders using visual stimuli have not differentiated between autism and Asperger Syndrome. The present study aims to find out whether individuals with autism and those with Asperger Syndrome differ in their styles of processing sensory information. If the underlying difference is based on a cognitive style then this should be present in other areas of abilities, which will be assessed in experiments using visual, acoustic and tactile perception.

2.3 SPEECH AND LANGUAGE ABILITIES

One of the core features of autism is the presence of significant difficulties in verbal communication (Rutter, 1978, Wing and Gould, 1979) already described by Kanner (1943) and Asperger (1944). These difficulties can be present in various degrees. Some people with autism fail to acquire functional speech but the majority will develop some verbal functions. The child with high functioning autism and the child with Asperger Syndrome characteristically exhibit good expressive language. However, verbal understanding is frequently impaired. Difficulties to maintain a conversation, inappropriate use of language, the tendency to go off at a tangent and the literal interpretation of verbal information are some of the problems these children encounter.

From a speech and language therapist's point of view, difficulties of this kind would have been diagnosed in the 1960's and 1970's as dysphasia, a disorder related to the concept of aphasia observed in adults who suffered from brain injury. However, Rapin and Allen (1983) proposed a nosological framework of developmental language disorders with six different subtypes, the "semantic-pragmatic syndrome" being one of them. This type was characterised by good expressive language but poor conversational skills, echolalia, pronominal reversals and odd verbal responses. Rapin and Allen (1983) regarded this type as a clinical entity although its features showed an astonishing similarity to what nowadays would be called Asperger Syndrome. Because of the unclear boundaries it generated a considerable controversy. However, the earlier work of Bartak et al. (1975) identified a group of nine children with difficulties in their verbal comprehension and an incomplete autistic presentation. These children could not be diagnosed with any then known clinical category and seemed to support Rapin and

Allen's view of the presence of a specific speech and language disorder which was similar to autism.

Bishop (1989) supported the idea of a specific language disorder with features similar to Asperger Syndrome but distinct from autism as suggested by Rapin and Allen (1983) and referred to this condition as "semantic pragmatic disorder". She felt the concept of an autistic spectrum was limited with regards to this specific language disorder. She introduced a two-dimensional model with one co-ordinate representing "meaningful verbal communication", and the other "interests and social relationships". Autism, Asperger Syndrome and semantic-pragmatic disorder occupied different areas in this system but showed an overlap.

Brook and Bowler (1992) reviewed the literature regarding children with semantic-pragmatic disorders. They found that the majority of studies reported these specific language difficulties and clear autistic features in their cohorts.

Brook and Bowler concluded that there was an overlap with autism but they did not explore the validity of the semantic-pragmatic disorder. The authors also highlighted the problem that clinicians rarely undertook a comprehensive, holistic assessment of a person, partially because of the nature of the request for an assessment, but also because of their professional orientation resulting in the examination of a specific function of a person. This could lead to an individual receiving different diagnoses regarding the same behaviour difficulties depending on the clinician who carried out the assessment (Bishop, 1989).

Gagnon et al. (1997) discussed the validity of the term "semantic-pragmatic disorder". In their pointed review of relevant literature they were not able to identify characteristic

features which were solely present in language impaired individuals but not in autism (Shields et al., 1996). The authors also felt that semantic-pragmatic type language difficulties could not be seen in isolation from a social context. Because this condition was related with other, non-verbal abilities it was concluded that it was in fact a pervasive developmental disorder. Gagnon et al. pointed out that until recently individuals presenting with these specific communication difficulties would not have received a diagnosis of autism because of their good academic abilities. Nowadays, the authors argue, a diagnosis of autistic spectrum disorder would have been more likely. The concept of semantic-pragmatic disorder historically “filled this very gap” (page 48). The authors therefore concluded that the concept should be abolished.

The semantic-pragmatic language difficulties as experienced by autistic individuals appear in quite a different light:

“In autism, the fundamental workings of learning to talk are distorted. Speech has a purpose. Some children with autism are unsure of its purpose. The main purpose of speech is to communicate. Autistics often use the speech they have in ways other than communication with another individual. They talk to themselves more than to others. They also often enjoy repeating specific phrases and words.” (O’Neill, 1999, page 48).

“Human language involves indirectness. It is the subtleties that are baffling to an autistic. They have difficulty grasping the same word or meaning in different contexts. It is sometimes hard for the youngster to understand that words which sound the same can be spelled another way, thereby meaning something completely different. When they learn one word they just don’t know that it can have variables.” (O’Neill, 1999, page 51).

These examples suggest that communication is experienced in a different way, and some of the semantic-pragmatic type difficulties could be interpreted as sensible coping strategies, e.g. the verbose child rambling on in the hope that some of his utterances will answer the question he was asked.

In the field of autism verbal abilities were frequently assessed with the *Wechsler Scale*. However, its verbal subtests were not designed to examine specific speech and language difficulties as observed in autism and Asperger Syndrome. The profile of subtest scores would therefore give a limited picture of an individual's verbal abilities. This could explain the sometimes puzzling discrepancy between good verbal scores in the *Wechsler Scale* in Asperger Syndrome but significant semantic-pragmatic type difficulties as experienced in every day life.

The literal interpretation of language and the lack of understanding of the implied meaning of verbal information are other specific difficulties a person with Asperger Syndrome typically presents. Asperger (1944) reported that the children of his cohort had good verbal abilities although he did not give detailed information of their language assessments. It seemed that Asperger based his opinion mainly on the children's good expressive language, which was observed during their assessment period. The cases presented in his article however indicated that the children had significant difficulties in their verbal understanding, e.g. they were not able to converse with their peers, they had difficulties to understand the rules of games and did not learn in conventional teaching situations. Asperger (1944) wrote about one of his boys:

“The content of his speech is different from what one would expect of a normal child: his reply to a question was rarely related to what he was asked. One has to repeat

questions several times, before they sink in.” (Asperger, 1944, page 87, translated by the present author).

However Asperger also observed a creative use of language: “He has an unusually mature and adult way to express himself which is not the un-reflected way of copying adult phrases, as children sometimes do, but developed from his own un-childlike but mature experience.” (Asperger, 1944, page 98, translated by the present author).

Asperger also found that the boys of his cohort did not have a concept of deceit or lying. He described a boy called Harro: “ He was said to be frequently lying. But he did not lie in order to get out of trouble when he had done something wrong. He was not interested in this as he always told the truth unashamedly. But he told long fantastic stories.”(Asperger, 1944, page 97, translated by the present author).

Conclusion

Asperger’s observations gave a much more differentiated picture of verbal abilities particularly in his cohort indicating an uneven profile of different language skills. The question arises whether there is a common pattern in individuals with Asperger Syndrome and whether this pattern is also present in autism.

This study explores whether autism and Asperger Syndrome can be identified on specific verbal measures. For this purpose different tests to assess psycholinguistic abilities have been chosen which provide more detailed information, particularly on the processing of verbal information. A questionnaire has also been developed to examine the understanding of common English idioms.

2.4 MOTOR SKILLS

Both Kanner (1943) and Asperger (1944) mentioned in their publications motor difficulties in the children they assessed. However, systematic examinations with well validated and standardised motor tests have only been carried out in the last ten years. It can be presumed that the presence of clumsiness in Asperger Syndrome was often based on the clinicians subjective impression.

In her early paper Wing (1981a) confirmed Asperger's (1944) notion. She found that 90% of her cohort were poor at games involving motor skills. Gross motor movements were described as "clumsy and ill co-ordinated". In the latest edition of the ICD-10 (World Health Organisation, 1992) clumsiness was included as a common feature of Asperger Syndrome but it was not regarded as an essential criterion for the diagnosis.

Gillberg (1989) used the *Griffiths Scales* (Griffiths, 1986) to assess motor abilities in children with autism and Asperger Syndrome. The latter ones exhibited general clumsiness, a stiff, awkward way of walking and they were uncoordinated in their gestures. Only a small proportion of autistic children had similar difficulties. However, autistic individuals were reported to develop more marked clumsiness in later life.

In their comparison of children with autism and Asperger Syndrome Szatmari et al. (1989) could not identify significant differences regarding motor abilities. However, a year later Szatmari et al. (1990) reported that a group with high functioning autism was significantly better than the Asperger group on a pegboard task when using the non-dominant hand but not the dominant hand. Rickaby et al., (1991) also observed clumsiness in all children of their cohort who were suffering from Asperger Syndrome.

Ghaziuddin et al. (1994) used the *Bruininks-Oseretsky Test* (Bruininks, 1978) to assess the motor abilities in children with high functioning autism and Asperger Syndrome. The results indicated deficits in both groups compared with age appropriate test norms. However, significant differences between the experimental groups were not found in their gross motor and fine motor skills as well as upper limb functioning. The Asperger group was marginally better than the group with high functioning autism on the coordination tests. In their discussion the authors drew attention to the poorly defined concept of “clumsiness” and its implications for research. They also speculated that a more specific pattern of motor deficits could probably reveal differences between the two groups.

Manjiviona and Prior (1995) examined motor abilities in high functioning autism and Asperger Syndrome with the *Test of Motor Impairment – Henderson Revision* (TOMI-H) (Stott et al., 1984). No significant differences between the groups were found in the four subtests. However, 50% of the Asperger group and 66.7% of the autistic group obtained very low scores indicating significant motor problems. The authors also found a significant negative correlation between IQ and TOMI-H scores, which suggested a verbal component in the performance of motor tasks. The outcome did not confirm different levels of motor skills in autism and Asperger Syndrome. The authors felt that this was due to the unavailability of clear diagnostic criteria to identify high functioning autism and Asperger Syndrome.

In a more recent study Ghaziuddin and Butler (1998) compared the performance of motor functions in children with autism, Asperger Syndrome and pervasive developmental disorders not otherwise specified (PDDNOS). All three groups showed coordination deficits on the *Bruininks-Oseretsky Test* (Bruininks, 1978). However,

individuals with Asperger Syndrome were found to be less impaired than participants of the other groups. When the motor scores were co-varied for Full Scale IQ, the analysis indicated no significant differences between the groups. The authors concluded that individuals with Asperger Syndrome might score better in a motor test because of their higher levels of intelligence. They also criticised the assessment tools and suggested to use different methods to examine coordination skills, e.g. motor analysis techniques.

Conclusion

The outcome of research studies regarding motor skills in autism and Asperger Syndrome was not consistent. In this study some motor abilities are assessed to find out whether autistic individuals and ones with Asperger Syndrome show different profiles.

3. HYPOTHESES

The general hypothesis that runs through the different research areas is whether Asperger Syndrome is a mild version of autism (i.e. qualitatively the same, differing only in degree of difference from normal) or whether Asperger Syndrome is a different condition from autism (even if their traits overlap to some extent). This question can be expressed in the Null and Experimental Hypothesis as follows:

H_0 : Asperger Syndrome is a mild version of autism.

Therefore EITHER (A) qualitatively the two groups cannot be differentiated on neuro-psychological measurements – they will show the same traits or abnormalities compared to normal children wherever these are found; (or at least autism will always show any abnormality that Asperger Syndrome shows);

OR (B) quantitatively children with Asperger Syndrome will show the same kind of abnormalities as autistic children but to a lesser degree – the scores of children with Asperger Syndrome will be between those of normal children and those of autistic children on any continuum measurements.

H_1 : Asperger Syndrome is not just a milder version of autism.

Therefore EITHER (A) qualitatively the Asperger group will show differences from control children on psychological measures where the autistic group do not;

OR (B) quantitatively children with Asperger Syndrome will show greater differences from normal than autistic children do on any continuum measurements.

3.1 Cognitive Profiles

The tests that were used to examine hypotheses in this area included:

- *Wechsler Scales*
- *Coloured Progressive Matrices* by Raven

Hypotheses regarding Wechsler Scales:

- (1) Can the study confirm a particular *Wechsler* profile of peaks in *Block Design*, *Digit Span* or *Similarities* and troughs in *Picture Arrangement*, *Picture Completion* or *Comprehension* in a combined group of Asperger Syndrome and autism?
- (2) Can Asperger Syndrome and autism be differentiated on *Wechsler* profiles?
- (3) Can Asperger Syndrome and autism be differentiated on specific subtests, e.g. *Similarities*? This particular test is assessing abstract thinking and concept formation, which Asperger found to be high in his cohort.
- (4) Does the Asperger group show higher PIQ than VIQ and the autistic group the reverse pattern?

Hypotheses regarding Raven's Matrices:

- (1) Does the Asperger group show a higher *Raven's* percentile than the autistic group?
- (2) Do Asperger Syndrome and autism differ when compared on different cognitive tasks in the *Matrices Test*?
- (3) Does the Asperger group show a higher percentile in the *Raven's* test than in the *Wechsler Scales*?

3.2 Cognitive Styles

The theory of cognitive styles suggests that there are different ways of functioning: a field dependent and a more field independent style. In this study a connection is made between this theory and Asperger's (1944) findings. The question is raised whether children with Asperger Syndrome show a preference for one style or the other. This is examined in the areas of visual and acoustic perception.

Gregory (1983) described four different types of visual illusions. Three of these were presented to all participants in this study:

- Ambiguous or reversible figures:

Duck – Rabbit Test Picture

Rubin Test Picture

- Paradoxical figures:

Escher Test Picture

- Geometrical illusions:

Müller – Lyer Illusion

Figure-Ground Perception is another specific function of visual perception. This ability was assessed by the test *Visual Closure* which is a subtest of the *Illinois Test* and is similar to the *Embedded Figures Test* (Witkin et al., 1971).

Auditory perception was assessed with the *Acoustic-Discrimination-Test* (see chapter 4.3, page 74).

Hypotheses regarding Visual Perception:

- (1) Are individuals of the experimental groups less able to change their visual perception in the *Duck – Rabbit*, *Rubin* and *Escher Test Picture* than controls?
- (2) Are participants with Asperger Syndrome different from ones with autism in their ability to change from one visual image to another?
- (3) Are individuals of the experimental groups in their visual judgements less affected by the optical illusion than controls (regarding the *Müller –Lyer Apparatus*)?
- (4) Do individuals with Asperger Syndrome differ in their judgements from ones with autism in the *Müller – Lyer Test*?

Hypotheses regarding Figure-Ground Perception:

- (1) Are participants of the experimental groups better at finding details in the *Visual Closure Test* than controls?
- (2) Do individuals with Asperger Syndrome and autism differ in their ability to find details in drawings?

Hypotheses regarding Acoustic Perception:

- (1) Are individuals of the experimental groups in their acoustic discrimination less influenced by distracting conditions than controls?
- (2) Do individuals with Asperger Syndrome differ in their acoustic discrimination from ones with autism?

3.3 Speech and Language Abilities

Speech and language abilities can vary in autistic spectrum disorders. As previously mentioned specific verbal deficits may not show up in traditionally used tests like the

Wechsler Scales. Two other tests were therefore used additionally to examine the hypotheses regarding this developmental area:

- Verbal subtests of the *Wechsler Scales*
- *Illinois Test of Psycholinguistic Abilities*
- *Literal Thinking Questionnaire*

The hypotheses in this research area were:

- (1) Do children with Asperger Syndrome and with autism show a specific verbal profile in their *Wechsler Scales*?
- (2) Do individuals with Asperger Syndrome differ from ones with autism regarding their verbal scores in the *Wechsler Scales*?
- (3) Do individuals with Asperger Syndrome and ones with autism show a specific profile in the *Illinois Test*?
- (4) Do individuals with Asperger Syndrome differ from ones with autism regarding their subtest scores in the *Illinois Test*?

Hypotheses regarding the *Literal Thinking Questionnaire*:

- (1) Are controls better than participants of the experimental group in understanding standard idioms of the English language?
- (2) Do individuals with Asperger Syndrome differ from ones with autism in their understanding of idioms?

3.4 Motor Skills

Both Asperger (1944) and Kanner (1943) found motor difficulties within their cohorts. However this feature did not seem to have been consistent in autistic spectrum disorders. Some researchers have observed good motor skills in autistic individuals but poor abilities in children with Asperger Syndrome, others could not confirm this pattern. This study also explores the role of visual control in fine and gross motor coordination.

The following tests were used to examine the hypotheses:

- *Movement ABC*
- *One – Leg – Balance*
- *Visual/Tactile Hand Control*

Hypotheses regarding *Movement ABC*:

- (1) Do individuals with Asperger Syndrome and autism show a particular pattern of motor skills, which is different from the test norms?
- (2) Do individuals with Asperger Syndrome differ from ones with autism in their motor skills as measured by the *Movement ABC*?

Hypotheses regarding *One-Leg-Balance*:

- (1) Do individuals of the experimental groups differ in *One-Leg-Balance* (with and without visual control) when compared with non-symptomatic controls?
- (2) Do individuals with Asperger Syndrome differ from ones with autism in *One-Leg-Balance* (with and without visual control)?

Hypotheses regarding *Visual/Tactile Hand Control*:

- (1) Do individuals of the experimental groups differ in *Posting Coins* (with and without visual control) when compared with non-symptomatic controls?
- (2) Do individuals with Asperger Syndrome differ from ones with autism in *Posting Coins* (with and without visual control)?

The categorisation of the experimental group was finally based on the *Childhood Autism Rating Scale* (CARS) which classified individuals into non-autistic, mildly-moderately autistic and severely autistic groups. Asperger Syndrome was not recognised as a separate condition by its authors. Schopler (1985) recommended to use the term “higher-level autism” or “mild autism” instead of Asperger Syndrome, which was characterised by a relatively low CARS score (see page 68). It was assumed that the participants of this study who were diagnosed by the consultants with Asperger Syndrome would fall into this category.

However it is important to point out that there are up to date no generally agreed definitions for “mild” or “severe autism”. These terms are used in the scientific literature to describe loosely varying degrees of severity of autism. Whenever they were used in the present study they were related to the CARS with its specific classification system and its inclusion of Asperger Syndrome as mild autism.

The hypotheses are summarised on the following pages in a table using the terminology of the CARS. They are formulated as experimental hypotheses.

HYPOTHESES	TASK
1) Individuals with autism (MA and SA) show a specific cognitive profile of peaks and troughs.	<i>Wechsler Scales</i>
2) Individuals with low CARS scores show a different profile than ones with high CARS scores.	<i>Wechsler Scales</i>
3) Individuals with low CARS differ significantly in specific subtests from individuals with high CARS scores.	<i>Wechsler Scales</i>
4) Low CARS scores are associated with VIQ>PIQ, high CARS scores with the reverse pattern.	<i>Wechsler Scales</i>
1) Individuals with low CARS scores show a higher Raven's percentile than ones with high scores.	<i>Raven's Matrices</i>
2) Individuals with low CARS scores differ regarding specific cognitive tasks from ones with high scores.	<i>Raven's Matrices</i>
3) Individuals with low CARS scores show higher percentiles in <i>Raven's Matrices</i> than in the <i>Wechsler Test</i> .	<i>Raven's and Wechsler Scales</i>
1) Individuals with autism (MA and SA) are less able to change their visual perception than controls.	<i>Duck-Rabbit, Rubin and Escher</i>
2) Individuals with low CARS scores differ from ones with high scores in their ability to change their visual perception.	<i>Duck-Rabbit, Rubin and Escher</i>
3) Individuals with autism (MA and SA) are in their judgement of optical stimuli less affected by illusions than controls.	<i>Müller-Lyer</i>
4) Individuals with low CARS scores differ significantly in their judgements of visual illusions from ones with high CARS scores.	<i>Müller-Lyer</i>
1) Individuals with autism (MA and SA) are better than controls in finding details in visual stimuli.	<i>Visual Closure</i> subtest
2) Individuals with low CARS scores differ from individuals with high CARS scores in finding missing details.	<i>Visual Closure</i> subtest
1) Individuals with autism (MA and SA) are less influenced by distracting auditory stimuli than controls.	<i>Acoustic Discrimination</i>
2) Individuals with low CARS scores differ in their acoustic discrimination from ones with high CARS scores.	<i>Acoustic Discrimination</i>

1) Individuals with autism (MA and SA) show a specific profile of verbal abilities in the <i>Wechsler</i> assessment.	<i>Wechsler Scales</i>
2) Individuals with high CARS scores differ from ones with low CARS scores in their verbal abilities.	<i>Wechsler Scales</i>
3) Individuals with autism (MA and SA) show a specific profile of peaks and troughs in the <i>Illinois Test</i> .	<i>Illinois Test</i>
4) Individuals with high CARS scores differ from ones with low CARS scores in their verbal abilities.	<i>Illinois Test</i>
1) Controls show a better understanding of idioms than autistic individuals.	<i>Literal Thinking Questionnaire</i>
2) Individuals with high CARS scores differ from ones with low CARS scores in their understanding of idioms.	<i>Literal Thinking Questionnaire</i>
1) Individuals with autism (MA and SA) show a specific pattern of motor abilities.	<i>Movement ABC</i>
2) Individuals with high CARS scores differ from ones with low CARS scores in their motor skills.	<i>Movement ABC</i>
1) Individuals with autism (MA and SA) differ from controls in their balance skills.	<i>One-Leg-Balance</i>
2) Individuals with high CARS scores differ from one with low CARS scores in their balance skills.	<i>One-Leg-Balance</i>
1) Individuals with autism (MA and SA) differ from controls in their visual/tactile hand control.	<i>Posting Coins</i>
2) Individuals with high CARS scores differ from ones with low CARS scores in their visual/tactile hand control.	<i>Posting Coins</i>

4. METHOD

4.1. Experimental Design

Previous studies in the field of autism and Asperger Syndrome have typically selected participants for research prior to the experimental assessments on the basis of certain diagnostic criteria. Because of insufficient agreement on these criteria and unclear boundaries the results varied widely and did not lead to a better understanding of these conditions (see chapter 2.1). This has been previously criticised by Fein et al. (1985). To avoid these difficulties in the diagnostic process the participants of the present study were therefore not selected on specific diagnostic criteria before the psychometric assessments but afterwards.

The experimental group consisted of individuals who were referred to the Child and Family Guidance Clinic Torquay or to the Child Development Centre of Torbay Hospital between April 1998 and May 1999 with a request for a psychometric assessment. They were initially seen by a Consultant Paediatrician or a Consultant Child and Adolescent Psychiatrist who raised the possibility of an autistic spectrum disorder and asked for a multidisciplinary assessment. The standard psychometric assessment for these requests consisted of an intellectual assessment. However, for the purpose of this study the usual test procedure was extended and included a wide range of standardised and non-standardised tests to collect relevant information in order to test specific hypotheses developed in this study.

The participants of the study were individually assessed. Each assessment consisted of three sessions of about one hour duration. The majority of children were seen on their

own. Eleven of the younger participants were assessed in the presence of their mothers, as they would not stay on their own with the clinician for various reasons, e.g. shyness, unfamiliarity with the environment and the test situation. The mothers were instructed to observe their child during the assessment and to give no help or direct support. The assessments took place in the same offices at the Child and Family Guidance Clinic or the Child Development Centre. They were carried out by the author of the study who also evaluated and scored the tests.

A comprehensive report based on the results was written for each child. It did not give a diagnostic conclusion but a summary of the individual's strengths and weaknesses and a short interpretation of its implications. The diagnosis for each child was made by the consultant after the multidisciplinary assessment was concluded.

Independently of the psychometric assessments the consultants were asked to complete three checklists (see appendix 9.1) on the basis of their own observations and assessments of each individual before the diagnosis was made:

- DSM-IV criteria for autism
- DSM-IV criteria for Asperger Syndrome
- Gillberg and Gillberg's (1989) criteria for Asperger Syndrome

These three lists of diagnostic criteria were based on observations regarding social interactions, verbal communication, obsessive and repetitive behaviours, imaginative play and the development of these functions. A certain number of criteria had to be present for eligibility of an autistic spectrum disorder, which is expressed in the diagnostic manuals. However the diagnostic lists for this study differed slightly from the

original ones, as they did not include the information of how many criteria were needed for a positive diagnosis of Asperger Syndrome or autism. The reason for this was to separate the process of data collection and diagnosis and use an independent collection of significant autistic characteristics, which could be used after the psychometric assessments to form experimental groups. The consultants' checklists were evaluated after all assessments were completed. The author of the study did not know the consultants' diagnostic opinions during the assessment phase.

Before the assessments the parents were asked to complete the *Childhood Autism Rating Scale* (CARS, Schopler et al., 1988, see appendix 9.2) on their children. They received an individual instruction by the experimenter on how to use this scale. If they were unsure about a specific rating it was discussed with the author of the study. This diagnostic instrument is based on observable behaviour regarding 14 different areas, all of which tap into behaviours relevant to Asperger Syndrome and autism including: relating to people, imitation, emotional response, body and object use, adaptation to change, visual and listening response, taste smell and touch response and use, fear or nervousness, verbal and non-verbal communication, activity level and intellectual response.

In each of the 14 categories the child receives a score ranging from 1 to 4. A score of 1 indicates no developmental delay whereas a score of 4 represents severely abnormal behaviour. The 15th item of the CARS gives the rater's overall impression of the degree of the autistic presentation. The summary score can vary between 15 and 60. The whole range is divided into three categories:

- 15 to 29 = non-autistic
- 30 to 36 = mildly-moderately autistic
- 37 to 60 = severely autistic

The CARS can be used by parents, teachers and other professionals. The author of the study carried out the evaluation of the rating scales after all psychometric assessments were completed. During the assessment phase the author did not know the consultants' or the parents' ratings. Similarly the parents did not know the consultants' diagnoses and the consultants did not know the parents' rating scores until testing was finalised. This experimental setting was therefore equivalent to a double blind study.

4.2 Participants and Experimental Groups

The experimental group consisted of 51 children aged from 60 to 130 months. One child moved out of the area during the assessment and did not complete the full test battery. Of the remaining 50 participants three were girls and 47 were boys. The experimental groups were formed after the psychometric assessments were completed. In accordance with the CARS guidelines the participants were divided into three subgroups (see chapter 5.2):

non-autistic	n = 11	mean age (months): 96.64 (s.d. 19.41)
mildly-moderately autistic	n = 25	mean age (months): 86.44 (s.d. 16.43)
severely autistic	n = 14	mean age (months): 94.21 (s.d. 22.72)

Table 3.1: Mean *Wechsler* IQs of experimental groups (s.d.):

	NA	MA	SA
VIQ	97.18 (18.71)	84.80 (19.39)	81.29 (17.62)
PIQ	99.10 (13.37)	99.00 (19.69)	93.86 (19.15)
FSIQ	98.00 (15.91)	90.68 (18.68)	85.71 (18.04)

The control group was matched on age and included 18 boys aged between 61 and 126 months. Their intellectual abilities were not assessed.

mean age : 95.33 months

standard deviation : 21.27

The participants of this group were children of colleagues and friends.

4.3 Assessment Protocol

All participants of the experimental group were assessed with a battery of eleven different tests. Four of these were standardised psychological tests while the other seven were developed for the present study. The tests were given in the same order for all participants as indicated below. To avoid the effects of the position of tests influencing the performance on other assessments the sequence was reversed at random, either from eleven to one or vice versa.

Description of the different tests:

- (1) *Wechsler Intelligence Scale for Children, UK Edition (WISC, Wechsler, 1977)* or *Wechsler Preschool and Primary Scale of Intelligence, Revised UK Edition*

(*WPPSI*, Wechsler, 1990) depending on the age of the child. 24 children were assessed with the *WISC* and 26 with the *WPPSI*.

The *Wechsler Scale* is a standardised intelligence test divided into six verbal and six performance subtests. A shortened version was administered with four verbal and four performance tests. The IQs were prorated on these results. The verbal tests included: *Information*, *Similarities*, *Arithmetic* and *Comprehension*. The performance tests: *Picture Completion*, *Block Design*, *Object Assembly* and *Picture Arrangement* (*WISC*) or *Geometric Design* (*WPPSI*).

The results of the subtests were transformed into scaled scores with a mean of 10 and a standard deviation of 3.

(2) *Duck – Rabbit Test Picture* (Deregowski, 1973)

This picture (see appendix 9.3) is a visually ambiguous drawing that depicts the heads of either a duck or a rabbit. The perception of a duck indicates right eye dominance whereas the rabbit suggests left dominance. The picture was presented to the participants at a distance of about 30 centimetres in front of their faces. The instruction was: “Look at this drawing. It is the picture of an animal but it is not very clear. Can you tell me what animal it could be?”

During the assessment the eye dominance was recorded. An additional measure was the ability to change the image deliberately from one animal to the other and back again. Participants were asked to change the perceived picture as fast as they could. The number of changes in 30 seconds was recorded.

(3) Müller – Lyer Illusion

The *Müller – Lyer Illusion* (see appendix 9.3) is an optical illusion named after the person who constructed it. It consists of two straight lines of the same length, which are usually presented one underneath the other. At the end of each line are arrow-type lines pointing at 45° either inwardly or outwardly. The position of the arrows induces the illusion and influences the perception of the length of the lines so that one appears to be either shorter or longer than the other.

For this experiment the presentation of the illusion was slightly changed. The two lines that had to be compared were positioned next to each other rather than one underneath the other. The lines and the arrows were engraved on a piece of black plastic board and were painted white. The length of one of the lines was variable; it could be moved forwards and backwards like a slide rule. During the experiment the line was slowly moved outward or inward and the participant was asked to say “stop” when both lines appeared to be of the same length.

As this was rather a complex task and, especially for children, difficult to understand, a different apparatus (see appendix 9.3) was used before the participants were shown the *Müller – Lyer Illusion*. This apparatus had the same dimensions as the illusion apparatus but showed the arrows in exactly vertically positions rather than at an angle. The slightly different presentation did not induce a visual illusion any more and rendered the task of comparing the length of the two lines much easier. The introduction of this apparatus had a dual purpose: to make sure that the participants understood the task of comparing the length of lines and

also to investigate their perceptual judgements without the illusion, in quasi “normal” circumstances. It was therefore a control condition.

For each, the control and the experimental condition, six trials were recorded, three times with the variable line moving outwards and three with it moving inwards, resulting in twelve scores for each participant. A scale on the reverse side of the apparatus allowed the assessor to read the deviation (in centimetres) from the correct position.

During the experiment the apparatus was held with the variable line at the right side from the child’s position. The adjustable part of the apparatus was slowly moved with a constant speed until the child said, “stop”. The distance between the participant and the apparatus was kept at about 100 centimetres.

(4) Literal Thinking Questionnaire

This questionnaire consisted of eight different common English idioms (see appendix 9.4). After they were read out the child was asked to explain the meaning of them: “Tell me, what does it mean when people say ...?”.

The responses were classified into five different categories:

- correct understanding: complete explanation of the idiom
- literal understanding: literal interpretation of the idiom even if the child is aware that it does not make any sense
- “Don’t know”: no explanation is offered. The child may be aware that the idiom is not understood in its literal sense.

- partially correct: the child is vaguely aware of the implied meaning
- wrong understanding: a completely different explanation is given with no relation to the literal or the implied meaning

For each child five scores were recorded, one for each category.

(5) *Movement Assessment Battery for Children* (Henderson and Sugden, 1992)

This test is a standardised assessment battery examining motor tasks in three different areas (see appendix 9.5):

- *Manual Dexterity* (consisting of three different activities)
- *Ball Skills* (consisting of two different activities)
- *Static and Dynamic Balance* (consisting of three different activities)

The motor activities can vary in different age groups, which are defined from 4-6 years, 7-8 years and 9-10 years, but relate to the above named areas. The results are expressed in impairment scores ranging from 0 to 5 for each activity. A score of 0 indicates no impairment whereas 5 suggests severe impairment. The highest impairment score in the category *Manual Dexterity* is 15, in *Ball Skills* 10 and in *Balance* 15. The total impairment score is transformed into a percentile with its usual meaning: a low numerical percentile suggests severe impairment whereas a high percentile indicates no impairment.

For each child three different motor scores were recorded. The overall result was expressed in a percentile.

(6) Illinois Test of Psycholinguistic Abilities (ITPA), (Kirk et al., 1968)

The *Illinois Test* was based on the observation that many children who were diagnosed with “mental retardation” frequently displayed an unbalanced profile in their auditory and visual abilities. It was presumed that these variations could be related to the individual’s cognitive processing of sensory information. Three different dimensions were identified:

- receptive process
- organising process
- expressive process

The standardised subtests examined auditory and visual functions of the participants in these three areas. Memory functions and closure were described as cognitive skills on an automatic level. They were additionally assessed with auditory and visual test items.

The results of the ten subtests were transformed into scaled scores, the mean of each of these was 36 with a standard deviation of 6.

(7) Acoustic Discrimination Test

The purpose of this experiment was to examine the participant’s ability to discriminate between two acoustic notes, which were produced on an electronic keyboard. A practise trial before the test helped the participant to understand the concept of two tones being compared.

In the main experiment the F above middle C was struck and the child had to judge whether the second tone which was either a semitone higher or lower, was perceived as being the same or different. Six paired comparisons were presented. Their sequence was determined at random prior to the experiment:

F - F sharp, F - E, F - F sharp, F - F, F - E, F - F

The presentation of the acoustic pairs was arranged in two conditions:

- The first tone sounded for the duration of one second which was followed by a pause lasting five seconds. The second tone was then presented for one second (time delay condition).
- Instead of a pause after the sounding of the first tone, the C major cord (C - E - G) was played for one second after which the second tone was presented (interpolated chord condition).

The number of correct judgements for each condition was recorded.

(8) Raven's Coloured Progressive Matrices (Raven, 1986)

The matrices test is a standardised non-verbal assessment of intelligence. It examines abilities such as abstract thinking, logical thinking and reasoning skills. The test items are presented as visual patterns arranged in a matrix and their level of difficulty is gradually increasing.

The test manual (Raven et al., 1986) described three different dimensions associated with the underlying cognitive principles of the tasks (see appendix 9.6):

- pattern matching (simple pattern completion)
- pattern completion (through identity and closure)
- pattern progression (abstract reasoning by analogy)

The scores for each of these categories were ascertained after the assessment. The overall result was expressed in a percentile score.

(9) Visual/Tactile Hand Control

This task was presented to all participants and examined their fine motor skills. Twelve plastic coins (with a diameter of 2.8 cm) had to be placed into a small cardboard box (length: 8.5 cm, width: 7.0 cm, height: 6.0 cm). The materials were taken from the *Movement ABC*.

Two different conditions were examined:

- the participants were allowed to control their hand movements visually
- a big cardboard box with a cut out hole at one side was put over the child's hand and the test materials. This allowed free movements of the hands but visual control was restricted; the task had to be completed "blindfolded".

The time taken (in seconds) to post all twelve coins in each condition was recorded for each child.

(10) One-Leg-Balance

The participants were asked to stand on one leg for a maximum of twenty seconds. Before the trial began the children were given time to find out which

was their preferred leg. They then stood on this leg for the duration of the experiment.

In a second experimental conditions the task was slightly changed. The children were asked to stand on their preferred leg with their eyes closed.

For each child the time (in seconds) that they stood on one leg before losing their balance was recorded. This was done in each of the two conditions: eyes open and eyes closed.

(11) Ambiguous Figures

All participants were presented with two well-known ambiguous pictures to assess their visual perception. One was the vase or faces by *Rubin* (see appendix 9.3) and the other a landscape scene with birds by *Escher* (see appendix 9.3).

The instruction for the first picture was: “What can you see here?” and for *Escher’s* picture: “In which direction do the birds fly?”

The pictures were held at a distance of about 30 cm in front of the participant’s face. The first response to each of the pictures was recorded and also whether participants were able to see the inverse figure.

4.4 Control Group

The control group was not assessed with the standardised tests as normative data was available. This group only completed the non-standardised tasks namely:

- (2) *Duck – Rabbit Test Picture*
- (3) *Müller – Lyer Illusion*
- (4) *Literal Thinking Questionnaire*
- (7) *Acoustic Discrimination Test*
- (9) *Visual/Tactile Hand Control*
- (10) *One Leg Balance*
- (11) *Ambiguous Figures*

5. RESULTS

The statistical analysis of the data was carried out with the Statistical Package for Social Sciences (SPSS, 1999).

5.1 Evaluation of Consultants' Questionnaires

The DSM-IV criteria for Asperger Syndrome and autism are based on the triad of social impairments (Wing and Gould, 1979). According to DSM-IV, the two conditions are mutually exclusive. However, the majority of their diagnostic features are shared by both conditions although Asperger Syndrome does not show a clinically significant delay in language and cognitive development, self-help skills and adaptive behaviour. It was expected that the whole experimental group could be divided into two sub-groups. However, twelve questionnaires were not returned and the evaluation of the remaining 38 forms revealed some inconsistencies (in this chapter Asperger Syndrome was abbreviated to AS and autism to AU).

Table 5:1: Classification of children by DSM-IV criteria:

	AS	AU	both AS and AU	neither AS nor AU
frequency	3	11	10	14
(n = 38)	(7.9%)	(28.9%)	(26.3%)	(36.8%)

Only fourteen questionnaires (36.8%) gave a clear indication of autism or Asperger Syndrome. The other questionnaires gave either an indication of both conditions (10 individuals), or neither condition (14 children). This somewhat puzzling result was discussed with the consultants and they were subsequently asked to give an overall

clinical opinion based on their experience of each participant regardless of the DSM-IV result.

Table 5:2: Classification of children by clinicians' overall diagnosis:

	AS	AU	both AS and AU	neither AS nor AU
frequency (n=38)	22 (57.9%)	5 (13.2%)	0 (0%)	11 (28.9%)

A different picture emerged. The clinicians felt that 57.9% (of the 38 returned questionnaires) of the cohort fell into the Asperger category and 13.2% received a diagnosis of autism. Eleven individuals showed autistic features but clinicians felt that the primary diagnosis was neither Asperger Syndrome nor autism. It was one or a combination of the following conditions including Attention Deficit / Hyperactivity Disorder (ADHD), Gilles de la Tourette, Obsessive Compulsive Disorder (OCD), dyslexia, dyspraxia, specific speech and language disorder or complex seizure disorder. The two different ways of categorising the cohort are amalgamated in the following table.

Table 5:3: Classification of children by DSM-IV and consultants' diagnoses (n = 38):

	AS	AU	both AS and AU	neither AS nor AU
AS (n=22)	2	7	6	7
AU (n=5)	0	3	2	0
both AS and AU (n=0)	0	0	0	0
neither AS nor AU(n=11)	1	1	2	7

(Columns represent the results of DSM-IV questionnaires; rows express the clinicians' overall diagnoses).

The results of the 38 returned DSM-IV questionnaires regarding Asperger Syndrome and autism were paired with the corresponding consultants' diagnoses and the level of agreement was calculated:

The outcome of the DSM-IV questionnaires coincided in only five cases with the clinicians' opinions of Asperger Syndrome or autism. Seven cases were identified with neither Asperger Syndrome nor autism by both questionnaires and overall diagnoses. However, in 26 / 38 cases the DSM-IV questionnaires did not correspond with the consultants' diagnoses. The value of *Cohen's Kappa* was $\kappa = 0.15$ indicating a very low agreement between the consultants' DSM-IV ratings and their overall diagnoses independently of DSM-IV criteria.

Gillberg and Gillberg's (1989) criteria for Asperger Syndrome expanded the triad of social impairments, and included 'speech and language peculiarities', 'non-verbal communication problems' and 'motor clumsiness'. The DSM-IV criteria for Asperger Syndrome stipulated no general delay in language development whereas Gillberg and Gillberg regarded this as a main criterion. It was therefore not expected that the Gillberg criteria would correlate highly with DSM-IV. The 38 returned Gillberg questionnaires identified 12 individuals with Asperger Syndrome and 26 without.

Table 5:4: Classification of children by DSM-IV and Gillberg (1989) criteria (n = 38):

	AS (DSM)	AU (DSM)	both AS and AU	neither AS nor AU
AS positive (Gillberg)	2	4	3	3
AS negative (Gillberg)	1	7	7	11

In only 2/38 cases (= 5.3%) DSM-IV and Gillberg criteria show agreement regarding Asperger Syndrome. However, the majority of individuals who received a positive or a negative Gillberg diagnosis were classified by DSM-IV as autistic, “both AS and AU” or “neither AS nor AU” but not as Asperger Syndrome.

The agreement between the consultants’ overall diagnosis irrespective of the DSM-IV results and the outcome of the Gillberg questionnaires is shown in Table 5:5:

Table 5:5: Classification of children by Gillberg criteria and consultants’ overall diagnoses:

	AS(overall)	AU(overall)	neither AS nor AU
AS positive (Gillberg) n=12	10	0	2*
AS negative (Gillberg) n=26	12*	5	9

In 10/38 cases (= 26.3%) the clinicians’ overall diagnoses coincided with the results of the Gillberg criteria. Because of the dichotomous nature of the Gillberg questionnaire the other 28 individuals could not be classified into other categories. However, in 14 cases (= 38.6%), marked by an asterisk, there was a disagreement between the two diagnostic judgements.

As the DSM-IV questionnaires showed profound inconsistencies in identifying Asperger Syndrome and autism their results could not be used to differentiate the experimental group. The Gillberg criteria only detected Asperger Syndrome and could therefore also not be used in classifying subgroups.

5.2 Evaluation of Parents' Questionnaires

The concept of Asperger Syndrome is in the United States a highly controversial one (see chapter 1.2 and 1.3). DSM-IV has recognised Asperger Syndrome only in its latest edition as a separate clinical entity but, as described earlier (Gillberg, 1998), the boundaries with “high functioning autism” are not clear. American research studies prefer to use the terms “mild” or “high functioning autism”. Schopler (1985) suggested to use the term “high-level autism” instead of Asperger Syndrome. The CARS (Schopler et al., 1986) follows this tradition and does not identify Asperger Syndrome as a separate condition. For this study it was therefore presumed that individuals who present with features of Asperger Syndrome could be found in this category according to CARS definition.

The CARS had the advantage that it assigned a numerical score to a person's presentation, thereby introducing a measure of severity. In his original article Asperger (1944) suggested already the concept of a continuum for the condition he described.

The questionnaires of all 50 participants were completed by their parents and were categorised into three groups.

Table 5:6: Classification of children by CARS rating scores:

	CARS score 15 – 29	CARS score 30 – 36	CARS score 37 – 60
frequency (n = 50)	12	24	14

Four of the eleven cases, which were identified by the consultants with different primary diagnoses (see page 80), were rated by the parents as mildly autistic. The high level of comorbidity of these individuals made it more difficult to differentiate between autistic spectrum disorders and other conditions. It was therefore decided to exclude the results of these participants from the “mildly autistic” group and add them to the “non-autistic” one. The presentation of five other individuals had so much improved over the years prior to the assessment that their present CARS scores were lower than 30. Because of the parents’ clear description of present problems in other areas and their developmental history they were moved into the mildly autistic group.

Table 5:7: Final classification of children by CARS rating scores:

	CARS score 15 – 29	CARS score 30 – 36	CARS score 37 – 60
frequency (n=50)	11	25	14

Eleven individuals with a CARS score of lower than 30 showed a variety of difficulties including autistic features. Because of the complex nature of their diagnoses this group was labelled as “non-autistic” throughout this study. They did not show the complete presentation of autism and could therefore be regarded as a quasi control group. The experimental groups were abbreviated throughout the study as follows:

non-autistic	=	CARS score 15 – 29	=	NA
mildly-moderately autistic	=	CARS score 30 – 36	=	MA
severely autistic	=	CARS score 37 – 60	=	SA

The highest CARS score in the present study was 43.5 and the lowest 15.5. The majority of individuals (43/50 = 86%) received scores between 25 and 44. Fourteen participants were placed in the category “severe autism” with the highest score of 43.5. Bearing in mind that the category “severe autism” can vary from 37 to 60 it can be presumed that the whole group represented the mild end of this category.

The classification of children was carried out before the data was analysed – independently of the outcome. Note that this classification will minimise the difference between groups (e.g. non-autism vs. autism) if the classification is wrong - as the main intention is to look for differences between groups any misclassification works against the hypothesis of difference and is in favour of the null hypothesis. False negatives are more likely than false positives.

The agreement between consultants’ overall diagnoses and the (corrected) parents’ ratings (CARS) is shown in table 5:8:

Table 5:8: Classification of children by CARS rating scores and consultants’ overall diagnoses (n = 50):

	NA (CARS)	MA (CARS)	SA (CARS)
neither AS nor AU(consultants)	11	0	0
AS (consultants)	0	20	10
AU (consultants)	0	5	4

In 24/50 cases the parents’ and the consultants’ ratings were identical regarding the diagnosis of Asperger Syndrome and autism. A disagreement between parental and consultants ratings occurred in 15/50 individuals. The overall level of agreement was

calculated with Cohen's Kappa. The value of $\kappa = 0.50$ ($z = 4.35$) was significant on the 0.01 level and indicated a moderate level of agreement between consultants overall diagnoses and parental ratings. The relatively high kappa score was mainly due to the level of agreement on Asperger Syndrome and "non-autistic". However, there was substantial disagreement in the category "severe autism". The parents generally rated the behaviour of their children as more severely. However, the significant level of agreement justified the use of the CARS to differentiate the whole experimental group into three subgroups.

5.3 Age Profiles

Before the results of the tests were analysed the homogeneity of variances regarding the age distribution of all four groups was examined.

Table 5:9: Mean ages (months) and standard deviations for experimental and control groups:

	NA	MA	SA	Control
	(n = 11)	(n = 25)	(n = 14)	(n = 18)
mean age	96.64	86.44	94.21	95.33
s.d.	19.41	16.43	22.72	21.27

The children classified as suffering from mild to moderate autism were the youngest. They were roughly eight months younger than the participants from the severe autism group were. An analysis of variance revealed a score of $F = 1.11$ ($p = 0.353$) confirming that the age distribution in the four groups did not differ significantly.

The variances of the *Wechsler* IQs between the three experimental groups were examined with an ANOVA. All three F-scores were not significant.

VIQ	F = 2.42 (p=0.10)
PIQ	F = 0.40 (p=0.67)
FSIQ	F = 1.45 (p=0.25)

5.4 Cognitive Profiles

5.4.1 Wechsler Scales

Table 5:10: *Wechsler* subtests in descending order (of average scaled scores) of experimental groups:

NA	MA	SA
<i>Object Assembly</i>	<i>Picture Arrangement</i>	<i>Picture Arrangement</i>
<i>Picture Completion</i>	<i>Picture Completion</i>	<i>Object Assembly</i>
<i>Arithmetic</i>	<i>Object Assembly</i>	<i>Block Design</i>
<i>Picture Arrangement</i>	<i>Block Design</i>	<i>Picture Completion</i>
<i>Information*</i>	<i>Arithmetic</i>	<i>Information</i>
<i>Comprehension*</i>	<i>Information</i>	<i>Arithmetic</i>
<i>Block Design*</i>	<i>Comprehension</i>	<i>Comprehension</i>
<i>Similarities*</i>	<i>Geometric Design</i>	<i>Similarities</i>
<i>Geometric Design</i>	<i>Similarities</i>	<i>Geometric Design</i>

(* identical scores in *Information* and *Comprehension*, also in *Block Design* and *Similarities*)

(1) The results did not confirm the particular profile in a combined group of mild and severe autism as described in chapter 2.1. *Picture Arrangement* which was the subtest with the lowest result in previously reported studies came up highest in both the mild and severe group whereas *Block Design* which was typically found to be the highest scoring subtest came fourth (mild autism) and third (severe autism) in the present study. The two lowest scoring subtests in this study were *Similarities* and *Geometric Design*. The superiority of the *Similarities* score which was reported in more recent research studies (e.g. Ehlers, et al., 1997) could not be confirmed, on the contrary, the subtest *Similarities* occupied the last two positions in the groups with mild and severe autism.

(2) The MA and SA group showed a fairly similar pattern (see table 5:10). Two subtests were in identical positions and the other seven tests occupied adjacent positions. MA and SA could not be differentiated on *Wechsler* profiles.

Table 5:11: Mean Scaled Scores (s.d.) of *Wechsler* subtests over experimental groups:

	NA (n = 11)	MA (n = 25)	SA (n = 14)	F	p
<i>Information</i>	9.45 (2.50)	8.00(3.85)	7.50 (3.57)	1.01	0.37
<i>Similarities</i>	9.18 (4.60)	6.28(4.02)	6.57 (3.30)	2.16	0.13
<i>Arithmetic</i>	10.27 (4.05)	8.40(3.73)	7.14 (3.61)	2.13	0.13
<i>Comprehension</i>	9.45 (3.24)	7.44(3.95)	6.79 (3.36)	1.78	0.18
<i>Picture Completion</i>	10.45(2.77)	10.08(2.97)	8.93 (3.56)	0.89	0.42
<i>Picture Arrangement</i>	10.14 (2.61)	12.45(2.34)	10.33 (3.78)	1.86	0.18
<i>Geometric Design</i>	7.75 (1.50)	6.64(2.87)	6.38 (3.16)	0.33	0.72
<i>Block Design</i>	9.18 (3.49)	9.48(4.93)	9.07 (5.20)	0.04	0.96
<i>Object Assembly</i>	10.55 (2.98)	10.00(2.43)	9.79 (2.69)	0.27	0.77

(The frequencies of participants for *Picture Arrangement* and *Geometric Design* were different from the main groups :

Picture Arrangement: NA: 7, MA: 11, SA: 6

Geometric Design : NA: 4, MA: 14, SA: 8)

The majority of participants (31/50 = 62%) obtained a Full-Scale percentile of lower than 50 whereas 19 individuals (= 38%) achieved a score higher than 49.

(3) The scaled scores were tested on significance with an analysis of variance (see table 5:11). The null hypothesis was accepted: the three groups did not differ significantly in any of the *Wechsler* subtests.

The subtest *Similarities* assessed abstract thinking and logical thinking. The MA and the SA group did not show significant differences between their scaled scores in this particular test.

Table 5:12: PIQ – VIQ pattern over three experimental groups:

	NA n=10	MA n=25	SA n=14
PIQ > VIQ	6(60%)	19(76%)	12(86%)
PIQ < VIQ	4(40%)	6(24%)	2(14%)

(4) The majority of the experimental groups (37/49 = 76%) showed a higher PIQ than VIQ, 12 participants (=24%) showed the opposite pattern and one person had identical scores. Both patterns were present in all three groups. The χ^2 score of 2.2 was not

significant on the 5% level (critical score: $\chi^2 = 5.99$, $df = 2$). MA and SA could not be differentiated on specific patterns.

However, the differences between VIQ and PIQ over all experimental groups showed some variation, the highest was found to be 53. The *Wechsler Test Manual* (1977) identifies a difference of 12 IQ points as being significant on the 5% level.

Table 5:13: Differences between PIQ and VIQ over experimental groups:

	NA (n = 10)	MA (n = 25)	SA (n = 14)
difference > 11	4(40%)	15(60%)	9(64%)
difference < 12	6(60%)	10(40%)	5(36%)

The majority of the whole cohort (56%) showed a significant difference between PIQ and VIQ of more than 11 IQ points. This high number of individuals with a significant difference was apparent in all three groups, however, the *Chi-square Test* did not indicate significant differences between the experimental groups ($\chi^2 = 2.37$, the critical score on the 5% level with $df: 2$ was 5.99).

5.4.2 Raven's Progressive Matrices

Eleven participants (= 22%) of the experimental group obtained a percentile Raven's score of lower than 50. 38 individuals (= 76%) showed a percentile of 50 or higher. One child was not able to complete the *Raven* due to poor understanding.

Table 5:14: Mean percentiles (s.d.) of *Raven's* scores of experimental groups:

	NA (n = 11)	MA (n = 24)	SA (n = 14)	F
mean percentile	63.64 (30.19)	71.25 (26.74)	63.29 (29.77)	0.46 (p=0.63)

(1) All three groups obtained mean percentiles of greater than 50 and certainly differed from the norm population of the *Raven's Test*. This is an extraordinary result as autism is usually defined as a condition displaying a pattern of deficits especially regarding intellectual abilities. The MA score was the highest whereas the scores of the other two groups were almost identical. However, the differences between the groups were not significant.

(2) The responses of the *Raven's Matrices* test were divided into three different categories (see page 75). The frequency distributions regarding the three categories over the three groups are shown below:

Table 5:15: Mean correct responses (s.d.) of experimental groups over three categories:

	pattern matching	pattern completion	pattern progression
NA (n = 11)	11.73 (0.62)	8.00 (3.16)	3.82 (3.92)
MA (n = 24)	11.33 (0.87)	8.00 (3.67)	4.92 (3.66)
SA (n = 14)	11.29 (1.07)	7.93 (2.84)	4.36 (2.90)
χ^2 (p)	2.01 (0.35)	0.18 (0.92)	0.95 (0.62)

The mean correct responses of the *Raven Matrices* were compared and tested on significance. The three groups did not differ significantly with regards to the different cognitive processes.

Table 5:16: Mean percentiles (s.d.) of *Wechsler* FSIQ and *Raven's* scores over three experimental groups:

	NA	MA	SA
Wechsler	47.44 (32.55)	38.32 (28.80)	29.51 (26.47)
Raven	63.64 (30.19)	71.25 (26.74)	63.29 (29.77)

(3) The mean percentiles of the *Wechsler* FSIQ in all three groups were lower than the mean *Raven* percentiles.

The *Pearson Product – Moment Correlation Coefficients* (Howell, 1992) between *Wechsler* FSIQ and *Raven* percentiles were calculated for each experimental group:

NA : $r = 0.639$ *

MA : $r = 0.648$ **

SA : $r = 0.614$ *

(* = significant on the 5% level, ** = significant on the 1% level)

All three scores showed significant correlations on the 5% or 1% level although the actual scores of the *Wechsler Scales* were lower than the ones of the *Raven Test*. This outcome could indicate that both tests assessed intellectual abilities in different ways: the *Wechsler Scales* incorporated more verbally based subtests (even the performance subtests required some language skills) whereas the *Matrices Test* consisted of purely non-verbal tasks.

Conclusion

The results of the *Wechsler Scales* did not confirm a particular profile of abilities for MA or SA. The experimental groups could not be differentiated on any subtest. Abstract thinking and concept formation were examined by the subtest *Similarities* and were low in both the MA and SA group. The majority of the experimental groups showed a significantly higher PIQ than VIQ.

In all three experimental groups the *Raven* scores were higher compared with the *Wechsler* scores. The groups did not differ regarding three different levels of abstraction.

5.5 Cognitive Styles

5.5.1 Visual Perception

When presented with the 'Duck – Rabbit' test picture 26 members (= 52%) of the experimental group (5 NA, 15 MA and 6 SA) saw only one animal, 24 were able to see both. The results of the control group indicated that 16 participants (= 89%) were able to see both animals.

The group means of changes per 30 seconds were calculated and compared with the *Kruskal-Wallis Test* instead of an F-Test because the data was not normally distributed.

Table 5:17: Mean changes per 30 seconds, standard deviations and rank positions for all four groups:

	mean	s.d.	mean rank	χ^2 (p)
NA (n = 11)	6.45	9.59	27.95	17.13(0.001)
MA (n = 25)	6.92	10.51	28.60	
AU (n = 14)	6.79	9.07	29.71	
Control (n = 18)	20.56	8.72	50.42	

(1) The three experimental groups did not differ from each other but showed a significantly lower ability to change the visual image when compared with the control group.

Table 5:18: Frequencies of the perception of different images of the *Rubin Test Picture* for all four groups:

	vase first	faces first	both (%)	χ^2
NA (n = 11)	10	1	7(64%)	5.84
MA (n = 25)	21	4	14(56%)	
SA (n = 14)	11	3	8(57%)	
Control (n = 18)	16	2	16(89%)	

All four groups were compared regarding their ability to see both images of the *Rubin-Test-Picture* with the *Chi-square Test*. The critical value of $\chi^2 = 7.82$ (on the 5% level) was not exceeded, indicating no significant differences between the four groups.

Table 5:19: Frequencies of the perception of different images of the *Escher-Test Picture* for all four groups:

	white birds first	black birds first	both
NA (n = 11)	11	0	10(91%)
MA (n = 25)	22	3	22(88%)
SA (n = 14)	13	1	11(79%)
Control (n = 18)	18	0	18(100%)

The *Chi-square Test* could not be used for the comparison of the four groups as more than 20% of the cells had expected frequencies of less than 5. Therefore paired comparisons were made and *Fisher's Exact Probability* was calculated to examine the differences. The comparisons of MA and SA ($p=0.26$), MA and NA ($p=0.43$), MA and NA ($p=0.19$), SA and NA ($p=0.32$), NA and "Control" ($p=0.38$) did not reach significance levels of at least 5%. However the comparison of SA and "Control" approached significance with a probability of $p=0.07$.

(2) No statistical differences were found between MA and SA in all three different test pictures.

The deviation scores (in centimetres) from the *Müller – Lyer Illusion* apparatus could be either negative or positive. In order to give a standardised measure of error regardless of direction, scores were transformed into root mean square scores (RMS) for each condition to give a measure of absolute error of judgement (Poulton, 1974).

Table 5:20: Mean perceptual error (in cm) on the *Müller – Lyer Control* condition over experimental and control groups:

	mean RMS (s.d.) in – out	mean RMS (s.d.) out – in
NA (n = 11)	3.19 (2.15)	3.55 (1.74)
MA (n = 17)	2.93 (1.23)	3.83 (2.01)
SA (n = 11)	3.42 (1.15)	3.95 (1.97)
Control (n = 18)	3.59 (2.27)	4.62 (2.02)
	F=0.43 (p=0.73)	F=0.82(p=0.49)

The mean scores of the practice condition showed no significant differences between the four groups.

Table 5:21: Mean perceptual error (in cm) on the *Müller – Lyer Illusion* condition over experimental and control groups:

	mean RMS (s.d.) in – out	mean RMS (s.d.) out – in
NA (n = 11)	5.72 (3.54)	9.93 (3.51)
MA (n = 17)	3.15 (2.23)	8.76 (2.48)
SA (n = 11)	4.40 (1.61)	8.42 (4.31)
Control (n = 18)	5.37 (2.78)	10.04 (2.15)
	F=2.96 (p=0.04)	F=1.01(p=0.40)

(3) The two conditions of the *Müller – Lyer Illusion* showed higher error scores than the control conditions. This was found in all four groups. There was also a significant difference depending on whether the adjustable line was extended or shortened. A greater error was found in all four groups when the variable line was shortened.

The analysis of variance was significant only in the condition “in-out”.

In all conditions however, the SA and MA groups were more accurate in their judgements than the control group and showed less increase in error on the illusion condition compared to their baseline error.

(4) The post – hoc examination of multiple comparisons of the illusion condition “in-out” was calculated with the *Tukey Test* and gave the following probabilities:

MA - SA $p = 0.61$

MA - NA $p = 0.07$

MA - Control $p = 0.07$

The difference only approached significance in comparison with the group NA and “Control” but not with the SA group.

5.5.2 Figure-Ground Perception

Visual Closure is a subtest of the *Psycholinguistic Abilities Test* (Kirk et al., 1968). It is similar to the *Embedded Figures Test* (Witkin et al., 1971) and examines figure-ground perception. The mean scaled scores of the experimental groups were compared. As this is a standardised test the control group was not examined on it. The population mean for *Visual Closure* is 36 with a standard deviation of 6.

Table 5:22: Mean scaled scores (s.d.) of *Visual Closure* of three experimental groups:

	NA (n = 11)	MA (n = 23)	SA (n = 13)	F
mean	39.18	37.17	37.46	0.33
	(6.62)	(6.08)	(8.43)	(p=0.72)

(1) The differences between the three experimental groups were not significant suggesting no differences in the visual perception of participants of the experimental groups.

(2) The mean scaled scores between the MA and the SA group did not differ significantly.

5.5.3 Acoustic Perception

The *Acoustic Discrimination Task* consisted of two conditions: five-second pause and interpolated chord. Recorded were correct responses of six trials in both conditions. The highest score was 6.

Table 5:23: Mean correct responses, standard deviations and mean ranks in the 5-second pause condition over four experimental groups:

	mean	s.d.	mean rank	χ^2 (p)
NA (n = 9)	5.44	0.73	26.67	0.60 (0.90)
MA (n = 17)	5.31	1.01	27.24	
SA (n = 11)	5.50	1.08	29.36	
Control (n = 16)	5.37	0.72	25.31	

For the examination of the results the *Kruskal-Wallis Test* was used. The differences between the four groups were statistically not significant.

Table 5:24: Mean correct responses, standard deviations and mean ranks in the interpolated chord condition over four experimental groups:

	mean	s.d.	mean rank	$\chi^2(p)$
NA (n = 9)	5.22	1.09	30.67	3.08 (0.38)
MA (n = 16)	5.13	0.96	28.81	
SA (n = 10)	4.60	1.26	22.50	
Control (n = 16)	4.75	0.86	22.75	

The *Kruskal-Wallis Test* was used to examine the differences between mean ranks of the experimental groups. The differences were not significant.

(1) Individuals of the experimental groups did not differ significantly from controls in both acoustic discrimination tasks.

(2) The MA and the SA group could not be differentiated with regards to their results in both acoustic discrimination tasks.

Conclusion

Significant differences between MA and SA could not be found in any of the six different perception tests. The *Rubin-Test Picture* as well as *Visual Closure* and *Acoustic Discrimination* did not differentiate between all four groups. However, the *Duck – Rabbit Test Picture* revealed a significant difference between the control group and the experimental groups. The *Müller – Lyer Illusion* condition indicated significant differences between MA and NA as well as MA and “Control”. The *Escher-Test Picture* showed a tendency towards significance between the groups SA and “Control”.

5.6 Speech and Language Abilities

Table 5:25: Rank order of verbal subtest scores of the *Wechsler Scales* over the three experimental groups:

NA (n = 11)	AM (n = 23)	SA (n = 13)
<i>Arithmetic</i>	<i>Arithmetic</i>	<i>Information</i>
<i>Information</i>	<i>Information</i>	<i>Arithmetic</i>
<i>Comprehension</i>	<i>Comprehension</i>	<i>Comprehension</i>
<i>Similarities</i>	<i>Similarities</i>	<i>Similarities</i>

(1) The rank order of the *Wechsler* subtest results showed an almost identical pattern between MA and SA. Only the two highest-ranking subtests had changed their positions. The rank profiles of MA and the group NA were identical.

(2) Regarding their verbal scores MA and SA did not differ significantly (see table 5:11).

Table 5:26: Rank order of auditory subtest scores of the *Illinois Test* over the three experimental groups:

NA (n = 11)	MA (n = 23)	SA (n = 13)
<i>Grammatical Closure</i>	<i>Grammatical Closure</i>	<i>Grammatical Closure</i>
<i>Verbal Expression*</i>	<i>Verbal Expression</i>	<i>Aud. Sequential Memory</i>
<i>Aud. Sequential Memory*</i>	<i>Aud. Sequential Memory</i>	<i>Verbal Expression</i>
<i>Auditory Association</i>	<i>Auditory Association</i>	<i>Auditory Reception</i>
<i>Auditory Reception</i>	<i>Auditory Reception</i>	<i>Auditory Association</i>

(* indicates identical scores)

- (3) The rank order of the auditory subtests was similar and indicated similar profiles between MA and SA. The MA and NA profiles were identical.

Table: 5:27: Mean scaled scores (s.d.) of all subtests of the *Illinois Test* over the three experimental groups:

	NA (n = 11)	MA (n = 23)	SA (n = 13)	F	p
<i>Auditory Reception</i>	34.91(8.79)	30.87(6.64)	30.15(7.57)	1.45	0.25
<i>Visual Reception</i>	33.27(9.25)	32.13(8.17)	32.23(7.53)	0.08	0.93
<i>Auditory Association</i>	36.64(7.75)	32.17(10.62)	26.54(8.73)	3.41	0.04
<i>Visual Association</i>	33.27(7.32)	33.13(6.97)	31.77(8.15)	0.17	0.84
<i>Verbal Expression</i>	37.09(5.89)	35.26(5.73)	31.46(4.81)	3.37	0.04
<i>Manual Expression</i>	36.73(4.34)	36.04(3.62)	35.00(5.29)	0.50	0.61
<i>Grammatical Closure</i>	39.73(7.09)	36.39(10.84)	35.38(12.10)	0.56	0.57
<i>Visual Closure</i>	39.18(6.62)	37.17(6.08)	37.46(8.43)	0.33	0.72
<i>Aud. Sequent. Memory</i>	37.09(6.55)	32.52(4.96)	34.38(4.93)	2.73	0.08
<i>Vis. Sequent. Memory</i>	38.73(8.28)	36.74(8.72)	33.77(9.27)	0.99	0.38

- (4) SA and MA did not differ significantly regarding their subtest scores in the *Illinois Test*. However, three subtests showed significant differences between MA or SA and the group NA. These occurred in *Auditory Association*, where a post-hoc comparison

between SA and NA produced a probability of $p=0.04$ with the *Scheffé Test*. *Verbal Expression* was approaching significance ($p=0.06$) between SA and NA and *Auditory Sequential Memory* revealed a tendency towards significance between the mean scores of MA and NA ($p=0.08$) on the *Scheffé Test*.

The *Literal Thinking Questionnaire* presented eight common idioms of the English language to all participants. The responses were divided into five categories the sum of which added up to 8.

Table 5:28: Mean scores (s.d.) of responses over five different categories of the *Literal Thinking Questionnaire* for experimental and control groups:

	NA (n = 11)	MA (n = 22)	SA (n = 13)	Control (n = 18)	χ^2 (p)
correct	4.36 (2.06)	2.95 (1.59)	2.62 (1.89)	4.39 (1.65)	9.98 (0.02)
literal	1.27 (1.35)	2.00 (1.27)	1.69 (1.25)	0.56 (0.62)	16.84 (0.001)
don't know	0.82 (1.25)	1.82 (1.65)	2.54 (2.03)	1.83 (1.89)	6.60 (0.09)
part. correct	0.55 (0.53)	0.50 (0.80)	0.46 (0.52)	0.56 (0.62)	0.71 (0.87)
wrong	1.00 (0.77)	0.73 (1.08)	0.69 (0.85)	0.67 (0.77)	2.23 (0.53)

(1) In each category the mean ranks of the four groups were compared with the *Kruskal-Wallis Test*. The *Chi-square* scores revealed significant differences between the groups in the categories “correct understanding” and “literal understanding” as well as a

tendency towards significance in “don’t know”. The groups did not differ in the categories “partially correct” and “wrong”.

Paired comparisons were calculated between the different groups and categories and the scores were tested on significance with the *Mann-Whitney Test*.

Table 5:29: Probabilities of paired comparisons of all four groups over the five different categories:

	correct	literal	don’t know	part. correct	wrong
MA-SA	0.56	0.51	0.35	0.75	0.88
MA-NA	0.07	0.10	0.05	0.48	0.17
MA-Control	0.02	0.00	0.84	0.51	0.84
SA-NA	0.05	0.37	0.01	0.69	0.32
SA-Control	0.02	0.01	0.30	0.73	0.80
NA-Control	0.96	0.16	0.10	0.94	0.20

Significant differences between groups were found in three of the five different categories. Significant differences occurred in the category “correct understanding” in comparisons between MA or SA with “Control”. The comparisons between MA or SA and NA showed a strong tendency towards significance. In the category “literal understanding” significant differences were only found in comparisons between MA or SA and “Control”. The category “don’t know” indicated significant differences in the comparisons of MA or SA with the group NA.

(2) The MA and SA groups did not differ significantly in their understanding of eight English idioms.

Conclusion

The MA and SA group did not show a particular verbal profile of peaks and troughs in their *Wechsler* results that was different from controls. Both groups also did not differentiate significantly in their verbal subtests. Abstract thinking as assessed by the *Similarities* subtest was one of the lowest ranking subtests and did not indicate high abilities in abstract thinking and concept formation.

The *Illinois Test* did not identify a specific pattern of verbal abilities of the MA and SA groups when compared with the group NA. Significant differences between SA and the group NA were found in “*Auditory Association*” and “*Verbal Expression*”. The low result in “*Auditory Sequential Memory*” of the MA group indicated a tendency towards significance in comparison with the group NA. These results suggested auditory difficulties that were specific for the MA group and others typical for the SA group.

The *Literal Thinking Questionnaire* revealed significant differences between MA/SA and the groups NA and “Control” in the categories “correct understanding”, “literal understanding” and “don’t know”. The differences between the groups were not significant in “partially correct” and “wrong”.

5.7 Motor Skills

5.7.1 Movement ABC

The overall results of the *Movement ABC* were expressed in percentile scores: a numerically high score indicated good motor functions and vice versa. The differences between the percentile scores of the three experimental groups were not significant.

Table 5:30: Mean percentiles of total impairment scores (s.d.) of the *Movement ABC* over the three experimental groups:

	NA (n = 11)	MA (n = 25)	SA (n = 13)	F
mean	21.00	21.84	9.15	1.26
percentile	(23.90)	(28.21)	(13.62)	(p=0.29)

The result of the SA group showed a low mean percentile indicating poor motor functions. A comparison of the means of MA and SA with a t -test resulted in a score of $t = 1.87$ ($p=0.07$) indicating a strong tendency towards significance. A comparison between SA and NA was not significant ($t = 1.52$, $p = 0.14$).

The results of the subtests were analysed with a non-parametric test as the data was on an ordinal level. The scores were impairment scores: a high numerical score indicated severe impairment whereas a low score signified little impairment.

Table 5:31: Impairment scores (s.d.) of three different categories of the *Movement ABC* over the three experimental groups:

	NA (n = 11)	MA (n = 25)	SA (n = 13)	χ^2
<i>Manual Dexterity</i>	5.23 (3.78)	5.98 (3.84)	5.85 (2.08)	0.73 (p=0.69)
<i>Ball Skills</i>	2.32 (2.93)	3.68 (3.18)	5.73 (3.21)	5.99 (p=0.05)
<i>Static and Dynamic Balance</i>	4.32 (3.81)	4.36 (4.33)	5.31 (3.45)	1.53 (p=0.47)

(1) In each category the mean ranks of the three experimental groups were compared with the *Kruskal-Wallis Test*. The groups did not differ significantly in categories *Manual Dexterity* and *Static and Dynamic Balance*. However in *Ball Skills* the SA group showed a significantly higher impairment score. Paired comparisons between the three experimental groups in the category *Ball Skills* with the *Mann-Whitney Test* indicated significant differences between SA and NA ($p=0.03$) and a tendency towards significance between MA and SA ($p=0.08$).

Regarding their motor skills a comparison with the test norms indicated generally low functions in all three groups.

(2) The subtest results of the MA and the SA group did not differ in *Manual Dexterity* and *Balance Skills* but showed a strong tendency towards significance in *Ball Skills*.

5.8.2 One Leg Balance

The ability to stand on the dominant leg was assessed under two conditions: with and without visual control (scores represent seconds).

Table 5:32: Mean time in seconds (s.d.) to keep balance on one leg over all four groups:

	NA (n = 11)	MA (n = 24)	SA (n = 13)	Control (n = 18)	F
with visual	13.73	12.17	12.92	19.39	4.59
control	(6.12)	(8.40)	(7.34)	(1.79)	(p=0.01)
without vis.	5.45	5.21	5.15	7.89	1.38
control	(3.64)	(5.56)	(3.80)	(4.57)	(p=0.26)

(1) The four groups differed significantly only in the condition with visual control. Post-hoc comparisons with the *Tukey Test* indicated that significance was mainly due to differences between MA and Control (p=0.01) and SA and Control (p=0.04).

(2) The results of the MA and SA groups did not show significant differences in either experimental condition suggesting no differences in the balancing abilities in participants of both groups.

5.8.3 Visual/Tactile Hand Control

The four groups were compared regarding their ability to post 20 plastic coins into a small cardboard box. The scores represent overall time it took to complete this task.

Table 5:33: Mean time in seconds (s.d.) to post coins for both experimental conditions over four groups:

	NA (n = 11)	MA (n = 24)	SA (n = 13)	Control (n = 18)	F
with visual	16.18	18.63	18.77	15.61	3.51
control	(1.89)	(3.92)	(4.42)	(3.13)	(p=0.02)
without vis.	30.91	39.57	36.85	27.78	5.01
control	(6.99)	(12.76)	(11.85)	(6.86)	(p=0.004)

(1) In both conditions significant differences were found between groups. Post-hoc multiple comparisons with the *Tukey-Test* confirmed significance only between MA and “Control” but a tendency towards significance between SA and “Control”. The probability in the condition “with visual control” between MA – “Control” was $p = 0.04$ and between SA – “Control” $p=0.08$. In the “blindfolded” condition the probabilities were $p=0.003$ between MA – “Control” and $p=0.09$ between SA – “Control”.

(2) The results of the MA and SA group did not differ significantly regarding the posting coin task.

Conclusion

The results of the *Movement ABC* did not indicate significant differences between the four groups in the categories *Manual Dexterity* and *Static and Dynamic Balance*. However the SA group showed a significantly higher impairment score in *Ball Skills* when compared with the Control group. The difference between MA and SA was in this category not significant. The comparison of the percentiles of total impairment scores indicated a significant difference between MA and SA, with SA lower than MA.

In the *One-Leg-Balance Test* the four groups differed significantly only in the condition “with visual control”. Both MA and SA showed significant differences when compared with Control.

The motor test *Tactile Recognition* showed a similar result. Significant differences were only found between MA and Control but not between MA and SA.

6. DISCUSSION

6.1 Consultants' and Parents' Questionnaires

The classification of the entire experimental group based on DSM-IV criteria revealed significant discrepancies: the results showed little agreement with the clinicians' overall diagnoses. The DSM-IV questionnaires returned by the consultants identified 28.9% with autism whereas the consultants diagnosed 13.2% of the 38 cases with autism. There was an agreement in only three cases (= 7.9%). The reverse pattern was found regarding Asperger Syndrome: 7.9% children received a diagnosis of Asperger Syndrome on the basis of DSM-IV compared with 57.9% when diagnosed by clinicians. The consultants diagnosed the majority of the cohort with Asperger Syndrome whereas the most frequently used DSM-IV category was "neither Asperger Syndrome nor autism". Generally a diagnosis of Asperger Syndrome was given about seven times more frequently by a consultant than by the DSM-IV system whereas the DSM-IV classified cases as autistic two times more often when compared with the diagnoses made by clinicians. An overall agreement between DSM-IV and clinicians was found in 12 cases (= 31.6%). However, in more than two thirds of the returned DSM-IV questionnaires the clinicians' opinions differed from DSM-IV.

Table 5:3 indicated that the disagreement between DSM-IV classification and clinicians' overall diagnoses was mainly due to 22 individuals who were diagnosed with Asperger Syndrome by the consultants. Only two of these cases received a diagnosis of Asperger Syndrome on the basis of DSM-IV criteria whereas 20 participants (= 53%) were allocated into different categories (7 cases were classified as autistic, 6 cases as "both Asperger Syndrome and autism" and 7 cases "neither Asperger Syndrome nor

autism”). This finding demonstrated the diagnostic dilemma frequently described in the literature (Fein et al. 1985, Bowman, 1988, Szatmari et al., 1989, Ozonoff et al., 1991, Eisenmajer et al., 1996, Gillberg, 1998, Tanguay et al., 1998, Howlin, 2000). The DSM-IV criteria are mainly based on the triad of social impairments. If the criteria of the triad are not completely present or if they are not severe enough the requirements for a diagnosis of autism or Asperger Syndrome are not met (Tanguay et al., 1998).

The diagnostic criteria based on the triad seemed to be less sensitive in identifying Asperger Syndrome than autism. In this study the use of DSM-IV criteria has led to an under-representation of Asperger Syndrome and an over- representation of autism in comparison with consultants’ diagnoses. It seemed as if DSM-IV criteria show a bias towards autism. One reason for this could be the selection of identifying criteria, which is mainly based on the triad. Other diagnostic systems (e.g. Gillberg and Gillberg, 1989, Szatmari et al., 1989) kept closer to Asperger’s (1944) original research and have included criteria specific of Asperger Syndrome. In the present study the Gillberg criteria seem to show a higher validity in identifying Asperger Syndrome if the clinicians’ assessments are taken to be accurate.

The lack of agreement gave rise to the question whether consultants used additional information or gave different weights to symptoms when making a clinical diagnosis. This study did not explore the issue of validity and reliability of consultants’ diagnostic processes and judgements with regards to Asperger Syndrome and autism.

Another result of the study suggested poor validity in identifying Asperger Syndrome by the DSM-IV system. Although Asperger Syndrome and autism are mutually exclusive (according to DSM-IV), 10 cases (=26.3%) scored positively in both

conditions. As mentioned earlier most of the diagnostic criteria for Asperger Syndrome and autism are identical apart from speech and language development and cognitive development. In contrast to DSM-IV, Gillberg and Gillberg (1989) did not regard intellectual abilities as defining criteria for Asperger Syndrome and did not include them in their list of criteria. However, they identified specific speech and language difficulties in Asperger Syndrome, which are included in their criteria for this condition:

“(4b) superficially perfect expressive language with a strong tendency to become formal and pedantic and usually with a flat, staccato-like prosody,
(4c) mild or moderate impairment of language comprehension with concrete misinterpretations of spoken language against a background of much better expressive language skills” (Gillberg and Gillberg, 1989).

In the present author’s clinical experience children with Asperger Syndrome often demonstrate good expressive language skills but show a lack in their ability to initiate or to sustain a conversation. The effects of these specific language difficulties were described by Asperger (1944): children of his cohort were sometimes not able to answer questions directly, e.g. “He did not respond to questions but rambled on, talking about his own experiences and feelings.”(Asperger, 1944, p.98, translated by the present author).

In contrast to the above observations the DSM-IV criteria regard these specific verbal difficulties as essential for the diagnosis of autism:

“(2b): in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others.”

This could explain the high number of autism diagnoses when using DSM-IV criteria, whereas the same cases were diagnosed with Asperger Syndrome by the consultants.

As described in chapters one and two, the majority of research studies, even the more recent ones (e.g. Manjiviona and Prior, 1999), used DSM criteria to identify experimental groups. The contradicting results in their findings could be due to poor validity and ambiguity of these criteria. It also has to be considered whether other diagnostic systems, which are mainly based on the triad of impairment, show a bias towards autism. As mentioned earlier, the *Autistic Diagnostic Interview – Revised* (Lord et al., 1994) showed a good success rate in identifying autism but less positive results in the differential diagnosis with other conditions on the autistic spectrum.

The dominance of a diagnostic model as described above has also resulted in a circular argument: research findings often reflected the diagnostic criteria used to define experimental groups and produced results that supported the theoretical model on which the diagnostic criteria were based. This has already been criticised by Fein et al., (1985) who confirmed wide variations in the presentation of children diagnosed as “autistic”. They suggested the examination of profiles of abilities and the development of clearer features in order to establish patterns of subgroups. However the present state of affairs indicated that a golden standard has yet to be found.

The criteria by Gillberg and Gillberg (1989) identified more children with Asperger Syndrome than the DSM-IV. This was to be expected as Gillberg and Gillberg added criteria from three other areas to the triad of impairments, i.e. “motor skills”, “non-verbal communication” and “imposition of routines and interests”. In contrast to

DSM-IV they also regarded specific speech and language difficulties as being typical for Asperger Syndrome.

The results of this study supported previous findings (e.g. Fein et al., 1985) of poor diagnostic properties of the DSM-IV criteria and the triad of social impairments with regards to the differential diagnosis of autistic spectrum disorders. The use of these criteria has shown to be difficult for a number of reasons:

- lack of validity
- poor operationalisation
- ambiguity of criteria
- low reliability

Diagnostic criteria have to be found that are independent and relate to universally accepted theoretical concepts otherwise research results will only validate their own premises (circularity). In a recent article Howlin (2000) called for a revision of DSM and ICD criteria.

To avoid the bias inherent in the DSM-IV classification the present study used a different system to assign the participants to different experimental groups. The CARS (Schopler et al., 1986) is a rating scale based on observable behaviour in 14 different areas, all of which are tapping into behaviours relevant to both Asperger Syndrome and autism. It covers a wider area of typical behaviour for these conditions than the triad and describes specific difficulties in a more comprehensive way. The use of a rating scale is advantageous as a numerical score indicates the severity of the condition. Asperger (1944) already suggested the concept of a continuum.

The CARS has also the advantage of not being related to any specific theoretical model or diagnostic system. It can be used by parents and professionals on the basis of observed behaviour without knowledge of any theoretical implications and does not require specific knowledge of autism. The criteria are clearly operationalised and the judgements are less open to subjective interpretations than are those necessary for DSM-IV.

In this study the rating scales were completed by parents after receiving an instruction by the experimenter. This procedure could be criticised on the basis that the parents had to make judgements relative to normally developed children. It has been suggested that parents may not be fully equipped to make these judgements. However if the parents were not clear about the rating process, the CARS was completed with the assistance of the experimenter.

However, this particular rating scale has some disadvantages. Its authors were supporting the concept of an autistic continuum as Wing and Gould described it and with regards to Asperger Syndrome they recommended the term “higher-level autism” instead (Schopler, 1985). Asperger Syndrome was thereby defined as an autistic disorder despite insufficient empirical evidence. This view has taken away the possibility of considering Asperger Syndrome in a different context. The consequence of the argument suggests in the present author’s view that in the absence of clear diagnostic criteria no clinical category should be used, not even Autistic Spectrum Disorder (ASD), which brings the discussion back to Asperger (1944) who has raised this point in his original article and criticised the disadvantages of typologies of his time. He suggested a comprehensive assessment of the strengths and weaknesses of a person on which an individualised remedial support program was based.

The overall score of the CARS falls into one of three categories, i.e. “severely autistic”, “mildly-moderately autistic” and “non-autistic”. It is not clear which criteria were used to define the cut-off points between these groups. The scores of the severely autistic group can vary between relatively wide margins (from 37 to 60) which raises the question whether other conditions come within this category.

The CARS summary score is a quantitative measure. However, individuals with the same score could present with different conditions. It is possible that different “autistic” disorders present with specific profiles of CARS scores. In short the CARS may not reflect one descriptive dimension.

The three experimental groups were compared with non-symptomatic controls in four areas of their sensory perception, in their comprehension of idioms and in two specific motor tasks (see chapter 4.4). The control group was matched on age but not on cognitive abilities.

Conclusion

Diagnostic systems based on the triad of impairments show a tendency to over-represent autism and to under-represent other conditions on the autistic spectrum. The triad does not seem to reflect the cardinal features of all autistic spectrum disorders. If it is assumed that the autistic spectrum is a valid clinical rather than a descriptive model then the diagnostic criteria have to be modified to include other conditions such as Asperger Syndrome.

The assignment of participants into experimental groups was not satisfactory. Even the use of a rating scale based on behaviour observations (CARS) did not result in more adequately defined groups.

The present author agrees with Howlin (2000) that current diagnostic criteria are too crude and thus do not allow a reliable differential diagnosis of individuals with autistic features (Myhr, 1998). Rating scales like the CARS that tap into a wide range of behaviours typical of conditions on the “autistic spectrum” seem to offer a more valid and reliable approach in identifying these conditions. They could also help to detect specific profiles, which could guide the clinician in his recommendations with regards to behaviour management and remedial support.

6.2 Cognitive Profiles

The results of the *Wechsler subtests* did not confirm a particular pattern of peaks and troughs, which was previously reported (e.g. Siegel et al., 1996, Manjiviona and Prior, 1999). High scores in *Block Design* or *Similarities* and low scores in *Picture Arrangement*, *Picture Completion* or *Comprehension* were expected. However in this study the highest-ranking subtest in both the MA and the SA group was *Picture Arrangement*. *Block Design* came third in the SA group and fourth in MA. *Similarities* was in both groups on the last two positions. The almost identical pattern of verbal subtests in all three experimental groups indicated a similar profile of strengths and weaknesses. A differentiation on the basis of specific profiles of the three experimental groups was not possible.

The pattern that was evident in all three experimental groups showed high results in performance subtests (with the exception of *Geometric Design*) but lower scores in verbal subtests which indicated specific rather than global cognitive difficulties.

The subtest *Geometric Design* was part of the pre-school version of the Wechsler Scales (WPPSI) and was only used for children up to the age of 7 years 3 months. It consisted of complex tasks and was assessing abilities such as visual perception, spatial vision, hand-eye coordination and fine-motor skills. As the *Wechsler* results showed generally average performance scores it can be assumed that low scores in this subtest were mainly due to poor motor functions and coordination (see chapter 5.7).

One reason for the weak discrimination ability of the *Wechsler Scales* could have been the lack of sensitivity in detecting specific verbal or performance deficits. This was supported by the results of the *Illinois Test* where significant differences were found in *Auditory Association*, *Verbal Expression* and *Auditory Sequential Memory*. Another reason could have been heterogeneity within the groups. The typical profile of non-verbal learning disability (NLD) was found in almost one quarter of participants. However, as they were not assigned to a separate group their scores could have resulted in a tendency to obscure profiles within groups. It was also possible that participants of the experimental groups were located at the mild end of the autistic spectrum and therefore showed a greater similarity in their subtest scores whereas individuals from more extreme positions on the spectrum would have shown a clearer difference of profiles.

In comparison with the *Wechsler* test norms the mean scaled score of *Picture Arrangement* of the MA group was above average and almost exactly average in the SA

group! These unusually high results were in contrast to previous research findings and needed further explanation. The subtest *Picture Arrangement* assessed the understanding of pictorially presented social scenarios. This complex task tapped into abilities like visuo-perception, executive functions and *Theory of Mind*. In chapter 5.2 it was mentioned that the majority of the participants of the present study received a CARS score which placed them on the mild end of the autistic continuum. Bowler (1992) has shown that children who fell into this category showed an understanding of *Theory of Mind* tasks. The high scores in *Picture Arrangement* could have been a combination of normal figure-ground perception (as demonstrated in average scores in *Picture Completion*) and no significant deficits in abilities regarding the *Theory of Mind*.

The mean scaled scores of *Block Design* in both the MA and SA group were average. The profiles did not indicate a peak but the test outcome suggested more a relative strength in this area than a weakness. *Picture Completion*, which required among other abilities a good figure-ground perception, showed in all three experimental groups an average result.

The low results in *Similarities* of both the MA and the SA group indicated a trough in the profiles of abilities. Although the higher score of the group NE was not significant it seemed to indicate that participants of the groups MA and SA showed a more profound deficit in their verbal abilities. This subtest was assessing abstract thinking and the ability of concept formation. However, a reason for poor performance in this subtest could have been the verbal presentation of the test items. The results of the *Illinois Test* (see chapter 5.6) indicated difficulties in assimilating verbal information and the very high *Raven* scores indicated the presence of good abilities in abstract thinking on a non-

verbal level. The low *Similarities* scores of this cohort did therefore not necessarily reflect poor abilities in this area but could have been related to specific cognitive processing of verbal information or a difference between abilities in tasks involving self-paced and externally-paced assimilation of information.

Both the MA and SA group obtained low scores in *Comprehension*, a test that examined the understanding of verbally presented problems and situations from daily life. The subtest *Picture Arrangement* examined the understanding of visually presented social scenarios and could be seen as the visual counterpart to *Comprehension*. The discrepancies between the scores of both subtests suggest that it is less likely that the understanding or reasoning itself is delayed but that the difficulties were related to the use of the verbal channel to convey information.

The analysis of variances of the mean scaled scores did not show significant differences between the three experimental groups regarding each of the *Wechsler* subtests (see table 5:11). MA and SA could not be differentiated on specific subtest scores e.g. *Similarities*. Although some individuals in the present cohort demonstrated very high abilities in this area, the overall differences between groups were not significant.

The comparison of discrepancies between PIQ and VIQ scores did not indicate significant differences between the experimental groups. However, it was surprising to find that 37 participants (=74%) showed a higher PIQ than VIQ. This pattern was present in all three groups.

The reverse pattern which was labelled Non-Verbal Learning Disability (Rourke, 1989) was found in 12 individuals. The current literature is unclear whether this particular

profile is indicative of a separate condition and how it relates to autistic spectrum disorders.

The extraordinary discrepancies between PIQ and VIQ displayed by some individuals and the presence of significant differences between PIQ and VIQ in the majority of participants suggested that this finding was typical for the whole experimental group. It suggested a better functioning of “performance” abilities than verbal ones. This result seemed to support Temple Grandin’s (in Sacks, 1995) description of “visual thinking” as being the predominant cognitive process in “autistic” individuals.

The lack of significant differences, particularly between MA and SA, was due to a similar presentation of abilities as examined by *Wechsler* subtests. It was possible that individuals from more extreme positions of the autistic spectrum would have shown characteristic profiles with significant differences between groups.

The results of the *Raven’s Matrices* showed an astonishing contrast to the *Wechsler* scores. Both tests were said to assess intelligence and it was expected that the results would be similar. The manual of the *Raven Test* (Raven et al., 1986) gave a moderate to high correlation of $r = 0.48$ and $r = 0.73$ between *Raven* score and FSIQ. However, in the present study all three groups obtained significantly higher mean percentiles in their *Raven Test* when compared with their VIQ and FSIQ of the *Wechsler Scales*. The significant correlations confirmed a close positive relationship between both measures; i.e. high *Raven* scores were associated with high *Wechsler* results. But the generally higher *Raven* scores indicated a better functioning when the task was a purely visual one and verbal aspects, e.g. explanation of the task, were minimised. The test items were based on visual patterns, which had to be completed by using progressing levels of

abstract thinking and non-verbal reasoning. A successful completion of its tasks required good visual perception and cognitive functions. As a non-verbal test it was using visual stimuli as opposed to verbal test items. The high *Raven* score and the high PIQ scores of the *Wechsler Scales* both indicated that the three groups showed a preference towards processing visual information when compared with auditory.

The responses of the *Raven Test* were divided into three groups characterising different cognitive processes. Although the three experimental groups did not differ significantly in these categories the numerical scores revealed some important tendencies. On “pattern matching” and “pattern completion” which represent more basic levels of reasoning and abstraction the scores between the groups were almost identical. However, “pattern progression” was characterised by more complex reasoning abilities. Here the MA group scored highest indicating slightly better abilities when compared with the other two experimental groups. Although not significant, this result seemed to support Asperger’s findings that his cohort showed high abstract thinking abilities.

Conclusion

The three experimental groups could not be differentiated on the results of *Wechsler* profiles or subtest scores or on the outcome of the *Raven Test*. The lack of discrimination could have been due to:

- the mild presentation of autistic features within the cohort
- heterogeneity within the experimental groups
- lack of sensitivity of the *Wechsler Scales* regarding specific cognitive deficits

- the classification of the experimental groups which resulted in a minimisation of differences (see chapter 5.2)

However, compared with *Wechsler* test norms individuals classified as MA scored above average in *Picture Arrangement* indicating good visual perception and an understanding of other people's mind.

Individuals of both the MA and SA group showed low results in *Similarities*, which seemed to contradict Asperger's findings. However, poor assimilation of verbal information rather than limited abilities in abstract thinking was likely to be the reason for this outcome. This was confirmed by the *Raven Test*, which showed that 78% of the cohort obtained a percentile of 50 or higher indicating good abstract thinking and non-verbal reasoning skills.

Rather than indicating global cognitive deficits the results of the *Wechsler Scales* of both the MA and SA group suggested specific difficulties related to verbal tasks. The results of the performance subtests were age appropriate.

The majority of participants of the experimental groups showed a significantly higher PIQ than VIQ. They seemed to be able to process visual information better than verbal information.

6.3 Cognitive Styles

The theory of cognitive styles hypothesised that people in general show different modes of functioning, a field dependent or a field independent one. It was hypothesised that

children with Asperger Syndrome would show a more field independent style of functioning. This was examined in the areas of visual, acoustic and tactile perception.

6.3.1 Visual Perception

Gregory (in Gross and McIlveen, 1998) described four types of visual illusions. Three of these were presented to the participants of the study in order to discriminate between different groups.

Ambiguous or reversible figures:

(1) The *Duck – Rabbit Test Picture* is a reversible drawing, depicting two animals. 52% of the experimental groups were not able to see both animals compared with 11% of the control group. This finding indicated that the majority of participants of the experimental groups found it difficult to change the visual image. They were in their perception more rigid. The participants of the experimental groups who were able to see both animals were significantly slower in changing their visual perception than the Controls, which also suggested a poorer ability to change in the experimental groups. The three experimental groups did not differ significantly in their ability to change the visual perception.

Previous research regarding visual functions (e.g. Hermelin and O'Connor, 1970) has found a shorter inspection time of visual stimuli in children with AU when compared with non-symptomatic controls. However the *Duck – Rabbit* experiment was a slightly different task than the one used by Hermelin and O'Connor. The participants were presented with one and not with several stimulus cards. The stimulus picture remained

the same and the observer had to change his visual perception. The change was not evident in the presented picture (externally); it could only be achieved by adopting a different visual mental “set”. All three experimental groups were not as able as the controls to change their perception and demonstrated a more rigid or field independent style of functioning.

The *Central Coherence Theory* (Frith, 1989) postulates that the superior visual perception is due to rigidly focussing on details, thereby losing the perception of the whole. It can be described as a process of seeing with visual templates rather than integrating the available visual information into a meaningful whole. However when in the present study the investigator gave visual prompts, e.g. outlining the rabbit’s head and pointing to details, to those participants who only saw one image, most of the children were still not able to see the other image, keeping rigidly to their original visual perception. This observation favoured the presence of a cognitive style rather than a specific visual strategy, which had contributed to the more rigid responses of the experimental group, compared with the controls.

(2) The *Rubin-Test-Picture* is a drawing of reversible figures similar to the *Duck-Rabbit Test Picture*, depicting either a vase or two faces looking at each other.

21 participants (=42%) saw only one image, whereas 29 children (=58%) were able to see both. 89% of the control group could see both objects. As in the previous test picture, a considerable number of individuals of the experimental group showed difficulties in changing their visual perception demonstrating a more rigid processing of visual images.

Paradoxical figures:

The *Escher-Test-Picture* showed a landscape with white birds flying from right to left. The spaces between these birds were black and could be seen as black birds flying in the opposite direction. Compared with the *Duck-Rabbit* and the *Rubin-Test-Picture* this picture was more detailed and gave various visual prompts to the perception of both the white and the black birds. It was easier to see both images. This resulted in a higher number of individuals who were able to see both. Only seven participants (=14%) of the experimental groups did not see both the white and black birds.

The results did not show significant differences between the experimental groups with regards to the ability to change from one image to the other. However the differences between the experimental groups and the control group indicated a tendency towards significance between SA and Control group indicating a lower ability to change visual perception in the SA group.

The white and black birds in the *Escher Test Picture* have congruent shapes, which would have supported the use of a visual template strategy. However the low ability to change the visual perception in the SA group suggested that a different strategy was used which was characterised by a more rigid processing of visual information. The results support the *Theory of Cognitive Styles*.

Geometrical Illusions:

The *Müller – Lyer* experiment was presented in two different conditions. As was to be expected the control condition showed very little differences between the experimental and the control groups. All four groups also demonstrated a trend to a slightly higher

perceptual error when the adjustable line was shortened compared with the opposite movement. The same tendency was found in the illusion condition in all four groups. It can therefore be presumed that it was a general visual perceptual effect rather than an inherent one specific to the four different groups.

However the results of the illusion condition indicated significant differences between groups. The MA group demonstrated the smallest error of judgement in the condition in – out. The group “Other” showed an error score almost double the amount of the error of the MA group. The post-hoc multiple comparisons indicated that the main significance was due to comparisons between the MA group with NA and Control. In the condition “out – in” the judgements of the SA group were slightly more accurate than the ones of the MA group, however, the scores did not differ significantly when compared with NA or Control.

Both the MA and SA groups were more accurate in all conditions and showed less increase in error in the illusion condition – so any abnormality cannot be attributed to visual practice effect or misunderstanding of the task.

These results confirmed a more field independent style of functioning, which was only significant for the MA group but not for SA. Happé (1996) did not differentiate in her study between MA and SA. Her findings confirmed that people with autism were in their visual perception less influenced by optical illusions than non-symptomatic controls.

6.3.2 Figure – Ground Perception

Shah and Frith (1983) found superior results for autistic children in the *Embedded Figures Test* (Witkin et al., 1971) when compared with non-symptomatic controls. They felt that the visual template strategy adopted by the autistic individuals had contributed to their improved performance, which supported the *Central Coherence Theory*.

Compared with the *Embedded Figures Test* the *Visual Closure Test* consisted of more complex tasks as the hidden objects were not always in full view and were sometimes visible from different angles. A template strategy would have been of a disadvantage and lower scores would have been expected. The MA and SA group of the present study must have used a different strategy in order to obtain their relatively high scores. Compared with the test norm population (mean: 36 and standard deviation: 6) the scores of all three groups were closely scattered around the mean, demonstrating normal figure-ground perception. The *Theory of Cognitive Styles* proposed that a more field-independent approach adopted by individuals of the MA and SA group would result in high scores. The fact that the results of the *Visual Closure Test* were the highest scores of the *Illinois Test* in both the MA and SA group supported the view that the experimental groups had adopted a more field-independent strategy.

The subtest *Picture Completion* of the *Wechsler Scales* was also assessing figure-ground perception. This complex task required the individual to compare the presented stimulus picture with an internally completed one. A visual template strategy could not be used, as there were no visual clues to guide the individual's visual search. The visual incongruity could only be found by a mental comparison.

The scores of the three experimental groups were all within the average range and did not show significant differences between the groups confirming the outcome of the *Visual Closure Test*.

6.3.3 Acoustic Perception

The *Acoustic Discrimination Test* examined the ability to differentiate between tone presentations in two different conditions. The four groups did not differ in either the 5-second pause condition or in the interpolated chord condition. The high test scores confirmed that the acoustic discrimination of the participants of the four groups was intact. The frequently reported apparent lack of hearing in children with Asperger Syndrome and autism could not be attributed to the ability to discriminate but rather to difficulties of higher cognitive functions or perhaps to difficulties in auditory attention such as low information handling rate.

The theory of cognitive styles assumes that a particular way of functioning pervades all areas of personality. It was therefore expected that compared with the control group the experimental groups in particular the MA group, would be lesser distracted by different interfering insertions. However the responses of the four groups were very similar and did not suggest significant differences in the functioning of their acoustic discrimination.

6.3.4 Tactile Perception

The task of posting 20 plastic coins into a small box was a complex one involving the coordination of mainly three different functions, i.e. visual, tactile and motor. The two

different experimental conditions compared the effects of varying visual control on the task. When visual control was excluded the recognition of objects was mainly relying on tactile perception. In this experimental condition all four groups needed longer to complete the task. The MA group was slowest which was significant when compared with the control group. Although not significant, the MA group needed more time than the SA group indicating that the MA group had more difficulties than any of the other groups in completing this task. The results also suggested a stronger dependency on the visual sense and a poor ability to compensate for the loss of information.

The lack of perceptual-motor integration indicated difficulties in adapting to new tasks and showed a poor ability in utilising new sensory-motor information, which was most apparent in the MA group.

The poor performance of the MA group in both experimental conditions raised the question whether low fine motor skills had contributed to the outcome.

Conclusion

Seven different tests were carried out to examine the cognitive style of functioning adopted by participants. Significant differences between the results of experimental groups and controls were found in four tests: *Duck-Rabbit*, *Escher*, *Müller-Lyer* and *Tactile Hand Control*. Here the experimental groups demonstrated a poor ability to change their visual perception and to integrate available sensory information. Their problem solving strategy was characterised by a very focussed and rigid style of functioning.

The acoustic perception test was mainly assessing acoustic discrimination. All groups obtained relatively high scores and showed little distraction in their judgements when presented with the two different experimental conditions. The differences between the experimental groups and the controls did not differ significantly. The participants of the experimental groups were in their judgements as accurate as the controls. These results confirmed that the frequently reported problems with “hearing” in children with autistic features were not associated with auditory defects but were more likely to be due to the processing of acoustic information on a more central level. The results of the speech and language tests (see chapter 5.6) indicated a more rigid understanding of verbal information in the MA and SA group.

Significant differences between MA and SA could not be confirmed in any of the perceptual experiments. However the results of the *Müller-Lyer Test* and the *Tactile Hand Control* indicated a more rigid style of functioning in MA: although significant only in comparison with the control group, the difference between the numerical scores of the MA and SA group in these tests raised the question whether Asperger Syndrome can be seen as a mild version of autism. The ambiguous diagnostic classification of participants could have contributed to the lack of significance.

A specific cognitive strategy, i.e. a field independent style, could be identified in participants of the experimental groups when completing different perceptual tests. This strategy was found in two of the three perceptual areas and could therefore be regarded as a cognitive style in the sense as Witkin and Goodenough (1981) described it. These results supported the hypothesis that the underlying difficulty in children presenting with autistic features is a particular cognitive style.

6.4 Speech and Language Abilities

Children with mild autism or Asperger Syndrome characteristically exhibit a variety of speech and language difficulties as described in chapter 2.3. Despite their good expressive language they frequently show poor verbal understanding, limited conversational skills, verbose explanations and going off at a tangent, literal understanding of verbal information and difficulties to understand the subtleties of verbal expressions. However these specific difficulties were only partially assessed by the *Wechsler Scales*.

The subtest *Similarities* was examining abilities such as concept formation and abstract thinking. Both the MA and the SA group scored below average. This result did not confirm Asperger's (1944) findings. He observed in his cohort very good abstract thinking abilities. However he based his conclusions mainly on the spontaneous verbal utterances of individuals. Asperger also used subtests of the Binet Test to assess verbal abilities though actual scores were not quoted. One of the subtests which was translated by Frith (1991) as "Similarities" consisted of tasks to describe the differences of two similar objects, e.g. tree and bush or stairs and ladder. The responses of the four boys in his article demonstrated clearly originality in their thinking but also the tendency to go off at a tangent and to ramble on. However the rich verbal responses could have been the result of the children's unusual perspective and also an expression of their original ideas which Asperger interpreted as good verbal abilities.

The poor responses in the subtest *Similarities* of the present cohort could have been due to the scoring criteria, which rewarded certain responses, but not unusual or spontaneous answers.

Asperger also noticed that “performance is best when the child can give a spontaneous response and worst when he has to follow a specific taught procedure especially when reproducing learnt information.” (page 106, translated by the present author). The author of the present study observed that participants were often able to give the correct responses when the standardised test questions were rephrased thus indicating specific difficulties in understanding the verbal task. This observation supported the *Theory of Cognitive Styles*, which predicted that a field-independent way of functioning would result in a poor ability of relating verbal information to other areas.

The low scores in *Comprehension* in both the MA and the SA group suggested difficulties in verbal understanding. The verbal responses of this subtest could either be credited with one or two points depending on the awareness of the wider implications of the situation described. The results indicated that participants of the MA and SA group often had a basic understanding of the depicted scenario but did not grasp the full scope of the problem. Here again a rigid style of functioning was apparent in both the MA and the SA group.

The subtest *Information* assessed what can be loosely termed as “general knowledge”. The task focussed on encyclopaedia-type facts, which could be learnt by rote. Here the cognitive functions of verbal assimilation and memory were required as opposed to association, which was characterised by the ability to relate information to other areas. Factual data could be seen as separate events, not related to each other. All three groups scored relatively high which indicated that these cognitive functions were a strength in all participants. They also suggested a specific preference of processing verbal information, which was compatible with a more field-independent style of functioning.

Relatively high scores in all three experimental groups were also found in *Arithmetic*. As the test items were verbally conveyed they could also be interpreted from a comprehension point of view. The results implied that the mathematical tasks were understood appropriately and did not indicate difficulties in the areas described above. It also appeared that numerical concepts seemed to carry less ambiguity than verbal ones. Numbers were similar to facts; they could be regarded as separate events whose meaning remained the same. Words on the other hand were more ambiguous and could change their meaning (see Temple Grandin, in Sacks, 1995). Good numerical abilities were already found by Witkin and Goodenough (1981) as being typical for the field-independent style of functioning.

The verbal subtests of the *Illinois Test* assessed specific auditory abilities and gave a more detailed picture of strengths and weaknesses in children with autistic features.

The subtest *Grammatical Closure* assessed the ability to assimilate and retain irregularities of the English language and tapped into abilities similar to the ones examined in the subtest *Information* of the *Wechsler Scale*. It was therefore not surprising that *Grammatical Closure* came highest in all three experimental groups compared with the other verbal subtests.

Auditory Expression was testing the ability to describe everyday objects. The differences were significant between the SA and the NA group, indicating poor verbal abilities. However during the assessments the investigator noticed that the low score of the SA group could have been due to the lack of structure. The participants were asked to describe a familiar object regarding five different dimensions, which was practised with one object before the trial began. When concrete questions about the object were asked the children were able to give the correct response. Without these verbal prompts

the participants seemed to be confused as to what else was necessary to say about an object, indicating a lack of a verbal structure or of an overall concept. However this seemed to be different in the MA group. The verbose expressions of the children of this group were very similar to the ones described by Asperger (1944). Their long-winded explanations often contained trivial and convoluted information and seemed to lead nowhere. However the digressing descriptions resulted consequently in a higher score which concealed underlying difficulties characterised by poor verbal structure.

A significant difference between the SA and NA group was also revealed in *Auditory Association*. The mean scaled score of the SA group was more than one and a half standard deviations lower than the one of the NA group. Individuals of the SA group demonstrated significant difficulties in the ability of placing verbal information into a meaningful context. They often associated related words with key words of the test question but failed to recognise the relevant information of the test item. This finding could be related to the Theory of Cognitive Styles, which proposed a rigid, field-independent style of functioning. Here again the MA group did not show significantly different results when compared with the NA group.

The above results can also be interpreted with the *Central Coherence Theory*. The perception of the whole is reduced, therefore appropriate associations cannot be made and the individual's expressions are either reduced or stay on a level of repetition and unusual, sometimes original responses.

Although the statistical analysis of the scaled scores regarding the subtest *Auditory Reception* did not reach significant levels it was noticed that both the MA and the SA scores were almost one standard deviation below the mean of the norm population.

These low scores indicated considerable difficulties in decoding verbal information. The test consisted of a series of nonsensical questions, e.g. “do dogs fly?” and the requested response was either “yes” or “no”. A rigid style of functioning would have resulted in clear answers. However, it was interesting to see that some children were seriously considering questions like the one quoted above. It seemed almost as if the verbal description of an impossible situation had given it a touch of reality and therefore posed a serious dilemma to some children of the experimental groups. The children seemed to show a lack of an internal point of reference, which made it sometimes difficult to respond to trivial questions in an effective way. This could also explain the sometimes unusual solutions to problems and can be both of an advantage and of a disadvantage.

The subtest *Auditory Sequential Memory* was similar to *Digit Span* of the *Wechsler Scales*. Previous research (e.g. Rumsey and Hamburger, 1988, Szatmari et al., 1990) has indicated that individuals with Asperger Syndrome or autism showed a strength in this area. The present study could only partially support this finding. In both groups the scores of the verbal memory test occupied relatively high ranks when compared with the other tests. However, the actual mean scaled score of the MA group was relatively low when compared to the norm population and showed a tendency towards significance when compared with the group NA. Participants of the SA group scored higher though the difference was not significant.

The responses of the *Literal Thinking Questionnaire* were classified into five categories. The first one recorded the number of correct interpretations of eight widely known English idioms. Significant differences were found when MA and SA scores were compared with the NA and the Control group suggesting poor grasp of these particular idioms. The rigid interpretation of language, which was similar to the one, found in the

subtest *Auditory Association*, indicated a field-independent style of processing verbal information. As the groups were not matched on intellectual abilities the differences between autistic and non-autistic individuals could have been due to different cognitive abilities.

Significant differences were also found in the category “literal”. Here the MA group interpreted more idioms in a literal way compared with the control group. The results of the SA group also differed significantly from non-symptomatic controls. Participants of both the MA and SA group demonstrated a high degree of literal understanding, which seemed to be a general characteristic of these groups.

The response category “don’t know” occurred relatively often in the MA and SA groups but significantly less in NA. The latter group seemed to have generally a better understanding of idioms.

The other two categories i.e. “partially correct” and “wrong” were not frequently used by any of the four groups and did not show any significant differences.

Conclusion

The results of the verbal subtests of the *Wechsler Scales* did not indicate significant differences between the MA and the SA group. The pattern of strengths and weaknesses in both groups was fairly similar and was different from the one described in previous research papers (e.g. Ehlers et al., 1997, Manjiviona and Prior, 1999). The present study has found relatively high scores in *Information* and *Arithmetic* but low results in *Similarities* and *Comprehension*. The items of the higher scoring subtests were relating to factual data. Verbal information like this could be treated as separate entities and could be learnt and reproduced by rote. The other two subtests consisted of items, which were embedded in analogies or social contexts. The responses had to be adapted to these situations and only specific, socially accepted answers were credited. The low scores in

these subtests indicated a rigid response strategy and a poor ability to relate verbal information into a wider context.

The frequently displayed tendency to go off at a tangent was in the investigator's opinion indicative of the lack of verbal understanding. When test questions were rephrased this tendency was reduced.

The detailed assessment of verbal abilities of the *Illinois Test* identified significant differences between the groups SA and NA. In *Auditory Association* the participants of the SA group demonstrated poor abilities in relating verbal information into a wider context. The low result in *Verbal Expression* indicated deficits in describing everyday objects. Participants had adopted a "matter of fact" attitude which almost implied a belief in a consensus amongst people's description of these objects. The presence of this attitude would contradict the *Theory of Mind*, which postulated that children with autistic features have difficulties in understanding the thoughts and beliefs of others.

Observations during the assessments also indicated that both the MA and SA group seemed to show a lack of a verbal concept when responding to these test items. These difficulties were suggestive of poor executive functions.

Although not significant the subtest profiles of the MA and SA group seemed to show slightly different patterns of strengths and weaknesses. The MA group demonstrated better abilities in *Auditory Association* and *Verbal Expression* whereas the SA group obtained a slightly higher score in *Auditory Sequential Memory*.

The results of the *Literal Thinking Questionnaire* showed significantly lower correct interpretations of English idioms and significantly higher literal interpretations in both the MA and the SA group when compared with controls. This rigid understanding of verbal information could be explained by a more field-independent way of functioning as proposed in the *Theory of Cognitive Styles*. This result has to be interpreted with caution, as the control group was not matched on cognitive abilities.

The significant differences found in the auditory subtests of the *Illinois Test* and the *Literal Thinking Questionnaire* supported Asperger (1944) who explained the unusual results of his cohort with a different way of processing verbal information. The results of the present study explained these difficulties in a more precise way. The significant discrepancies between the scores of SA and NA were apparent in *Auditory Association* and *Verbal Expression* indicating a rigid understanding of verbal information and also a poor ability to integrate verbal information into a wider context. The low scores in *Auditory Reception* in both MA and SA were suggestive of difficulties in decoding verbal information.

6.5 Motor Skills

Results of research on motor skills in autistic spectrum disorders have been controversial. Some studies have found good motor skills in autism and high-functioning autism but poor abilities in Asperger Syndrome (Gillberg, 1989, Szatmari et al., 1990), others did not find significant differences between Asperger Syndrome and autism (Ghaziuddin, 1994, Manjiviona and Prior, 1995). These findings reflected to a certain degree the diagnostic criteria that were used to define the experimental groups. Studies, which have found no differences between Asperger Syndrome and autism, have typically used DSM or ICD criteria, both of which were based on the triad of

impairments. Whereas studies that have found differences between the two conditions were based on clinician's observations and assessments (Asperger, 1944, Wing, 1981a) or on other diagnostic criteria e.g. Gillberg and Gillberg (1989) or Szatmari et al. (1990). To avoid the bias inherent in different diagnostic systems the present study used a behaviour rating scale (CARS) which was not based on a particular theoretical model to define the experimental groups.

Motor tasks in general consist of a complex sequence of different functions: muscular and proprioceptive functions, visual perception, spatial vision and executive abilities to name the most important ones. A high degree of integration and coordination of these skills is required in order to perform good motor activities. The *Theory of Cognitive Styles* is hypothesising different styles of integrating information. The field independent style assumes a rigid way of functioning suggesting poor abilities in integration not only of sensory information but also generally in all areas of the personality. In this context low motor skills could indicate poor integration of different skills.

The *Movement ABC* is a standardised test to examine fine and gross motor skills in children. In the present study the mean percentiles of the total *Impairment Score* did not exceed a score of 22, indicating poor motor skills in all three experimental groups.

The scores of MA and NA were almost identical but the SA group showed a lower score indicating a higher motor impairment. The differences between the results of MA and SA showed a strong tendency towards significance.

The analysis of the three different areas of motor tasks revealed relatively high levels of impairment in all three groups in *Manual Dexterity* as well as *Static* and *Dynamic*

Balance in comparison with the test norms (a score of zero indicated no impairment). The subtest *Ball Skills* required good hand-eye coordination, spatial vision, judgement of the speed of an object and of its expected course of direction. Here the SA group demonstrated marked difficulties when compared with the other two experimental groups. As the subtests *Manual Dexterity* and *Balance Skills* did not show significant differences between the groups, it can be presumed that the subtest *Ball Skills* involved a component not examined by the other motor tasks. This could be related to the anticipatory judgements required in ball play activities. Compared with the NA group the participants of the group SA were less able to calculate the speed and the direction of a ball and needed more time to prepare themselves in order to catch a ball.

Although the movement of a ball can be regarded as an inanimate activity the outcome of this test can be related to the *Theory of Mind* (Baron-Cohen et al., 1985). It predicts that people with an autistic spectrum disorder find it difficult to understand a different point of view other than their own. In ball play activities information about the movements of a ball are vital. Poor or erroneous judgements will result in dissatisfaction and consequently in the end of the game. Participants with severe autism showed greater deficits in their motor coordination and in anticipatory preparations when catching a ball.

The results of the MA group were higher confirming Bowler's (1992) finding that individuals with Asperger Syndrome have developed a theory of mind and were therefore able to make correct predictions about other people or objects.

The test *One-Leg-Balance* indicated significant differences between experimental and control groups only in the condition where visual control was conceded. The superiority of the Control group disappeared when this task had to be performed "blindfolded".

The significantly higher score of the control group in the condition “with visual control” indicated a better integration of visual information when performing motor tasks whereas the experimental groups seemed to use visual information to a lesser degree. This result supported the hypothesis that the experimental groups demonstrated a more rigid style of functioning.

The test *Visual/Tactile Hand Control* was presented in two conditions, one with visual control and the other without. In both tasks the control group was significantly better than the MA group. Post-hoc comparisons also indicated a tendency towards significance between Control and SA. These findings seemed to indicate that the Control group made better use of the available sensory information and showed a higher level of integration of tactile and visual stimuli.

As this test also had a fine motor element it was suggested that the significantly better performance of the Control group in both conditions could have been due to poor fine motor skills in the experimental groups.

The score of the MA group in the condition where visual control was excluded was worse than the SA result. The difference was not significant but it could suggest that people with Asperger Syndrome show a stronger tendency to function in a more field-independent style and were less able to integrate different sensory information.

Conclusion

The results of the *Movement ABC* indicated poor motor abilities in all three experimental groups. However mild and severe autism could not be differentiated on particular profiles of strengths and weaknesses. Significant perceptual difficulties, in particular the judgement of the speed and direction of a ball were found between SA and NA confirming *Theory of Mind* deficits. Both the MA and the SA group showed a poor integration of visual information when performing motor tasks in the *One-Leg-Balance Test* and *Visual/Tactile Hand Control*. The results of the latter test also showed a slight tendency towards poorer integration abilities in participants with MA.

These findings indicated that sensory perception as one component of complex motor tasks plays a decisive role in the performance of motor activities. Individuals with mild or severe autism seemed to be able to integrate the available sensory information to a limited degree. This lack of integration was typical for a more rigid way of processing sensory information as described in the *Theory of Cognitive Styles*.

7. CONCLUSION

At the starting point of this study was the growing dilemma of the clinician to come to a satisfactory diagnosis when assessing individuals exhibiting features of autism. Clients who presented with the so-called triad of social impairments were quickly and reliably identified. However an increasing number of children referred to Child Development Centres and Child Guidance Clinics did not show the complete triad and consequently failed to receive a diagnosis. Current diagnostic manuals like the DSM-IV did not offer clear guidelines and seemed to perpetuate the confusion. This was confirmed by the results of the present study: Using DSM-IV criteria only 36.8% of the cohort could be identified with Asperger Syndrome or autism whereas the consultants overall diagnoses, based on their clinical expertise, classified more than 71% of the participants into these two categories. The level of agreement between DSM-IV and consultants diagnoses reached a score of $\kappa=0.15$ which was below the level of statistical significance.

A different classification system, *The Childhood Autism Rating Scale* (CARS), was used in this study to collect additional and independent information regarding the participants' behaviour. This scale was not derived from a specific theory or model as the DSM and ICD but was based on fourteen areas of observable behaviours, all of which were typically found in children who presented with autistic features. Specific knowledge in the field of autism was not required to complete the scale. It was assumed that parents were in the best position to rate their children's behaviour on the wide range of activities. The agreement between parents' ratings and consultants' diagnoses was higher and reached a significant score of $\kappa=0.50$. The CARS was finally adopted to assign the participants of the study into three experimental groups. This rating scale

combined a high level of agreement with clinicians' overall diagnoses and an independent rating. However, although the agreement between parents and consultants was improved it only reached a success rate of 50% in identifying Asperger Syndrome, autism or other conditions compared with a statistical chance of 1 in 3. The failure rate of 50% appeared to be relatively high. However the improved level of agreement suggested that behaviour rating scales could prove to be more reliable in the development of future diagnostic tools.

One aim of the study was to identify reliable criteria, which could differentiate between different conditions presenting with autistic features in particular between Asperger Syndrome and autism. The assessment covered a wide range of tests including intellectual abilities, speech and language skills, fine and gross motor functions, auditory perception and tactile perception. The outcome of the statistical analyses, however, indicated that the scores of both groups did not differ significantly in any of the 35 tests or subtest that were carried out. Specific profiles or abilities that differentiated between Asperger Syndrome and autism could not be identified. The use of a more reliable classification system based on behavioural observations did not produce subgroups with clear boundaries. Did this lack of significance confirm that both conditions were principally the same but presenting in varying degrees as the concept of the autistic spectrum suggests?

A number of reasons could have contributed to the lack of significance:

(1) The participants of this study were unselected. They were referred by a medical consultant for a multidisciplinary assessment. The majority of the participants showed

enough autistic features to raise the suspicion of an autistic disorder. However it was unlikely that individuals with severe autism would have come through the system, as they would have been reliably diagnosed earlier on. The lack of individuals with severe autism could have resulted in less extreme scores which consequently added to the lack of a clear distinction between groups.

(2) The authors of the CARS based their system on the concept of an autistic continuum and divided the rating scale in three categories, i.e. “non-autistic”, “mildly-moderately autistic” and “severely autistic”. Asperger Syndrome was regarded as “high functioning autism” (Schopler, 1985). The range of the rating scale identifying “mild to moderate autism” occupied seven of the 45 point scale whereas the area defining “severe autism” spanned an area three times larger which suggested a wide variation in the presentation. In contrast to this Wing (1998), relating to the Camberwell Study (1979), confirmed that the number of children with clear autistic features, “pure cases” as she called them, were in the minority. The disproportionate division of the CARS gave rise to the question whether the large area indicating “severe autism” did incorporate individuals with mild autism or even other conditions with autistic features. If this were the case then the CARS would also show a bias towards autism similar to the DSM-IV and would have classified more individuals with “severe autism”. In the present study all scores of the severe autism group were placed within the less severe third of this category which could indicate that a number of participants could have been mislabelled. The specific cut-off points by the CARS could have led to an inflation of the number of the autism group and therefore did not produce significant differences between the experimental groups.

(3) Another reason for the lack of significance between groups is related to the ambiguity of the overall CARS score. Individuals with the same numerical score could show a different spread of behavioural features. This was highlighted by a group of participants who presented with a profile characterised by significantly higher VIQ than PIQ scores. This pattern of abilities was labelled as “non-verbal learning difficulties” or NLD (Rourke, 1989, Rourke et al., 1994). Their WISC scores were almost opposite to the ones found in the majority of the cohort, i.e. high performance scores and low verbal ones. However their social and behavioural difficulties were almost identical with Asperger Syndrome. An inclusion of individuals with this profile could have obscured the differences between groups.

(4) It was mentioned earlier (chapter 2.1) that researchers have found a change in the severity of autistic features over time. Gillberg (1998) believed it was possible for an individual to receive a diagnosis of autism when young and a diagnosis of Asperger Syndrome at a later age. He did not clarify at what age this change was likely to occur and the reason for it. Pomeroy (1998) confirmed that children with Asperger Syndrome seemed to mature in a different way than children with “classic autism”. He found that individuals who presented with “classic autism” exhibited the same cognitive deficits when young adults. Sigman (1998) confirmed stable individual characteristics in individuals with autism. These findings seemed to imply that Asperger Syndrome is characterised by a change in presentation but that this change is less likely to occur in autism. With regards to the present study it is possible that even within the relatively narrow age range of 5 to 10 years there were some individuals classified as autistic who might receive a diagnosis of Asperger Syndrome at a later age.

(5) The differences between Asperger Syndrome and autism were found to be small in the present study due to the mild presentation of autistic features in participants. The relatively low numbers in experimental groups could have contributed to the lack of significance. In order to identify differentiating criteria the sample size has to be increased to improve the power of the psychometric assessments.

How can it be reconciled that there were no significant differences between Asperger Syndrome and autism although when assessed on criteria based on the triad Asperger Syndrome and autism could be differentiated?

If the majority of the individuals of the present study who were classified as “severely autistic” were in fact mildly autistic as the test results suggested, then the lack of significance between Asperger Syndrome and autism would support the idea of a strong similarity between high functioning autism (HFA) and Asperger Syndrome. However the question remains whether, what is loosely labelled as HFA should be regarded as an autistic condition or should be subsumed under a different label. Gillberg and Ehlers (1998) came to the conclusion that it was not clear to what extent Asperger Syndrome and HFA were representing different, overlapping or identical conditions. With regards to Asperger Syndrome they strongly felt that this condition was different from autism.

Gillberg (1998) criticised the frequent use of the label HFA in research although there were no uniformly agreed criteria. It seemed that this term was often used for individuals with autistic features who did not show a significant delay in their cognitive abilities and/or in their speech and language skills. However other researchers regarded these criteria as essential for Asperger Syndrome (Gillberg, 1989, Szatmari et al., 1989).

Schopler et al. (1998) edited a recent publication, which was described as the state-of-the-art in the field of high functioning autism and Asperger Syndrome. However uniformly agreed definitions of both conditions were conspicuously missing. A panel of fourteen distinguished clinicians and scientists did not come to a unanimous verdict: Six authors definitely felt that Asperger Syndrome and high functioning autism were not distinct conditions compared with two who maintained that there was enough evidence that supported a difference. Six authors were undecided and regarded the distinction as being ambiguous.

Schopler (1985) felt strongly that Asperger Syndrome should be regarded as an autistic disorder. He based his views on the concept of an autistic continuum on which all conditions with autistic features could be placed. However the question remains open as to what constitutes an autistic spectrum disorder. With regards to Asperger Syndrome, which he regarded as high-functioning autism, he suggested that the term Asperger Syndrome should not be used until empirical evidence was available to support its clinical entity. However by placing this condition on the autistic spectrum he implicitly defined Asperger Syndrome as an autistic disorder. The logical consequence of his argument would in the view of the present author suggest that in the absence of clear diagnostic criteria no other clinical category should be used, not even Autistic Spectrum Disorder (ASD). Schopler's suggestion has not clarified the situation.

In a more recent article Schopler (1998) reiterated that the Asperger Syndrome label “should have been left in the investigative state until a valid subgroup had been established” (page 397). He pointed out that the popularisation of this label had more

negative than positive consequences. This may be correct from his point of view. However as was mentioned earlier Asperger himself has never regarded the children he assessed as suffering from autism. In a more recent publication he wrote, “the two types are at once so alike and yet so different” (Asperger, 1979, page 49). Therefore the question arises whether the premature conceptualisation of the “autistic psychopath” or indeed “Asperger Syndrome” as an autistic spectrum disorder has contributed to the present confusion and not the popularisation of Asperger’s ideas.

Presuming that the majority of the participants categorised as “severely autistic” were probably presenting with high functioning autism the test results could then be interpreted in a different way. An unusual profile of abilities in Asperger Syndrome and autism as well as significant differences between both conditions and Controls clearly described a specific way of processing information and a certain style of functioning:

- The assessment of intellectual abilities revealed that the majority of participants obtained a significantly higher PIQ than VIQ. High scores in the subtest *Picture Arrangement* indicated age appropriate understanding of visually presented social scenarios. However low results in *Comprehension* suggested difficulties in verbal understanding. The overall percentile of *Raven’s Matrices* was higher than the mean of the test norms and higher than the percentile of the Full-Scale IQ indicating high abilities in abstract thinking and non-verbal reasoning.
- Despite age appropriate visual abilities (as assessed by the *Illinois Test*) both groups showed significant difficulties in changing their visual perception which was found in three different test pictures (*Duck-Rabbit*, *Rubin* and *Escher*). This very focused

and rigid way processing visual information had resulted in significantly better judgements in the *Müller-Lyer Illusion Test*.

In their auditory perception both groups did not differ from non-symptomatic controls indicating no deficits in their acoustic discrimination.

- Higher PIQs and lower VIQs were found in all three experimental groups and indicated right hemisphere strength and left hemisphere weakness. This pattern was confirmed by the results of the *Illinois Test*. Almost one quarter of the cohort exhibited the opposite pattern, which was labelled non-verbal learning difficulty (*NLD*) and indicated left hemisphere strength.
- The *Wechsler* results indicated low verbal abilities. The more detailed assessment of the *Illinois Test* revealed significant difficulties in decoding auditory information. Participants also showed deficits in relating verbal information into a meaningful context. Both groups were displaying a lack of verbal structure, which was less evident in the MA group because of its better expressive language skills. Better visual memory functions were found in MA and better auditory ones in SA. Both groups showed a significantly lower understanding of idioms and interpreted more idioms in a literal way.
- The assessment of motor abilities identified generally poor motor functions in both groups. The SA group showed additional difficulties in Ball Skills and Balance Skills. Other motor tests revealed a lack of integration of different sensory information (*One Leg Balance, Visual/Tactile Hand Control*).

The results of the combined group revealed specific functioning of visual, auditory and motor skills. The underlying principle of these features suggested a specific way of processing sensory information, which seemed to be represented by a more rigid style of functioning. This was Asperger's (1944) main idea: the type he described was not a new condition as such but was characterised by an all pervading attitude or functioning. He understood the main factor that contributed to the "autistic psychopath" as an extreme form of logical thinking, which he felt, was more present in men than in women. He used terms like "extreme male thinking" to describe a very focussed way of functioning which he felt was opposite to a female way of functioning. This was interpreted by other researchers as a kind of personality disorder. But it is disputable whether this interpretation did reflect Asperger's understanding of this type. He felt the observable peculiarities were not clearly definable as a new medical condition but rather as an ordinary way of functioning that was present in an extreme form. He was the first to point out that the characteristics he described could be located on a continuum with a severe and a mild end which continued into normality.

Asperger did not have a traditional concept of classification in mind when describing the "autistic psychopath". In his detailed assessments he tried to understand how individuals were functioning and he developed on this basis a remedial educational program. The development of a list of essential diagnostic criteria was not necessary to Asperger because he did not feel it was a mental disorder but rather a different way of functioning.

Within five years of his original publication other researchers (Asch and Witkin, 1948) explored the area of visual perception and cognitive functioning. They found very

similar results but interpreted these in a different context. They identified two different cognitive styles, which were pervasive and stable over time. The more rigid way of functioning was called field independent style and showed a striking resemblance to the type that Asperger described. The authors did not relate their findings to Asperger's observations or to the field of autism. However the results of the present study question whether Asperger's findings could be interpreted within this concept rather than the concept of autism.

Asperger saw the "autistic psychopath" as a highly creative person and had an optimistic outlook on his future, if the right educational setting could be provided. He also found that many relatives of the children he assessed seemed to show similar personality profiles. These adults were often labelled as "eccentric" by their environment. It was astonishing to read that they had found highly respected professional positions where their idiosyncratic way of functioning was particularly useful. They were able to find their place in society and "fulfil their role in a way, better than anyone else could do" (Asperger, 1944, page 135, translated by the present author).

This description does not correspond with the idea of cognitive deficits (see chapter 2.1) but it could be explained with the presence of different cognitive styles.

Rather than identifying distinguishing criteria for Asperger Syndrome and autism this study has found that the difficulties in individuals of both groups were apparent in four different areas i.e. visual, tactile, auditory and motor functions. They could not be seen as separate deficits as they were pervading different areas of a person. The results of the assessments also suggested that the underlying cause for these "deficits" was characterised by a more focussed and rigid way of functioning. It could be described as a

cognitive style, which typically showed a poor ability to integrate all the available information. In some tasks of the assessment e.g. *Müller-Lyer Illusion Test* the lack of integration resulted in a better performance. In others e.g. *Duck-Rabbit Test* and *Visual/Tactile Hand Control* the results of MA and SA were significantly lower compared with non-symptomatic controls.

The effect of the cognitive style was also apparent in verbal abilities: tasks that were ambiguous and open to different interpretations e.g. *Literal Thinking Questionnaire* posed a greater challenge to participants of the MA and SA group than test questions that assessed unambiguous or factual knowledge such as *Grammatical Closure*. The more rigid style of functioning was a deficit in ambiguous tasks but an asset in unambiguous ones. To describe the typical response patterns of people with autistic features as “cognitive deficits” appears in this context to be inappropriately judgmental.

Social situations can be regarded as highly ambiguous for people with Asperger Syndrome or autism. Donna Williams (1992) described this vividly. Temple Grandin (in Sacks, 1995) explained how she solved this dilemma: she visually memorised in detail how people behaved in different circumstances and utilised this information to guide her own behaviour. In the present author’s experience children with Asperger Syndrome frequently showed a strong interest in other people but their clumsy attempts to socialise were ridiculed, ignored or rejected by their peers. These social difficulties experienced by some people with autistic features have to be interpreted differently. They did not seem to show an inherent lack of social interest but could be seen as a sequel of a different way of functioning and experiencing the world. The continuous change of social situations requires a high level of integration of the relevant information. A slight

change in emphasis can result in a completely different interpretation of a social scenario. Although this has to be related to both verbal and non-verbal communication, the outcome of the assessments indicated that verbal information appeared to be a greater source of ambiguity than non-verbal information (see table 5:11: difference of scaled scores between *Comprehension* and *Picture Arrangement*).

The majority of participants of this study demonstrated significantly higher visual scores than verbal ones, indicating better functioning of visual abilities. This result confirmed findings of early research studies by Asperger (1944) as well as Hermelin and O'Connor (1970). Grandin (in Sacks, 1995) described her thought processes as being mainly visual and suggested that people with autism were “visual thinkers”.

These findings have wider implications especially for treatment and behaviour management. Early intervention programmes, which focus on sensory integration, could help to improve the children's perception of the world (Ayres, 1987, Linderman and Stewart, 1999). Verbal explanations by other people have to include visual prompts to ensure that the person with Asperger Syndrome or autism has fully understood what was said. Education plays a decisive role as Asperger (1944) has already pointed out. His contributions are as relevant now as when they were written. Specific educational provisions have to be developed. Particular strategies and interventions have to be used to support people with these difficulties (Gray, 1998, Kuncé and Mesibov, 1998).

Gray (1998) emphasised the importance of raising the general awareness. She discussed the stigmatising effect of the defining criterion “social impairment” and pointed out that a social interaction involves by definition at least two people. If these two people have

different ways of communicating then the “impairment” does not necessarily lie with the person who has autism. This argument was highlighted in O’Neill’s poem (see Introduction).

The difficulties surrounding the diagnosis of people with autistic features was described in a recent paper by Howlin (2000) who strongly recommended the development of valid assessment instruments. The use of different classification systems in the present study has not resulted in more reliable diagnoses of the participants. The results have shown again that the classification of subgroups is usually based on a particular concept that will influence the formation of experimental groups and will subsequently determine whether differences between groups can be found. Although a purely behavioural classification system was used in the present study the specific cut-off points could have provided a bias towards autism. The directions of the CARS also allowed only a relatively broad rating of a child’s behaviour and did not give a more detailed quantitative reference. However the present author felt that categories based on behavioural observations could be better operationalised and could prove to be more reliable and valid than DSM-IV or ICD 10.

The lack of significant differences between Asperger Syndrome and autism in this study has not necessarily confirmed that Asperger Syndrome is an autistic spectrum disorder. There is not enough evidence to classify Asperger Syndrome as an autistic condition. The slightly higher *Raven’s* percentile suggested good non-verbal reasoning skills. If Asperger Syndrome was a mild version of autism then it would be expected that the score would be located between the Control group and the SA group. It was however the highest score.

In the *Müller-Lyer Illusion Test* (condition in-out) participants with mild autism demonstrated a more accurate judgement than the SA group. Here again their score was highest and did not fall between Control group and SA. Individuals with MA showed a very focussed style of processing visual information and did not succumb to the visual illusions as much as the other experimental groups. Their better visual judgements could not be explained as a milder version of severe autism but supported the view of different cognitive processes.

The detailed assessment of the verbal skills in the MA group revealed deficits mainly in *Auditory Reception* whereas the SA group exhibited more global language problems in the three *Auditory tests: Reception, Association and Expression*. In their short-term memory functions the MA group showed better scores when visual stimuli were presented rather than auditory ones. The results of the SA group indicated a preference for the opposite pattern. The MA group revealed a slightly different profile of verbal abilities compared with the SA group, although this was not statistically significant.

In their motor skills the MA group showed better scores than the SA group particularly in the subtests *Ball Skills* as well as in *Static and Dynamic Balance*. The results of the SA group indicated wider deficits not just more severe ones.

Although not significant, the outcome of this study indicated that children with Asperger Syndrome seemed to show slightly different traits and abnormalities than individuals with autism which supported Asperger's view that Asperger Syndrome cannot be regarded as a mild version of autism.

The present study has confirmed a specific cognitive style that was evident in four different areas i.e. intellectual abilities, sensory perception, speech and language abilities and motor skills. It has also found verbal deficits specific for the MA group, which could be interpreted as sequel of this cognitive style, whereas the results of the SA group seemed to suggest wider problems. However, the majority of participants shared this specific style of processing information. Further research is necessary to establish whether it is mainly present in people who suffer from Asperger Syndrome or whether all individuals who present with autistic features share it.

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APPENDIX 9.1: Diagnostic Questionnaires

Diagnostic Criteria for Autistic Disorder (DSM-IV, 1994)

Name of child : _____

Date of assessment : _____

A Qualitative impairment in social interaction:

- (1) marked impairment in the use of multiple nonviable behaviours such as eye-to-eye gaze, facial expression, body postures and gestures to regulate social interaction yes / no
- (2) failure to develop peer relationships appropriate to developmental level yes / no
- (3) a lack of spontaneous seeking to share enjoyment, interests or achievements with other people(e.g. by a lack of showing, bringing or pointing out objects of interest to other people) yes / no
- (4) lack of social or emotional reciprocity yes / no

B Qualitative impairments in communication:

- (1) delay in, or total lack of, the development of spoken language(not accompanied by an attempt to compensate such as gesture or mime) yes / no
- (2) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others yes / no
- (3) stereotyped and repetitive use of language or idiosyncratic language yes / no
- (4) lack of varied, spontaneous make-belief play or social imitative play appropriate to developmental level yes / no

C Restricted repetitive and stereotyped patterns of behaviour, interests and activities:

- (1) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus yes / no
- (2) apparently inflexible adherence to specific, non-functional routines or rituals yes / no
- (3) stereotyped and repetitive motor mannerisms(e.g. hand or finger flapping or twisting, or complex whole-body movements) yes / no
- (4) persistent preoccupation with parts or objects yes / no

D Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years:

- (1) social interaction yes / no
- (2) language as used in social communication yes / no
- (3) symbolic or imaginative play yes / no

E The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrated Disorder

yes / no

Diagnostic Criteria for Asperger Syndrome (DSM-IV, 1994)

Name of child : _____

Date of assessment : _____

A Qualitative impairment in social interaction

- (1) marked impairment in the use of multiple non-verbal behaviours such as eye-to-eye gaze, facial expression, body postures and gestures to regulate social interaction yes/no
- (2) failure to develop peer relationships appropriate to developmental level yes/no
- (3) a lack of spontaneous seeking to share enjoyment, interests or achievements with other people (e.g. by a lack of showing, bringing or pointing out objects of interest to other people) yes/no
- (4) lack of social or emotional reciprocity yes/no

B Restricted, repetitive and stereotyped patterns of behaviour, interests and activities

- (1) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus yes/no
- (2) apparently inflexible adherence to specific, non-functional routines and rituals yes/no
- (3) stereotyped and repetitive motor mannerisms(e.g. hand or finger flapping or twisting, or complex whole-body movements) yes/no
- (4) persistent preoccupation with parts or objects yes/no

C The disturbance causes clinically significant impairment in social, occupational or other important areas of functioning yes/no

D There is no clinically significant general delay in language(e.g. single words by age 2 years, communicative phrases used by age 3 years) yes/no

E There is no clinically significant delay in cognitive development or in the development of age appropriate self-help skills, adaptive behaviour(other than in social interaction) and curiosity about the environment in childhood yes/no

F Criteria are not met for another Pervasive Developmental Disorder or schizophrenia yes/no

Diagnostic Criteria for Asperger Syndrome (Gillberg and Gillberg, 1989)

Name of Child : _____

Date of Assessment : _____

1.) Social impairment:

- | | |
|--|----------|
| (a) Inability to interact with peers | yes / no |
| (b) Lack of desire to interact with peers | yes / no |
| (c) Lack of appreciation of social cues | yes / no |
| (d) Socially and emotionally inappropriate behaviour | yes / no |

2.) Narrow interests:

- | | |
|-----------------------------------|----------|
| (a) Exclusion of other activities | yes / no |
| (b) Repetitive adherence | yes / no |
| (c) More rote than meaning | yes / no |

3.) Repetitive routines:

- | | |
|---------------------------------|----------|
| (a) On self, on aspects of life | yes / no |
| (b) On others | yes / no |

4.) Speech and language peculiarities:

- | | |
|---|----------|
| (a) Delayed development | yes / no |
| (b) Superficially perfect expressive language | yes / no |
| (c) Formal pedantic language | yes / no |
| (d) Odd prosody, peculiar voice characteristics | yes / no |
| (e) Impairment of comprehension including
misinterpretations of literal / implied meanings | yes / no |

5.) Non-verbal communication problems:

- | | |
|-----------------------------------|----------|
| (a) Limited use of gesture | yes / no |
| (b) Clumsy / gauche body language | yes / no |
| (c) Limited facial expression | yes / no |
| (d) Inappropriate expression | yes / no |
| (e) Peculiar stiff gaze | yes / no |

6.) Motor clumsiness

- | | |
|---|----------|
| Poor performance on neuro-developmental examination | yes / no |
|---|----------|

C • A • R • S

The Childhood Autism Rating Scale

Eric Schopler, Ph.D., Robert J. Reichler, M.D.,
and Barbara Rothen Renner, Ph.D.

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wps

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12031 Wilshire Boulevard
Los Angeles, California 90025-1251

Name: _____ Sex: _____

ID Number: _____

Test Date: Year _____ Month _____ Day _____

Birth Date: Year _____ Month _____ Day _____

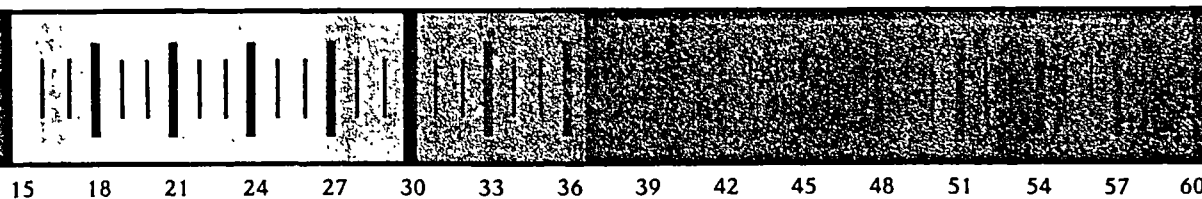
Chronological Age: Years _____ Months _____

Rater: _____

Category Rating Scores

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	Total Score	

Total Score



Non-Autistic

Mildly-Moderately
Autistic

Severely
Autistic

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Directions: For each category, use the space provided below each scale for taking notes concerning the behaviors relevant to each scale. After you have finished observing the child, rate the behaviors relevant to each item of the scale. For each item, circle the number which corresponds

to the statement that best describes the child. You may indicate the child is between two descriptions by using ratings of 1.5, 2.5, or 3.5. Abbreviated rating criteria are presented for each scale. See chapter 2 of the Manual for detailed rating criteria.

I. RELATING TO PEOPLE	
1	No evidence of difficulty or abnormality in relating to people • The child's behavior is appropriate for his or her age. Some shyness, fussiness, or annoyance at being told what to do may be observed, but not to an atypical degree.
1.5	
2	Mildly abnormal relationships • The child may avoid looking the adult in the eye, avoid the adult or become fussy if interaction is forced, be excessively shy, not be as responsive to the adult as is typical, or cling to parents somewhat more than most children of the same age.
2.5	
3	Moderately abnormal relationships • The child shows aloofness (seems unaware of adult) at times. Persistent and forceful attempts are necessary to get the child's attention at times. Minimal contact is initiated by the child.
3.5	
4	Severely abnormal relationships • The child is consistently aloof or unaware of what the adult is doing. He or she almost never responds or initiates contact with the adult. Only the most persistent attempts to get the child's attention have any effect.
Observations:	

III. EMOTIONAL RESPONSE	
1	Age-appropriate and situation-appropriate emotional responses • The child shows the appropriate type and degree of emotional response as indicated by a change in facial expression, posture, and manner.
1.5	
2	Mildly abnormal emotional responses • The child occasionally displays a somewhat inappropriate type or degree of emotional reactions. Reactions are sometimes unrelated to the objects or events surrounding them.
2.5	
3	Moderately abnormal emotional responses • The child shows definite signs of inappropriate type and/or degree of emotional response. Reactions may be quite inhibited or excessive and unrelated to the situation; may grimace, laugh, or become rigid even though no apparent emotion-producing objects or events are present.
3.5	
4	Severely abnormal emotional responses • Responses are seldom appropriate to the situation; once the child gets in a certain mood, it is very difficult to change the mood. Conversely, the child may show wildly different emotions when nothing has changed.
Observations:	

II. IMITATION	
1	Appropriate imitation • The child can imitate sounds, words, and movements which are appropriate for his or her skill level.
1.5	
2	Mildly abnormal imitation • The child imitates simple behaviors such as clapping or single verbal sounds most of the time; occasionally, imitates only after prodding or after a delay.
2.5	
3	Moderately abnormal imitation • The child imitates only part of the time and requires a great deal of persistence and help from the adult; frequently imitates only after a delay.
3.5	
4	Severely abnormal imitation • The child rarely or never imitates sounds, words, or movements even with prodding and assistance from the adult.
Observations:	

IV. BODY USE	
1	Age appropriate body use • The child moves with the same ease, agility, and coordination of a normal child of the same age.
1.5	
2	Mildly abnormal body use • Some minor peculiarities may be present, such as clumsiness, repetitive movements, poor coordination, or the rare appearance of more unusual movements.
2.5	
3	Moderately abnormal body use • Behaviors that are clearly strange or unusual for a child of this age may include strange finger movements, peculiar finger or body posturing, staring or picking at the body, self-directed aggression, rocking, spinning, finger wiggling, or toe-walking.
3.5	
4	Severely abnormal body use • Intense or frequent movements of the type listed above are signs of severely abnormal body use. These behaviors may persist despite attempts to discourage them or involve the child in other activities.
Observations:	

V. OBJECT USE

- 1** Appropriate use of, and interest in, toys and other objects • The child shows normal interest in toys and other objects appropriate for his or her skill level and uses these toys in an appropriate manner.
- 1.5**
- 2** Mildly inappropriate interest in, or use of, toys and other objects • The child may show atypical interest in a toy or play with it in an inappropriately childish way (e.g., banging or sucking on the toy).
- 2.5**
- 3** Moderately inappropriate interest in, or use of, toys and other objects • The child may show little interest in toys or other objects, or may be preoccupied with using an object or toy in some strange way. He or she may focus on some insignificant part of a toy, become fascinated with light reflecting off the object, repetitively move some part of the object, or play with one object exclusively.
- 3.5**
- 4** Severely inappropriate interest in, or use of, toys or other objects • The child may engage in the same behaviors as above, with greater frequency and intensity. The child is difficult to distract when engaged in these inappropriate activities.

Observations:

VI. ADAPTATION TO CHANGE

- 1** Age appropriate response to change • While the child may notice or comment on changes in routine, he or she accepts these changes without undue distress.
- 1.5**
- 2** Mildly abnormal adaptation to change • When an adult tries to change tasks the child may continue the same activity or use the same materials.
- 2.5**
- 3** Moderately abnormal adaptation to change • The child actively resists changes in routine, tries to continue the old activity, and is difficult to distract. He or she may become angry and unhappy when an established routine is altered.
- 3.5**
- 4** Severely abnormal adaptation to change • The child shows severe reactions to change. If a change is forced, he or she may become extremely angry or uncooperative and respond with tantrums.

Observations:

VII. VISUAL RESPONSE

- 1** Age appropriate visual response • The child's visual behavior is normal and appropriate for that age. Vision is used together with other senses as a way to explore a new object.
- 1.5**
- 2** Mildly abnormal visual response • The child must be occasionally reminded to look at objects. The child may be more interested in looking at mirrors or lighting than peers, may occasionally stare off into space, or may also avoid looking people in the eye.
- 2.5**
- 3** Moderately abnormal visual response • The child must be reminded frequently to look at what he or she is doing. He or she may stare into space, avoid looking people in the eye, look at objects from an unusual angle, or hold objects very close to the eyes.
- 3.5**
- 4** Severely abnormal visual response • The child consistently avoids looking at people or certain objects and may show extreme forms of other visual peculiarities described above.

Observations:

VIII. LISTENING RESPONSE

- 1** Age appropriate listening response • The child's listening behavior is normal and appropriate for age. Listening is used together with other senses.
- 1.5**
- 2** Mildly abnormal listening response • There may be some lack of response, or mild overreaction to certain sounds. Responses to sounds may be delayed, and sound may need repetition to catch the child's attention. The child may be distracted by extraneous sounds.
- 2.5**
- 3** Moderately abnormal listening response • The child's responses to sounds vary often ignores a sound the first few times it is made; may be startled or cover ears when hearing some everyday sounds.
- 3.5**
- 4** Severely abnormal listening response • The child overreacts and/or underreacts to sounds to an extremely marked degree, regardless of the type of sound.

Observations:

IX. TASTE, SMELL, AND TOUCH RESPONSE AND USE

- 1** Normal use of, and response to, taste, smell, and touch • The child explores new objects in an age appropriate manner, generally by feeling and looking. Taste or smell may be used when appropriate. When reacting to minor, everyday pain, the child expresses discomfort but does not overreact.
- 1.5**
- 2** Mildly abnormal use of, and response to, taste, smell, and touch • The child may persist in putting objects in his or her mouth; may smell or taste inedible objects may ignore or overreact to mild pain that a normal child would express as discomfort.
- 2.5**
- 3** Moderately abnormal use of, and response to, taste, smell, and touch • The child may be moderately preoccupied with touching, smelling, or tasting objects or people. The child may either react too much or too little.
- 3.5**
- 4** Severely abnormal use of, and response to, taste, smell, and touch • The child is preoccupied with smelling, tasting, or feeling objects more for the sensation than for normal exploration or use of the objects. The child may completely ignore pain or react very strongly to slight discomfort.

Observations:

X. FEAR OR NERVOUSNESS

- 1** Normal fear or nervousness • The child's behavior is appropriate both to the situation and to his or her age.
- 1.5**
- 2** Mildly abnormal fear or nervousness • The child occasionally shows too much or too little fear or nervousness compared to the reaction of a normal child of the same age in a similar situation.
- 2.5**
- 3** Moderately abnormal fear or nervousness • The child shows either quite a bit more or quite a bit less fear than is typical even for a younger child in a similar situation.
- 3.5**
- 4** Severely abnormal fear or nervousness • Fears persist even after repeated experience with harmless events or objects. It is extremely difficult to calm or comfort the child. The child may, conversely, fail to show appropriate regard for hazards when other children of the same age avoid.

Observations:

XI. VERBAL COMMUNICATION

- 1** Normal verbal communication, age and situation appropriate.
- 1.5**
- 2** Mildly abnormal verbal communication • Speech shows overall retardation. Most speech is meaningful; however, some echolalia or pronoun reversal may occur. Some peculiar words or jargon may be used occasionally.
- 2.5**
- 3** Moderately abnormal verbal communication • Speech may be absent. When present, verbal communication may be a mixture of some meaningful speech and some peculiar speech such as jargon, echolalia, or pronoun reversal. Peculiarities in meaningful speech include excessive questioning or preoccupation with particular topics.
- 3.5**
- 4** Severely abnormal verbal communication • Meaningful speech is not used. The child may make infantile squeals, weird or animal-like sounds, complex noises approximating speech, or may show persistent, bizarre use of some recognizable words or phrases.

Observations:

XII. NONVERBAL COMMUNICATION

- 1** Normal use of nonverbal communication, age and situation appropriate.
- 1.5**
- 2** Mildly abnormal use of nonverbal communication • Immature use of nonverbal communication; may only point vaguely, or reach for what he or she wants, in situations where same-age child may point or gesture more specifically to indicate what he or she wants.
- 2.5**
- 3** Moderately abnormal use of nonverbal communication • The child is generally unable to express needs or desires nonverbally, and cannot understand the nonverbal communication of others.
- 3.5**
- 4** Severely abnormal use of nonverbal communication • The child only uses bizarre or peculiar gestures which have no apparent meaning, and shows no awareness of the meanings associated with the gestures or facial expressions of others.

Observations:

XIII. ACTIVITY LEVEL

- 1** Normal activity level for age and circumstances • The child is neither more active nor less active than a normal child of the same age in a similar situation.
- 1.5**
- 2** Mildly abnormal activity level • The child may either be mildly restless or somewhat "lazy" and slow moving at times. The child's activity level interferes only slightly with his or her performance.
- 2.5**
- 3** Moderately abnormal activity level • The child may be quite active and difficult to restrain. He or she may have boundless energy and may not go to sleep readily at night. Conversely, the child may be quite lethargic, and need a great deal of prodding to get him or her to move about.
- 3.5**
- 4** Severely abnormal activity level • The child exhibits extremes of activity or inactivity and may even shift from one extreme to the other.

Observations:

XIV. LEVEL AND CONSISTENCY OF INTELLECTUAL RESPONSE

- 1** Intelligence is normal and reasonably consistent across various areas • The child is as intelligent as typical children of the same age and does not have any unusual intellectual skills or problems.
- 1.5**
- 2** Mildly abnormal intellectual functioning • The child is not as smart as typical children of the same age; skills appear fairly evenly retarded across all areas.
- 2.5**
- 3** Moderately abnormal intellectual functioning • In general, the child is not as smart as typical children of the same age; however, the child may function nearly normally in one or more intellectual areas.
- 3.5**
- 4** Severely abnormal intellectual functioning • While the child generally is not as smart as the typical child of his age, he or she may function even better than the normal child of the same age in one or more areas.

Observations:

XV. GENERAL IMPRESSIONS

- 1** No autism • The child shows none of the symptoms characteristic of autism.
- 1.5**
- 2** Mild autism • The child shows only a few symptoms or only a mild degree of autism.
- 2.5**
- 3** Moderate autism • The child shows a number of symptoms or a moderate degree of autism.
- 3.5**
- 4** Severe autism • The child shows many symptoms or an extreme degree of autism.

Observations:

APPENDIX 9.3: Visual Perception

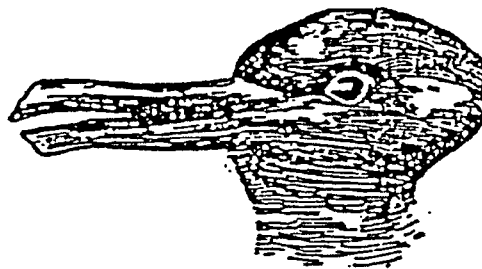
Duck-Rabbit Test Picture (in Deregowski, 1973)

Name of child : _____

Date of assessment : _____

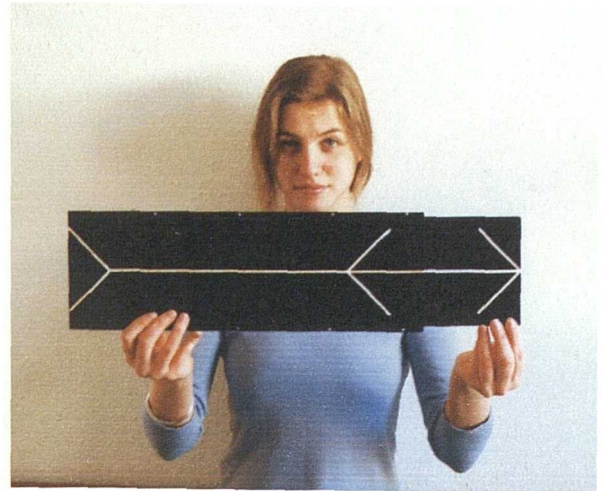
Response : _____

Changes per minute : _____

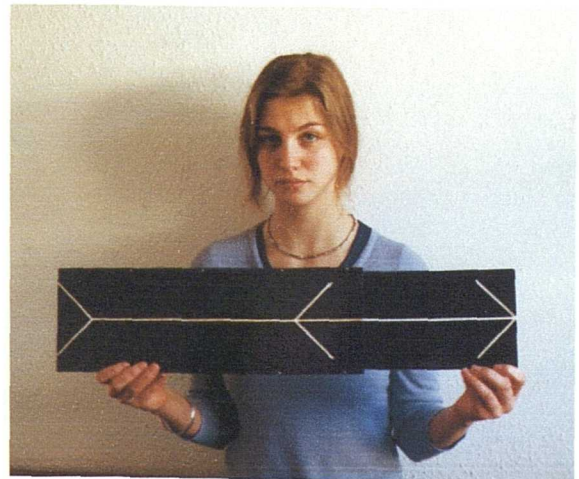


Müller-Lyer Illusion

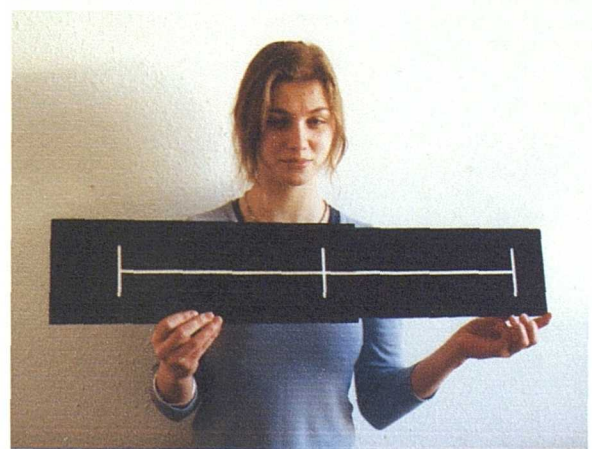
Müller-Lyer Illusion Apparatus
(lines are of different lengths)



Müller-Lyer Illusion Apparatus
(equilateral position)



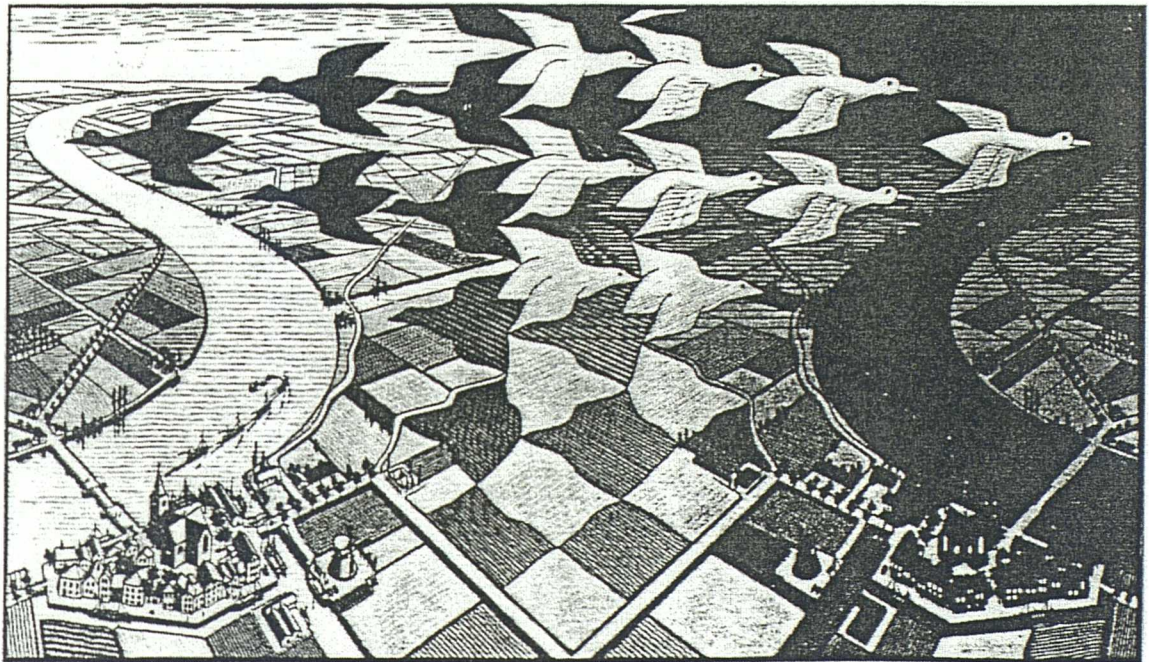
Müller-Lyer Control Apparatus
(equilateral position)



Rubin Test Picture (in Gregory and Gombrich, 1973)



Escher Test Picture (in Gregory and Gombrich, 1973)



APPENDIX 9.4

LITERAL THINKING QUESTIONNAIRE

Name of child : _____

Date of assessment : _____

What do the following idioms mean?

1. It is raining cats and dogs.
2. Can you give me a hand, please.
3. Keep your eyes on the ball.
4. To pull someone's leg.
5. To behave like a bull in the china shop.
6. To be a pain in the neck.
7. To be as good as gold.
8. To pick a bone with someone.

APPENDIX 9.5

Movement Assessment Battery for Children (Henderson and Sugden, 1992)

Age group 4-6 years:

Manual Dexterity	<ol style="list-style-type: none">1. posting coins2. threading beads3. bicycle trail
Ball Skills	<ol style="list-style-type: none">1. catching bean bag2. rolling ball into goal
Static and Dynamic Balance	<ol style="list-style-type: none">1. one-leg balance2. jumping over cord3. walking heels raised

Age group 7-8 years:

Manual Dexterity	<ol style="list-style-type: none">1. placing pegs2. threading lace3. flower trail
Ball Skills	<ol style="list-style-type: none">1. one-hand bounce and catch2. throwing bean bag into box
Static and Dynamic Balance	<ol style="list-style-type: none">1. stork balance2. jumping in squares3. heel-to-toe walking

Age group 9-10:

Manual Dexterity	<ol style="list-style-type: none">1. shifting pegs by rows2. threading nuts on bolts3. flower trail
Ball Skills	<ol style="list-style-type: none">1. two-hand catch2. throwing bean bag into box
Static and Dynamic Balance	<ol style="list-style-type: none">1. one-board balance2. hopping in squares3. ball balance

APPENDIX 9.6: Cognitive tasks in Raven Test

A	A _B	B
1	1	1
1	1	1
1	1	2
1	2	2
1	2	3
1	2	3
1	2	3
2	3	3
2	2	3
2	2	3
3	2	3
3	3	3

Principle 1: pattern matching

Principle 2: pattern completion (through identity and closure)

Principle 3: pattern progression (by analogy)

Declaration

I certify that all material in this thesis which is not my own work has been identified and that no material is included for which a degree has previously been conferred upon me.

A handwritten signature in black ink, appearing to read "B. L. Lunn". The signature is fluid and cursive, with the first letter of each name being capitalized and prominent.

April 2001