"THEORY OF MIND" AND
THE NONVERBAL LEARNING DISABILITY SYNDROME:
ANALYSIS OF CASE STUDIES

By

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A thesis submitted in conformity with the requirements
for the degree of Master of Arts
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Dedicated to Dr. Kenneth Schwartz
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ABSTRACT

We assessed 5 children on Theory of Mind, nonverbal abilities, and intellectual functioning tasks. Three of the children who were identified as having a Nonverbal Learning Disability syndrome (NLD) demonstrated impairment on higher order Theory of Mind (ToM) tasks and on nonverbal tasks even though their verbal skills were in the average to superior range. Results are discussed in terms of the relationship between nonverbal abilities, Central Drive for Coherence, and Theory of Mind, as well as the role of the right cerebral hemisphere as one of the potential, common mediating structures for these functions.
"THEORY OF MIND" AND
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CHAPTER 1: INTRODUCTION

Although not well understood (Little, 1993), psychosocial deficits in the Nonverbal Learning Disability syndrome (NLD) are reported to render the individual at particular risk for depression and suicide (Rourke, 1989). Recent advancements in the appreciation of children's normal development of social understanding is reflected in the theory that children's social development is based on their learning of a series of social concepts collectively termed a "theory of mind". Without the development of a "theory of mind" individuals would be at a loss in their social lives because theory of mind underlies all interpersonal relations, and pragmatic language and social abilities.

Normal development of a theory of mind is crucial for the future of the child's functioning in the social world. Without a "theory of mind" we would be unable to "read between the lines", understand hidden intentions and motives, or understand lies and jokes; we would not be able to effectively engage in meaningful social discourse and social interactions. We hypothesized that individuals with NLD have deficits in their theory of mind abilities. These deficits could be associated with their failure in establishing interpersonal relationships and to the social isolation and depression that follows this failure. Individuals with NLD are reported to have impairments in the
following areas: difficulty assessing another person’s emotional state; deficits in the ability to assess social cause-and-effect relationships; attribution of unreasonable, oversimplified causes for the behaviour of others, inability to appreciate humour, to pretend and to anticipate; pragmatic language impairments; and the inability to develop meaningful social interactions (Johnson & Myklebust, 1971; Rourke, 1987, 1989). Research shows that these abilities are dependent upon normal development of a theory of mind (see Astington, Harris, & Olson, 1998). Our hypothesized attribution of theory of mind deficits to individuals with NLD was also intended to demonstrate that such deficits can occur in individuals who demonstrate some linguistic competencies, but whose main problem is in nonverbal learning.
CHAPTER 2: NONVERBAL LEARNING DISABILITY SYNDROME

2.1: Neuropsychology of Nonverbal Learning Disability Syndrome

Characteristics of NLD, which is a subtype of learning disability, were first described by Johnson and Myklebust (1971) as being evident in children who are unable to acquire the ability to determine the significance of basic nonverbal aspects of daily living, even though their verbal intelligence is at or above the average level; who cannot pretend and anticipate; and who fail to learn and appreciate the implications of actions such as gestures, facial expressions, caresses, and other elements of attitude (Myklebust, 1975). According to Rourke (1987), the social impairments of these children leaves them at risk for the development of internalized socio-emotional pathology, including withdrawal, anxiety, and depression that could lead to suicidal behaviors.

Research has shown that individuals with NLD manifest many of the same clinical features associated with adults with right-hemisphere brain damage: disturbances in visuospatial integration, nonverbal memory, attention, and the expression, recognition, and integration of emotion and affective states (Semrud-Clikeman, 1990; Hynd & Willis, 1988; Tranel, Hall, Olson, & Tranel, 1987; Voeller, 1986; Weintraub & Mesulam, 1983). It is reported that the two hemispheres have different processing modes that are involved in different aspects and stages of cognition; the right hemisphere is specialized in intermodal integration and is more adept at processing novel information, whereas the left
hemisphere is better equipped for processing familiar, codable, and modality specific material (Goldberg & Costa, 1981).

Rourke (1987) describes the characteristics of the NLD syndrome, from a neuropsychological perspective, as a “final common pathway” of white matter disease/dysfunction at the level of the cerebral hemispheres. The neuropsychological characteristics observed in children with NLD include: an excellent memory for verbal material and superior word-reading skills; deficits in performance and visuospatial abilities; weaknesses in arithmetic, reading comprehension and concept formation, and difficulties solving nonverbal problems. The deficits observed are thought to be in the abilities and skills that are subserved by systems within the right cerebral hemisphere (Rourke, 1987). Individuals with NLD are hypothesized to have either right hemisphere deficits or difficulty accessing right hemisphereal systems (Gross-Tsur, 1995; Rourke, 1987, 1989; Semrud-Clikeman, 1990; Hynd & Willis, 1988; Tranel, et al., 1987; Voeller, 1986; Weintraub &Mesulam, 1983).

2.2: Relationship Between the Socio-Emotional Difficulties and Neuropsychology of Nonverbal Learning Disability Syndrome

Researchers are still debating whether and why this particular subgroup of learning disability is at a greater risk for internalized psychopathology. Rourke (1987) has hypothesized that the specific configuration of neuropsychological deficits, skills, and abilities in NLD can be the cause of the adaptive difficulties that leave the individual at
risk for depression and suicide. He hypothesizes that these adaptive difficulties are the result of primary psychomotor clumsiness and problems in tactile sensitivity; visual-spatial-organizational deficits; difficulties in dealing with novelty; and problems in intermodal integration. According to Rourke (1987), limitations in the capacity for intermodal integration can cause the following impairments in social development: difficulty assessing another person's emotional state; deficits in the ability to assess social cause-and-effect relationships; and the inability to appreciate humor.
CHAPTER 3: THEORY OF MIND

3.1 Theory of Mind Development in Children

Having an understanding of other people as people who have desires, beliefs and emotions independent from ours and from the state of the world is referred to as having a "theory of mind" (Perner & Wimmer, 1985). Theory of Mind is the ability to attribute mental states, such as intentions, beliefs, desires, emotions etc., to oneself and to others and to understand and predict others’ behavior accordingly (Baron-Cohen, Leslie & Frith, 1985, 1986; Baron-Cohen, 1989a). There is a broad consensus that by the age of 4 or 5, children share with adults basic mental state concepts and view people as mental beings who experience desires and beliefs (representative collections and reviews include Astington, Harris, & Olson, 1988)

Theory of mind is composed of several related conceptual structures. Each of these structures is an important part of the overall ability to understand and predict the behaviour of others. The basic conceptual structures include the ability to understand what it means when a person points at an object, the ability to share attention with another person, and the ability to appropriately attribute a wide variety of mental states such as believing, believing falsely, desiring, thinking and knowing. Collectively, these structures connect to form a working plan of what it means to be a thinking social
creature—a “theory of mind” that is used to understand, describe and predict the behaviour of others (Baron-Cohen et al., 1985).

Children’s acquisition of folk psychological understanding—development of a theory of mind—is based on their discovery that first, the mind contains mental entities—mental representations—that are different from things in the world and second, the mind is active and defines and interprets situations (mental activity) (Astington, 1993). The first discovery is usually achieved by the age of three in normally developing children. At this stage children do not yet have an understanding of mental activity. The second development is achieved by the age of four through children’s acquisition of a ‘representational theory of mind’, at which point they begin to understand that mental entities are representations that are constructed by the mind. Children are then able to understand that people act based on their representations of the world regardless of whether those representations are true or false (misrepresentations) (Astington, 1993).

The capacity to respond to another’s mental state involves making inferences about others’ minds; according to Dennett (1971), it also involves the capacity to represent “propositional attitudes” which are different from but related to “propositional contents”. For example, the statement: “There is a cat in the room” may be a true or false proposition about the state of the world, but the statement: “I think (know, believe, hope, etc) that there is a cat in the room” involves a mental attitude toward that proposition regardless of the truth or falsehood of the statement. The capacity for computations of the prepositional-attitude type seems to appear around 18 months of age, in pretend play
According to Perner (1991), this capacity is progressively generalized to understanding mental state verbs such as believe, think, and know. At about 4 years of age this capacity extends to understanding false-belief; which is revealed through children’s ability to predict others’ behavior based on their misrepresentation of the world (false beliefs) and not on reality (Premack & Woodruff, 1978). A recent flood of empirical research has generated consensus that by at least 4 or 5 years of age, normally developing children can attribute false beliefs to both self and others (e.g., Astington & Gopnik, 1988; Harris, 1991; Leslie, 1988; Perner, 1991; Wellman, 1990).

While false-belief understanding begins to be mastered by age 4 in normally developing children, the ability to make second-order belief attributions develops later, closer to age 6 or 7 (Perner & Wimmer, 1985). Second-order mental state attributions require recursive thinking which is the ability to understand that people have beliefs about others’ beliefs and desires; it is the ability to predict a person’s thoughts about another person’s thoughts, making a ‘second-order attribution’ (attributing a mental state about a mental state), as in the example: John thinks that Mary thinks that...(Perner & Wimmer, 1985).

According to Harris (1989), also at about the age of 6 or 7, children will be able to understand that others feel emotions that are based on their false beliefs about the world. They are able to understand that others can feel different emotions based on the same belief (different desires) and that their emotions can be based on a false belief. This ability too requires recursive thinking; in order to make an accurate prediction of
another's emotion the person's belief and desire have to be linked successfully. Understanding the relationship between false belief and emotion is a slightly later development than understanding how false belief and behavior are related (Harris, 1989).

Wimmer, Gruber & Perner (1984) found that till about the age of six children call all untrue statements lies, regardless of the intentions of the speaker. Leekam (1991), however, showed that four-year-old children can distinguish between a lie and a joke, but it is not until much later that they are able to understand white lie, irony, figure of speech, and sarcasm. These require a higher level (higher-order) of understanding which is dependent on the ability to distinguish between pragmatics and semantics; that is, the ability to distinguish between what the speaker means versus what his or her statement means. Without such ability individuals will have difficulty with the subtleties of language, reading between the lines and, thus, will not be able to effectively engage in meaningful social discourse. Development of higher-order theory of mind allows individuals to understand hidden intentions and motives, to think about things from others' point of view, to be empathic and to develop meaningful social relationships (Astington & Jenkins, 1995).
3.2: Theory of Mind Tasks

There are a series of tasks developed by researchers (e.g. Baron-Cohen, et al., 1985; Happé, 1994; and Perner, Frith, Leslie, & Leekam, 1989) to examine children’s theory of mind. A number of these tasks require the individual to attribute mental states to oneself or to another person, making “first-order attributions” (a mental state about the state of the world) for example, to attribute a false belief and to predict behaviour accordingly. Predicting others’ behaviour based on their false-belief requires the ability to attribute a false-belief to others based on their misrepresentation of the world and to understand that they will act according to this misrepresentation (false-belief) (Premack & Woodruff, 1978). Second-order attribution tasks, which were first developed by Perner and Wimmer (1985) and have since been used with autistic children (Baron-Cohen, 1989b); are considered to be more difficult than the first-order theory of mind tasks. Second-order tasks require recursive thinking which is the ability to understand that people have beliefs about others’ beliefs (Astington, 1993). As such, second-order tasks require the individual to predict a person’s thoughts about another person’s thoughts, making a ‘second-order attribution’. While first-order attribution tasks begin to be mastered by the age of four (e.g., Astington & Gopnik, 1988; Gopnik & Wellman, 1994; Harris, 1991; Perner, 1991; Wellman, 1990) the ability to make second-order belief attributions develops later, closer to age 6 or 7 (Perner & Wimmer, 1985).

As previously pointed out, a still higher level of theory of mind ability is the ability to understand hidden emotions and motives, white-lies, irony, sarcasm and so on.
A set of Strange Stories was designed by Happé (1994), which require not only the ability to perform first-and second-order theory of mind tasks but also, higher-order and more complex theory of mind abilities. These stories describe situations that could occur in everyday life and involve understanding simple motivations for utterances that are not literally true. For example, if a friend asked you for your opinion on a new dress which you thought was ugly you might say it was “nice” to avoid hurting your friend’s feelings, or to be sarcastic or funny. In everyday life we can infer these different motivations using contextual information such as situational context, emotional expression, and tone of speaker. Happé’s stories are unambiguous so that only one interpretation can be made. These stories examine the child’s ability to understand hidden intentions and emotions through understanding of lies, irony, sarcasm and so on. Research shows that it is not until the age of six or seven that children are able to pass such tasks (Wimmer, et. al., 1984; Happé, 1994).
CHAPTER 4: Theory of Mind Deficits in Clinical Populations

4.1: Theory of Mind Deficits in Autism

Deficits in theory of mind are considered to be the cause of social impairments in autism. Autism is a developmental disorder associated with three crucial symptoms: impairments in communication, socialization and imagination (Wing & Gould, 1979). More specifically, autistic children show impairments in their language development and in their ability to communicate; in social relationships leading to their aloneness even when they are surrounded by others; and in spontaneous engagement in pretend play. Individuals with autism are considered to be severely impaired in their acquisition of a folk psychology—the ability to ascribe beliefs and desires to others in order to predict their behavior. Empirical studies show that low functioning autistic individuals generally fail tasks that require a mental state attribution (Perner, Leekam, & Wimmer, 1987; Wimmer & Perner, 1983). Even high-functioning autistic individuals who do pass these tests have been found to be either impaired on more complex, second-order, tests of false-belief understanding or unable to apply those skills to real life situations (Ozonoff, Pennington, & Rogers, 1991; Bowler, 1992).

There are several hypotheses regarding the coexistence of social impairments and success of high functioning autistic individuals on theory of mind tasks. A number of researchers argue that theory of mind abilities are fundamentally related to general
language ability and more specifically to either semantic or syntactic ability (e.g., Astington & Jenkins, 1999; Jenkins & Astington, 1996; Olson, 1988). Based on this view, high-functioning autistic individuals' better performance on false-belief tasks may be related to their higher linguistic capacity. Other researchers link the theory of mind deficits of individuals with autism to their difficulties with pragmatic aspects of communication (Baron-Cohen, 1988; Eisenmajer & Prior, 1991). There is a need for further investigations to find out which aspects of linguistic functioning are most strongly related to theory of mind development: syntactic, semantic or pragmatic abilities.

Baron-Cohen (1992), Leslie, and Thaiss (1992), and Frith (1989) have suggested that autism is caused by a primarily cognitive deficit, which has secondary emotional consequences. Baron-Cohen (1992) believes that social impairments in autism result from a “specific developmental delay” in the area of ‘metarepresentational development’ that underlies normal social development. As such, the emergence of theory of mind is dependent upon the biological maturation of genetically based neurocognitive substrates, such as those underlying metarepresentation and shared attention (Leslie 1987; Leslie & Thaiss 1992; Baron-Cohen & Swettenham, 1996). Metarepresentational development is the general ability to utilize mental representations of hypothetical events, and is seen as having its earliest manifestation in pretend play. Shared attention is the awareness that another person is also paying attention to the same object or event. Still other researchers believe that the maturation of neurocognitive systems may be necessary for the child to be able to capitalize upon social experience, or the experience may be necessary to trigger innate mechanisms (Hobson, 1990).
Based on this view, individuals with autism are severely delayed in their acquisition of theory of mind. Studies show that low functioning autistic individuals generally fail tasks that require a mental state attribution despite having mental ages that generally ensure success in normally developing children (Perner, et al., 1987; Wimmer & Perner, 1983). Even high-functioning autistic individuals who do pass these tests are unable to apply that skill to everyday life (Ozonoff, et al., 1991; Bowler, 1992). Researchers argue that these individuals might not have developed this ability until later than 6-7 years of age which is considered to be the normal age for success on theory of mind tasks, and that an intact theory of mind is necessary by this age in order for normal reciprocal social interaction to develop (Ozonoff, et al., 1991; Bowler, 1992).

Happé (1994), examined the performance of autistic patients on a battery of more naturalistic and complex stories (higher-order Strange Stories). She found that even those autistic individuals who passed all first and second order theory of mind tasks showed impairments on the more naturalistic story materials relative to normal adult controls. According to Happé (1994), one possible reason for this failure is an additional deficit in "central coherence". This refers to the brain’s hypothetical drive for cohesion-a central information processing which integrates separate pieces of information into meaningful wholes (Frith, 1989). In this regard, autistic individuals are hypothesized to have a specific impairment in their central drive for cohesion characterized by their impairment in extracting meaning in context, and a preference for processing local versus global information (Frith, 1989). Autistic individuals’ social and communication problems are, therefore, considered to be the result of not only their inability to attribute accurate
mental states but also to their inability to integrate information. For example, when interacting with others, autistic individuals focus on individual actions and give a literal interpretation to individual statements rather than integrating information taken from the whole situation.

4.2: Theory of Mind Deficits in Schizophrenia

Frith (1992) suggests that individuals with schizophrenia have an impairment in the ability to represent mental states. A number of other researchers have also examined mentalizing ability in individuals with schizophrenia. Corcoran, Mercer, and Frith (1995), for example, demonstrated extremely poor performance on a hinting task by these individuals and argued that this kind of difficulty arises from problems inferring the intentions, thoughts, and beliefs of other people. In a further study, individuals with schizophrenia with negative symptoms were shown to perform poorly on tests designed to tap knowledge of universal conversational rules, demonstrating a specific deficit of “on-line” mentalizing when confronted with situations that required appreciation of another person’s mental state. (Corcoran & Frith, 1996).
4.3: Theory of Mind, the Right Hemisphere, and the Nonverbal Learning Disability Syndrome

Recent advances in developmental social cognition (Leslie, 1987; Baron-Cohen, 1989a; Frith, 1989; Karmiloff-Smith, 1992; Happé, 1994) permit a reconceptualization of the psychosocial deficits seen in NLD in terms of abnormalities in “theory of mind”. There appears to be an association between the kind of social and cognitive impairments found in NLD and the cognitive and social deficits associated with theory of mind impairment. As already described, individuals with NLD are hypothesized to have a right hemisphere deficit and present with the following impairments: difficulty assessing another person’s emotional state; deficits in the ability to assess social cause-and-effect relationships; and an inability to appreciate humor. These are impairments that are also associated with deficits in theory of mind.

Studies show that patients with right-hemisphere Traumatic Brain Injury, and right-hemisphere stroke, demonstrate difficulties on tasks of story integration, joke completion, interpretation of nonliteral utterances, pragmatics, and interpersonal skills. The psychosocial deficits and pragmatic difficulties evidenced in these patients are explained in terms of a loss in ‘theory of mind’ abilities (Happé, Brownell, & Winner, 1999; Winner, Brownell, Happé, Blum, & Pincus, 1998; Siegal, Carrington, & Radel, 1996; Kaplan, Brownell, Jacobs, & Gardner, 1990; Brownell, Michel, Powelson, & Gardner, 1983; Bryan, 1988; Bihrle, Brownell, Powelson, & Gardner, 1986). However, as previously indicated, theory of mind deficits are not specific to right hemisphere damage.
and have been demonstrated in other developmental and psychiatric disorders, i.e., Autism and schizophrenia. Therefore, it remains unclear what the role of the right hemisphere may be with respect to theory of mind abilities.

According to Meltzoff (1999), normal capacity for intermodal integration is important for the beginning of theory of mind development in infancy. Goldberg and Costa (1981) have demonstrated that intermodal integration is a right hemispheric function. Since individuals with NLD have difficulty accessing right hemispheric systems (Rourke, 1989); they are assumed to have impairments in this function. Rourke (1987) suggests that it is this impairment that causes their social and interpersonal problems. This could be what Frith and Happé (1994) refer to as a deficit in central drive for coherence. It is possible that individuals with NLD who have difficulty accessing right hemisphere systems lack this central drive for cohesion and their social and communication problems arise from this same source. Recently, Winner, Brownell, Happé, Blum, and Pincus (1998) demonstrated that patients with primarily right hemisphere damage who present with problems with intermodal integration show deficits in “theory of mind”. It is possible that limitations in the capacity for intermodal integration of individuals with NLD, or as Frith and Happé (1994) put it, their lack of a central drive for coherence, cause deficits in their theory of mind. In turn, their theory of mind deficits and their inability to attribute appropriate mental states may cause the socio-emotional/adaptational problems that lead to their social isolation, depression and their increased risk for suicidal behavior.
4.3.1: The Aim of the Study

The objective of this research was to examine “theory of mind” abilities in individuals with NLD to further the understanding of the nature of their psychosocial deficits. It was hypothesized that children with NLD will show deficits in their “theory of mind” even when their verbal IQ is at or above the average level: it was hypothesized that participants with NLD will be less accurate in answering questions that require a mental state attribution than in answering control questions which do not require such attribution compared to two age-matched, control participants (one typical control with no verbal/nonverbal impairments and one with verbal impairment but no nonverbal impairments); it was further hypothesized that NLD participants will have difficulty with and will perform inferior to controls on a set of higher-order ToM Strange Stories even when they are able to pass control physical stories.

4.3.2 Research Questions

This study attempted to answer the following four questions about theory of mind functioning of children with Nonverbal Learning Disability syndrome:

1. Are children with NLD able to pass First-Order Theory of Mind Tasks?
2. Are children with NLD able to pass Second-Order Theory of Mind Tasks?
3. Are children with NLD able to pass Higher-Order Theory of Mind Tasks?
4. How does age affect the performance of NLD participants on theory of mind tasks?
CHAPTER 5: Method

5.1 Participants

Using a case study approach we compared the performance of five children (MA, JG, ED, ML, and JL) on theory of mind tasks. Three of the children (MA, JG, ED) were identified as having Nonverbal Learning Disability syndrome (NLD) as described by Rourke (1989). Data were also collected from 2 right-handed, 6:11 year old control participants (ML and JL), who were matched as closely as possible to the youngest of the NLD children (MA) for age, sex, grade, and full scale IQ (See Table 1).

| TABLE 1 |

Demographic Information for the Control and NLD Group

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th></th>
<th>NLD</th>
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<tbody>
<tr>
<td>Participants</td>
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<tr>
<td>FIQ</td>
<td>116</td>
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<td>101</td>
</tr>
</tbody>
</table>
5.1.1 Inclusion and Exclusion Criteria

The diagnosis of NLD for MA, ED and JG was based upon the following accepted criteria as outlined by Rourke (1989):

1- Emotional and interpersonal behavioral problems.

2- Impaired visuospatial skills. Verbal IQ (VIQ) significantly higher than Performance IQ (PIQ), and VIQ > 85.

3- Significantly superior reading skills compared to arithmetic skills with reading > 85 and arithmetic < 85.

The inclusion criteria for the verbally impaired control participant ML, included the following:

1. Impaired verbal skills. Preserved visuospatial skills. Performance IQ (PIQ) significantly higher than Verbal IQ (VIQ) and PIQ > 85.

2. Impaired reading skills with reading < 85 and arithmetic skills > 85

JL, the typical control, had to have both Verbal and Performance IQ > 85 with no significant discrepancy. JL's reading and arithmetic scores also had to both be > 85. Exclusion criteria for JL included history of psychiatric illness current or past, neurological disorder, and any symptom indicative of socio-emotional impairment.
5.1.2: Neuropsychological-Academic-and Socio-Emotional Assessments

Neuropsychological, academic and socio-emotional assessments were conducted to clarify the nature of the participants’ current neuropsychological profile and level of socio-emotional functioning. Participants were assessed for socio-emotional functioning using the Child Behavior Checklist-Parents’ Report (CBCL- Achenbach & Edelbrock, 1983); current intellectual functioning using the Wechsler Intelligence Scale for Children-III (WISC-III; Wechsler, 1991); academic functioning using the Wide Range Achievement Test 3- Reading & Arithmetic (WRAT 3- Wilkinson, 1993); and visual-spatial/nonverbal functioning using the Judgment of Line Orientation (JLO; Benton, 1963) and the Test of Nonverbal Intelligence-3 (TONI-3- Brown, Sherbenou, & Johnsen 1997). The WISC-III is a well known measure of intelligence with strong reliability and validity. The WRAT-3 is a measure of single word reading, spelling and arithmetic calculation with acceptable psychometric properties. The JLO is widely used as a pure measure of visual-spatial ability and line orientation and it is well accepted in documenting Right Hemisphere dysfunction. TONI-3 is a measure of visual-spatial, abstract abilities, and nonverbal intelligence with well established validity and reliability.

Neuropsychological and academic achievement measures indicated that MA, JG, and ED met the criteria for the Nonverbal Learning Disability syndrome (NLD) as described by Rourke (1989). MA, JG, and ED were impaired on visual-spatial and nonverbal intelligence tasks (PIQ, WISC-III; JLO; and TONI-3), and scored significantly lower on arithmetic than on reading skills. Furthermore, they presented with average to high average verbal skills (VIQ, WISC-III). JG (the oldest NLD participant) was included
in the comparison in order to examine age as a contributing factor to the failure of the NLD participants on "theory of mind" tasks. ED also had a diagnosis of agenesis of the corpus callosum. ED was specifically selected because of her diagnosis to examine Rourke's hypothesis regarding deficits in children with NLD in "accessing" right hemispheric systems. ED provided a comparison involving a child with an NLD profile and known brain insult implicating the right hemisphere (see Table 2).

5.1.3: Case Descriptions of NLD Participants

MA was a 6:11 year-old right handed boy, who was reported to have difficulty with social interactions. MA's parent reported that MA was getting teased a lot at school. He was reported to have difficulty making friends and a tendency to play by himself. They described his behaviour as often irrelevant and inconsistent with the situation and this was also noted during testing. For example, he manifested verbosity and a tendency to make perseverative comments about objects in the environment. He also talked about topics that were unrelated to the task at hand. His tone of voice was somewhat loud and his affect was flat throughout the testing. His cooperation and attention were fair and rapport was adequately established. The results of his assessment are considered to be valid.

MA's global intellectual functioning was in the average range (FIQ =101) and his verbal IQ (VIQ: 123) was significantly higher (1% level) than his performance IQ (PIQ: 78). Tests of visual-spatial and nonverbal functioning in conjunction with his performance on the WISC-III indicated impaired nonverbal and perceptual organizational
abilities and difficulties in nonverbal intelligence. His vocabulary and verbal comprehension, however, were in the superior range. His perceptual organizational skills seemed impaired as he scored in the borderline range on the perceptual organizational subtests of the WISC-III. MA experienced difficulties on the TONI-3, which are likely due to visual spatial deficits, difficulty processing novel material and deficits in problem-solving abilities. These functions are associated with the right cerebral hemisphere. MA performed within the low average range on the JLO. On the CBCL, two areas fell in the borderline range of clinical concern. These included: withdrawal and anxious/depressed. There was no indication of symptom exaggeration or misinterpretation of the questions, therefore these results were considered valid (see Table 2).

JG was an 11:10 year-old right handed girl, who was reported to be doing poorly in school and was attending grade 6 in a Special Education class. She was reported to have great difficulties with social interaction and did not have any friends. She was also reported to have problems understanding other people's intentions, lies, and jokes. In addition, she was reported to have difficulty recognizing relevant information in a given context. This was also noted during testing. For example, she was very talkative but made little eye contact and was distracted by the objects in her environment. Rapport was adequately established and she cooperated throughout the testing. She was alert and fairly attentive throughout the testing and her results were considered to be valid.

JG’s global intellectual functioning was in the low average range (FIQ = 87), and she presented with a significant discrepancy (1% level) between her verbal IQ (VIQ: 111)
and her performance IQ (PIQ: 68). She scored within the severely impaired range on measures of visual-spatial and nonverbal functioning. Her verbal comprehension and vocabulary were, however, in the high average range. Her perceptual organizational skills were severely impaired as she scored in the extremely low range on perceptual organizational subtests of the WISC-III. JG also experienced difficulties on the TONI-3 which is a measure of visual spatial abilities, processing of novel material and problem-solving abilities. JG performed at the floor level on the JLO where she completely failed to make accurate judgment of line orientation which is a right hemispherical function. On the CBCL, two areas fell in the clinical range of concern. These areas included: withdrawal and anxious/depressed. There was no indication of symptom exaggeration or misinterpretation of the questions, therefore these results were considered valid (see Table 2).

ED was a 10:02 year-old right-handed girl who had a diagnosis of agenesis of corpus collusum. She was reported to do poorly in school and was attending Special Education classes. She had few friends and was reported to have difficulty with social interaction. ED’s parent described ED’s behavior as passive and avoidant; this was also noted during testing. For example, she appeared shy and would make little eye contact nor ask many questions or initiate conversation. However, rapport was gradually established and she was attentive and cooperative during the testing. The results of her assessment were considered to be valid.
ED's global intellectual functioning fell in the borderline range (FIQ = 70), and her verbal IQ (VIQ: 86) was significantly higher (1% level) than her performance IQ (PIQ: 58). Tests of visual-spatial and nonverbal functioning in conjunction with her performance on the WISC-III revealed severely impaired nonverbal and perceptual organizational abilities and profound difficulties in nonverbal intelligence. Her vocabulary and verbal comprehension, however, were in the low average range. Her perceptual organizational skills were severely impaired (WISC-III). ED also performed at the floor level on the JLO, completely failing to make accurate judgment of line orientation. On the CBCL, two areas fell in the clinical range of concern. These areas were withdrawal and anxious/depressed. There was no indication of symptom exaggeration or misinterpretation of the questions, therefore these results were considered valid (see Table 2).
### TABLE 2

**Neuropsychological-Academic Assessments of the 5 Participants**

<table>
<thead>
<tr>
<th>Participants</th>
<th>Control</th>
<th>NLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Yr-Mo)</td>
<td>6:11</td>
<td>10:02</td>
</tr>
<tr>
<td>FIQ</td>
<td>100</td>
<td>87</td>
</tr>
<tr>
<td>VIQ</td>
<td>90</td>
<td>86</td>
</tr>
<tr>
<td>PIQ</td>
<td>111</td>
<td>68</td>
</tr>
<tr>
<td>(WRAT-3) Reading</td>
<td>85</td>
<td>102</td>
</tr>
<tr>
<td>(WRAT-3) Arithmetic</td>
<td>113</td>
<td>78</td>
</tr>
<tr>
<td>JLO (%ile)</td>
<td>75</td>
<td>0</td>
</tr>
<tr>
<td>TONI-3</td>
<td>105</td>
<td>81</td>
</tr>
</tbody>
</table>
5.1.4: Case Description of Control Participants

In order to control for other factors that could have contributed to the failure of participants with NLD on "theory of mind" tasks the control participants (ML and JL) were matched to the youngest participant with NLD (MA) on age, sex, grade and, as closely as possible, full scale IQ (all three of these participants had at least an average IQ, but JL’s IQ (the typical control) was higher because he did not have a significant VIQ-PIQ discrepancy).

JL was a 6:11 year-old right-handed boy, with no Learning Disability or academic impairments. He was reported to be socially very active and to have many friends. He was a very talkative boy who joked around a lot and appeared somewhat restless. JL was friendly, made good eye contact and was able to engage easily in conversation. He was attentive during the testing and eager to receive feedback from the examiner. Throughout the testing he was oriented, motivated and engaged. His results were considered to be a valid representation of his cognitive abilities.

JL was selected as a control subject and was matched to MA on the basis of his age, sex, and grade, with no discrepancy between his verbal and his nonverbal abilities. The purpose of JL’s inclusion was to provide representational data for the typical same age population. JL’s results were within the average to high average range on all measures. On the CBCL JL did not present with any symptom indicative of socio-emotional impairment (see Table 2).
ML was a 6:11 year-old right-handed boy, who was reported to have difficulty at school with reading and writing. ML’s parent described ML’s behavior as younger than his age. He was reported to have a few friends and to be sensitive in his social interactions. His eye contact was fair, he was cooperative during the testing and rapport was established easily. ML was attentive during the testing and the results of his assessment were considered to be a valid representation of his true cognitive abilities.

ML was selected as a control subject and was matched to MA for age, sex, grade, and full scale IQ (See Table 1). ML was selected because of the discrepancy between his significantly lower VIQ and his higher PIQ in order to examine the relationship between verbal and nonverbal abilities and theory of mind. On purer WISC-III measures of verbal and nonverbal ability than his Verbal and Performance IQ’s, ML presented with a low average Verbal Comprehension factor score (WISC-III, VC: 89) and a significantly higher Perceptual Organizational factor score (WISC-III, PO: 115). He also scored significantly higher on arithmetic than on reading (WRAT 3, Reading: 85 & Arithmetic: 113). With his lower verbal abilities and reading skills and his preserved visual-spatial and nonverbal intelligence ML’s cognitive profile was considered to be indicative of verbal impairment, and opposite to that of MA (see Table 2).

5.2 Instruments

The theory of mind domain was comprised of five dependent measures. Reasons for including more than one theory of mind task are as follows:
1) To be able to test participants' performance on 3 different aspects of mental state attribution: first-order, second-order, and more complex higher-order theory of mind abilities.

2) It was necessary to administer more than one task for each domain to ensure that participants' performance on each task, pertinent to each aspect of theory of mind, was not by chance.

3) To be able to account for individual differences by obtaining a continuum score for participants' performance on each aspect of theory of mind ability, since having a theory of mind is not an all-or-none affair.

5.2.1: First and Second-Order Theory of Mind Tasks

The theory of mind domain included two First-Order theory of mind tasks: the "Smarties" task (Perner et al., 1987, 1989) and the "Sally-Anne" task (Baron-Cohen et al., 1985) (unexpected-content and change in the location false-belief tasks); two Second-Order false-belief tasks: the "Jenny's-Cookie" task (Homer, 1995) and "John's Crayon" task (Homer, 1995); and one set of Higher-Order Strange Stories adopted from Happé (1994) (see Appendix A for examples of first-order, and second-order ToM tasks, and Appendix B for Strange Stories and Control Physical Stories examples).

The "Smarties" False Belief task required the participants to understand that their past belief (false belief) had been their representation of the reality at the time. It required metarepresentational ability—their understanding that their representation of the Smarties
box represented it as containing Smarties when in reality it contained pencils. In order to answer the belief questions correctly they would have to remember their own false belief (Smarties in the box) and coordinate this past belief with their present true knowledge of the world (pencils in the box) and realize that, what was true for them then was false for them now (‘I didn’t know’ what was in the box before, but ‘I thought’ I knew, because my mind represented the Smarties box as containing Smarties, ‘I had a false-belief’, but now ‘I know’ that in reality there are pencils in the box). Participants were therefore required to be able to attribute a false-belief to themselves and to a friend who had not seen inside the box.

In the “Sally-Anne” task the ability of the participants to attribute a false belief to others was examined. This task measured the participant’s ability to predict a protagonist’s behaviour on the basis of the protagonist’s false belief. In order to give a correct answer, participants should have been able to distinguish between a false-belief (marble in the basket) and reality (marble in the box). They would have to be able to coordinate their own knowledge (the way things really are, the marble is really in the box) with Sally’s knowledge of the world (she thinks the marble is in the basket because that’s where she left it). They would have to realize that what is true for Sally (marble is in the basket) is false for them (marble is not in the basket it is in the box) and therefore attribute a false-belief to Sally and predict her behavior according to this false-belief (she is going to look for it in the basket because that’s where she believes the marble is).
The “John’s Crayon” task involved a change in location paradigm and required both a first and a second-order false belief attribution. Participants first had to infer Mary’s mental state about whether she thinks John can see her, then they had to predict Mary’s mental state about John’s mental state. They would have to attribute a false-belief to Mary about John’s behavior. The participants would have to understand that even though they know that John does not hold a false-belief (since he saw Mary putting the crayon in the basket), Mary does not know this. Mary thinks that John has a false-belief about the location of the crayon, and therefore Mary should attribute a false-belief to John and predict his behavior according to this false-belief (John will look for his crayon on his desk).

The “Jenny’s Cookies” task involved a similar second-order belief-attribution paradigm as the previous task, and therefore the same rationale applies. Participants had to predict Mom’s mental state about Jenny’s mental state. They would have to attribute a false-belief to the mother about Jenny’s behavior. The participants would have to understand that even though they know that Jenny does not hold a false-belief (since they know that Jenny saw the cookies), Jenny’s mother does not know this. The mother thinks that Jenny has a false-belief about the dessert (Mom thinks that Jenny thinks they will have apples), and therefore she will attribute a false-belief to Jenny (Jenny does not actually think they will have apples) and predict her behavior according to this false-belief (She will say they will have apples).
5.2.2: Higher-Order Strange Stories

The set of Higher-Order Strange Stories comprised a total of 16 stories including 2 blocks with 8 types of stories. Each block comprised one example of each story type. The stories were accompanied by a picture and at least two main questions: (1) Accuracy Question: “Was it true, what X said?”; (2) Justification Question for motivation of story character: “Why did X say that?”. The stories included Pretend, Lie, White Lie, Figure of Speech, Joke, Persuade, Irony, and Double Bluff. These stories became increasingly longer and more complex (e.g. Double-Bluff scenarios). There was also a set of 4 Control Physical Stories that did not involve any mental states.

The Strange Stories required not only the ability to perform first-and second-order theory of mind tasks but also, higher-order and more complex theory of mind abilities. In everyday life we infer different intentions and motivations using contextual information such as situational context, emotional expression, and tone of speaker. In order, to succeed on these tasks, the participants are required to use contextual information provided by the story to make accurate judgments about the true and hidden intention of the story character. They are required to interpret what the speaker means rather than what the utterance says.
5.3 Procedure

All participants were tested in a quiet room, either at their home or in the participating institutions. Informed consent and assent were obtained from parents and participants prior to their participation in the study. Participants were reimbursed for their traveling expenses and were informed that they could discontinue testing at any time if they wished.

The measures of the experimental battery were presented in one of two predetermined orders; the order was counterbalanced across participants. The full testing of the ‘theory of mind’ battery took less than two hours; and was conducted in two sessions, with time for several breaks. Participants were assessed using all first and second order tasks and all 16 higher-order stories. All first and second order stories were read aloud to each child and modeled with dolls. The set of strange stories were also read aloud and presented with a picture. All tasks were either identical or very similar to those in the original references, and were scored exactly as described except for the Accuracy Questions on the set of Higher-Order Strange Stories (see Appendix B for descriptions of the stories).

5.3.1: Scoring Criteria for the First and Second Order Tasks:

Control Questions: Each First and Second Order task contained at least one control question regarding the facts of the story. The control questions were designed in
such a way as to ensure that the participants understood the facts of the story. Participants received a score of either 0 or 1 on the control questions.

**First-Order and Second-Order Belief Questions:** Participants obtained a separate score for each of the First-Order and Second-Order Belief questions. They were credited with a correct response for each of the Belief Questions only if they passed the Belief Question and all the Control Questions. Again, failure on the Control Question would mean that the participant had not understood the task. Passing the Control Questions, on the other hand, guaranteed that they had understood the facts of the story and that failure on the Belief Question was not due to poor comprehension, but rather to the inability to attribute mental states.

**Justification Questions:** Participants were credited with a correct response for the Justification Questions only if they passed the Justification Question, all the Control Questions, and the Belief Question. Participants' responses to the Justification Questions were coded into the following five categories:

- **IJPH:** Incorrect Physical Justification Response.
- **CJPH:** Correct Physical Justification Response.
- **IJMS:** Incorrect Mental State Justification Response.
- **CJMS** Correct Mental State Justification Response.
- **JDK:** "I Don’t Know" Responses.
5.3.2: Scoring Criteria for the Higher-Order Strange Stories

Accuracy Questions: Participants could obtain a score of 0 or 1 on the Accuracy questions. The Accuracy questions required the participants to make a judgment about the accuracy of the utterance (e.g., “it’s not literally true”). The stories were designed in such a way that only one appropriate interpretation of the utterance could be made. Therefore, if a participant was not able to understand that an utterance was not literally true then he/she would obtain a score of 0. Failure on the Accuracy questions would mean that the participant had difficulty realizing that the literal meaning of the speaker’s utterance did not make sense; difficulty inferring accurate mental states to the story characters; difficulty understanding hidden intentions and motives; difficulty utilizing the information provided by the stories (the context) to make accurate judgments; and difficulty understanding simple motivations for utterances that are not literally true.

Justification Questions: Participants could obtain a score of 0 or 1 on the Justification questions. Justification responses to the “why” questions were rated as either correct or incorrect. The Justifications were incorrect if they involved errors about the facts of the story or because they involved an inference that was inappropriate as a reason for the story character’s utterance.

The justifications were also scored as either involving mental states or physical states. Many of the utterances could be justified correctly either in terms of mental states or physical states. For example, in the joke story where a boy calls a dog an elephant, this
can be correctly explained by the physical justification, “the dog is as big as an elephant”, or the mental state justification, “He’s joking”. Mental state answers included all those that referred to thoughts, feelings, desires, traits, and dispositions. They included terms such as “like”, “want”, “happy”, “upset”, “mad”, “afraid”, “know”, “think”, “joke”, “pretend”, “lie”, and “sarcasm”. Justifications were scored as representing a physical state when they referred to non-mental events, physical appearance, action of objects, physical events, and outcomes. Physical state answers included terms such as “big”, “looks like”, “to get rid of them”, “to sell them”, “it is shaped like”, and so on. In each case only one score was given per story, giving the subject credit for their “best” answer. That is, if a subject gave one correct answer and one inappropriate answer, the correct answer was taken. Similarly, if a subject’s answer appealed to both physical and mental states, the justification would be scored as a mental state. Appendix B includes examples of answers rated as mental states and physical states.

Control Stories: the Accuracy and the Justification questions of the Control stories were scored the same way as those for the Strange Stories. However, since the Control Stories did not refer to or require a mental state justification, the justification responses were not coded into categories. Participants obtained a score of 0 or 1 on these questions.
CHAPTER 6: RESULTS

6.1: Theory of Mind Assessments

6.1.1: First-Order and Second-Order Theory of Mind Tasks

Every participant passed all of the Belief questions of the First-Order tasks and the Justification question of the First-Order Sally-Anne task. They also passed all First-Order Belief questions of the Second-Order tasks and all Control questions of both First-Order and Second-Order tasks. However, MA, the youngest participant identified as having the NLD syndrome, JG, the oldest NLD participant, and ML, the VI Control participant failed the Second Order Belief question of one of the two Second-Order tasks (see Table 3). Neither ED (older NLD participant with agenesis of corpus collosum) nor JL (the typical control) failed any of the Second-Order tasks.

In response to the Justification questions for the second-order tasks (see Table 3), JL, the typical control, provided the most number of correct mental state justification terms in contrast to ML, the VI control, who did not refer to any mental state terms in his responses, providing only physical state terms. On the other hand, MA and JG, two of the NLD participants, referred to mental states only for both their correct and incorrect justifications. ED, the other NLD participant, used both mental states and physical states.
### TABLE 3

Percentage of Accuracy, and Total Number of Mental-State Terms Used in the Second-Order ToM Tasks Among the Five Participants

| Participants | Second-Order Responses |  |
|--------------|------------------------|--|---|---|
|              | Percent Accuracy of 2nd-order Belief Question | Correct Mental-State Justification Terms | Incorrect Mental-State Justification Terms |
| Control (Type) |                        |                           |                                   |
| JL (Typical) | 100% | 3 | 0 |
| ML (VI) | 50% | 0 | 0 |
| NLD (Age) |                   |                           |                                   |
| MA (6:11) | 50% | 1 | 1 |
| ED (10:02) | 100% | 1 | 0 |
| JG (11:10) | 50% | 2 | 1 |
6.1.2 Higher-Order Strange Stories Theory of Mind Tasks

All NLD participants (MA, JG, and ED) showed difficulty on both the accuracy questions and the justification questions of the Higher-Order Strange Stories (Accuracy: 62% to 75%; Justification: 50% to 68%) (see Table 4). ML (the VI Control), however, showed difficulty only on the Justification questions of the higher-order Strange Stories (Accuracy: 100%; Justification 64%). JL (the typical Control), on the other hand, passed all higher-order Accuracy and Justification questions (Accuracy: 100%; Justification 100%).

Table 5 summarizes the number of correct responses by each of the participants to the Accuracy and the Justification questions of all the story types. Graph 1 compares the performance of all 5 participants on the total Accuracy and Justification scores. JL, the typical Control has the highest performance for both Accuracy and Justification. ML, the VI control, equals JL in Accuracy, but scores more at the level of NLD participants for Justification. The 3 NLD participants have the lowest Accuracy scores and, except for JG, the lowest Justification scores among the 5 participants. MA, the 6:11 year-old NLD participant, scored lower in Accuracy and Justification than both his age-matched controls, ML the VI participant and JL the typical participant.
TABLE 4

Percentage of Correct Responses to the Accuracy Questions and the Justification Questions, and Percentage of Correct Mental and Physical Justification Responses to the Higher-Order Strange Stories Among the Five Participants

<table>
<thead>
<tr>
<th>Participants</th>
<th>Accuracy</th>
<th>Justification</th>
<th>Mental-State Justification</th>
<th>Physical Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Type)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JL (Typical)</td>
<td>100%</td>
<td>100%</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>ML (VI) a</td>
<td>100%</td>
<td>64%</td>
<td>46%</td>
<td>18%</td>
</tr>
<tr>
<td>NLD (Age)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA (6:11)</td>
<td>62%</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td>ED (10:02) b</td>
<td>73%</td>
<td>53%</td>
<td>40%</td>
<td>13%</td>
</tr>
<tr>
<td>JG (11:10)</td>
<td>75%</td>
<td>68%</td>
<td>50%</td>
<td>18%</td>
</tr>
</tbody>
</table>

a: Percentages based only on 14 rather than 16 stories because ML failed the Comprehension Control Question for the two Double Bluff stories.

b: Percentages based on 15 rather than 16 stories because ED failed the Comprehension Control Question for one of the Double Bluff stories.
### TABLE 5

**Number of Correct Responses to the Accuracy Questions and the Justification Questions of the Higher-Order Strange Stories Among the Five Participants**

<table>
<thead>
<tr>
<th>Story Type (2 stories per type)</th>
<th>Participants</th>
<th>Q</th>
<th>Pretend</th>
<th>Joke</th>
<th>Lie</th>
<th>White Lie</th>
<th>Figure of Speech</th>
<th>Persuasion</th>
<th>Irony</th>
<th>Double Bluff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>JL</strong> (Typical)</td>
<td>AQ</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JQ</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>ML</strong> (VI)</td>
<td>AQ</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JQ</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>NLD</strong> (Age)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MA</strong> (6:11)</td>
<td>AQ</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JQ</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>ED</strong> (10:02)</td>
<td>AQ</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>JG</strong> (11:10)</td>
<td>AQ</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
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<tr>
<td></td>
<td></td>
<td>JQ</td>
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<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

AQ: Accuracy Questions  
JG: Justification Questions  
a: No scores included due to failure on the Comprehension Control Question (CCQ)  
b: Only scores from one of the two stories included due to failure on one of the CCQ
GRAPH 1

Percentage of Correct Responses Among the Five Participants to the "Accuracy" Questions and the "Justification" Questions of the Higher-Order Strange Stories

Note: CA: Correct "Accuracy" Responses
     CJ: Correct "Justification" Responses
     JL: Typical Control (6:11)
     ML: VI Control (6:11)
     JG: NLD (11:10)
     ED: NLD (10:02)
     MA: NLD (6:11)
CHAPTER 7: DISCUSSION

The objective of this research was to examine the "theory of mind" abilities in individuals with NLD to further the understanding of the nature of their psychosocial deficits. We examined whether NLD participants would show deficits in their "theory of mind" even when their verbal IQ was at or above the average level: it was hypothesized that participants with NLD would be less accurate in answering questions that require a mental state attribution than in answering control questions which do not require such attribution, compared to their matched control counterparts. It was further hypothesized that NLD participants would perform inferior to their control counterparts on higher-order theory of mind tasks.

All participants passed the First-Order tasks. In addition, two of the three NLD participants (MA and JG), along with ML (the VI Control) had difficulty only with the Second-Order belief question of one of the two Second-Order tasks. Unlike JL (the typical control participant), or ML (the VI control), all NLD participants were found to have difficulty on the Accuracy part of the Higher-Order Strange Stories. Furthermore, all NLD participants failed both the Accuracy and the Justification part of the Irony Story, and, unlike his age matched typical and VI controls, MA (the youngest NLD participant) failed both the Accuracy and the Justification parts of the Joke, Double Bluff, and the Irony stories.
7.1: Interpretation of the Findings:

Relatively poorer performance on the Higher-Order ToM tasks and complete success on the physical control stories for these tasks suggests that NLD participants are not hampered by poor comprehension, concentration, and other possible causes of failure on such tasks. They were able to understand the control stories which were at a level of comprehension equal to that of Higher-Order Strange Stories, nor did they demonstrate any problem with concentration for these stories. For NLD participants, greater difficulty on the Second-Order ToM tasks and the Strange Stories, but success on First-Order stories suggests their theory of mind is less established for more complex, higher order functioning. Furthermore, it seems unlikely that age has contributed in any significant way to NLD participants’ performance. JL (the typical control), who was 6:11 and was matched with the youngest of the NLD participants (MA) on age, passed 100% (Accuracy and Justification) of the Higher-Order theory of mind tasks. In comparison to JL, JG who was the oldest NLD participant at 11:10, also scored only 75% for Accuracy and 68% for Justification.

Both the VI control (ML) and the typical control (JL) were able to make correct judgments regarding the accuracy of the utterances in the Strange Stories. This suggests that both the typical and the VI control realized that the literal meaning of the speaker’s utterances did not make sense and were able to utilize the contextual information in order to make accurate judgments about the accuracy of the utterances. NLD participants’ difficulty on the Accuracy part of the Strange Stories was particularly meaningful. Since the stories were designed in such a way that only one interpretation of the utterances
could be made, failure on the Accuracy Questions meant that NLD participants were unable to utilize the context to make accurate judgments regarding the accuracy of the utterance. They did not realize that the literal meaning of the speaker’s utterance did not make sense. NLD participants seemed to take most of the utterances to be literally true without understanding their implications or their hidden meanings. By not taking into account the context they failed to understand the characters’ true mental states and hidden intentions. For example, in a Joke story where a boy tells her friend who has a huge dog “You don’t have a dog you have an elephant”, MA, the youngest NLD participant said that the utterance was true and that the boy said that because “it was too big for a dog”.

NLD participants not only took some of the utterances to be literally true but also attempted to explain the utterances’ true meaning and the characters’ intentions by attributing inappropriate mental states to the characters (the mental state might be correct but it was “inappropriately applied” to that specific utterance). For example, in one of the Irony stories, in response to the Justification question of the speaker’s sarcastic remark “That’s what I call politeness”, one NLD participant stated that: “She wants to be nice to her”. The same NLD participant had failed the Accuracy part of this story meaning that she had taken the literally false utterance which was intended to be sarcastic to be a literally true statement.

In this respect, the NLD participants incorrect mental state answers are of interest. Their responses may be taken as context-inappropriate answers, that is, answers that fit the utterance in isolation but not in the story context given (e.g., “She knows that rain is
good for the plants” in response to the utterance “Oh yes, it’s a lovely day for a picnic alright" on a rainy day). The NLD subjects would accept the literal meaning of the statement to be true, and would utilize this false information to guide their judgement regarding the character’s true mental states, intention and motivation. It seemed that NLD participants were unable to utilize the context provided by the story to first make an accurate judgement about the accuracy of the utterance and, second, to attribute an appropriate mental state to the story character which could be inconsistent with the character’s overt behavior (the utterances).

The apparent lack of consideration of context by the NLD participants is similar to the findings of Gardner, Brownell, Wapner, & Michelow (1983) that the problem experienced by individuals with right-hemisphere brain damage is not that they are incapable of making inferences, but that the inferences they make about social and emotional content do not apply in the particular situation or context. Casey and Strang (1994) have reported the same problem for individuals with NLD. The tendency to make generalizations on the basis of the specific details heard, without sufficiently considering the social context of the information, is a source of social skills difficulties for these individuals. Borod, Andelman, Obler, Tweedy, and Welkowitz (1992) have suggested that the ability to contextualize the interpretation of an emotion may require sensitivity to the relationships among emotions which depends on spatial and organizational right-hemisphere based strategies.
NLD participants in the study had particular difficulty comprehending the stories involving jokes, irony, double bluff and figures of speech. Although, the ability of older participants with NLD (JG and ED) to understand jokes seemed to be better, the younger NLD participant, MA, had great difficulty with this type of story. MA also could not interpret the Double Bluff. Even by age 10:02 the older NLD participant ED was also having problems interpreting the Double Bluff. Regardless of age, all NLD participants failed to interpret Irony. Also, they all had difficulty with justifying the accuracy questions for Figures of Speech.

In contrast, JL, the younger typical control was successful in all the stories. With the exception of the Double Bluff Story, ML, the VI control, passed the Accuracy questions for all the stories, but failed some of the Justification questions. Whether ML’s failure on these latter type of questions reflects the interference of language difficulties in formulating and expressing justifications, rather than a weakness in theory of mind per se, is a possibility requiring further investigation for individuals who are identified as having verbal impairment.

According to Happé (1994), the problem in story interpretation experienced by the NLD participants reflects an impairment in the ability for metarepresentation. For example, the following utterances which were intended to be sarcastic, “That’s what I call politeness”, “Oh yes, a lovely day for a picnic alright!”, and the following verbal expressions “This room is a pig-sty”, “You have a frog in your throat”, could only be understood by representing the speaker’s intention, that is, as metarepresentations. It
seems that children with NLD have difficulty with the more subtle aspects of communication and social situations, such as humour and verbal expressions. This is consistent with Rourke’s (1989) view of individuals with NLD. According to Rourke (1989), individuals with NLD will continue to have difficulty understanding humor and verbal expressions in their adulthood, despite their average to superior verbal skills.

As described previously, Leslie suggests (1992) that the development of theory of mind is dependent upon the normal development of an innate mechanism, “the theory of mind module”, that underlies the cognitive ability of producing metarepresentations. Where primary representations are beliefs about the world, metarepresentations are secondary representations that are suspended from the world and embedded in relationships such as think and pretend. As such, NLD’s social and pragmatic difficulties may be caused by a primary cognitive deficit in metarepresentational abilities.

Frith (1989), however, argues that the fundamental cognitive problem in theory of mind is a deficit in central information processing, that is, an inability to integrate separate pieces of information into meaningful wholes. Frith explains that the brain exhibits a strong “central drive for cohesion”, for overall sense and structure. Theory of mind deficits and the social and communication problems associated with them could be the result of a weak drive for cohesion. This is consistent with Rourke’s hypothesis in explaining the NLD’s Socio-emotional problems in terms of limitations in intermodal integration. Like Rourke, Frith argues that information needs to be integrated in order to be able to form correct interpretations of events. Individuals with NLD may not be able to
do this because they lack this central drive for cohesion. In other words, like the NLD participants in this study, they give literal interpretations to individual statements without taking into account the context, expectations, presuppositions, and so on. The fact that NLD participants scored lower on the Accuracy Questions and showed characteristically inappropriate mental state justification answers, may suggest that a deficit in central coherence is a more universal or persistent impairment in NLD than the inability to attribute mental state alone.

7.2: Conclusions

This study suggests that children with NLD may have an intact system for accessing verbal information. Their ability to perform successfully first-order theory of mind and control tasks and their average or higher verbal IQ seems to indicate an intact general language ability and semantic storage and retrieval skills. It is their pragmatic skills, their ability to “use” language in order to communicate effectively which is impaired. In this regard, it is their ability to understand others’ intentions which is affected. Baron-Cohen et al. (1988) indicate that children’s acquisition of language is indeed fundamental to their discovery of the mind-development of a theory of mind. However, what may be important is not so much the acquisition of the meanings of words (semantics) or the ability to put words together in grammatically correct order (syntax), but to the ability to ‘use language’ intentionally in order to communicate (pragmatics)—the way intentions of language users are coded and interpreted.
To the extent that the cognitive profile of the NLD participants in this study was characterized by visual-spatial deficits, and such deficits can be associated with right hemisphere dysfunction (Goldberg & Costa, 1981), the difficulties that they experienced on higher-order ToM tasks could be related to deficits in right hemispheric systems or accessing such systems. Poor right hemisphere resources may have impaired their ability to make the correct inferences in the more novel and complex situations characterizing some of the stories, including their ability to integrate and utilize contextual information. The present results suggest that problems in the attribution of emotions and mental states may not be solely related to verbal IQ, (in the current study, NLD participants had low Average to Superior Verbal IQ’s), but also to nonverbal abilities and perhaps right hemisphere dysfunction. Findings from studies of individuals with verbal impairment (e.g. ML) may lead us to attribute theory of mind development to verbal skills alone. However, a closer look suggests that theory of mind development could also, or alternatively, be primarily related to nonverbal/pragmatic abilities.

7.3: Limitations and Future Research

Further exploration of the two cognitive deficits, a deficit in the theory of mind and a deficit in the central drive for coherence, and their possible relationship, will be important in understanding the behavioral phenotype of NLD, and remediating NLD.

Based on the findings from the cases in this study, it is not possible to make definitive statements as to the role of the right hemisphere and its associations with both "central drive for cohesion" and "theory of mind " functioning in NLD. A larger sample
is required to examine the possible relationship between central drive for coherence, theory of mind ability and right hemisphere functions, and how these factors are associated in patients with right hemisphere brain damage compared to those with the NLD syndrome. Neural imaging studies will be critical in showing areas of the brain that are activated in performing verbal and nonverbal functions that may be associated with the development of theory of mind in NLD. Also, future longitudinal studies of larger samples of NLD children will allow us to examine if there are in fact delays in the course of their development of a theory of mind and how these delays may be related to their social-emotional difficulties.

In addition, comparison of the performance of children with NLD to a larger group of verbally impaired children is required in order to investigate in more detail the relationship between linguistic (semantics, syntactic and pragmatic) and nonverbal abilities, and theory of mind development.
REFERENCES


Appendix A:

First and Second-Order Theory of Mind Tasks

First-Order Belief-Attribution Tasks

For this section, 2 first-order belief tasks were included: “Smarties” False-Belief task (Perner, et al., 1989) and “Sally-Anne” False-Belief task (Baron-Cohen, et al., 1985). First-order theory of mind tasks required the participant to attribute a mental state to oneself or to others, making “first-order attributions”. The Sally-Anne “change in the location” false-belief task requires the participant to attribute a false-belief to another about the location of an object and to predict their behavior accordingly.
“Smarties” False-Belief Task (Perner, et al., 1989)

Description: The participant was shown a closed box of Smarties that contains pencils rather than Smarties. The experimenter drew the participant’s attention to the box and asked, “What is in the box?”. After the participant answered Smarties the box was opened and the participant was shown that the box actually contained pencils. The box was then closed again and the participant was asked the 4 questions described in the next section.

Control Questions/Memory Prompts:

Q1: What is really in the box?

Belief Questions:

Q2: Did you know what was inside the box before we opened it?

Q3: What did you think was inside the box before we opened it?

Q4: If your friend X (friend’s name) who has not seen inside the box comes in now and I show him/her this box, what will he/she think is in the box?
“Sally Anne” False-Belief Task (Baron-Cohen, et al., 1985)

**Description:** The following scenario was presented to the participants: I am going to tell you a story about Sally who has a marble and a basket and Anne who has a box. I want you to listen carefully because when I’m finished I will ask you some questions. This is Sally (point to the doll) and this is Anne (point to the doll). Sally likes to play with her marble. After a while she stops playing and puts the marble in her basket and leaves the room. While she is away Anne takes the marble out from the basket and puts it in her box. Sally now returns and wants to play with her marble again. The 5 questions described in the next section were then be asked of the participants.

**Questions:**

**Control Questions/Memory Prompts:**

Q1: Where did Sally leave her marble before she went out of the room?

Q2: Where is the marble now?

Q3: Did Sally see Anne putting the marble in her box?

**Belief Questions:**

Q4: Where will Sally look for her marble?

**Justification Question:**

Q5: Why will Sally look there for her marble?
Second-Order Belief Attribution Tasks

This section included 2 Second-Order belief tasks: “John’s Crayon” task (Homer, 1995) and “Jenny's Cookies” task (Homer, 1995). The second-order belief attribution tasks were administered only after the participants passed the simpler first-order theory of mind tasks because second-order attribution tasks are more difficult than the first-order theory of mind tasks and research has shown that individuals who are not able to pass more than one theory of mind task generally fail all second-order theory of mind tasks.
“John's Crayon” Task (Homer, 1995)

Description: This is a story about John and his sister Mary. This is John (point out doll) and this is Mary (point out doll). This is John's favorite crayon, his desk, an easel and a basket.

One day, Mary and John are in John's room. John is drawing with his crayon. "I'm going to get a drink of water," says John. He puts his crayon into the desk and leaves the room. John knows that his sister likes to play tricks on him, so he peers back through the keyhole at Mary.

When Mary sees that John has left, she decides to play a trick. She takes John's crayon from the desk and puts it in the basket. John sees her do this through the keyhole but Mary can't see John!

Control Questions/Memory Prompts:

Q1: Can John see Mary?

Q2: Can Mary see John?

Q3: Where does Mary think the crayon is hidden?

Q4: Where does John think the crayon is hidden?

First-Order False Belief:

Q5: Does Mary think that John can see her?

Second-Order False Belief:

Q6: Where does Mary think John will look for the crayon when he comes back into the room?

Justification Question:

Q7: Why does she think this?
“Jenny's Cookies” Task (Homer, 1995)

Description: This is a story about Jenny and her Mom. This is Jenny (point to doll) and this is her Mom (point to doll). This is a bag of groceries.

Jenny's mom is putting away groceries, just before dinnertime. "Can we have cookies for dessert tonight?" asks Jenny. Jenny's mom is going to have cookies but decides to surprise Jenny. She answers, "I'm sorry Jenny! I forgot to buy cookies. We'll have to have apples for dessert instead. Now you go and wash your hands." As Jenny turns to go wash her hands, she notices a bag of cookies sticking out of the grocery bag! "Oh," she thinks, "Mom is going to surprise me with the cookies! I will not tell her that I saw them."

Control Questions/Memory Prompts:

Q1: What is Jenny's mom going to serve for dessert?
Q2: Did Jenny see the cookies?
Q3: What does Jenny think is going to be for dessert?

First-Order False Belief:

Q4: Does Mom know that Jenny saw the cookies?

Second-Order False Belief:

Q5: What does Mom think Jenny would say they are going to have for dessert?

Justification Question:

Q7: Why does she think this?
APPENDIX B

**Higher-Order ToM “Strange Stories”**

**Description:**

The set of Strange Stories (Happé, 1994) described situations that could occur in everyday life and involved understanding simple motivations for utterances that were not literally true. Each story was accompanied by a picture and at least 2 main questions.
Story Type: “Banana-Pretend-a”

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

Accuracy Question:

Is it true what Emma Says?

Justification Question:

Why does Emma say this?
Story Type: “Baseball Bat-Pretend-b”

Jacob and Robert are playing in the yard. Robert picks up a stick from the ground and hits a ball. He says to Jacob, “Look! This is a baseball bat!”

Accuracy Question:
Is it true what Robert Says?

Justification Question:
Why does Robert say this?
Today James is going to Claire’s house for the first time. He is going over for tea, and he is looking forward to seeing Claire’s dog, which she talks about all the time. James likes dogs very much. When James arrives at Claire’s house Claire runs to open the door, and her dog jumps up to greet James. Claire’s dog is huge; it’s almost as big as James! When James sees Claire’s huge dog he says, “Claire, you haven’t got a dog at all. You’ve got an elephant!”

Accuracy Question:
Is it true, what James says?

Justification Question:
Why does James say this?
Story Type: "Driving-Joke-b"

Mike and David are best-friends. Mike is a very slow driver. One day when Mike is giving David a ride he drives even slower than usual. David says to Mike "You should slow down Mike, you’re driving too fast!"

Accuracy Question:
Is it true, what David says?

Justification Question:
Why does David say this?
One day while she is playing in the house, Anna accidentally knocks over and breaks her mother’s favorite crystal vase. Anna thinks: “Oh dear, when mother finds out she will be very cross!” So when her mother comes home and sees the broken vase and asks Anna what happened, Anna says, “The dog knocked it over, it wasn’t my fault!”

Accuracy Question:
Was it true, what Anna told her mother?

Justification Question:
Why did she say this?
**Story Type: “Hockey Game-Lie-b”**

Oscar did not want to go to work. He wanted to go to a hockey game with his friends. So he called in sick at work and went to the hockey game.

The next day at work, the boss asked Oscar, “Did you get a lot of rest yesterday?”

Oscar answered “Yes, I was resting in bed the whole day.”

**Accuracy Question:**

Was it true, what Oscar told his boss?

**Justification Question:**

Why did he say this?
Story Type: “Christmas-White Lie-a”

Helen waited all year for Christmas, because she knew at Christmas she could ask her parents for a rabbit. Helen wanted a rabbit more than anything in the world. At last Christmas Day arrived, and Helen ran to unwrap the big box her parents had given her. She felt sure it would contain a little rabbit in a cage. But when she opened it, with all the family standing round, she found her present was just a boring old set of encyclopedias, which Helen did not want at all! Still, when Helen’s parents asked her how she liked her Christmas present, she said, “It’s lovely, thank you. It’s just what I wanted.”

Accuracy Question:
Is it true, what Helen said?

Justification Question:
Why did she say that to her parents?
Story Type: "Birthday Party-White Lie-b"

Father and mother were very excited that they were invited to their best-friend's birthday party. But when they arrive at the party they find out that they don't know anyone and think the music is too loud. They become really bored at the party. Still, when the best-friend asks the father if they are enjoying the party, father says: "Oh yes, we are having a great time."

Accuracy Question:
Is it true, what the father says?

Justification Question:
Why did he say that?
Story type: "Pig-Sty-Figure of Speech-Idiom-a"

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

Accuracy Question:
Is it true that William keeps pigs in his room?

Justification Question:
Why does William's mother say this?
Story Type: “Cough-Figure of Speech-Idiom-b”

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

Accuracy Question:

Is it true, what Father says to Emma?

Justification Question:

Why does he say that?
Story Type: “Army-Double Bluff-a”

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

Comprehension Control Question:
Is it true what the prisoner said?

Accuracy Question:
Where will the other army look for his tanks?

Justification Question:
Why did the prisoner say what he said?
Story Type: “Ping-Pong Bat-Double Bluff-b”

Simon is a big liar. Simon’s brother knows this, he knows that Simon never tells the truth! Now yesterday, Simon stole Jim’s ping-pong bat and hides it under his bed. Now Jim knows Simon has hidden it somewhere, though he can’t find it. He’s very cross. So he finds Simon and says: “Where is my ping-pong bat? You must have hidden it either in the cupboard or under your bed, because I’ve looked everywhere else. Where is it, in the cupboard or under your bed?” Simon tells him the bat is under his bed.

Comprehension Control Question:
Is it true, what Simon told Jim?

Accuracy Question:
Where will Jim look for his ping-pong bat??

Justification Question:
Why will Jim look for his bat there?
**Story Type: “Dinner-Irony-a”**

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

**Accuracy Question:**

Is it true, what Ann’s mother says?

**Justification Question:**

Why does Ann’s mother say this?
Story Type: “Picnic-Irony-b”

Sarah and Tom are going on a picnic. It is Tom’s idea, he says it is going to be a lovely sunny day for a picnic. But just as they are unpacking the food, it starts to rain, and soon they are both soaked to the skin. Sarah is cross. She says, “Oh yes, a lovely day for a picnic alright!”

Accuracy Question:
Is it true, what Sarah says?

Justification Question:
Why does she say this?
Jill wanted to buy a kitten, so she went to see Mrs. Smith, who had lots of kittens she didn’t want. Now, Mrs. Smith loved the Kittens and she wouldn’t do anything to harm them, though she couldn’t keep them all herself. When Jane visited she wasn’t sure she wanted one of Mrs. Smith’s kittens, since they were all males and she had wanted a female. But Mrs. Smith said, “If no one buys the kittens I’ll just have to drown them!”

Accuracy Question:
Was it true, what Mrs. Smith said?

Justification Question:
Why did Mrs. Smith say this to Jane?
Story Type: “Video Game-Persuasion-b”

Steve had a big collection of video games. One day his younger brother Max asks to borrow one of Steve’s video games. Steve picked out a video game that he did not like at all and never used anymore and told Max “If you give me your favorite racing car I will give you my best video game”. He told Max “This is my favorite video game, I play with it all the time”.

Accuracy Question:
Was it true, what Steve said?

Justification Question:
Why did Steve say this to Max?
**Story Type: “Garden-Control Physical Story-a”**

Sally is in the garden. She is sowing seeds, so that next year she will have lots of vegetables in her garden. She sows seeds for carrots, lettuces and peas. She sows the seeds well, but when she goes inside after sowing them, the birds fly down and eat up all Sally’s seeds! Poor Sally, not one of her seeds is left!

**Accuracy Question:**

Is it true that Sally sowed seeds for turnips and tulips?

**Justification Question:**

Why will Sally not have any vegetables in her garden?
Story Type: “Snowman-Control Physical Story-b”

It was snowing and Bill went out into the garden to build a snowman. He made a fine snowman with the snow in the garden. But after Bill had gone to bed that night, the weather got a lot warmer—and by the morning the snowman had melted away. There was nothing left but a puddle of water in the garden, where the snowman had stood.

Accuracy Question:
Is it true that Bill made a snowman?

Justification Question:
Why was the snowman not there the next morning?

'Next Morning'
**Story Type: “Fog-Control Physical Story-e”**

Two enemy powers have been at war for a very long time. Each army has won several battles, but now the outcome could go either way. The forces are equally matched. However, the Blue army is stronger than the Yellow army in foot soldiers and weapons. But the Yellow army is stronger than the Blue army in air power. On the day of the final battle, which will decide the outcome to the war, there is a heavy fog over the mountains where the fighting is about to occur. The sky is covered with clouds and the Yellow army’s pilots can’t see the ground. By the end of the day the Blue army has won.

**Accuracy Question:**
Is it true that the Blue army could see clearly from their planes?

**Justification Question:**
Why did the Blue army win?
Story Type: “Glasses-Control Physical Story-d”

Sarah is very long-sighted. She has only one pair of glasses, which she keeps losing. Today she has lost her glasses again and she needs to find them. She had them yesterday evening when she looked up the television programs. She must have left them somewhere that she has been today. She asks Ted to find her glasses. She tells him that today she went to her early morning gym class, then to the library, and last to the flower shop. Ted goes straight to the library.

Accuracy Question:
Is it true that Sarah stayed home all day today?

Justification Question:
Why is the library the most likely place to find Sarah’s glasses?
Examples of Participants Answers to the “Why” Question of the Strange Stories

**Answers Rated as Mental State Justifications:**

She is pretending
Didn’t want mother to be mad at her
Didn’t want them to feel sad
She wanted her to buy one
He doesn’t want them to hurt him
She doesn’t want to get in trouble
She wants to get rid of them
She is afraid that her mother will get mad at her.
She is mad at her for not looking
She knows that rain is good for the plants
She’s being sarcastic
He is joking
He knew that they wouldn’t believe him
She wanted to sell them
She wants to be nice to her
It’s an expression
He doesn’t want them to know that it’s a bad birthday
He’s just pretending that there is a frog in her throat

**Answers Rated as Physical State Justifications:**

Looks like a telephone
You can use it as a baseball bat
Because the dog is as big as an elephant
They will look if he says the right way they’ll go the wrong way
He’s driving too slow
Cause almost as big as an elephant
Too big for a dog
The Best Family

Once upon a time there was a great family and the mom had a hard thesis. One day she finished her thesis and the son was very happy. The son was named Arta. The End.