A Comparative Study: Visual Spatial Abilities in Autistic and Non-autistic children

MS THESIS

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Thesis submitted in Partial fulfillment of the requirements for the MS Degree

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بسم الله الرحمن الرحيم

IN THE NAME OF ALLAH, THE MOST GRACIOUS,
THE MOST MERCIFUL

Dedicated to the

Autistic children whose rehabilitation is sought for making them a useful part of the society

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APPROVAL CERTIFICATE

It is certified that the MS thesis entitled "A comparative study: Visual Spatial Abilities in Autistic and non-autistic children" by ZakiaAslam toward the partial fulfillment of MS Degree program has been approved for submission to International Islamic University, Islamabad.

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Zakia Aslam

ABSTRACT

The present research was conducted to study the visual spatial ability in autistic and non-autistic children. The sample consisted of 100 children; 50 autistic and 50 non-autistic. There was an equal number of non-autistic boys (n=25) and girls (n=25) while there were 23 autistic girls and 27 autistic boys in the sample. The sample was collected from hospitals, special education centers and rehabilitation centers of Rawalpindi and Islamabad. The age range was 6-12 years. Childhood autism Rating Scale (CARS) and Wechsler Intelligence Scale for Children-Revised (WISC-R) along with a demographic data sheet were used for data collection. Score on Block Design Task (BDT) of WISC was used to measure visual spatial ability of autistic and non-autistic children. It was found that autistic children scored higher than the non-autistic children on Block Design Task (BDT). Results indicated no significant gender difference in mean scores for both autistic and non-autistic children. It was concluded that Autistic children have superior visual spatial ability as compared to the non-autistic children. Exploratory analysis was done and the results indicated that age, birth-order and number of siblings play a significant role in visual spatial ability of autistic and non-autistic children.

INTRODUCTION

Chapter I

INTRODUCTION

Childhood is the most sensitive and significant period of life. It is critical because it encompasses all major aspects of physical and psychological development of the individual. Every aspect of growth and maturation is influenced in childhood. Many psychological disorders began to arise during childhood or early adolescence. There are many factors due to which these disorders may arise. Excessive or under sensory stimulation (Gajzago & Prior, 1974), inappropriate diet (Feingold, 1977), home environment (Paternite & Loney, 1980), hostile family (Rutter & Quenton, 1984), traumatic experiences & parental personalities (Morrison, 1980) and biological abnormalities (Rapoport & Ferguson, 1981) are few among a myriad of factors responsible for psychological disorders in children. Some of these disorders disappear without any clinical treatment at the other hand some of them could be treated with ease while others may continue throughout one's life.

Autistic disorder is a developmental disorder in which there is a marked impairment in social and communication development. There is a triad of symptom in autism including; severe deficits in social interaction, impairments in communication, restricted interests and repetitive behaviors. The term autism came from a Greek word autos and means a preoccupation with the self. Eugen Bleuler, a Swiss Psychiatrist used the term "autism" for the first time in 1906 to discuss a peculiar style of thinking in schizophrenics (Ritvo, 1976). Psychiatrist Leo Kanner (1943) used the term "autism" to describe the condition of a group of 11 infants that he examined in his clinical practice at Harvard. These infants were unresponsive to others, they often engage in repetitive, purposeless activities called stereotyped behavior. They seemed more interested in objects rather than in their parents or other relatives and were unable to communicate with anyone (Nietzel, Mathew, Elizabeth, McCauley, & Daouglas., 1998).

Onset and Prevalence of autism

Autism first appears during the childhood and usually follows a steady course without remission. The overt symptoms of autism begin to show themselves gradually after the age of six months and become established when the child is two or three years of age and continue throughout the adulthood. These symptoms often continue in muffled form making the autistic individual completely isolated from the world (WHO, 2007).

Autism occurs most frequently among males. Epidemiological studies show that this predominance of boys over girls ranges from 2.5: 1 (Lotter, 1967) to 4.3: 1 (Rutter & Lockyer, 1967). In females autism usually co-occurs with mental retardation. It has diagnosis throughout the world but its prevalence varies in different countries. China reported an extremely low rate while Japan has a rate of 3 to 5 times higher than most of the other countries in the world. Autism is usually identified at the age of 30 months although the symptoms become apparent in the initial few weeks of life (Rutter, 1978).

According to a local survey conducted by a non-governmental organization (RAMAQ, 2011) approximately 3, 45,600 individuals are on the spectrum of autism in Pakistan. Due to misdiagnosis and not reporting of the cases the number of people on the spectrum may be even higher than the estimates.

Characteristics of autism

The characteristics of autism have been revised and broadened repeatedly. The symptoms may manifest themselves in early infancy, with the infant shying away from the parents, not responding to the parent who came after some absence and the third and most obvious is the inappropriate gaze (Wood, 1997). The child may fail to meet language and other developmental milestones. Generally a 3-year delay is reported between the report of symptoms to physicians and diagnosis of autism. The diagnosis is usually made at the age of 5 years (Klin & Volkmar, 1999).

Following are some most frequently found characteristics and symptoms of autism

Aloneness

Autism is one of the severest disorders of childhood. Autistic children appear to be alone in the world. Autistic children withdrawal from others prevents them from being able to begin an effective social involvement with the people around. It was found that autistic children rarely offer spontaneous welcome or goodbye, vocally or through gestures in departing or meeting others (Hobson & Lee, 1998). They show resistance and anger to the one who tries to engage them in the play. If take part in play they enjoy more in physical play than in symbolic play when compared to intellectually comparable children (Sigman et al., 1987).

Very less autistic children initiate play with others but still they are usually unresponsive to anyone who approaches them. They lake eye contact and when in some cases they make eye contact, their gaze is of different quality. Normal children gaze to gain the attention of others or to direct the other person's attention to a specific object but the autistic children do not make this social exchange (Mirenda, Donnellan and Yoder, 1983).

Autistic child's social isolation might be the cause of the retarded development in other areas, such as language. On the other hand it is possible that the core deficit is an inability to process certain kind of sensory input, leaving the child helpless to understand and respond to the world around them (Ornitz, 1989).

Communication deficit

Autistic individuals have rigorous communication problems. Even before acquiring language autistic children show deficits in communication. Babbling in autistic children is also depictive of their deficits in communication. These children produce almost totally non-sense gibberish which could only be understood with great difficulty.

There babbling seems just a noise conveying very less information than children without autism (Ricks, 1972). A two year old normal child is able to use vocabulary to point to different items present around and they can construct sentences using one or two words. In 50 percent of autistic children language does not develop at al. (Paul, 1987). In remaining 50 percent who learn to speak can produce speech but many peculiarities are there. One feature of such peculiarities is the echolalia. In the echolalia child echoes what they hear from another person. The autistic child usually echoes with remarkable fidelity. Echolalia is an effort of the children with autism to convey inner thoughts and to respond to the external stimulus (Prizant, 1983).

Pronounce reversal is the second most commonly found speech peculiarity in autistic children. In this problem the child uses the inappropriate pronounce for themselves such as "he" "she" "you" or uses their own proper names to refer to themselves. In autistic speech pronounce reversal is a direct result of echolalia. The autistic child uses while using echolalic speech refers to themselves exactly in a way as they have heard other persons to speak of them and thus misuse pronouns. The pronounce reversal is highly resistant to change but in some cases it can be expected to disappear if the speech continues to develop with age (Tramontana & Stimbert, 1970). Neologisms are another characteristic of the speech of autism. A two year child might refer to candy as "cana" and continue to do so well beyond the time when a normal child has learned to say the right word.

Behavioral peculiarities

Stereotype movements and rituals or Obsessive Compulsive acts are prominently seen in autism. Autistic children become very distressed on changes in their daily routines and surrounding settings. They exhibit repetitive or restricted behavior in many forms, which are broadly classified by Lam & Aman, (2007) into six types of behaviors. These are compulsive behavior, stereotype, ritualistic behavior, sameness, self-injury and restricted behavior. Compulsive behavior is a behavior in which the child kept on doing the same purposeless activity again and again. For example the autistic children appears to arrange and rearrange objects in heaps or lines. Stereotypy is recurring movement, such as making particular sounds, hand flapping, body rocking or head rolling. In ritualistic behavior there is a rigidly followed sameness in the pattern of activities. Sameness is the resistance to change such as refusing to be interrupted. This is closely associated with sameness and suggestions are being given to combine sameness with ritualistic behavior. Self-injury includes movements due to which the person may get injured for example skin poking, hand biting, eye poking and head banging. The restricted behavior includes being very limited in focus, activity and interests such as being preoccupied with the same toy, game or television program (Johnson & Myers, 2007).

There is no sole repetitive behavior, specific in autism but these behaviors occur more frequently and more severely. A study reported that 30% of autistic children are affected by self injury in some form (Tager-Flusberg, 2008).

Imitation deficit

Difficulty with imitation of other people's movements appears very frequent in autism. The discrimination between autistic disorder and other developmental disorders could be made in early years of life. According to Charman et al., (1997) at the age of 2 year the autistic child could be discriminated from those with other developmental disorders with the help this disability in autistic children. This deficiency results in a hollow behavior of the child with prominent discrepancies in learning social emotional gesture from others (Stern, 1985). Almost all of the discrepancies in emotional and social behaviors are the result of being unable to imitate. These problems continue into the adulthood (Rogers et al., 1996) making the child more and more isolated from the social circles (Rogers & Pennington, 1991). Imitation deficit plays a significant role in development of symptoms associated with autism (Meltzoff & Gopnik, 1993). There are Significant differences in ability to imitate in autistic children (Sigman & Ungerer, 1984). These differences accounts for the different level of responsiveness and social involvement in these children. The more a child is able to imitate the greater would be the socialization resulting in greater social involvement. There is a direct relation between imitation ability and the social and emotional responsiveness which is the fundamental deficit in autism (Nadel, Croue, Mattlinger, Canet, Hudelot, Lecuyer & Martini., 2000).

Theories of Autism

There are many theoretical explanations of autism from which the most frequently discussed are

- Theory of Mind (TOM) hypothesis (Baron-Cohen, 1989)
- Theory of Weak Central Coherence (Frith, 1989)
- Executive Function Theory (Shallice, 1988)
- Theory of Reduced generalization (Plaisted, 2001)
- Paradoxical Functional Facilitation (Mottron & Burack, 2001)

Theory of Mind (TOM) hypothesis

According to TOM hypothesis, the ability to understand the feelings and behaviors of others is very important in understanding all kind of social behaviors. This ability helps in constructing the Theory of Mind in individuals making them a socially responsive and emotionally developed person. The Theory of Mind is the two dimensional ability of the individual which makes them able to understand their own behavior, feelings, emotions, wishes, plans and motives on the one side and on the other side enables them to associate their own internal states with the others around them. In other words theory of mind is the ability to understand thoughts and behavior of ones own as well as of those around them. It is a meta-representational ability and plays a decisive role in the development of social cognition.

This theory describes the basic deficiencies in autism as a direct result of the lack of Theory of Mind. Autistic individuals are unable to understand feelings, behaviors and thoughts of oithers as well as their own. Due to which they remains hindered in understanding the complex social exchange process.

TOM impairments have a deep effect on social relationships of an autistic child. As emotional, affective and behavioral responses depend upon understanding mental state of another person. Thus, the discrepancies in social interface of autistic child could be explained efficiently with the help of theory of mind hypothesis. These discrepancies are lack pretence, embarrassment, empathy and other social exchanges.

Wimmer and Perner (1983) presented a false belief test to the children with typical development, autism and Down's syndrome. The test measured the ability of the subject to understand and tell the mistaken belief of the story character about a specific situation. It was found that the normal 4 year old children and those with Down syndrome passed the False Belief Test while autistic child failed the test. Autistic individuals lack the ability to infer mental states as they lack Theory of Mind due to which they failed to answer correctly. Some criticizing evidences are also found which weakens the reliability of TOM hypothesis. In a study Bowler (1992) found some autistic individuals who passed the first-order false belief tests. That test measured the individual's ability to infer what one person thinks.

Theory of Weak Central Coherence

Frith (1989) suggested that a specific perceptual and cognitive style which could be explained as a limited capability to appreciate context, is the basic cause of central disturbance in autism. The theory explains it as a domain general process. The key strength of this theory is that it gives the rationale of both social and non-social or personal aspects of autism. According to this theory individual with typically development take and process information by extorting the whole meaning and attend more on global aspects of the stimulus. This ability of the individuals is known as central coherence. In normal individuals there is a drive for central coherence which is very weak in autistic individuals. Happe & Frith (2006) proposed that in autism there is a weak or even absent drive for global coherence. Autistic Individuals process things in a piece-meal or bit by bit way processing the components, rather than the global aspect of the stimulus. The research into the perceptual abilities of autistic individuals is revitalized by the theory of weak central coherence, which was started by Hermelin and O Connor in the 1960s (Rogers & Ozonoff, 2005).

Executive function deficit Theory

According to executive function deficit theory (Shallice, 1988) autistic individuals fail the tests of executive function. Executive function enables the person to flexibly shift the attention, reduce unplanned responses, engender purposeful behavior, and to solve problems in a strategic and tactic way. The Supervisory Attentional System (SAS) controls all these functions. If this system fails, the actions are controlled by the environment. In this condition the individual began to respond to the environmental cues with the behavior only resulting from the activity of reflexes. In this condition action schemas or motor programs compete for execution creating a state of confusion. This phenomenon occurs under the Contention Scheduling System (CSS). CSS is the function of a basal ganglia while the SAS is a frontal lobe.

Autistic individuals have damages in their frontal lobe (Hughes & Russell, 1993). Due to which they fail the central executive tasks. They remain unable to shift attention and disengage from themselves which is very important in the development of social and emotional bounds in healthy and adaptive way.

Theory of Reduced generalization

In his theory of reduced generalization Plaisted (2001) proposed that in autism perceptual processes could be explained in terms of reduced generalization. It was stated that superior autistic performance on some perceptual task is a phenomenon of reduced processing of similarities present between stimuli and situations. A key strength of this theory is that it explains a characteristic style of learning in autistic individuals that was previously very hard to explain theoretically. It is of considerable difficultly for Individuals with autism to generalize newly learned behavior to a new situation. According to the theory of Reduced Generalization this difficulty in generalizing learned material to new situation is due to the fact that autistic individuals have narrow range of concept with sharper and more vividly delineated boundaries. Therefore in order to facilitate learning process in autism teachers must work to facilitate the generalizing processes in these children. And in order to facilitate generalization process practitioners may be inclined to make efforts to change the environment steadily and gradually by progressing through graded contexts.

Paradoxical Functional Facilitation

Paradoxical Functional Facilitation by Mottron and Burack (2001) states that usually deficit in one of the two neurological systems shows the way to the enhancement of other system. For example an individual with visual impairment is likely to get enhanced tactile sense.

The autistic individuals have difficulty in processing input on a deeper level, which causes increased dependence on processing at a lower level. In other words the finer processing on a lower level is presented as a result of weak processing on a deeper level.

Psychological bases of autism

The earliest explanations about etiology of autism were psychogenic, according to which psychological or more concisely childhood experiences with parents are responsible for autism. Now this elucidative perspective has been changed by biological evidences in the search of causes for this disorder. Kanner (1943) assumed that autistic children have seemingly normal physiological functioning. Kanner's supposition led early theorists to reduce the importance of biological factors. It was assumed that for a biological factor to underlie autism, it would have other signs such as bodily handicaps found in Down syndrome.

According to Bruno Bettelheim (1967) autism bear a resemblance to the indifference and hopelessness of prisoner in concentration camps in Germany during World War II. Something quite negative must have been taken place in very early childhood. If a child has totally rejecting parents and he/she feels their negative feelings the child began to think his or her actions have a little to no impact on parents' unresponsiveness. Due to this early impact the child comes to believe that his or her efforts have no power to influence others, due to the early belief that the world is insensitive to his or her action.

It was also proposed by Tustin (1994) that autism is an infantile version of Posttraumatic Stress Disorder. According to this breast feeding mother and the susceptible child are very close. The child feels weaning as a catastrophic and traumatic separation. As a result the infant develops a deadening insulation causing autism.

The Intersubjection theory (Roser & Buchholz, 1996) assumes that autism results when a biologically vulnerable child has an anxious and preoccupied mother. Such a mother remains unable to read the cues of the child so giving insufficient response to him or her.

According to behaviorist childhood learning experiences are a cause of autism. It was suggested that the inattentiveness of the parents, mainly of the mothers, prevent the establishment of associations, making human being a social reinforcer. The parents failed in unable becoming social reinforcers for their child's behavior and the ultimate result is the autistic disorder (Ferster, 1961).

From psychological perspective it is evident that particular personality features of parents of autistic children contribute to the disorder. Kanner (1973) acclaimed of these parents as very intelligent people yet obsessive and cold and "refrigerator parents". Once children are confronted by such parents, certain innate deficiencies are exacerbated and blossom into a full autistic syndrome of withdrawal and isolation.

Biological Bases of autism

The early onset of autistic disorder along with the collection of neurological and genetic facts suggests a biological basis for autism. Twin studies provide a stringer evidence of genetic transmission in autism. It was found that there is 60 to 91 percent concordance rate of autism between identical twins when compared to concordance rates of 0 to 20 percent in the fraternal twins. Genetic link of autism and broader spectrum of. deficits in the social and communication area was reported in a series of studies on twins and families with one autistic member (Bailey et al., 1995). The evidence from family and twin studies robustly supports the genetic as a cause of autistic disorder.

Studies using Electroencephalograms of autistic children found that many autistic children had abnormal brain wave patterns (Hutt, Hutt, Lee, 1964). Signs of damages were also detected in other neurological examinations of many autistic children (Gillberg & Svendsen, 1983). In magnetic resonance imaging (MRI) young autistic men was found to have enlarged brains relative to normal people. According to Haas et al., (996) evidence supporting the prospect of brain dysfunction derives from sixteen Magnetic Resonance Imaging and autopsy studies from nine autonomous groups conducting research. All of those biological studies found severe abnormalities in cerebellum of children with autism. Studies of neurological patients with parietal damage indicate that they have a much narrowed attentional focus, and patients with damage to the cerebellum are incapable of shifting their attention quickly. Therefore, it is possible that the dysfunctions in specific brain areas of autistic individuals might partly explain the observed lack of response to the information outside the attentional focus.

30 percent individuals having autistic symptoms as a child begin experiencing epileptic seizures in adolescence. It is another sign of brain defect involved in this disorder. The occurrence of autistic disorder in children with mothers having rubella

during their pregnancy is approximately ten times higher than that in general population of children. These findings together with the degree of mental retardation commonly found in autism give a strong link.between autism and brain damage (Courchesne et al., 1988).

Assessment of autism

The Assessment of Autism is a multifaceted and ongoing process. It usually involves sizeable effort and time. There is a great variability in researchers and clinicians in their approach toward the assessment of autism. The comprehensive evaluation of autistic disorder should include a thorough developmental and medical history, family history, psychological evaluation, assessment of communication abilities, and consideration of differential diagnoses (Assouline et al., 2009).

In the past decades the formal diagnostic criteria for autistic disorder have been reconsidered and consequently modified many times (Volkmar, & Klin, 2005). The recent criteria of autism is based on that given in International Classification of Diseases–10th edition (2007) and Diagnostic and Statistical Manual of Mental Disorders IV (2000). Together these systems of diagnosis define autism in approximately same terms. The features of autism presented in ICD and DSM are also approximately same as given by Kanner in 1943and later modified by Rutter in 1978.

The key features in these theoretically identical definitions include; rigorous and pervasive impairments in social interaction and communication, unusual interests and stereotyped patterns of behavior and the onset before 3 years of age.

In addition to ICD and DSM standardized instruments and rating scales have been developed to assess the presence of autism. Diagnostic instruments such as rating scales and checklists are the most frequently used procedures. The advantage of using these tools is that they enable the teachers, parents, and clinician to access involvement in diagnostic practice (Eaves & Milner, 1993). Often the diagnostic instruments are based on two sources of information; the descriptions given by caregivers about course of development and existing behavior patterns and direct assessment of behavior (Saemundsen et al., 2003).

Many instruments have been developed for diagnosis of autism. The most familiar and those being widely used for the purpose are:

- Childhood Autism Rating Scale (Schopler et al, 1980)
- Gilliam Autism Rating Scale (Gilliam, 1995)
- Social Communication Questionnaire (Rutter, Bailey & Lord, 1999)
- Autism Diagnostic Interview (Le Couteur et al., 1989)
- Autism Diagnostic Observation Schedule (Lord, et al., 1989)
- Social Responsiveness Scale (Constantino, 2005)
- Behavior Rating Inventory of Executive Function (Gerard et al., 2000)
- Autistic Continuum (Aarons & Gittens, 1992)
- Vineland Adaptive Behavior Scales, Second Edition (Sparrow, Cicchetti, & Balla, 1984)

From all of the above mentioned scales Childhood Autism Rating Scale (CARS) is the most widely used and extensively documented rating scale of autistic behaviors (Lord, 1997).

Cognitive abilities in Autism

Study of Cognitive abilities is very significant in the field of autism. In order to take a comprehensive picture of an individual's cognitive abilities, functioning level and prognosis, the Intellectual functioning is to be assessed in detail (Barnhill et al., 2000). Research has been conducted on the intellectual functioning in autistic individuals and the emphasis has varied over time. Studies examined "savant" abilities in individuals with low cognitive functioning (Scheuffgen et al., 2002), cognitive strengths and weaknesses in autism (Matson et al., 2008), and cognitive differences between autism subtypes (Eaves, Helena & Eaves, 1994).

In the field of research with autism achieved IQ on the Wechsler Scales are used as the operational definition of intelligence (Huber, 2007). This approach is well-accepted as is evidenced by the following statement from Klin et al., (2005) "Among the various intelligence batteries currently in use, the age-proven Wechsler scales provide the standards for testing of intelligence in terms of psychometric properties, standardization procedures, and extent of research. Whenever possible, these batteries should be used because they provide valid measures across a large number of relevant constructs and yield profiles that can be readily transferred into intervention objectives. The scales' division into various factor scores can be particularly helpful in the interpretation of profiles of children with autism spectrum disorders given the typical performance scatter found in these children's protocols".

Most researchers in autism believed autism to be associated with Mental Retardation (MR) (Ghaziuddin, 2000; Volkmar & Klin, 2005). Approximately 75% of individuals with autism have associated cognitive deficits and overall intellectual functioning within the MR range (Lincoln et al., 1988). Studies (Mayes & Calhoun, 2003b, 2004; Strum, Fernell, & Gillberg, 2004) on autistic intelligence examined Full Scale IQ, Verbal IQ and Performance IQ on the Wechsler Scales.

Research on cognitive profiles in autism indicated relative strengths in nonverbal abilities over verbal abilities which appear consistent with the developmental delays in language acquisition and development seen in autism (Huber, 2007; Lincoln, Allen & Kilman, 1995). Lincoln et al., (1988) examined Intellectual profiles on WISC-R of 8 to12 years old children with autism (N = 13), receptive developmental dysphasia (n = 12), oppositional defiant disorder (n = 10), and dysthymia (n = 12). Results indicated significant relative deficits in Verbal Intelligence Quotient (VIQ) in comparison to Performance Intelligence Quotient (PIQ) for the autism group, with a mean PIQ – VIQ difference of approximately 24 points. This pattern of performance was not found in the remaining clinical samples, and thus was believed to be specific to the diagnosis of autism.

A relative strength of autistic individuals on the Block Design subtest of Wechsler Scales was found consistently (Barnhill et al., 2000; Ehlers, Gilberg & Wing, 1997; Lincoln et al., 1988; Ozonoff, South & Miller, 2000). Relative weaknesses have consistently been reported on the Coding (Mayes & Calhoun, 2003b) and Comprehension subtests (Lincoln et al., 1988; Mayes & Calhoun, 2003b).

Visual Spatial Ability in autism

Linn and Peterson (1985) defined visual-spatial ability as skills in representing, transforming, recalling and generating the symbolic and nonlinguistic information. Spatial rotation, spatial orientation, visual cognition, spatial visualization, mental rotation and spatial perception are terms used interchangeably for visual spatial ability. Regardless of the different term being used all of these involve the ability to mentally manipulate objects through rotations, reflections, and translations. It is to mentally transform a two or three dimensional figure into the other settings of figure (Condron, O'Riley & Damarin, 1993). Visual-spatial ability is important in many fields, including physics, mathematics, architecture, engineering, chemistry, biology and geology (Robichaux & Guarino, 2000). Therefore success in many careers tends to be related with higher visual-spatial abilities.

Thinking in visual images is a primary way of thinking and problem solving in autistic individuals. Block design performance is an indication of visual thinking as a dominant method of processing information. Other indicators are solving jigsaw puzzles, finding way around the city and memorizing massive amount of information at a glance (Grandin, 2006).

Nikola Tesla was a visual thinker and was an autistic individual. He had visual image for everything he heard or read. According to him whenever he heard or read some word, the word at once became converted into the visual image of the related object. He stated that when he designed electric turbines for power generation he built each turbine in his head. He operated it in his imagination and corrected all the faults detected. According to him it did not matter whether the turbine was tested in his thoughts or in his shop, the results would be the same (Luria, 1987).

The Block Design Task (BDT) was invented by Kohs in 1923. It has been used very frequently to measure visual spatial ability in autistic and non-autistic individuals (Shah & Frith, 1993; Happe, 1994; Jarrold et al., 2000; Ropar & Mitchell, 2001). This task measures the ability to make the design as swiftly as possible. According to Kohs this task is an efficient measure of general intelligence. It is an important feature of currently popular batteries for measuring intelligence. It features in Wechsler Intelligence and the British Ability Scale (Elliot, Murry & Pearson, 1979). According to Sattler (1974) BDT is a useful tool for the assessment of non-verbal abstract concept and power of spatial visualization.

Psychiatric patients and patients suffering from certain cerebral lesions have been reported to perform poorly on Block Design task (Shapiro, 1952). Patients of Williams syndrome also show deficit in performance on Block design task and experience noticeable difficulties in processing the global feature of a stimuli in figure copying task (Bihrle et al., 1989). Different forms of errors on the BDT can be distinguished in adult patients with lesions in left-hemisphere and right-hemisphere (Kaplan, 1983). Patients with deterioration in right hemisphere in comparison to those with left-hemisphere-damage make errors due to which the overall pattern become disturbed (Ben-Yishay et al., 1971). The errors made by right hemisphere damaged patients are not specific to those with right hemisphere lesions but normal adults without lesions and adults with a history of alcoholism show these problems (Kramer et al., 1991).

A bulk of research supports the finding that autism is related to heightened performance on tasks involving visual spatial ability. The earliest evidence of heightened visual spatial ability in autism was reported on the basis of performance on an embedded figure task. Autistic participants as compared to non-autistic were found to be faster in finding a target figure which was hidden in a complex figure (Shah & Frith, 1983).

Another demonstration of autistic visual spatial abilities was offered by a study, which selected blocks having pieces of design to be made only on one face. The subject had to arrange those pieces in order to make full design. The subjects having been diagnosed with autism completed the task more quickly and with fewer mistakes than those without any developmental disorder. The children with typical development took an obvious benefit from seeing the target design pre-segmented but those with autism performed comparatively well in both conditions; whether the design was segmented or un-segmented. The pre-segmentation did not improved performance of autistic individuals because they could apprehend the elements of the stimulus even when presented un-segmented (Shah & Frith, 1993).

Brian and Bryson (1996) also confirmed the autistic superiority on visual spatial tasks and assumed that it might be due to two reasons. One was meanings suggested by shapes used in embedded figure tasks. The non-autistic individuals might become captivated by meanings while autistic individuals having no knowledge into meaning are free of this meaning capturing process. The second reason they presented was the styles of interpretation and classification of figures by the participants. In the case of non-autistic individuals, naturally the stimulus is perceived as a whole irrespective of interpretation and classification, while autistic individuals attend each and every part without processing it as a whole. Embedded figure Task was presented to both autistic and non-autistic individuals. Two kinds of figures were presented to rule out the above given reasons. One of them was similar to an object and the other was an abstract drawing of line. Two assumptions were made that if meaning of the stimuli was the significant than autistic dominance would only be evident when stimuli were representational, whereas if the ability to analyze parts was important, then autistic individuals would perform pretty well with both forms of embedded figures. The findings gave no conclusion because on both forms of embedded figures task autistic superiority was not found.

Jolliffe & Baron-Cohen (1997) used embedded figure task to assess visual spatial abilities of normal people with autistics and those with asperger's disorder. It was found that patients with asperger's and autistic disorder showed heightened ability than normal individuals on the task.

Beside the findings that autistic individuals perform relatively good on embedded figure task and block design task, they also seem at ease when performing at "impossible figure" task. In a study it was found that autistic individuals showed fewer obscurities than non-autistic individuals in reproducing an impossible figure. It was suggested that peculiarities and strangeness in figures or designs disturb them less frequently as compared to non-autistic individuals. The strangeness of the stimulus situation has smaller ability to intervene in autistic performance at the task therefore perform well on tasks requiring visual spatial abilities (Mottron & Belleville, 1993).

The visual spatial skills in artistically talented children with typical development and those with autism (regardless of their ability in arts) were measured using Block Design Task from WISC (Happe, 1994). Both groups were faster on task completions compared to non-autistic typically developing children. Again it was confirmed that autistic children have superior artistic abilities with visual spatial skills as compared to non-autistic children.

In another study autistic individuals performed visual spatial tasks relatively more easily than the non-autistic subjects. The task in which it was required to divide the design or figure into basic parts was completed by autistic individuals faster than the controls. For example, autistic individuals perceived the component blocks in an unsegmented condition of a Block Design Task more easily (Ehlers, Gilberg, & Wing, 1997).

Another study used Block design and Embedded Figure Tasks in combination to measure visual spatial abilities in autistic and non-autistic individuals (Ropar & Mitchell, 2001). Participants with autism scored higher than comparison participants on the task, and it was concluded that autistic individuals have higher visual spatial ability than non-autistic individuals.

A series of experiments (Carona et al., 2003) was conducted to access spatial abilities of autistic individuals by using a labyrinth of the size of a human. Findings showed that at all the tasks involving spatial ability tasks, autistic individuals performed at a higher or at least at an equivalent level to the control group. In route test no difference was found between the two groups. Superior performance of autistic individuals was found in test situations with maps, in the shape of better accuracy in graphically cued recall of path and took less time in learning maps. Superior ability to sense, match and duplicate simple elements of visual presentation elements yields finer performance in tasks of detecting and graphically reproducing visual elements to compose map. In autism the presence of better discrimination, recognition, and visual memory simple patterns, accounts for the superior achievement on visual spatial tasks. It greatly involves the recognition of patterns, both in the form of recognition and memory of landmarks and/or in the detection of similarity between map and features of landscape.

Autistic expertise relative to control participants on embedded figures and block design tests was also related to the prior knowledge of stimulus of the participants. According to Ropar and Mitchell (2001) the expertise is due to the more attention on constituent features. Processing global features more is affected by inappropriate processing of the constituent elements of a stimulus. Prior knowledge of the stimulus was considered to be an important factor in processing global features. Individuals with autism are more precise than comparison participants in the judgment of the shape of a slanted circle in a context in which no visual cue was given. It shows that their prior knowledge was not intervening in their perception of the shape of slant. In a visual array at the search of feature and conjunctive targets they were sharper than the comparison participants.

In a study (Jarrold, Gilchrist & Bender, 2005) it was suggested that autistic Individuals display relatively stronger performance on tasks that require identification of constituent parts in a visual stimulus. It was assumed to be the resultant of processing local elements in a stimulus that comes due to a weakened ability of information integration at global level. The findings of that study showed that the ability of children with autism to search an embedded figure was related to performance on visual search trials where the target was identified by a unique perceptual feature. In contrast, performance of controls on the same task was specifically related to their performance on visual search trials where the target was defined by a conjunction of features. This suggests that enhanced performance on perceptual tasks by children with autistic disorder is not a simple consequence of a quantitative difference in ability to engage in global processing.

The reasons for this phenomenon were explored in an influential study (O'Riordan & Plaisted, 2010). The performance of autistic and typically developing children was compared on a series of tasks involving visual search to explore the reason of heightened visual spatial ability in autistic individuals. The results showed that discriminability is the factor which determine rate at which children discriminate between displayed items. It was found that autistic children have higher rate of discrimination as compared to those with normal development. Thus, it seems that an enhanced ability to discriminate between display items underlies superior visual search in autism.

Autism Quotient (AQ) was developed after the research on autistic traits. It was made to measure the degree to which an intellectually normal adult had autistic traits. It was aimed to assess the predictability of performance on block design task on the basis of traits on AQ scale. The test had two tasks to be completed; whole and a segmented task. According to findings high AQ scorers performed better than low scorers on the whole task of the block designs. It was concluded that autistic traits predicts ability to perform on block design task. Individuals with more number of autistic traits tends to perform better on the task due to their better developed visual spatial abilities as compared to those with less or no autistic traits (Stewart et al., 2011). Some other studies (O'Riordan et al., 2001; Plaisted, O'Riordan, & Baron-Cohen, 1998b) also showed that autistic children are superior of typically developing children when visual search is demanded in any task.

Gender difference in visual spatial ability

Many studies were carried out on gender differences in cognition. Two frequently studied cognitive gender differences are in tasks involving verbal fluency and visual-spatial ability. Researches in this area are inconsistent and inconclusive but general finding is that males perform better on visual spatial tasks while females perform better on verbal tasks. The most obvious reason for inconsistencies found in the results is the different ways of operationally defining these two cognitive abilities (Haecker, 2004).

Autistic girls demonstrate less proficiency than boys on tests of both verbal and visual-spatial skills. Girls may function better in some respects than boys; for example, they may play more and engage in fewer stereotypies (Lord, Schopler, Revicki, 1982). A study by Auyeung et al., (2009) found no gender difference between autistic children on block design task performance. The average score was 19.14 for boys and 16.26 for girls, but the standard deviation for both genders was probably somewhere between 9.5 and 10, making the difference between the gender a little less than one-third of a standard deviation, and thus not statistically significant.

Gender differences in the domain of verbal, nonverbal and visual spatial episodic memory were analyzed (Voyer et al., 1995) and the results showed that female performed at a higher level on composite verbal and nonverbal episodic memory while male perform at a higher level on episodic memory tasks involving visual spatial processing. Men can use their superior visual spatial abilities to excel in highly visual spatial episodic memory tasks, whereas women can excel in episodic memory tasks which involve verbalization of the material.

Among the pioneers showing a significant difference between male and female performance on visual-spatial tasks were Maccoby and Jacklin (1974). Using an experimental procedure known as meta-analysis Hyde (1990) found no gender difference in verbal abilities and only moderate differences in spatial ability. In another research performed on university scholars, Weiss (2003) found that women perform better on verbal tasks and men perform better on spatial tasks but the achieved effect size was small.

Significant gender differences were measured in visual spatial abilities of late elementary and middle school children. In boys and girls of fifth grade there was almost no difference in spatial visualization performance but differences were found in sixth through eighth grade (Ben Chaim, Lappan & Houang, 1988). According to Johnson and Meade (1987) male advantage in spatial ability appears at least as early as fourth grade (age 10) and some of the results of their study it was suggested that there exists a male advantage in spatial ability as early as the first grade. They found the most dramatic spread in the scores at tenth grade.

Masters and Sanders (1993) confirmed the strong gender difference in performance on mental rotation tasks. Using meta-analytic technique, they found that males performed significantly higher in all 14 studies that administered the tests of Mental Rotation to adolescents and adults between 1975 and 1992.

Voyer et al., (1995) in an analysis of studies conduced in previous 50 years found gender differences in favor of males in the tests that assess mental rotation and spatial perception skills. Caldera et al., (1999) found no gender difference when they tested visual spatial skills of fifty one preschool children.

Social and environmental factors have a significant role in gender difference seen in cognitive abilities of individuals. Zajonc and Markus (1975) presented their view that social and environmental factors are to a great extent responsible for gender difference in cognitive abilities. This model was known as confluence model. Individual is considered as a part of the environment and is persistently being influenced by it. The Intelligence and all of the cognitive abilities are very much dependent on intellectual environment.

This intellectual environment includes number of siblings, birth order, and age spacing. In addition, some other factors like genetic background and child rearing practices in family are also influential.

Research shows manipulation of different kinds of play practices in childhood and educational experiences (Voyer et al., 1995) can substantially reduce or eliminate gender differences in spatial task performance. Therefore the performance differences are primarily due to socialization. It do not reflect the basic underlying differences in capability between males and females (Vasta, Knott & Gaze, 1996).

For both genders; male and female, involvement in activities with spatial component was found to be related to spatial ability of the individual (Baenninger & Newcombe, 1989). Participation in musical activities (Robichaux, 2002), artwork involvement (Caldera et al., 1999), previous knowledge of geometry, vocational training into some specific activities, work experience, and participation in such kind of sports (Sorby, Leopold & Gorska., 1999), playing with toys having spatial components (Sorby & Baartmans, 2000), are few among the multitude of factors helping in improvement of visual spatial ability.

Age, education, number of siblings and birth order also influence the cognitive abilities of the individual. The relationship between environmental factors at home and thinking ability of the child was studied by Rachel (1970). A strong relationship between the two variables was found. It was concluded that home environment and parental resources have a great influence on intellectual abilities of the child.

Age is an important determinant of visual spatial abilities in autistic as well as non-autistic children. With the devolvement of brain visual ability of brain also develops and so is the performance on the tasks. Prefrontal cortex is responsible for the working memory, attention and visual spatial ability. Throughout the childhood physical development and organization of prefrontal cortex continues. According to Piaget and Inhelder, (1948/1956) at the age of 7 years children become able solve simple visual spatial tasks. However, subsequent studies (Newcombe & Frick, 2010) on the early emergence and development of these abilities show that they can emerge earlier than the age Piaget and Inhelder (1948/1956) claimed.

Age related improvement in the performance on visual spatial tasks was reported in several studies (Sulloway, 2009; Anourova et al., 1999) reported age related efficiency in the level and accuracy in several visual spatial task performance. Other studies (Salthouse et al., 1990; Hale, Bronik & Fry, 1997; Luciana & Nelson, 1998; Kemps, Rammelaere & Desmet, 2000) also concluded that older children perform better than younger ones on visual spatial tasks.

Belmont & Marolla (1973) found that birth order and family size have an important role in the intelligence of children in family. Franklin (2010) concluded that birth order have a definite negative relation with cognitive abilities of autistic as well as typically developing children. The older siblings have higher cognitive abilities as compared to the younger siblings. Rodgers and MacCallum (2006) analyzed hundreds of studies showing birth order differences in cognitive abilities. Velandia, Grandon, & Page (1978) also confirmed the decline in scores by birth order. According to Wichman et al., (2006) differences in cognitive abilities attributed to birth order are not a within family phenomenon. Instead they results from the factors varying between families.

Age and birth order interacts in their influence on cognitive abilities of the child. Studies (Zajonc, 2001) found that at smaller age levels, the second born child is always ahead of the first born in intellectual performance. Beginning at age levels of 8 and 9 years, the firstborn child began to surpass the younger siblings. The only child can not take any benefit from the teaching function in the family. Hence they may have a lower score than either of the children in two child families except at youngest age levels, when there is less opportunity for instructing siblings. Within-family sibling study by Tabah and Sutter (1954) found that the scores of the first born were higher than those of the second born. It was concluded (Bjerkedal et al., 2007) cognitive abilities and overall intellectual level of children in family reduces with an increase in size of the family.

Resource Dilution Model (RDH) explains the significance of birth order and number of siblings in cognitive abilities of children. This model describes the relationship between family resources, parental resource allocation and children's outcomes (Downey, 2001). RDH begins from the observation that all type of parental resources are intrinsically limited. When the size of family increases, parental resources available to each child decreases. Children in larger families get fewer parental resources as compared to the children in smaller families. It results in poorer intellectual outcomes on the part of the child. This resources dilution results in differences in cognitive abilities of the children in the family due to family variables.

Autism affects all facets of the sufferer's life. Due to associated problems autistic children are kept pathetically low in academic as well as professional lives. There is a strong need to impart complete awareness about autism and possible autistic expertise to parents and institutes so as they might become able to respond more positively to the autistic children. Lack of awareness into the different ways through which autistic children could be rehabilitated to life many of them are kept locked away in homes. The first autism awareness campaign was launched in the country by a Non-Governmental Organization "Ramaq" in 2005.

According to the estimates of RAMAQ (2011) in Pakistan due the cultural prevalence of cousin marriages 1 in 500 children is on the spectrum. Due to under-reporting, misdiagnosis and social stigma it could be rightly said that this number is in reality is much higher.

Pakistan has recently been exposed to the awareness, research and documentation on Autism that has existed in the developed world for decades. Some researches on autism are found in which genetics, immune system defects, thimerosal vaccination (Ali Yawar, 2005) and the therapies for decreasing undesirable behavior in autistic children (Uzma Ahmed, 2008) are studied. More than a disease Autism is a condition with which the sufferer has to live for whole life. Therefore in the field of psychological rehabilitation above all there is a strong need to explore the autism from baseline.

Cognitive ups and downs in autism is theoretically as well as practically significant area of research which is still unattended in Pakistan.

The research in the field of autism in Pakistan is in its initial stages and the major focus of the researchers is the genetics, neurobiological disturbances and therapies for behavioral modification. In the case of autism the need is to break the chain of worthlessness and to rehabilitate the autistic ones in the academic as well as professional life. This need could only be fulfilled by recognizing the hidden potentialities of autistic children. The visual spatial abilities are one of those hidden potentialities. By recognizing the visual spatial abilities and the impact of variables like gender age and education venues for research in the direction of autistic expertise would open. It would be possible to adapt specific methods in which autistic children could be trained and taught.

Autistic children have higher visual spatial ability than non-autistic children. There might be some gender differences in these abilities, which were supposed to be hindered or enhanced by education. The present study examined visual spatial abilities of autistic children and a comparison was made with that of non-autistic children. Those with autism have a different nature of intelligence which is visual spatial intelligence. When compared with individuals of comparable age and intelligence they are found to be superior in visual spatial ability. Variables such as gender, age, education, birth order and number of siblings needs to be studied in relation to the cognitive abilities. The study of these variables would provide detailed information into the parenting style, home environment and needs of the child. This information would play a major role for devising policies effective in enhancing present abilities and would also enable the practitioners to use those abilities for overall learning purposes.

The present study would be a considerable contribution in educational planning for autistic children. By knowing the strength area of the children with autism, educational strategies using visual spatial skills could be planned to teach the lessons otherwise impossible to be taught to the autistic students. By recognizing this ability in autistic children venues would open for further exploration of the ways, strategies and underlying theoretical implications behind this ability. Visual spatial ability in autistic children could be enhanced and than used to develop personalized learning plan for autistic children. Making. fruitful teaching plans would compensate for verbal and other disabilities in autistic children.

METHOD

Chapter II

METHOD

Objectives of the study

Following are the main objectives of the present study

1. To study the visual spatial ability in autistic and non-autistic children
2. To study the gender difference in visual spatial ability in autistic & non-autistic children
3. To study the Visual Spatial Ability in different age groups of autistic & non-autistic children
4. To study the role of birth-order on visual spatial ability of autistic and non-autistic children
5. To study the role of number of siblings on visual spatial ability of autistic and non-autistic children

Hypotheses

Following hypotheses were formulated for the present study

1. Autistic children will have higher visual spatial ability than non-autistic children.
2. Boys will have higher visual spatial ability than girls in both autistic & non-autistic children.
3. Autistic and non-autistic children of different age groups will have different visual spatial abilities.
4. There will be difference in visual spatial abilities of autistic and non-autistic children of different birth-order.

5. There will be difference in visual spatial abilities of autistic and non-autistic children with different number of siblings.

Operational Definitions of the variables

Autism

DSM IV (APA, 2002) describes important features of autistic disorder as noticeably abnormal or impaired development in interpersonal relations and communication and markedly limited interests and activities. The specific symptoms vary with age and developmental level. The diagnostic criteria requires that the individual show signs of a total of six of the symptoms from items listed in following three categories: 1) problems in social interaction 2) problems in communication and 3) repetitive, limited and stereotype patterns of activities, behaviors and interests. At least two of the items must be from (1) and one each from (2) and (3) sections (Appendix B).

For the present purpose

The children in the age range of 6-12 years who received a score in the autistic range (30 or above) on Childhood Autism Rating Scales (CARS) were diagnosed as autistic children. The children in the age range of 6-12 years who received a score below 30 on CARS were diagnosed as non-autistic children.

Visual spatial ability

For the present purpose visual spatial ability was operationally defined as the score of the subject on Block design subtest of Wechsler Intelligence Scales for Children Revised version (Wechsler, 1974).

Instruments

Following instruments were used in the present study.

Childhood Autism Rating Scale (CARS)

It is a scale on which behavior is rated in an intention to describe autistic features with varying intensity. Matson et al., (1998) considered it as a gold standard in the diagnosis of autism. Development of this scale started in 1966. It incorporates the criteria of autism as proposed by Kanner (1943) and Creak (1964), and the symptoms which commonly feature childhood autism.

It is a diagnostic assessment method that rates a child on a scale from one to four. It ranges from normal to severe and gives a composite score. This composite score gives a diagnostic severity on the spectrum of autism. It ranges from non autistic to severely autistic, giving some in between conditions of mildly autistic and moderately autistic. It is used to observe and subjectively rate the child on fifteen areas (Appendix C). These areas are relationship to people, imitation, emotional response, body use, object use, adaptation to change, visual response, listening response, taste-smell-touch response and use, fear and nervousness, verbal communication, non-verbal communication, activity level, level and consistency of intellectual response and general impressions.

This scale could be rated by parents, teacher or the clinician on the basis of their subjective observations of the behavior shown by the child. The child's behavior on all of the fifteen categories is rated according to the standard rating method such as a score of 1 is given for the behavior quite normal for child's age, score of 2 is assigned to mildly abnormal behavior, moderately abnormal behavior is given a score of 3 while 4 is assigned to severely abnormal behavior of the child.

For the behaviors occurring in between the above scored categories of 1, 2, 3 and 4 midpoints of the scores such as1.5, 2.5, and 3.5 can also be used. Total CARS scores range from a fifteen to 60, with a minimum score of thirty considered as cutoff score for the diagnosis of autism on the mild end of the autism spectrum.

Wechsler Intelligence Scales for Children-Revised (WISC-R)

Wechsler Intelligence Scales for Children revised (Wechsler, 1974) is an individually administered clinical instrument for assessing the cognitive ability of children aged 6 years through 16 years 11 months. In this scale Full Scale IQ (FSIQ) comprises two IQ scores; Verbal IQ and Performance IQ.

The IQs are calculated using five verbal and five performance tests. Digit span on the verbal scale and Mazes on the performance scale were not used in calculating the IQ. They have been retained as supplementary tests, to be administered when time permits, or serve as substitutes if a regularly administered test cannot properly be given or validated.

The scoring criteria for WISC-R (Appendix E, F and G) contain general as well as detailed specific scoring rules for all the subtests. The scoring rules for most WISC-R tests are objective and do not require subjective interpretation of the child's responses. However, for similarities, vocabulary, and comprehension, and for some information items, the examiner's judgment may be called upon. The scoring systems for these tests are based on the actual responses of children, and samples are provided in manual (WISC-R, 1974) to illustrate various levels of responses.

In many instances, borderline responses are given rather than obviously correct or incorrect answers, since these are likely to present the greatest difficulty to the scorer. It is the examiner's task to evaluate the child's responses according to the scoring rules for each item. For items which are scored 1 or 0, the examiner should give 1 point to any response that is similar to or better than the 1-point samples. The same principle would govern the assignment of scores of 2, 1 or 0, where multi-point items are involved. It is imperative that only the content of the response not the elegance of the child's expression-be evaluated. A child's score on a verbal item should never be penalized because of improper grammar or poor intonation.

Demographical data sheet

The simple demographical Sheet (Appendix A) was used to collect demographical information about the subjects. It consisted of items related to gender, age, years of schooling, number of siblings and birth order.

Procedure

The study was carried out in two phases

Phase I: Pilot Study

Phase II: Main Study

Phase I: Pilot study

Pilot study was carried out to test the reliability statistics for Childhood Autism Rating Scale and Wechsler Intelligence Scales for Children-Revised.

Sample

For the purpose of determining the reliability of CARS and WISC-R, 10 autistic and 10 non-autistic children were selected from institutes of Rawalpindi and Islamabad. All of the children were in the age range of 6-12 years.

Procedure

The subjects were approached in their respective institutes and informed consents were taken from their parents and the respective organizations. In the first session CARS was administered on each subject. After CARS the subtests of, WISC-R were administered in the following sequence

1) Information

2) Picture completion
3) Similarity
4) Picture arrangement
5) Arithmetic
6) Block Design
7) Vocabulary
8) Object assembly
9) Comprehension
10) Coding

After administration data was analyzed to calculate the reliability coefficient of CARS and the ten subtests of WISC-R and all the Scales were found to be reliable for using in the present study.

Phase II: Main Study

After determining the reliability of the scales the main study was carried out in the second phase.

Sample

The sample consisted of 100 participants; 50 autistic and 50 non-autistic children. The subjects ranged in age from 6 to 12 years. The sample consisted of an equal number of non-autistic boys (n=25) and non-autistic girls (n=25), while there were 23 autistic girls and 27 autistic boys. The data was collected from Pakistan Institute of Medical Sciences (PIMS), Rawalpindi General Hospital (RGH), Holy Family Hospital Rawalpindi (RGH), National Institute of Rehabilitation Medicine (NIRM), Pakistan Autism Society (PAS) and Step to Learn (STL).

Procedure

The data was collected from the subjects at their respective institutes and clinical settings. Informed consent was taken from parents and respective organizations. Autistic children were diagnosed formally on Childhood Autism Rating Scale (Schopler et al., 1980). Subjects were diagnosed as autistic and non-autistic based on the cut of score of 30. After CARS, Wechsler Intelligence Scales for Children Revised (Wechsler, 1974) was administered on all the subjects in the sample. Rules of administration were strictly followed as given in the manual. Test administration was carried out in a testing room with good ventilation and lightening. The subjects were seated comfortably in the position in which they were able to handle the testing material properly. Subjects were encouraged time to time while performing at the tasks and majority of them attempted the test with a considerable interest. Performance on any cognitive task is strongly related to the intellectual status of the task taker. Therefore efforts were made to take all the subjects with comparable intelligence. In order to get subjects with comparable intelligence all the children included in the sample were those who scored an IQ in the range of 35-55 on Wechsler Intelligence Scales for Children-Revised. Those with an IQ of above or below 35-55 were excluded from the sample.

The subtests were administered in the following order

1. Information
2. Picture completion
3. Similarity
4. Picture arrangement
5. Arithmetic
6. Block Design
7. Vocabulary
8. Object assembly
9. Comprehension
10. Coding

The verbal and performance test were alternated in order to keep the subjects involved in testing sessions. Directions for starting and discontinuing rules (Appendix D) were strictly followed and raw scores were noted carefully on record forms (Appendix H).

The scoring was made according to general scoring rules of WISC-R. The raw scores were converted to scaled scores to get Full Scale IQ (FSIQ) on WISC-R. All the subjects with FSIQ in the range of moderately retarded (35-55) were included in the sample while the remaining were excluded.

Data analysis

The data was analyzed to test the hypotheses of the study. In order to test the difference in scores of autistic and non-autistic children on block design task (BDT) *t*-test was applied. Analysis of variance *(ANOVA)* was carried out to determine the role of age, birth order and number of siblings.

RESULT

RESULTS

Table I

Reliability coefficient of Childhood Autism Rating Scale (CARS) and Wechsler Intelligence Scales for Children –Revised (WISC-R) (N=20)

Scales	Number of items	Reliability coefficient
CARS	15	0.84
Subscales of WISC-R		
Verbal subtests		
Information	30	0.76
Similarity	17	0.72
Arithmetic	18	0.63
Vocabulary	32	0.81
Comprehension	17	0.35
Performance subtests		
Picture completion	26	0.71
Picture arrangement	12	0.54
Block Design	11	0.76
Object assembly	4	0.45
Coding	120	0.68
WISC -FSIQ	10	0.64

Note: CARS=Childhood Autism Rating Scale; WISC-R= Wechsler Intelligence Scale for Children-Revised; FSIQ= Full Scale Intelligence Quotient.

Table 1 shows the reliability of Childhood Autism Rating Scale (CARS) and Wechsler Intelligence Scales for Children-Revised (WISC-R) as 0.84 and 0.64 respectively which shows that the instruments are reliable. The reliabilities of ten subscales of WISC-R are also shown in the table indicating that all the subscales of WISC-R except comprehension were found to be reliable.

Table 2

Mean, Standard deviation, & t-value for the scores of autistic and non-autistic children on subscales of WISC-R (N=100)

	Autistic children (n=50)		Non-autistic children (n=50)				95% CI		
	M	SD	M	SD	t	p	LL	UL	Cohen's d
Verbal Scales									
Information	3.22	1.67	3.74	1.71	1.54	0.13	-0.19	0.51	-0.31
Similarity	3.12	1.44	3.98	1.52	2.91	0.00	-1.45	-0.27	-0.5
Arithmetic	3.38	1.64	3.82	1.60	1.36	0.18	-1.08	0.20	-0.27
Vocabulary	2.35	1.55	2.28	1.56	0.21	0.83	-0.55	0.69	0.04
Comprehension	2.24	1.16	3.13	1.71	2.84	0.00	-1.52	-0.27	-0.6
VIQ	56.18	6.84	59.40	6.22	2.46	0.02	-0.02	-0.58	-0.49
Performance Scales									
Picture Completion	3.26	1.69	3.82	1.52	1.74	0.08	-1.20	0.08	-0.35
Picture Arrangement	2.88	1.59	3.04	1.48	0.53	0.60	-0.78	0.45	-0.10
Block Design	6.46	2.27	5.54	1.97	2.16	0.033	-0.76	1.76	0.43
Object Assembly	7.06	2.22	5.16	1.93	4.57	0.00	1.075	2.725	0.91
Coding	3.10	1.786	3.40	2.13	0.72	0.47	-1.15	0.534	-0.15
PIQ	64.60	6.97	62.32	6.73	1.66	0.10	-0.44	5.00	0.33
FSIQ	56.64	6.35	57.40	5.71	0.63	0.53	-3.16	1.64	-0.13

Note. CI= confidence interval; LL = lower limit; UL = upper limit; VIQ = Verbal Intelligence Quotient; PIQ = Performance Intelligence Quotient; FSIQ= Full Scale Intelligence Quotient.

Table 2 shows the Mean, Standard deviation, & t-value for the scores of autistic and non-autistic children on subscales of WISC-R. From the results it is evident that on block design task autistic children scored higher than non-autistic children and the difference is significant as shown in *t*-value. The autistic children scored significantly lower than non-autistic children on similarity and comprehension. On object assembly autistic children scored significantly higher than non-autistic children. No significant difference was found in scores of autistic and non-autistic children on information, arithmetic, vocabulary, picture completion, picture arrangement and coding. Autistic children scored significantly lower than non-autistic children in Verbal IQ (VIQ) while no significant difference was found in performance IQ (PIQ). On block design task autistic children scored higher than non-autistic children and the difference is significant as shown in *t*-value.

Table 3

Mean, Standard deviation, & t-value for the scores of autistic and non-autistic boys and girls on Block Design Task (BDT) (N=100)

	Gender	M	SD	t	p	Cl 95% UL	Cl 95% LL	Cohen's d
Autistic (n=50)	Boys (n=27)	7.00	2.51	1.87	0.07	-0.09	2.43	0.53
	Girls (n=23)	5.83	1.80					
Non-Autistic (n=50)	Boys (n=25)	5.79	2.15	0.86	0.39	-0.64	1.61	0.24
	Girls n=25)	5.31	1.81					

Note. Cl= confidence interval; LL = lower limit; UL = upper limit.

Table 3 shows the mean, standard deviation and *t*-value for scores of boys and girls on block design task. From the results it is evident that the gender difference in mean scores of autistic and non-autistic children is not significant as shown in *t*-values.

Table 4

Mean, Standard deviation, & Analysis of Variance (ANOVA) for the scores of autistic and non-autistic children on Block Design Task (BDT) with regard to age (N=100)

	Age groups	M	SD	F	p	Post-hoc
	6-7years (n=21)	7.05	2.27			
Autistic (n=50)	8-9 years (n=26)	6.46	1.86	7.06	0.002	1>2>3
	10-11 years (n=3)	2.33	1.53			
	6-7years (n=23)	6.48	1.81			
Non-autistic (n=50)	8-9 years (n=26)	4.77	1.80	5.87	0.005	1>2>3
	10-11 years (n=1)	4.00	-			

Table 4 shows the mean, standard deviation and F-value for scores of autistic and non-autistic children on block design task with regard to their age. From the results it is evident that there is a significant difference in mean scores of autistic as well as non-autistic children of different ages as shown in *F value*. From post-hoc analysis it is evident that autistic and non-autistic children in group 1 of age (6-7 years) scored highest while those in group 2 of age (10-11 years) scored lowest on the task.

Table 5

Mean, Standard deviation, & Analysis of Variance (ANOVA) for the scores of autistic and non-autistic children on Block Design Task (BDT) with regard to birth-order (N=100)

	Birth-Orders	M	SD	F	p	Post-hoc
	1st Born (n=20)	7.20	2.26			
Autistic (n=50)	2nd Born (n=14)	4.93	2.02	5.31	0.00	1>2<3
	3rd Born (n=16)	6.88	1.93			
	1st Born (n=12)	6.83	1.69			
Non-autistic (n=50)	2nd Born (n=15)	5.47	1.99	4.25	0.02	1>2>3
	3rd Born (n=23)	4.91	1.83			

Table 5 shows the mean, standard deviation and *F*-value for scores of autistic and non-autistic children on block design task with regard to their birth-order. From the results it is evident that there is a significant difference in mean scores of autistic as well as non-autistic children of different birth-orders as shown in *F value*. From post-hoc analysis it is evident that autistic and non-autistic children in group 1 (1st born) scored highest as compared to those in group 2 (2nd born) and group 3 (3rd born).

Table 6

Mean, Standard deviation, & Analysis of Variance (ANOVA) for the scores of autistic and non-autistic children on Block Design Task (BDT) with regard to number of siblings (N=100)

	Number of Siblings	M	SD	F	p	Post-hoc
Autistic (n=50)	No Sibling (n=3)	6.33	2.31	6.13	0.00	1<2>3
	1 sibling (n=22)	7.59	1.80			
	More than one sibling (n=25)	5.48	2.26			
Non-autistic (n=50)	No Sibling (n=1)	4.00	-	12.36	0.00	1<2>3
	1 sibling (n=13)	7.46	1.45			
	More than one sibling (n=36)	4.89	1.69			

Table 6 shows the mean, standard deviation and *F*-value for scores of autistic and non-autistic children on block design task with regard to their number of siblings. From the results it is evident that there is a significant difference in mean scores of autistic as well as non-autistic children with different number of siblings as shown in *F value*. From post-hoc analysis it is evident that autistic and non-autistic children in group 2 of number of siblings (1 sibling) scored highest as compared to those in group 1 (no sibling) and group 3 (more than one siblings).

DISCUSSION

Chapter IV

DISCUSSION

The present study was conducted to compare the Visual Spatial Ability of autistic and non-autistic children. The age range of the sample was 6-12 years. Childhood Autism Rating Scale (Schopler et al, 1980) and Wechsler Intelligence Scales for Children-Revised (Wechsler, 1974) along with a demographic data sheet were used for data collection. In the first phase of the study reliability of the scales was determined on ten autistic and ten non-autistic children. Both of the instruments were found to be reliable at 0.84 and 0.64 respectively. The reliability coefficient of subscales of WISC-R were found to be 0.76 for information, 0.72 for similarity, 0.63 for arithmetic, 0.81 for vocabulary, 0.35 for comprehension, 0.71 for picture completion, 0.54 for picture arrangement, 0.74 for block design, 0.45 for object assembly and 0.68 for coding subscales (table 1).

In the present study autistic children scored significantly lower than the non-autistic children on similarity and comprehension. On object assembly and block design autistic children scored significantly higher than non-autistic children. No significant difference was found in scores of autistic and non-autistic children on information, arithmetic, vocabulary, picture completion, picture arrangement and coding. Autistic children scored significantly lower than non-autistic children in Verbal IQ (VIQ) while no significant difference was found in performance IQ (PIQ). The findings are consistent with the previous research in which it was found that there is a significant difference in scores of autistic and non-autistic children on subscales of Wechsler Intelligence scale (Leeanne et al., 1994).

Autistic children in the present study scored higher on Performance IQ than on Verbal IQ. These findings are consistent with the previous studies (Lincoln et al., 1988). On subscales of verbal intelligence autistic children scored lowest on comprehension and showed a relative strength on arithmetic while non-autistic children scored highest on similarity and lowest on vocabulary. On subscales of performance intelligence autistic children scored highest on object assembly and lowest on picture arrangement (table 2). These findings confirm the trend of autistic profile on WISC given by studies on autistic intelligence in which it was found that autistic children scored highest on object assembly and block design task while performing worst on comprehension (Sigman et al., 1987).

Comprehension subtest assesses social knowledge and open ended verbal expression, typically posses the greatest difficulty for autistic children. In the present study autistic children scored relatively low on comprehension, similarities and vocabulary, which are the areas of relative weakness for autistic children, suggesting the basic deficits underlying autism.

Visual Spatial Ability in autistic and non-autistic children

The results showed that autistic children scored higher than non-autistic children on block design task. The difference in mean score of autistic and non-autistic children on Block Design Task was found to be significant (table 2). These findings confirmed the hypothesis of the study that autistic children will have higher visual spatial ability than the non-autistic children. These findings are in line with that of the previous researches (O'Riordan & Plaisted, 2010; Stewart et al., 2011) in which it was found that autistic individuals have a tendency to perform more easily and efficiently on visual spatial tasks.

In non-autistic population global aspects of a scene are processed more rapidly than local detail in the scene. This bias in favor of wholes can be seen as a manifestation of central coherence (Frith, 1983). Autistic individuals have weak Central Coherence due to which they have a tendency to attend more on parts rather than whole. The autistic children complete the designs more efficiently as compared to the non-autistic children because they have a tendency to attend more keenly to each part of the design regardless of the whole. The concept of central coherence explains the less efficient performance of the non-autistic children on the task as compared to the autistic children. Non–autistic children have a relatively stronger Central Coherence due to which they attend less to the parts as compared to the wholeness in the designs.

The designs BDT are made up of different geometrical shapes and lines such as segmentation, rotation and obliqueness. The superior performance on the task needs concentration on all parts irrespective of the wholeness. Non-autistic children having a relatively stronger Central Coherence working on Global Precedence effect (Navon, 1977) concentrate more on wholeness, ignoring the local details in the designs. Due to this ignorance of the local details they took more time and made more errors in completing the designs.

Concentrating on one aspect and ignoring the other is related to the perceptual processes of the individual. Enhanced Perceptual Functioning (EPF) model (Mottron & Burak, 2001) attributes superior performance in visual spatial task to the effect of an overall superior perceptual functioning in low level tasks. According to EPF model, superiority of perceptual flow of information in contrast to higher order processes lead to an unusual relationship among high and low order cognitive processes in autistic disorder. As a consequence of this atypical relationship the perceptual processes become harder to control and more troublesome to the development of other behaviors and abilities. This enhanced perceptual functioning in autism enables the autistic children in the study to give superior performance on the task as compared to the non-autistic children.

The reason behind this enhanced perceptual functioning in autistic children can also be explained in an adaptive aspect such as Paradoxical functional facilitation (Kapur, 1996). A deficit in one neurological system can lead to the development of another. Being deficit in higher order cognitive processes autistic individuals have developed some low order perceptual functioning in enhanced way. Due to this compensatory ability of autism autistic children performs more efficiently as compared to non-autistic children.

Gender difference in visual spatial ability

Gender plays an important role in almost all kind of abilities. From the results in the present study it is found that the difference in scores of boys and girls on Block design Task (BDT) is insignificant, for both autistic and non-autistic children (table 3). It means that the present study found no significant gender difference in visual spatial ability of autistic as well as non-autistic children.

The present findings are consistent with that of a study by Auyeung et al., (2009) in which no significant gender difference was found between autistic children on block design task performance. It was found that the average score on task was 19.14 for boys and 16.26 for girls, but the standard deviation for both genders was between 9.5 and 10, making the difference between the gender a little less than one-third of a standard deviation, and thus not statistically significant. Lord, Schopler, Revicki (1982) also found that Autistic girls demonstrate less proficiency than boys on tests of both verbal and visual-spatial skills but no comment was made on significance of the results.

The significance of gender difference in cognitive abilities always remained inconclusive (Haceker, 2004). McGee, (1979) and Kimura, (1999) emphasized the biological factors while Durkin (1995) put forward psychosocial factors, behind gender difference in visual spatial abilities. In fact the genuine catalyst is the interaction between the two. Along with nature, nurture is also among the basic sources of gender gap in all kind of cognitive abilities including visual spatial ability. In a study (Hoffman, Gneezy & John, 2011) it was concluded that nurture plays a significant role in gender gap in cognitive abilities.

Child's interactions with the environment, playing with toys or activities such as sports which have spatial component to them are very obvious to improve the visual spatial abilities. Studies found (Baenninger & Newcombe, 1989) significant relationship between spatial activity participation and spatial ability in children. In the world the child gets specific kind of interaction with the environment and all of its available resources. According to those available resources the activities of the child molds and thus are the abilities. Male dominance in visual spatial abilities is due to the more participation of boys in spatial tasks as compared to the girls. As the social cognition regarding gender is changing both boys and girls are being provided with almost equal kind of activities to participate. The nurturance differences across the gender is minimizing so is the gap in cognitive abilities therefore there remained insignificant gender difference in visual spatial ability like any other cognitive ability.

Role of age in visual spatial ability

In the present study autistic and non-autistic children in different age groups scored differently on block design task and the difference was found to be significant. From the results it is evident that in autistic as well as non-autistic children 6-7 years old children scored highest while10-11 years old scored lowest on the task (table 4). The data points toward the deceleration of scores with age. These findings mean that the visual spatial ability decreased with age in both groups of children; autistic and non-autistic. These findings are inconsistent with the previous studies in which age related improvement in performance of autistic (Jolliffe & Baron-Cohen, 1997) & non-autistic children (Hale, Bronik & Fry, 1997) was reported.

In autistic children there might be two most acting reasons behind the deceleration of visual spatial ability with age. The first reason is the improvement in symptoms of autism over time. According to McDuffie et al., (2010) symptoms of autism improve over time for individuals with autism. The most important of these symptoms are communication qualities , social smiling, showing and directing attention, offering to share, seeking to share enjoyment, offering comfort, quality of social overtures, appropriateness of social responses, social talking, reciprocal conversation, pointing, nodding, and gesturing. As a result of these improvements they began to attend more to social situations and relations. Their social learning enhances their mental ability to attend to the global aspects of others. Their central coherence increases and they began to attend global aspects of a stimuli, which results in comparatively less efficient performance on block design task.

In the development of visual spatial ability physiological development of prefrontal cortex (Luna et al., 2002; Casey et al., 2000) and training of the task (Baenninger & Newcombe, 1989) are very influential factors. Age and experience have an interactive effect on development and organization of prefrontal cortex (Salthouse, Timothy & Mitchell, 1990) which is responsible for the visual spatial ability. From these evidences it follows that the second reason of deceleration in scores of autistic children on BDT with age is the lack of proper training and rehabilitation programs. In the present study out of 50 autistic children in the sample only 30 children were reported to be admitted in a rehabilitation center or an institute while 20 children are not getting any kind of institutionalized care. No standardized plan is being followed by the rehabilitation centers or institutes in Pakistan. Due to these factors autistic children are getting older without getting the interactive and experiential effect of age. The lack of proper training is among the most influential factors behind the observed decrease in BDT scores with age.

The lack of sufficiently stimulating environment is the most important and contributing factor behind the declaration of visual spatial ability in non-autistic children. The non-autistic children in the present study are all those with an IQ in the range of 49-69 on WISC-R, all of them are mentally deficient and need special help to work and live a routine life. In the present study out of 50 non-autistic children only 18 were reported to be admitted in an institute while 32 children were not getting any training or rehabilitation. Abilities including visual spatial ability increase with training (Medina, Gerson & Sorby, 1998). When the mentally deficient children do not get proper training and stimulation they began to lose their abilities and blocking their neural pass ways for further learning. Therefore with age they began to lose their existing abilities.

Autistic as well as non-autistic children are getting older but their neural pass-ways and working memory is not developing. Lack of new experience and a stimulating environment results in blockage and deterioration of existing abilities of the autistic as well as non autistic children. There is a strong need to recognize their abilities and to make productive rehabilitation plans for empowering them to play a valuable part.

Role of Birth-order in visual spatial ability

Birth order plays a very important role in the development of visual spatial abilities. In the present study significant differences were found in scores of autistic and non-autistic children with different birth orders. First born autistic children scored highest while 2^{nd} born autistic children scored lowest on BDT. On the other hand in the case of non-autistic children 1^{st} born scored highest and 3^{rd} born scored lowest on the task. These findings depict that birth-order has a significant role in visual spatial ability of autistic as well as non-autistic children (table 5). These results are consistent with previous studies in which it was found that birth-order plays a significant role in visual spatial ability of autistic (Franklin, 2010) & non-autistic (Rodgers & MacCallum, 2006) children.

According to Resource Dilution Model (Downey, 2001) all of the parental resources are limited. Parental resources; money and personal attention, have a vital effect on child's cognitive ability. This effect is largely due to the relative affluence of the family environment provided to the child. Resource dilution model very effectively explains the role of birth-order and number of siblings on cognitive abilities of children. The role of these two factors; birth-order and number of siblings is a resultant phenomenon of the parental allocation of their resources. In the present findings it was found that first born child scored highest on the task as compared to the 2^{nd} or third born children in both; autistic and non-autistic children. According to the model parents allocate all of their resources to the first born child giving the full of their attention and material resource to the child's development. In this way the first born gets the maximum resources for development and ultimately results in getting high standing in cognitive abilities. The later coming siblings; 2^{nd} born and 3^{rd} born, gets the diluted resources due to which their cognitive abilities remains less than that of 1^{st} born child.

Role of number of siblings in visual spatial ability

It was found in the present study that autistic children with 1 sibling scored highest while autistic children with more than 1 sibling scored lowest on BDT. In the case of non-autistic children it was found that children with 1 sibling scored highest while those with no sibling scored lowest. The difference in scores of autistic and non-autistic children in different categories of number of siblings were found to be significant (table 6). The findings are consistent with the studies in which role of number of siblings in cognitive abilities of autistic (Minton et al., 2009) and non-autistic (Bjerkedal et al., 2007) children was studied. These studies found a significant role of number of siblings in cognitive abilities of autistic and non-autistic children.

The role of sibship-size (number of siblings) could also be explained by Resource dilution Model. According to this model additional siblings in the family reduce the share of parental resources received by one child in the family. Parents divide all of their resources in their children and when the number of siblings increases resources available for each child decreases. There is an inverse relation between resources available to each child and sibship-size. Decreased resources result in cognitive downfall of the child due to which on cognitive tasks children with more sibling scores lower than the children with fewer siblings.

Another finding is that autistic as well as non-autistic children with one sibling scored higher than those with no sibling. These findings points toward the intellectual environment in family available to the child. According to confluence model (Zajonc & Markus, 1975) the child who gets a chance to act as a teacher to the younger siblings in the family gets more cognitive abilities as compared to the other children. This teaching role of the child with one sibling is among the reasons of the higher visual spatial ability. The interaction between number of siblings, birth-order, age, and the teaching role of the child might be another variable playing a significant role in cognitive abilities of children.

The results of the present study confirmed the hypothesis that autistic children will have higher visual spatial ability than non-autistic children. No significant gender difference in visual spatial ability was found in autistic as well as non-autistic children. Gender difference in visual spatial ability is attributed to an interaction between nature and nurture. With changing patterns of nurturance gender difference in visual spatial ability is becoming insignificant. It was found in the present study that older autistic and non-autistic children showed lower visual spatial ability than the younger children. For the improvement of abilities age and experience interacts but lack of proper rehabilitation and training results in deceleration of cognitive ability with age. There is a strong need to indulge these children in proper training programs in order to make them live in a better condition. Birth order and number of siblings are important demographical variables which have their significant role in visual spatial ability of autistic as well as non-autistic children.

Limitations

Due to lack of time and resources the present study have following limitations

- A narrow age range 6-12 years with a small sample size was used due to which role of age could not be analyzed on a broader aspect.
- Only mentally deficient autistic and non-autistic children are included in this study. A sample with a broader range of IQ could have given more information regarding the Visual spatial abilities in high functioning autistic children.
- Due to scarcity of time and resources no impact of specialized parental training programs was analyzed on visual spatial abilities of the autistic children.
- No investigation regarding the strategies being used in rehabilitation institutions, where the children are being trained, was made.
- Only Visual Spatial abilities are studied in this research. Other abilities like picture imagery and musical ability in autistic children are also worth to be studied in detail.

Suggestions

For future research on the topic it is recommended that a larger sample size with more variability could be used to get more detailed results regarding the role of demographical variables on visual spatial abilities. A further exploration into the proximal variables such as nutritional status, child's education, and home environment and that of distal variables such as and socioeconomic status and parental education could be suggested. These findings would demonstrate the importance of evaluating proximal and distal variables in study of cognitive abilities, as they might be important confounding variables.

Parental training to enhance the skillful learning process in children is more important than the formal education of parents especially in the case of parents with autistic children. A repeatedly reviewed and researched training program must be introduced to the parents so as to enable them to give their maximum contribution in order to enhance the cognitive abilities of their children. In a further study the impact of the specialized parental training program on cognitive abilities of children could be analyzed in detail.

In further study a broader age and IQ range is suggested in order to compare different age groups and to get results for the interacting effect of age and IQ on visual spatial abilities.

Autistic children have a different rather than a deficient mind. It is suggested for future research that a study could be conducted to investigate other ways through which autistic minds could be channeled to work properly. Other autistic abilities like musical and picture imagery could be explored and efforts could be made to discover the strategies behind these abilities in autistic minds.

Autism is a broad and very important field of research. There is a strong need to explore each and every aspect of this disorder through repeatedly reviewed research findings. The most important area of research in autism seems the cognitive strengths in autism. Investigation into strength areas of the autistic children would enable researchers to propose different strategies for enhancement and productivity in autistic individuals. These proposals could be used by the educationists for implementation in classrooms to get their maximum autistic abilities at work and to prepare them as a useful and productive part of the society.

REFERENCES

REFERENCES

Aarons, M., & Tessa, G. (1992). *The Autistic Continuum.* Western Psychological Services.

Ali Yawar. (2005). *Autism: new pieces of the puzzle.* Unpublished Masters thesis, Community Medicine, Shifa College of Medicine, Islamabad.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders.* 4rth TR ed. Washington DC: Author.

Anourova, I., Rama, P., Alho, K., Koivusalo, S., Kahnari, J., & Carlson, S. (1999). *Selective interference reveals dissociation between auditory memory for location and pitch. NeuroReport,* 10,3543–3547.

Assouline, S. G., Foley, N. M., & Doobay, A. F. (2009). *Profoundly gifted girls and autism spectrum disorder: A psychometric case study comparison.* Gifted Child Quarterly, 53, 89-106.

Auyeung, B., Baron-Cohen, S., Ashwin, E., Knickmeyer, R., Taylor, K., & Hackett, G. (2009). *Fetal testosterone and autistic traits.* British Journal of Psychology, 100, 1-22. doi: 10.1348/000712608X311731

Baenninger, M., & Newcombe, N. (1989). *The Role of Experience in Spatial Test Performance - a Meta-Analysis.* Sex Roles, 20(5-6), 327-344.

Bailey, A., Le Courteur, A., Gottesman, I., Bolton, P., Simonoff, E., Yuzzda, E., & Rutter, M. (1995). *Autism as a strongly genetic disorder: Evidence from a British twin study.* Psychological Medicine, 25, 63-77.

Barnhill, G. P., Hagiwara, T., Myles, B. S., & Simpson, R. L. (2000). *Asperger syndrome: A study of the cognitive profiles of 37 children and adolescents.* Focus on Autism and Other Developmental Disabilities, 15, 146-153.

Baron-Cohen, S. (1989). *The autistic child's theory of mind: a case of specific developmental delay.* Journal of child psychology and psychiatry, 30, 285-297.

Ben-Yishay, Y., Diller, L., Mandelberg, I., Gordon, W., & Gerstman, L. J. (1971). *Similarities and differences in block design Performance between older, normal, and brain injured persons: a task analysis.* Journal of Abnormal Psychology, 78, 113-119.

Ben-Chaim, D., Lappan, G., & Houang, R. T. (1988). *The effect of instruction on spatial visualization skills of middle school boys and girls.* American Educational Research Journal, 25(1), 51-71.

Belmont, L., & Marolla, F. A. (1973). *Birth order, family size, and intelligence*. Science, 182, 1096-1101.

Bettleheim, B. (1967). *The empty fortress.* New York: Free press.

Bihrle, A. M., Bellgl, U., Delis, D. C., & Marks, S. (1989). *Seeing either the forest or the tree: dissociation in visual spatial processing.* Brain & Cognition, 11, 37-49.

Bjerkedal, T., Kristensen, P., Skjeret, G. A., & Brevik, J. I. (2007). *Intelligence test scores & birth order among young Norwegianmen analyzed within & between families.* Journal of Intelligence, 1(4), 17-25.

Bowler, D. M. (1992). *Theory of Mind in Asperger Syndrome*. Journal of Child Psychology and Psychiatry, 33, 877-895.

Brian, J. A., & Bryson, S. E. (1996). *Disembedding performance and recognition memory in autism/PDD.* Journal of child Psychology and Psychiatry, 37,865-872.

Caldera, Y. M., Culp, A. M., O'Brian, M., Truglio, R. T., Alvarez, M., & Huston, A. C. (1999). *Children's play preferences, construction play with blocks, and visual-spatial skills: Are they related?* International Journal of Behavioral Development, 23(4), 855-872.

Carona, M. J., Mottron, C. Rainvilled, E. & Chouinard, S. (2003). *Human Perception and Performance.* Journal of Child Psychology and Psychiatry, 34, 743-749.

Casey, B. J., Giedd, J. N., & Thomas, K .M. (2000).Structural and Functional brain development and its relation to cognitive development. Biological Psychology, 54, 241-257.

Charman, T., Swettenham, J., Baron-Cohen, S., Cox, A., Baird, G., & Drew, A. (1997). *Infants with autism: An investigation of empathy, pretend play, joint attention, and imitation.* Developmental Psychology, 33, 781-789.

Condron, L., O'Riley, P., & Damarin, S. (1993). *Women and the discourses of the visual: Where are women in this picture?.* U.S.; Ohio: April 23, 2005, from the ERIC database.

Constantino John, N. (2005). *Social Responsiveness Scale (SRS).* MD Western Psychological Services.

Courchesne, E., Yeung-Courchesne, R., Press, G. A., Hesselink, J. R., & Jernigan, T. L. (1988). *Hypoplasia of cerebellar vermal lobules VI and VII in autism.* New England Journal of Medicine, 318, 1349-1354.

Creak, M. (1964). *Schizophrenia syndrome in childhood: Progress report of a working party.* Cerebral Palsy Bulletin, 3, 501-504.

Davison Gerald. C., & John M. Neale. (2001). *Abnormal Psychology.* New York: John Wiley & Sons Inc.

Downey, D. B. (2001). Number *of Siblings and Intellectual Development. The Resource Dilution Explanation.* American Psychologist, 56(6/7),497-504.

Durkin, K. (1995). *Developmental Social Psychology.* NewYork: Wiley Blackwell Publishers.

Eaves, R.C., & Milner, B. (1993). *The criterion related validity of the childhood autism rating scale and the autism behavior checklist.* Journal of Abnormal Child Psychology, 21(5), 481-492.

Eaves, Linda. C Helena H. and David M. Eaves. (1994). *Subtypes of autism by cluster analysis.* Journal of Autism and Developmental Disorders, (24)1, 3-22. DOI: 10.1007/BF02172209.

Ehlers, S., Gilberg, C., & Wing, L. (1997). *A screening questionnaire for Asperger syndrome & other high functioning autism spectrum disorders in school age children.* Journal of autism and developmental disorders, 29, 129-140.

Elliot, C. D., Murray, D. J. & Pearson, L. S. (1979). *The British ability scales.* Windsor: NFER-Nelson Publishing co Ltd.

Feingold, B. F. (1977). *Behavioral disturbances linked to the ingestion of food additives.* Delaware Medical Journal, 49, 89-94.

Ferster, C. B. (1961). Positive *reinforcement & behavioral deficits of autistic children.* Child Development, 32, 437-456.

Franklin Hall B, (2010). *The effect of Birth order on cognitive ability and symptom severity in children with autism.* International Meeting for Autism Research. Philadelphia Marriott Downtown.

Frith, U. (1989). *Autism: explaining the enigma.* Oxford Blackwell publishing incorporation.

Gajzago, C., & Prior, M. (1974). *Two cases of recovery in Kanner syndrome.* Archives of Genetic Psychiatry, 31(2), 264-68.

Gerard, A. Gioia, Peter, K., Isquith, Steven, C. Guy, & Lauren. (2000). *Behavior Rating Inventory of Executive Function (BRIEF).* Western Psychological Association.

Ghaziuddin, Mohammad. (2000). *Autism in mental retardation.* Current Opinion in Psychiatry,13 (5), 481-484.

Gillberg, C., & Svendsen, P. (1983). *Childhood psychosis and computerized tomographic brain scan findings.* Journal of Autism and developmental disorders, 13, 19-32.

Gilliam, J. (1995). *Gilliam Autism Rating Scale.* Texas: Pro-ed.

Grandin, Tample. (2006). *Visual Thinking in autism by Great Britain.* Vintage USA Bloomsbury publishing Plc

Haas, R. H., Townsend, J., Courchesne, E., Lincoln, A. J., Schreibman, L., & Yeung-Courchesne, R. (1996). *Neurological abnormalities in infantile autism.* Journal of Child Neurology, 11, 84-92.

Haecker, Jael. B. (2004). *The Variables affecting male and female performance on verbal and spatial tasks.* Missouri Western State: Brian Cronk Incorporation.

Happe, F. (1994). *Wechsler IQ profile and theory of mind in autism: A research note.* Journal of Child Psychology and Psychiatry, 35, 1461-1471.

Happe, F., & Frith, U. (2006). *The weak coherence account: detail-focused cognitive style in autism spectrum disorders.* Journal of Autism and Developmental Disorders, 36(1), 5–25.

Hale S., Bronik M.D. & Fry A.F. *(1997). Verbal and spatial working memory in school-age children: Developmental differences in susceptibility to interference. Developmental Psychology,*33,364–371.

Hobson, R. P., & Lee, A. (1998). *Hello and good bye: A study of social engagement in autism.* Journal of Autism and developmental disorders, 28, 117-127.

Hoffman, Moshe., Gneezy, Uri., & John, A. (2011). *Nurture affects gender differences in spatial abilities.* Proceedings of National Academy of Sciences of the United States of America.

Hughes, C., & Russell, J. (1993). Autistic children difficulty with mental disengagement from an object—its implications for theories of autism. *Developmental Psychology, 29*(3), 498–510.

Huber, D. H. (2007). *Clinical presentation of autism spectrum disorders in intellectually gifted students.* Unpublished Doctoral dissertation, The University of Iowa, Iowa City.

Hutt, C., Hutt, S. J., Lee, D., & Ountsted, C. (1964). *Arousal and childhood autism.* Nature, 204, 908-909.

Hyde, J. (1990). *Meta-analysis and the psychology of gender differences.* Journal of Women in Culture & Society, 16, 55-74.

Jarrold, C., Butler, D., Cottington, E., Jimenez, F. (2000). *Linking theory of mind & Central coherence bias in autism and in the general population.* Developmental psychology, 36, 26-138.

Jarrold, Christopher., Gilchrist, Iain. D., Bender, Alison. (2005). *Embedded figures detection in autism and typical development: preliminary evidence of a double dissociation in relationships with visual search.* Developmental Science, 8(4), 344–351. DOI: 10.1111/j.1467-7687.2005.00422.x, July 2005

Johnson, E. S., & Meade, A. C. (1987). *Developmental patterns of spatial ability: An early sex difference.* Child Development, 58(3), 725-740. Retrieved April 25, 2005, from the JSTOR database.

Johnson, C. P., & Myers, S. M. (2007). *Council on Children with Disabilities. Management.* American Psychological Association, 10-29.

Jolliffe, T. & Baron-Cohen, S. (1997). *Are people with autism and Asperger syndrome faster than normal on the Embedded Figures Test?* Journal of Child Psychology & Psychiatry, 38, 527–534.

Kapur, N. (1996). *Paradoxical functional facilitation in brain behavior research. A critical review.* Brain, 119, 1775-1790.

Kanner, L. (1943). *Autistic disturbance of affective contact.* Nervous Child, 2, 217-250.

Kanner, L. (1973). *Childhood Psychosis: Initial studies and new Insights.* Washington, D.C. V.H. Winston and Sons.

Kaplan, E. (1983). *A process approach to neuropsychological assessment*: In: T. K. Boll & B. K. Bryant (Eds.). *Clinical neuropsychological brain function research measurement and practice* (pp. 129-167). Washington, DC: American psychological Association press.

Kemps, E., De Rammelaere S. & Desmet T. (2000). The development of working memory: Exploring the complementarity of two models. Journal of Experimental & Child Psychology,77, 89–109.

Kimura, D. (1999). Sex and cognition. London: MIT Press.

Klin, A., Volkmar, F. R., Sparrow, S. S., Cicchetti, D. V., & Rourke, B. P. (1995). *Validity and neuropsychological characteristics of Asperger's Syndrome: convergence with nonverbal learning disabilities syndrome.* Journal of child Psychology and Psychiatry, 36, 1127-1140.

Klin, A., Saulnier, C. D., Tsatsanis, K. D., & Volkmar, F. R. (2005). *Clinical evaluation in autism spectrum disorders: Psychological assessment within a transdisciplinary framework.* In F. R. Volkmar, R. Paul, A. Klin, & D. Cohen (Eds.), Handbook of autism and pervasive developmental disorders, (3rd Eds.). John Wiley & Sons.

Klin, A. & Volkmar, F. R. (1999). *Autism and other Pervasive Developmental Disorders.* In S. Goldstein & C. R. Reynolds (Eds.), Handbook of Neurodevelomental and genetic disorders in children (pp. 247-276). New York: Guilford Press.

Kohs, S. C. (1923). Intelligence Measurement. New York: Macmillan.

Kramer, J. H., Kaplan, E., Blusewicz, M. J., & Preston, K.A. (1991). *Visual hierarchical analysis of the block design configural errors.* Journal of Clinical and Experimental Neuropsychology, 13, 455-465.

Lam, K. S., Aman, M. G. (2007). *Autism Spectrum Disorder.* Journal of Child & Adolescent Psychopharmacology, 12(4), 311–321.

Lé Courteur, A., Rutter, M., Lord, C., Rios, P., Robertson, S., Holdgrafer, M., & McLennan, J. D. (1989). *Autism Diagnostic Interview: A semi-structured interview for parents and caregivers of autistic persons.* Journal of Autism and Developmental Disorders, 19, 363-387.

Leeanne G, Deborah F., Stephen Joy, & Lynn. (1994). *Cognitive functioning in autism.* Water house. American Psychological Association.

Lincoln, A., Allen, M., & Kilman, A. (1995). *The assessment and interpretation of intellectual abilities in people with autism.* In E. Schopler & G. Mesibov (Eds.), Learning and cognition in autism (pp. 89-117). New York: Plenum Publishers.

Lincoln, A. J., Courchesne, E., Kilman, B. A., Elmasian, R., & Allen, M. (1988). *A study of intellectual abilities in high-functioning people with autism.* Journal of Autism and Developmental Disorders, 18, 505-524.

Linn, M. C., & Petersen, A. C. (1985). *Emergence and characterization of gender differences in spatial abilities: A meta-analysis.* Child Development Vol. 56: 1479-1498.

Lord, C., Schopler, E., Revicki, D. (1982). *Sex differences in autism.* Journal of Autism & Developmental Disorders, 12, 317-330.

Lord, C. (1997). *Diagnostic instruments in autism spectrum disorders.* In Cohen, D. J., & Volkmar, F. R. (Eds.). Handbook of Autism and Pervasive Developmental Disorders (pp. 460-483). New York: Wiley.

Lord, Catherine., Michael Rutter, Pamela, C. DiLavore., & Susan, Risi. (1989). *Autism Diagnostic Observation Schedule (ADOS).* Western Psychological Services

Lord, T., & Holland, M. (1997). *Preservice secondary education majors and visual-spatial perception: An important cognitive aptitude in the teaching of science and mathematics.* Journal of Science Teacher Education, 8(1), 43-53.

Lotter, V. (1967). *Epidemology of autistic condition in young children. II: Some characteristic of parents and children.* Journal of Social psychiatry, 1, 163-173.

Luciana, M. & Nelson C.A. *(1998). The functional emergence of prefrontally-guided working memory systems in four- to eight-year old children.* Neuropsychologia, 36,273–293.

Luna, B., Minshew, N. J., Garver, K. E., Lazar, N. A., Thulborn, K. R., Eddy, W. F., & Sweeney, J. A. (2002). *Neocortical system abnormalities in autism: An FMRI study of spatial working memory.* Neurology, 59, 834–840.

Luria, A. R. (1987). The *mind of a mnemonist: A little Book about a vast Memory.* Maxwell publisher., pp. 48.

Maccoby, E. E., & Jacklin, C. N. (1974). *The Psychology of Sex Differences.* Stanford, CA: Stanford University Press.

Masters, M. S., & Sanders, B. (1993). *Is the gender difference in mental rotation disappearing?* Behavior Genetics, 23(4), 337-341.

Matson, J. L., Dempsey, T., Lovullo, S. V., Wilkins, J. (2008). *The effects of intellectual functioning on the range of core symptoms of autism spectrum disorders.* Journal of Research on Developmental Disability, 29(4), 341-50.

Mayes, S. D., & Calhoun, S. L. (2003b). *Analysis of WISC-III, Stanford-Binet IV, and academic achievement test scores in children with autism.* Journal of Autism and Developmental Disorders, 33, 329-341.

Mayes, S. D., & Calhoun, S. L. (2004). *Influence of IQ and age in childhood autism: Lack of support for DSM-IV Asperger's disorder.* Journal of Developmental and Physical Disabilities, 16, 257-272.

McDuffie, A., Abbeduto L, Lewis P, Kim JS, Kover ST, Weber A, (2010). *Autism Spectrum Disorder in Children and Adolescents with Fragile X Syndrome: Within-Syndrome Differences and Age-Related Changes American.* Journal on Intellectual and Developmental Disabilities. Forthcoming edition.

McGee, M. G. (1979). Human spatial abilities: Psychometric studies and environmental, genetic, hormonal, and neurological influences. Psychological Bulletin 86, 889-918.

Medina, A. C., Gerson, H. B. P., & Sorby, S. A. (1998). *Identifying gender differences in the 3-D visualization skills of engineering students in Brazil and in the United States. Brazil*: April 23, 2005, from the ERIC database.

Meltzoff, A. & Gopnik, A. (1993). *The role of imitation in understanding persons and developing a theory of mind. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), Understanding other minds (pp. 335-366).* Oxford: Oxford University Press.

Minton, Judith., Campbell, Magda., Green, Wayne. H., Jennings, Susan., & Samit, Carol. (2009). *Cognitive assessment of siblings of autistic children.* Encyclopedia of Applied Psychology, 307-314.

Mirenda, P. L., & Donnellan, A. M., & Yoder, D. E. (1983). Gaze behavior: a new look into old problem. Journal of Autism and developmetal disorders, 13, 397-409.

Mitchell, Peter., & Ropar, Danielle. (2004). *Visuo-spatial abilities in autism: A review.* Infant and Child Development, 13 (3), 185-198.

Morrison, J. (1980). *Adult psychiatric disorders in parents of hyperactive children.* American Journal of Psychiatry, 137 (7), 825-27.

Mottron, L., and Burack, J. A. (2001). *Enhanced perceptual functioning in the development of autism.* Brain and Cognition, 26, 207-311.

Mottron, L., and Belleville, S. (1993). *A study of perceptual analysis in a high level autistic subject with exceptional graphic abilities.* Brain and Cognition, 23, 279-309.

Nadel, J., Croue, S., Mattlinger, M., Canet, P., Hudelot, C., Lecuyer, C., & Martini, M. (2000). *Do children with autism have expectancies about the social behavior of unfamiliar people?* Autism, 4, 133-145.

Navon, D. (1977). *Forest before trees: the precedence of global features in visual perception.* Cognition Psychology.9, 353–383.

Nietzel, T., Mathew, L., Elizabeth, A. McCauley., & Daouglas, A. Bernstein. (1998). *Abnormal Psychology*: Boston. Allyn & Bacon incorporation.

O' Riordan, M. A., Plaisted, K. C., Driver, J. & Baron-Cohen, S. (2001). *Superior visual search in autism. Journal of Experimental Psychology:* Human Perception & Performance, 27, 719-730.

O' Riordan, Michelle., & Plaisted, Kate. (2010). Spatial *discrimination in children.* Journal of Child Psychology and Psychiatry, 54(4), 961-979.DOI 10.9080/713756000

Ornitz, E. M. (1989). *Autism at the interface between sensory and information processing.* In G. Dawson (Ed.), Autism: nature, diagnosis and treatment (pp. 174-207). New-York and London: Guilford Press.

Ozonoff, S., South, M., & Miller, J. N. (2000). *DSM-IV-defined Asperger syndrome: Cognitive, behavioral and early history differentiation from high-functioning autism.* Autism, 4, 29-46.

Paul, R. (1987). *Communication.* In D. J. Cohen, A. M. Donnellan, & R. Paul (Eds). *Handbook of autism and pervasive developmental disorders* (pp. 61-84). New York: Wiley Incorporation.

Paternite, C. E., & Loney, J. (1980). *Childhood hyperkinesis: Relationships between symptomology and home environment.* In C. K. Whelan & B. Henker (Eds.), Hyperactive children: The social ecology of identification and treatment. New York: Academic Press.

Piaget, J., & Inhelder, B. (1948/1956). *The child's conception of space (F. J. Langdon & J. L. Lunzer, Trans.).* London: Routledge and Kegan Paul incorporation.

Plaisted, K. C. (2001). *Reduced generalization in autism: an alternative to weak central coherence.* In J. A. Burack, T. Charman, N. Yirmiya, & P. R. Zelazo (Eds.), The development of autism: Perspectives from theory and research (pp. 149–172). Mahwah, NJ: Lawrence Erlbaum Associates.

Plaisted, K., O'Riordan, M., & Baron-Cohen, S. (l998b). *Enhanced discrimination of novel, highly similar by adults with autism during a perceptual learning task.* Journal of Child Psychology and Psychiatry, 39, 765-775.

Prizant, B. M. (1983). *Language acquisition and communication behavior in autism: Toward an understanding of the whole of it.* Journal of autism and hearing disorders, 48, 296-307.

Rachel, S. Ball., (1970). *The relation of home Environmental Factors to thinking ability of children.* Educational Resource information center, ED03904, retrieved on 22, Feb, 2011 from http://www. eric.edu.gov.com

RAMAQ (2010). *A Survey on Autism spectrum disorders in Pakistan.* Ramaq NGO. Retrieved Feb 10, 2011, from http://www.ramaq.ngo.pk

Rapoport, J. L., & Ferguson, H. B. (1981). *Biological validation of the hyperkinetic syndrome.* Developmental Medicines and Child Neurology, 23(5), 667-82.

Ricks, D. M. (1972). *The beginning of social Communication in infants & children.* Unpublished Doctoral dissertation, University of London, London.

Ritvo, E. R. (1976). *Autism: From adjective to noun.* In E. R. Ritvo (Eds.), Autism: *Diagnosis, Current research & management* (pp. 3-6). New York: Spectrum publications.

Robichaux, R. R., & Guarino, A. J. (2000). *Predictors of visualization: A structural equation model.* U.S; Louisiana. Retrieved on April 24, 2005, from the ERIC database.

Robichaux, R. (2002). *Predictors of spatial visualization: Structural equations modeling test of background variables.* Journal of Integrative Psychology, 2(2), 1-3.

Rodgers, & MacCallum. (2006). *A multilevel analysis of birth-order effects.* Personality & Psychology Bulletin, 32, 117-127.

Rogers, S. J., & Ozonoff, S. (2005). *Annotation: What do we know about sensory dysfunction in autism? A critical review of the empirical evidence.* Journal of Child Psychology and Psychiatry, 46(12), 1255–1268.

Rogers, S. J., Bennetto, L., McEvoy, R., & Pennington, B. F. (1996). *Imitation and pantomime in high functioning adolescents with autism spectrum disorders.* Child Development, 67, 2060-2073.

Rogers, S. J. & Pennington, B. F. (1991). *A theoretical approach to the deficits in infantile autism.* Development and Psychopathology, 3, 137-162.

Ropar, D. and Mitchell, P. (2001). *Susceptibility to illusions and performance on visual spatial tasks in individuals with autism.* Journal of Child Psychiatry and Psychology, 42, 539-549.

Roser, K. & Buchholz, E. S. (1996). *Autism from an intersubjective Perspective.* Psychoanalytical Review, 83, 305-323.

Rutter, M., Anthony, Bailey & Lord, Catherine. (1999). *Social Communication Questionnaire (SCQ).* Western Psychological Services.

Rutter, M. (1978). *Diagnosis & definition: Autism.* New York: Pergamon press Inc.

Rutter, & Lockyer, L. A. (1967). *A five to fifteen year follow-up study of infantile psychoses. Social description of sample.* British journal of psychiatry, 13-116.

Rutter, M., & Quenton, D. (1984). *Parental psychiatric disorder: Effects on children.* Psychological medicine, 14, 853-80.

Saemundsen, E., Magnusson, P., Smari, J., & Sigurdardottir, S. (2003). *Autism diagnostic interview-revised and the childhood autism rating scale: Convergence and discrepancy in diagnosing autism.* Journal of Autism and Developmental Disorders, 33(3), 319-328.

Salthouse, Timothy, A. Babcock, Renee, L., Skovronek, Eric., Mitchell, Debora, R. D., Palmon, Roni. (1990). *Age and experience effects in spatial visualization.* Developmental Psychology, 26(1), 128-136.

Salthouse, Timothy., & Mitchell, D. R. (1990). *"Effects of age and naturally occurring experience on spatial visualization performance".* Developmental Psychology, 26 (5), 845–854.

Sparrow, Sara, S., Domenic, V., Cicchetti, & Balla, David. A. (1984). Vineland Adaptive Behavior Scales. (2nd ed). NCS Pearson, Inc.

Sattler, J. M. (1974). *Assessment of children's intelligence.* Philadelphia: Saunders.

Schopler, E., Reichier, R. J., & Renner, B. R. (1980). *The Childhood Autism Rating Scale (CARS) for diagnostic screening and classification in autism*: New York: Irvington.

Scheuffgen, K. Happe, Francesca. Anderson, Mike., & Frith, U. (2002). *High "intelligence," low "IQ"? Speed of processing and measured IQ in children with autism.* Louisiana State University, Baton Rouge, USA.

Shapiro, M. B. (1952). *Experimental studies of a perceptual anomaly: 2. Confirmatory and explanatory experiments.* Journal of mental science, 98, 605-617.

Shah, A. & Frith, U. (1983). *An islet of ability in autistic children: a research note.* Journal of Child Psychology & psychiatry, 24, 613–620.

Shah, A. & Frith, U. (1993). *why do autistic individuals show superior performance on the block design task?* Journal of Child Psychology & Psychiatry, 34, 1351–1364.

Shallice, T. (1988). *From neuropsychology to mental structure.* Cambridge: Cambridge University Press.

Sigman, M. & Ungerer, J. (1984). *Cognitive and language skills in autistic, mentally retarded, and normal children.* Developmental Psychology, 20, 293-302.

Sigman, M., Ungerer, J. A., Mundy, P., & Sherman, T. (1987). *Cognition in autistic children.* In D. J. Cohen, A. M. Donnellan& R. Paul (Eds.). Handbook of autism and pervasive developmental disorders (pp. 103-120). New York: Wiley.

Sorby, S. A., & Baartmans, B. J. (2000). *The development and assessment of a course for enhancing the 3-D spatial visualization skills of first year engineering students.* Journal of Engineering Education, 89(3), 301-307.

Sorby, S. A., Leopold, C., & Gorska, R. (1999). *Cross-cultural comparisons of gender differences in the spatial skills of engineering students.* Journal of Women and Minorities in Science and Engineering, 5, 279-291.

Stern, D. N. (1985). *The interpersonal world of the human infant.* NY: Basic Books.

Strum, H., Fernell, E., & Gillberg, C. (2004). *Autism spectrum disorders in children with normal intellectual levels: Associated impairments and subgroups.* Developmental Medicine & Child Neurology, 46, 444-447.

Stewart, Mary, E. Watson, J., Allcock, Ashlie-Jane., & Yaqoob, Talat. (2011). *Autistic traits predict performance on block design task.* Journal of autism, 29(4), 110-119.

Sulloway, Frank. J. (2009). *Birth Order and Intelligence.* Science Vol. 316, 5832 pp. 1711-1712 DOI: 10.1126/science.1144749

Tabah, L., & Sutter, J. (1954). *Le niveauintellectuel des enfant d'agescolaire:Cahier. La détermination des aptitudes, l'influence desfacteursconstitutionnels, familiauxètsociaux.* Institute of National d'ÊtudesDémographiques.Paris: Presses Universitaire de France.

Tager-Flusberg, H. (2008). *Autism spectrum disorders: clinical and research frontiers.* Archives of Disorders in Children, 93(6), 518–23.

Tramontana, J. & Stimbert, V. (1970). *Some techniques of behavior modification with the autistic child.* Psychological Reports, 27, 498-515.

Tustin, F. (1994).*Autistic children who are assessed as not brain damaged.* Association of child Psychotherapists, 20, 103-131.

Uzma Ahmed. (2008). *Behavior therapy and its applicability in reduction of maladaptive behavior of autistic children.* Unpublished PhD thesis, University of Karachi, Karachi.

Velandia, W., Grandon, G. M., & Page, E. B. (1978). *Family size, birth order, and intelligence in a large South American sample.* American Educational Research Journal, 15, 399-416.

Volkmar, F., & Klin, A. (2005). *Diagnosis and classification.* In F. R. Volkmar, R. Paul, Klin, & D. Cohen (Eds.) Handbook of autism and pervasive developmental disorders (3rd ed.; pp. 5-41). Hoboken, NJ: John Wiley & Sons, Inc.

Vountela, V., Rama, P., Raninen, A., Aronen, H. J. & Carlson, S. (1999). *Selective interference reveals dissociation between memory for location & color.* NeuroReport, 10, 2235-2240.

Voyer, Daniel, Susan, Bryden, Philip, M. (1995). *Magnitude of gender differences in spatial abilities: A meta-analysis and consideration of critical variables.* Psychological Bulletin, 117(2), 250-270.

Vasta, R., Knott, J. A., & Gaze, C. E. (1996). *Can spatial training erase the gender differences on the water-level task?* Psychology of Women Quarterly, 20, 549-567.

Wechsler, D. (1974). *Manual of the Wechsler Intelligence Scale for Children-Revised.* New York, Psychological Corporation.

Weiss, E.M. (2003). *Sex differences in cognitive functions.* Personality & Individual Differences, 35, 863-875.

Wichman, Aaron L., Rodgers, Joseph Lee., & MacCallum Robert C. (2006). *Birth Order Has No Effect on Intelligence.* Personality and social psychology bulletin, 33 , 9, 1195-1200.

Wimmer, H., & Perner, J. (1983). *Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception.* Cognition, 13, 103-128.

Wood, D. (1997). *Autism- Part I.* Harvard Mental Health Letter, 13 (9), pp. 1-5.

World Health Organization. (2007). *Manual of the international statistical classification of diseases (ICD-10).* Geneva: Author.

Zajonc, R. B. & Markus, G. B. (1975). *Birth order and intellectual development.* Psychological Society, 82, 74-88.

Zajonc, R. B. (2001). *The Family Dynamics of Intellectual Development.* American Psychologist, 56(6/7), 490-496.

APPENDIXES

Appendix A

Demographical Data Sheet

Please fill in the following information

Name: ______________________________

Gender: ______________________________

Age: ______________________________

Number of siblings: ______________________________

Birth-order: ______________________________

Appendix B

Diagnostic Criteria for 299.00 Autism

Must meet criteria 1, 2, and 3:

(1) Clinically significant, persistent deficits in social communication and interactions, as manifested by all of the following:

(a) Marked deficits in nonverbal and verbal communication used for social interactions
(b) Lack of social reciprocity
(c) Failure to develop and maintain peer relationships appropriate to developmental level

(2) Restricted, repetitive patterns of behavior, interests, and activities as manifested by 2 of the following:

(a) stereotyped motor or verbal behaviors, or unusual sensory behaviors,
(b) Excessive adherence to routines and ritualized patterns of behavior; and/or
(c) Restricted, fixated interests

(3) Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities)

Appendix C

CHILDHOOD AUTISM RATING SCALE (CARS)

Institute of Clinical Psychology
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Karachi-75290, Pakistan.

C·A·R·S

The Childhood Autism Rating Scale

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

Published by
WPS WESTERN PSYCHOLOGICAL SERVICES
Publishers and Distributors
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

15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60

Non-Autistic | Mildly-Moderately Autistic | Severely

• CARS Rating Sheet •

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

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.

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.

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.

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:

II. IMITATION

Appropriate imitation • The child can imitate sounds, words, and movements which are appropriate for his or her skill level.

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.

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.

Severely abnormal imitation • The child rarely or never imitates sounds, words, or movements even with prodding and assistance from the adult.

Observations:

III. EMOTIONAL RESPONSE

1 **Age-appropriate and situation-appropriate emotional responses** • The ch shows the appropriate type and degree of emotional response as indicated by a c in facial expression, posture, and manner.

1.5

2 **Mildly abnormal emotional responses** • The child occasionally displays a som what inappropriate type or degree of emotional reactions. Reactions are sometim unrelated to the objects or events surrounding them.

2.5

3 **Moderately abnormal emotional responses** • The child shows definite sign inappropriate type and/or degree of emotional response. Reactions may be quite i hibited or excessive and unrelated to the situation; may grimace, laugh, or becom rigid even though no apparent emotion-producing objects or events are present.

3.5

4 **Severely abnormal emotional responses** • Responses are seldom appropriate the situation; once the child gets in a certain mood, it is very difficult to change th mood. Conversely, the child may show wildly different emotions when nothing h changed.

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 mo unusual movements.

2.5

3 **Moderately abnormal body use** • Behaviors that are clearly strange or unusual f a child of this age may include strange finger movements, peculiar finger or body po turing, staring or picking at the body, self-directed aggression, rocking, spinning, fin 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

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.

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).

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.

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

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.

Mildly abnormal adaptation to change • When an adult tries to change tasks the child may continue the same activity or use the same materials.

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.

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

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.

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.

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.

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.

VIII. LISTENING RESPONSE

1 **Age appropriate listening response** • The child's listening behavior is normal appropriate for age. Listening is used together with other senses.

1.5

2 **Mildly abnormal listening response** • There may be some lack of response, c mild overreaction to certain sounds. Responses to sounds may be delayed, and so 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 v 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 underre 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 c 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 chi may persist in putting objects in his or her mouth; may smell or taste inedible objec may ignore or overreact to mild pain that a normal child would express as discomfo

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 chi is preoccupied with smelling, tasting, or feeling objects more for the sensation than 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 which other children of the same age avoid.

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 [illegible] to get him or her to move about.
3.5	
4	Severely abnormal activity level • The child exhibits extremes of activity or [illegible] tivity 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 [illegible] 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 [illegible] mal 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	

Appendix D

Starting and Discontinuing Rules WISC-R (Weschler, 1974)

Starting Rules

Directions for staring each test are given in manual (WISC-R; 1974) and are also indicated on the Record Form. With Similarities, Object Assembly, Comprehension, and Digit Span, the examiner begins with Item 1 for all children. With Coding either coding A or Coding B could be administered depending upon the child's chronological age. For the remaining three verbal and four performance tests, the examiner is instructed to begin at different points in the sequence of items, depending on the child's age and estimated level of ability. Children who are below age 8, and older children suspected of mental deficiency, always begin with Item 1 on these tests. In examining the emotionally disturbed or other atypical child, it is often advisable to start the test with Item 1 even if there is no suspicious of mental deficiency.

The general procedures for older children, not suspected of mental deficiency, are given below.

Verbal Tests (Information, Arithmetic, Vocabulary)

- For normal children aged 8 -10 years, 11-13 years, and 14-16 years, begin at the specified point in the item sequence. (For the information test, for example, the starting points are items 5, 7, and 11, respectively.)
- If a child aged 8-16 obtains perfect scores on the first two items he/she is administered, give him/her full credit for all earlier items.
- If he does not earn perfect scores on his/her first two items, administer the earlier items in reverse sequence until he obtains two consecutive perfect scores (not continuing the starting-point item).

- When this criterion is reached, give him full credit for any early items that did not have to be administered. Then, proceed with the test until the discontinuing criterion is met.
- Exception: Arithmetic Items 1-4 are always administered in the order 1,2,3,4, since the reverse order would be illogical in terms of item content.

Performance Tests (Picture completion, Picture arrangement, Block Design, Mazes)

- For normal children aged 8-16, start at the specified item
- If a child aged 8-16 obtains a perfect score on the first item he is administered, give him full credit for all earlier items.
- If he does not earn a perfect score on his first item, go back to Item 1 and administer all earlier items before proceeding with the test.
- Exceptions; With Picture Completion, perfect scores must be earned on two items (cards 5 and 6). With Mazes, if the child obtains a score of 0 on his first maze, demonstrate the Sample Maze before administrating Maze 1.

Note that for the three Verbal tests, the child who does not obtain perfect scores on his first two items is given the earlier items in reverse sequence. This spares the older child the embarrassment of going from an advanced question (such as Item 11 or Item 12 on information) to an elementary question ("What do you call this finger?"). For the four Performance tests, returning to Item 1 should present no problem, since the starting points for these tests are not very far into the item sequence.

For Information, Picture Completion, Arithmetic, and Vocabulary, if the child receives less than a perfect score on the first of his two starting items, the examiner should return directly to the earlier items. For Picture Arrangement and Block Design, however, if the child fails the first trail of his starting item, the second trail should be administered before going back to Item 1.

If the examiner is unsure of the scoring of an item, and unable to decide quickly whether to administer earlier items or move on to more difficult ones, he should give the earlier items until he is certain that the criterion has been met. If subsequent scoring of the test reveals that some of the earlier items were administered unnecessarily, the child should be given full credit for these items-even if he earned partial or no credit. This rule, which applies only to normal children aged 8 and above (not to children aged 6-7, or older children suspected of mental deficiency), was followed when scoring standardization cases.

Discontinue Rules

The directions for discontinuing each test are provided on the Record Form as well as in manual (WISC-R; 1974). The criterion for all tests except Object Assembly and Coding is a certain number of consecutive failures.

The word "failure", whenever it is used in manual (WISC; 1974), refers to a score of zero. A child who achieves partial credit on a multi-point item is considered as having "passed" that item. With Picture Arrangement, Block Design and Digit Span, an item is considered "failed" only if both trails are failed.

If the examiner is unsure of the scoring of an item, and cannot determine quickly whether to discontinue a test, he may give additional items until he is certain that the criterion for discontinuing has been met. If, in a subsequent review of his scoring, he finds that a child was given one or more items beyond the point at which testing should have ended, he should record a score of 0 for each such item-even if the child gave a response that would ordinarily earn credit. (This procedure was followed when scoring the standardization cases.)

SIMILARITIES (Subtest WISC) SCORING CRITERIA

ITEMS 1-4

1 Point for each correct response. Sample responses are given in the manual (WISC; 1974)

ITEM 5-17

Each item is scored 2, 1, or 0, (consult the general scoring principles and the illustrative sample answers)

GENERAL SCORING PRINCIPLES

2 points- any general classification which is primarily pertinent for both members of the pair (e.g., "Beer and wine are alcoholic beverages," "An apple and a banana are fruits") points-any specific properties or functions which are common to both and constitute a relevant similarity. Also give 1 point to less pertinent, but correct, general classifications (e.g., "Beer and wine are drinks," " An apple and a banana are foods"). 0 points- specific properties of each member of the pair, generalizations which are incorrect or not pertinent, differences between the members of the pair, or clearly wrong responses.

The degree of abstraction of the child's response is an important determinant of his score on Items 5-17. That is why pertinent general categorizations are given 2 points, while the naming of one or more common properties or functions of the members of a pair (a more concrete problem-solving approach) merits only 1 point. Thus, stating that a pound and a yard (Item 10) are "Both measures" (their general category) earns a higher score than saying "You can measure with them" (a main function of each).

Similarly, calling anger and joy (Item 11) "Feelings" or Emotions" is less concrete (and hence worth a higher score) than "The way you feel."

Of course, even a relatively concrete approach to solving the items requires the child to abstract something similar about the members of the pair. Some children are unable to do this, and may respond to each member separately rather than to the pair as a whole. Although such a response is a true statement, it is scored 0 because it does not give a similarity.

If the child gives multiple acceptable responses, score his best response. If he gives differences or wrong answers in addition to some correct responses, ask, Now which one is it? And score according to his decision. Spontaneous improvement of responses is easily recognized and a query is not necessary. Added remarks obviously not a part of child's answer do not enter into the scoring.

Appendix F

VOCABULARY (Subtest of WISC) SCORING CRITERIA

Each word is scored 2, 1 or 0. (Consult the general scoring principles and the sample answers).

In general, any recognized meaning of the word is acceptable, disregarding of the elegance of expression. However, poverty of content is penalized to some extent; if the child indicates only a vague knowledge of what the word means, he does not earn full credit.

GENERAL SCORING PRINCIPLES

2 points

1. A good synonym ("A hat is a cap,' "join means unite,' "Brave means courageous").
2. A major use ("A knife is for cutting," "An umbrella keeps the rain off you").
3. One or more definitive features or primary features of objects ("A clock has hands that move around on a dial").
4. A general classification to which the words belongs ("A donkey is an animal").
5. A correct figurative use of the word ("Procrastination is the thief of time").
6. Several less definitive but correct descriptive features which cumulatively indicates the understanding of the word ("A bicycle has wheels and pedals", "A nail is thin, pointy at the end and is made of metal").
7. Verbs: A definitive example of action or a causal relation ("You clock a horse to see how fast he can run," You can join pieces of paper with glue").

1 Point

In general, a response which is not incorrect but shows poverty of content.

1. A vague or less pertinent synonym ("A donkey is something like a horse," A fable is a proverb," "Hazardous means poisonous").

2. A minor use, not elaborated ("A knife is to eat with," "An umbrella is to keep off the sun").
3. An attribute which is correct but not definitive or not a distinguishing features ("A clock has hands," A nail is for hammering," "A diamond goes in a ring").
4. An example using the word itself, not elaborated ("Join the army," "Gamble money").
5. A concrete instance of the word, not elaborated ("Brave means you fight a bear," "Nuisance is when your kid brother won't leave you alone").
6. A correct definition of a related form of the word (defining "gambler" instead of "gamble," selection" instead of "seclude," "spy" instead of "espionage").

0 point

1. Obviously wrong answers.
2. Verbalisms ("Alphabet soup," " A brave man"), when no real understanding is shown after inquiry.
3. Not totally incorrect responses, but ones which, even after questioning, are very vague or trivial or show great poverty of content (" A bicycle has a seat," "A belfry is real high).

To help further in the scoring, sample answers are given below each word. Needless to say, these lists contain only a few of the many possible responses. TO illustrate the scoring principles, samples of relatively inferior replies- rather than clearly creditable ones- have been given in many cases. Thus, the 2-point samples tend to be among the poorest obtained which still deserve a score of 2, and the 0-point and 1-point response are often marginal ones.

MAXIMUM SCORE: 64 points

Appendix G

COMPREHENSION (Subtest WISC) SCORING CRITERIA

Each word is scored 2, 1 or 0 of the responses, depending on the degree of understanding expressed and the quality of the response. In some cases the scoring will be fairly obvious; in others it may be difficult. The examiner should match the child's response against the general criteria and the sample answers given in manual for each question. The examiner will undoubtedly find unusual responses which are not covered below, as no attempt has been made to include all possible replies. In these instances he will have to use his own judgment. Most of the 0-point examples given typify marginal responses; those which contain evidence of some understanding may be queried in the neutral manner prescribed on page 96 of the manual.

When scoring the items which require two correct responses for full credit.

MAXIMUM SCORE: 34 points

The examiner should be particularly careful. In order to receive 2 points, the child has to express at least two of the general ideas which are indicated. If he gives two answers, both of which express the same idea he receives only 1 point.

Appendix H

Wechsler Intelligence Scales for Children- Revised
(WISC-R)
RECORD FORM

WISC-R RECORD FORM

Wechsler Intelligence Scale for Children—Revised

NAME ____________ ____________ AGE ______ SEX ______

ADDRESS ____________________________

PARENT'S NAME ____________________________

SCHOOL ____________________ GRADE ______

PLACE OF TESTING ____________________ TESTED BY ______

REFERRED BY ____________________________

WISC-R PROFILE

linicians who wish to draw a profile should first transfer the child's *scaled scores* to the row of boxes elow. Then mark an X on the dot corresponding to the scaled score for each test, and draw a line nnecting the X's.*

Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score	Picture Completion	Picture Arrangement	Block Design	Object Assembly	Coding	Mazes	Scaled Score
	VERBAL TESTS							PERFORMANCE TESTS						
19							19							19
18							18							18
17							17							17
16							16							16
15							15							15
14							14							14
13							13							13
12							12							12
11							11							11
10							10							10
9							9							9
8							8							8
7							7							7
6							6							6
5							5							5
4							4							4
3							3							3
2							2							2
1							1							1

Chapter 4 in the manual for a discussion of the significance of differences between scores on the tests.

ES

	Year	Month	Day
Date Tested			
Date of Birth			
Age			

	Raw Score	Scaled Score
VERBAL TESTS		
Information		
Similarities		
Arithmetic		
Vocabulary		
Comprehension		
(Digit Span)	( )	( )
Verbal Score		
PERFORMANCE TESTS		
Picture Completion		
Picture Arrangement		
Block Design		
Object Assembly		
Coding		
(Mazes)	( )	( )
Performance Score		

	Scaled Score	IQ
Verbal Score		
Performance Score		
Full Scale Score		

*Prorated from 4 tests, if necessary.

1. INFORMATION

Discontinue after 5 consecutive failures.

		Score 1 or 0
	1. Finger	
	2. Ears	
	3. Legs	
	4. Boil	
8-10 yrs.	5. Nickel	
	6. Cow	
11-13 yrs.	7. Week	
	8. March	
	9. Bacon	
	10. Dozen	
14-16 yrs.	11. Seasons	
	12. America	
	13. Stomach	
	14. Sun	
	15 Leap Year	
	16. Bulb	
	17. 1776	
	18. Oil	
	19. Border	
	20. Ton	
	21. Chile	
	22. Glass	
	23. Greece	
	24. Tall	
	25. Barometer	
	26. Rust	
	27. Los Angeles	
	28. Hieroglyphics	
	29. Darwin	
	30. Turpentine	
		Max.=30
	Total	

2. PICTURE COMPLETION

Discontinue after 4 consecutive failures.

		Score 1 or 0		Score 1 or 0
	1. Comb		14. Playing Card	
	2. Woman		15. Girl Running	
	3. Fox		16. Coat	
	4. Hand		17. Boy	
8-16 yrs.	5. Cat		18. Scissors	
	6. Mirror		19. Girl	
	7. Clock		20. Screw	
	8. Elephant		21. Cow	
	9. Ladder		22. Thermometer	
	10. Dresser		23. House	
	11. Belt		24. Telephone	
	12. Man		25. Profile	
	13. Door		26. Umbrella	
				Max.=26
			Total	

3. SIMILARITIES

Discontinue after 3 consecutive failures.

	Score
	Score 1 or 0
1. Wheel—ball	
2. Candle—lamp	
3. Shirt—hat	
4. Piano—guitar	
	Score 2, 1, or 0
5. Apple—banana	
6. Beer—wine	
7. Cat—mouse	
8. Elbow—knee	
9. Telephone—radio	
10. Pound—yard	
11. Anger—joy	
12. Scissors—copper pan	
13. Mountain—lake	
14. Liberty—justice	
15. First—last	
*16. The numbers 49 and 121	
17. Salt—water	
	Max. =30
Total	

*If the child gives a 1-point response to Item 16, say, "How else are the numbers 49 and 121 alike?"

4. PICTURE ARRANGEMENT

Discontinue after 3 consecutive failures.

Arrangement		Time	Order	Score (Circle the appropriate score for each item.)
Scale (SAMPLE)				
1. Fight	45″	1 / 2		0 · 1 OUT · 2 OUT
2. Picnic	45″	1 / 2		0 · 1 DOG · 2 DOG
16 yrs.* ➤ 3. Fire	45″	1 / 2		0 · 1 FIRE · 2 FIRE
4. Plank	45″	1 / 2		0 · 1 WALK · 2 WALK
5. Burglar	45″			0 · [16-45] 3 · [11-15] 4 · [1-10] 5 · THUG
6. Sleeper	45″			0 · [16-45] 3 · [11-15] 4 · [1-10] 5 · RUSH
7. Artist	45″			0 · [16-45] 3 · [11-15] 4 · [1-10] 5 · VAMP
8. Lasso	45″			0 · [16-45] 3 · [11-15] 4 · [1-10] 5 · CASH
9. Boat	60″			0 · 2 HCASE · [21-60] 3 · [11-20] 4 · [1-10] 5 · CHASE
10. Gardener	60″			0 · 2 WROMS · [26-60] 3 · [16-25] 4 · [1-15] 5 · WORMS
11. Bench	60″			0 · 2 BECHN · [26-60] 3 · [16-25] 4 · [1-15] 5 · BENCH
12. Rain	60″			0 · 2 COLUD · [26-60] 3 · [16-25] [illegible] · [1-15] 5 · CLOUD

*Give Sample item first.

Max.=48

Total

5. ARITHMETIC

Discontinue after 3 consecutive failures.

Problem	Response	Score 1 or 0
1. 30″		
*2. 30″		
*3. 30″		
4. 30″		
10 yrs. ➤ 5. 30″		
6. 30″		
7. 30″		
13 yrs. ➤ 8. 30″		
9. 30″		
16 yrs. ➤ 10. 30″		
11. 30″		
12. 30″		
13. 30″		
14. 45″		
15. 45″		
16. 75″		
17. 75″		
18. 75″		

*Problems 2 and 3 are given ½ point each if child makes error but corrects it within time limit.
†Round half-scores upward.

Max.=18†

Total

6. BLOCK DESIGN

Discontinue after 2 consecutive failures.

Design		Time	Pass-Fail	Score (Circle the appropriate score for each design.)
1.	45″	1 / 2		0 · 1 · 2
2.	45″	1 / 2		0 · 1 · 2
8-16 yrs. ➤ 3.	45″	1 / 2		0 · 1 · 2
4.	45″			0 · [21-45] 4 · [16-20] 5 · [11-15] 6 · [1-10] 7
5.	75″			0 · [21-75] 4 · [16-20] 5 · [11-15] 6 · [1-10] 7
6.	75″			0 · [21-75] 4 · [16-20] 5 · [11-15] 6 · [1-10] 7
7.	75″			0 · [21-75] 4 · [16-20] 5 · [11-15] 6 · [1-10] 7
8.	75″			0 · [26-75] 4 · [21-25] 5 · [16-20] 6 · [1-15] 7
9.	120″			0 · [56-120] 4 · [36-55] 5 · [26-35] 6 · [1-25] 7
10.	120″			0 · [76-120] 4 · [56-75] 5 · [41-55] 6 · [1-40] 7
11.	120″			0 · [61-120] 4 · [56-60] 5 · [41-55] 6 · [1-40] 7

Max. 62

Total

7. VOCABULARY Discontinue after 5 consecutive failures.	Score 2, 1, or 0
1. Knife	
2. Umbrella	
3. Clock	
4. Hat	
5. Bicycle	
6. Nail	
7. Alphabet	
8. Donkey	
9. Thief	
10. Join	
11. Brave	
12. Diamond	
13. Gamble	
14. Nonsense	
15. Prevent	
16. Contagious	
17. Nuisance	
18. Fable	
19. Hazardous	
20. Migrate	
21. Stanza	
22. Seclude	
23. Mantis	
24. Espionage	
25. Belfry	
26. Rivalry	
27. Amendment	
28. Compel	
29. Affliction	
30. Obliterate	
31. Imminent	
32. Dilatory	
Total	Max.=64

8. OBJECT ASSEMBLY Give entire test to all children.

Object	Time	Enter Number of Correctly Joined Cuts	Multiply by	Score (Circle the appropriate score for each item.)
Apple (SAMPLE)				
1. Girl 120"		(0-6)	1	0 1 2 3 4 5 [31-120: 6, 21-30: 7, 1-20: 8 — PERFECT ASSEMBLY]
2. Horse 150"		(0-5)	1	0 1 2 3 4 [36-150: 5, 21-35: 6, 16-20: 7, 1-15: 8 — PERFECT ASSEMBLY]
3. Car 150"		(0-9)	½*	0 1 2 3 4 [51-150: 5, 36-50: 6, 26-35: 7, 1-25: 8 — PERFECT ASSEMBLY]
4. Face 180"		(0-12)	½*	0 1 2 3 4 5 [76-180: 6, 51-75: 7, 36-50: 8, 1-35: 9 — PERFECT ASSEMBLY]

*Round half-scores upward.

Total | Max.=33

9. COMPREHENSION Discontinue after 4 consecutive failures.

Item	Score 2, 1, or 0
1. Cut finger	
2. Find wallet	
*3. Smoke	
*4. Policemen	
5. Lose ball	
6. Fight	
*7. Build house	
*8. License plates	
*9. Criminals	
10. Stamps	
11. Inspect meat	
*12. Charity	
13. Secret ballot	
*14. Paperbacks	
15. Promise	
*16. Cotton	
*17. Senators	

*If the child replies with only one idea, ask him for a second response. Rephrase the test item appropriately, saying, "Tell me another thing to do (reason why, advantage of)...."

Total | Max.=34

10. CODING

	Time	Score
A (for children under 8) 120"		(0-50)
B (for children 8 & older) 120"		(0-93)

[redacted]

11. DIGIT SPAN (Optional)

Discontinue after failure on *both trials* of any item. Administer *both trials* of each item, even if child passes first trial.

DIGITS FORWARD

	Trial 1	Pass-Fail	Trial 2	Pass-Fail	Score 2, 1, or 0
1.	3-8-6		6-1-2		
2.	3-4-1-7		6-1-5-8		
3.	8-4-2-3-9		5-2-1-8-6		
4.	3-8-9-1-7-4		7-9-6-4-8-3		
5.	5-1-7-4-2-3-8		9-8-5-2-1-6-3		
6.	1-6-4-5-9-7-6-3		2-9-7-6-3-1-5-4		
7.	5-3-8-7-1-2-4-6-9		4-2-6-9-1-7-8-3-5		

Total Forward: ____ Max.=14

Administer DIGITS BACKWARD even if child scores 0 on DIGITS FORWARD.

DIGITS BACKWARD

	Trial 1	Pass-Fail	Trial 2	Pass-Fail	Score 2, 1, or 0
1.	2-5		6-3		
2.	5-7-4		2-5-9		
3.	7-2-9-6		8-4-9-3		
4.	4-1-3-5-7		9-7-8-5-2		
5.	1-6-5-2-9-8		3-6-7-1-9-4		
6.	8-5-9-2-3-4-2		4-5-7-9-2-8-1		
7.	6-9-1-6-3-2-5-8		3-1-7-9-5-4-8-2		

Total Backward: ____ Max.=14

____ + ____ = ____ Max.=28
Forward Backward Total

12. MAZES (Optional)

Discontinue after 2 consecutive failures.

8-16 yrs.

Maze	Maximum Errors	Errors	Score (Circle the appropriate score for each maze.)					
SAMPLE								
1. 30"	1		0	1 Error 1	0 Errors 2			
2. 30"	1		0	1 Error 1	0 Errors 2			
3. 30"	1		0	1 Error 1	0 Errors 2			
4. 30"	2		0	2 Errors 1	1 Error 2	0 Errors 3		
5. 45"	2		0	2 Errors 1	1 Error 2	0 Errors 3		
6. 60"	3		0	3 Errors 1	2 Errors 2	1 Error 3	0 Errors 4	
7. 120"	3		0	3 Errors 1	2 Errors 2	1 Error 3	0 Errors 4	
8. 120"	4		0	4 Errors 1	3 Errors 2	2 Errors 3	1 Error 4	0 Errors 5
9. 150"	4		0	4 Errors 1	3 Errors 2	2 Errors 3	1 Error 4	0 Errors 5

Total: ____ Max.=30

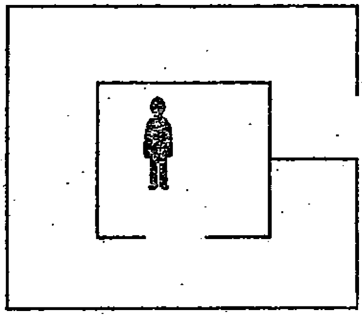
WISC-R

MAZES
CODING

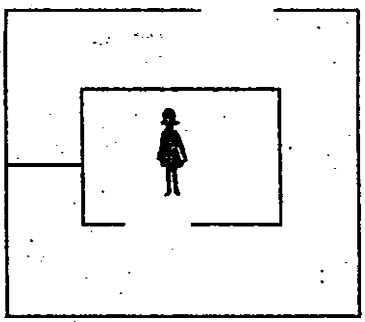
NAME ____

EXAMINER ______________________ DATE ______________

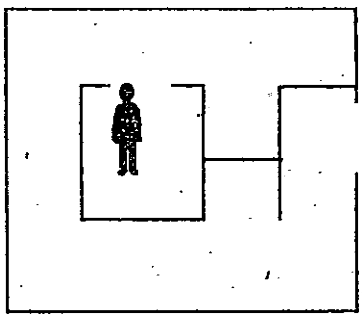
SAMPLE



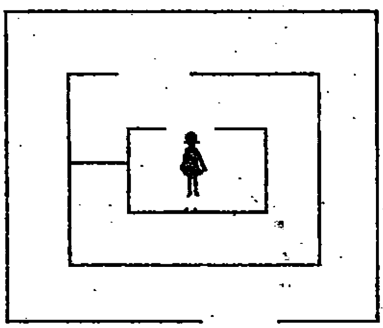
1



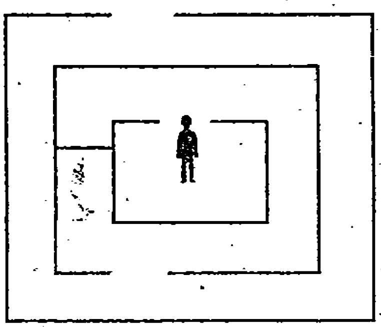
2



3



4



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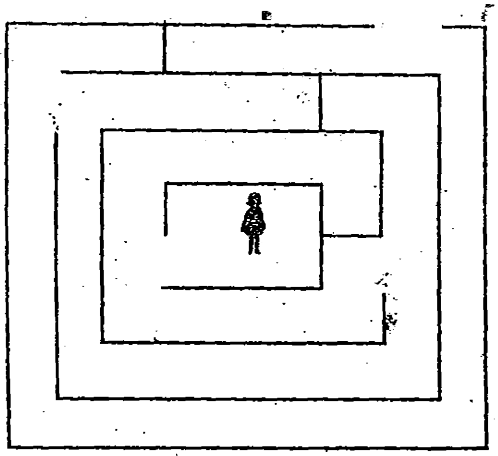

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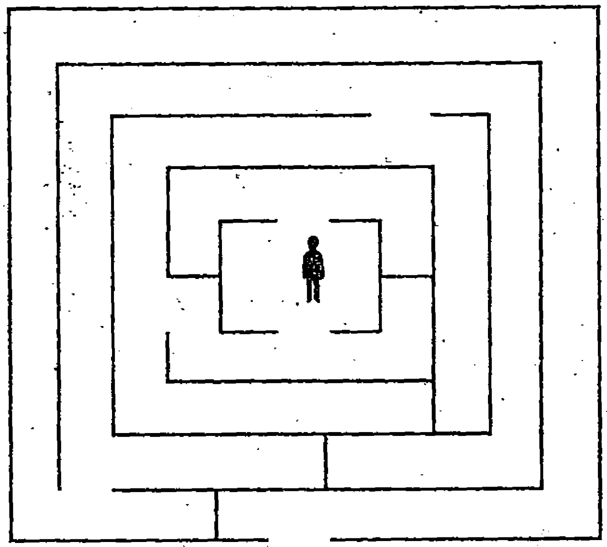

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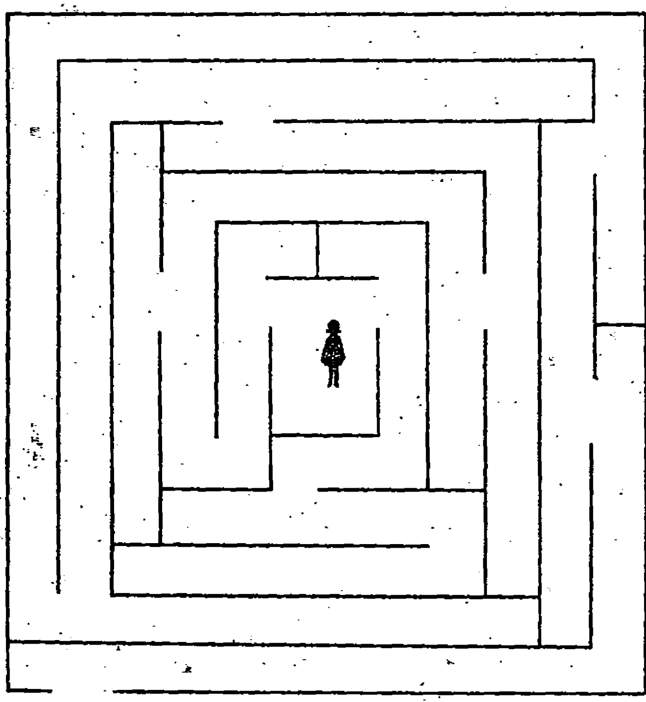

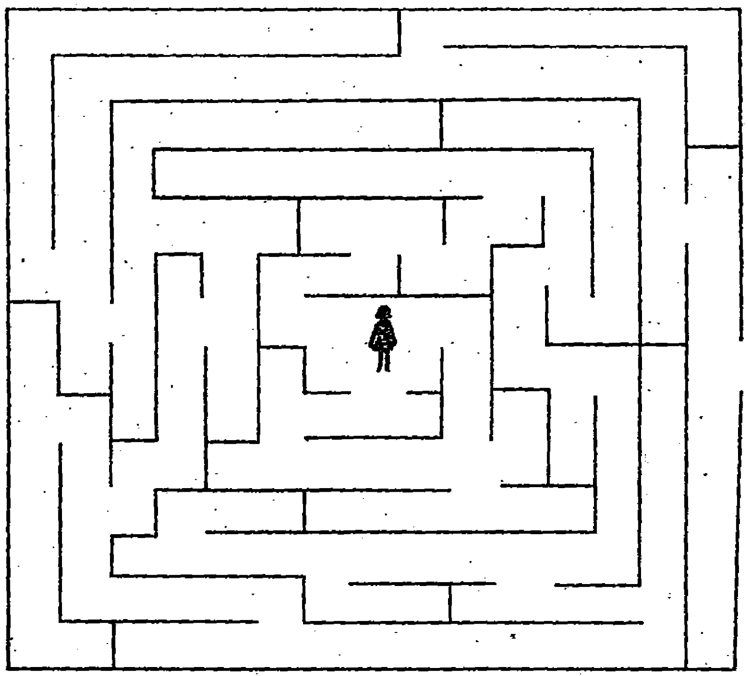

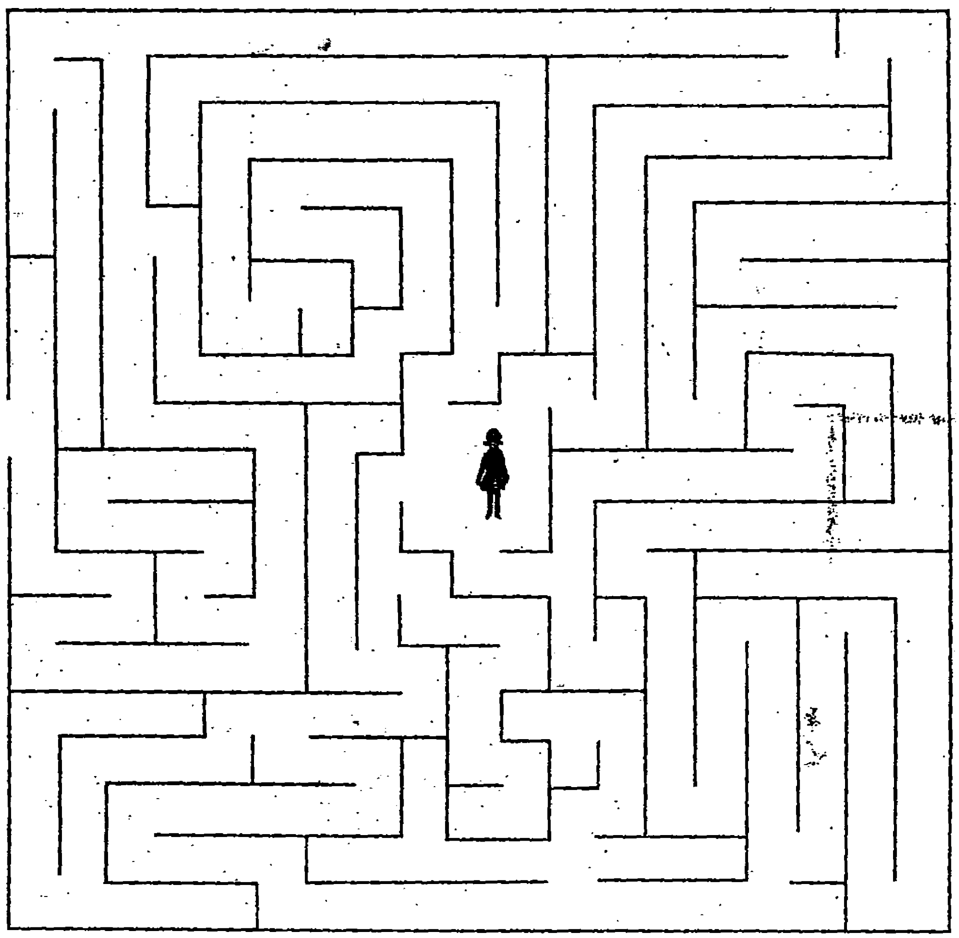

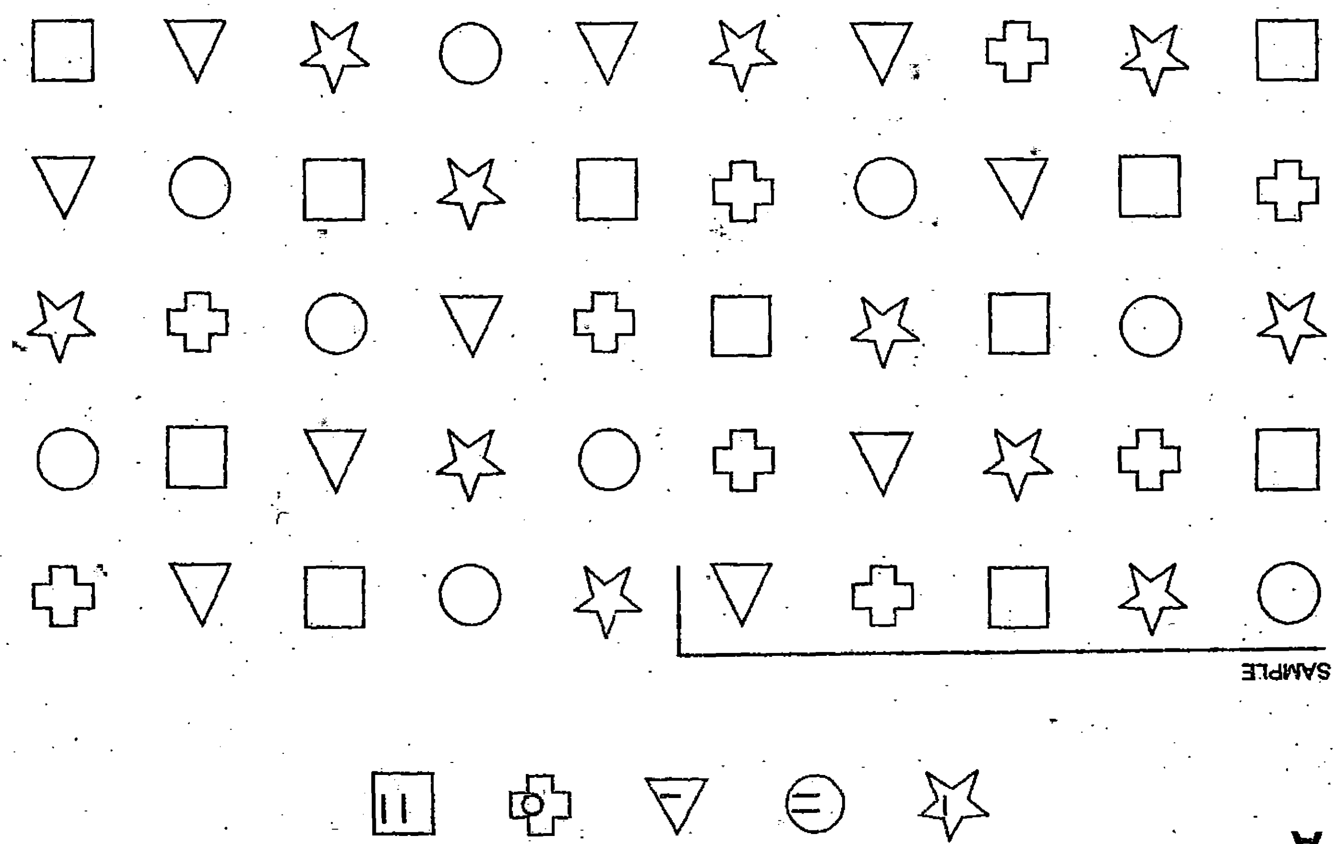

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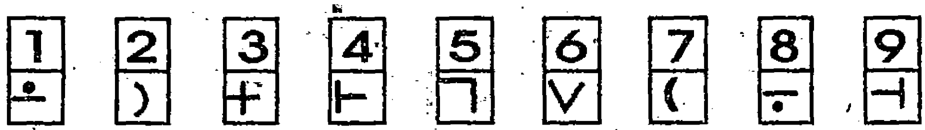

SAMPLE

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