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Relationship between Theory of Mind Performance in a

Nonverbal Task and Functioning Level of Children with Autism

BY

Michael J. Grenda

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Specialist in School Psychology

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

2009
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Running head: THEORY OF MIND

Relationship between Theory of Mind Performance in a Nonverbal Task and Functioning Level of Children with Autism

Thesis for a Specialist's Degree

in School Psychology

Eastern Illinois University

Charleston, Illinois

Michael J. Grenda

Chair: Ronan S. Bernas, Ph.D.

Christine McCormick, Ph.D.

Marjorie Hanft-Martone, M.A.

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ABSTRACT

Individuals with autism often show deficits in Theory of Mind (ToM), their ability to understand the perceptions of others. The relationship between functioning level and ToM abilities in children with autism has not been adequately explored. This study utilized a nonverbal task of ToM adapted from previous research (Colle, Baron-Cohen, & Hill, 2007) which allowed examination of lower functioning or nonverbal individuals. Participants included nine individuals with autism spectrum disorders and nine normally developing individuals. Functioning level was estimated using a brief autism rating scale. When controlling for nonverbal abilities and age, no significant differences in ToM abilities were found between the autism and control groups. Likewise no relationship between functioning level and ToM emerged within the autism group. These results may be due to several methodological issues.

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Autism spectrum disorders have recently become a hot-topic in the fields of psychology and medical research due to increasing prevalence which was estimated to be as high as 1 in 150 by the Centers for Disease Control in 2007. Autism is a complex pervasive developmental disorder, meaning it will have life-long symptoms, which can affect the communication (both verbal and nonverbal), social, and general behavioral functioning of an individual. The criteria for a diagnosis of autism require impairments in the area of social interaction and communication (both verbal and nonverbal), as well as restricted repetitive or obsessive patterns of behavior, interests, or activities (American Psychiatric Association [APA], 2000; National Institute for Neurological Disorders and Stroke [NINDS], 2006).

Symptoms of Autism

Impairment in social interaction is the hallmark of autism and is frequently observed as abnormal social behaviors and abnormal or lack of interest in other people. Even in some of the first published work on children with autism, they were described as being aloof, indifferent to other people, living in a shell, and blocking anything from the outside world (Kanner & Eisenberg, 1956). For instance, individuals with autism may avoid eye contact with other individuals or appear to be gazing through them. Likewise, there may be a total disinterest in social interaction all together. These symptoms are often first noted by parents, as they can manifest during early infancy with the infant acting unresponsively to other people. These features may manifest through a withdrawal from normal development, that is to say a normally developing infant or child will suddenly appear to regress and withdraw socially (NINDS, 2006). Impairments in social interaction may also be more abstract with the individual unable to recognize and experience emotions, which is crucial when communicating with others, as many aspects of interaction are given through nonverbal cues e.g. facial expression. These difficulties may also lead to a failure to reciprocate emotion, as individuals with autism may fail to identify another's excitement, happiness, sadness, or disappointment.

These features are closely related to communication, the second area of impairment in autism. Communication impairment can range from an individual being entirely nonverbal with no other alternative communication systems (e.g., signing or miming), to one having adequate verbal abilities or being unable to begin or sustain a conversation with others (APA, 2000). The latter is particularly related to social interaction ability. Often qualitative labels of high-functioning and low-functioning autism are guided by communication abilities. High-functioning individuals are frequently those who have adequate verbal communicative abilities or who know an alternative non-verbal system, and can be independent, to some degree, as a result; whereas low-functioning individuals may have no intelligible communication system or are severely limited. An inability to communicate obviously has a bigger impact in daily functioning than impairment in social interaction; however overall functioning level requires examining skills and abilities besides communication.

The third and final set of symptoms is defined as "restricted repetitive and stereotyped patterns of behavior, interest, and activities" according to the *Diagnostic and Statistical Manual 4th edition text-revision* (APA, 2000). Behaviors such as whole-body rocking or spinning and hand or finger flapping, are classic examples of repetitive behaviors seen in autism. Hand-flapping, is common and involves repetitive contortions of the hand or other strange hand and finger movements. It should be noted that these behaviors are not exclusive to autism and are frequent in other pervasive and developmental disabilities, such as mental retardation. For low-functioning individuals these perseverations may be observed by a child being fixated by a piece of string being dangled, whereas a more high-functioning individual may constantly research and speak about one topic of interest. For example, a young man with autism may speak endlessly about the history or trains and how they work etc. Although this may seem to be positive aspect of the disorder, it is often coupled with a communication or social interaction deficit, which means any conversations are often one-sided, such as the young man just talking about trains, unable to switch to a new topic. Thus the areas of impairment (social interaction, communication, and repetitive behaviors) are associated with one another, but are identified as individual features nonetheless (APA). Stereotyped or repetitive activities refer to routines or rituals that may be daily or more frequent, such as at the beginning of each class for a school-age child with autism. This need for routine is often beneficially exploited during treatment by providing a concrete or consistent environment and schedule.

In addition to the core symptom areas, there are also abnormalities in sensory sensitivity or experience. These sensory abnormalities may make some repetitive behaviors self-stimulating or reinforcing or perhaps explain some confusion in communication. Individuals with autism may have aversions to certain kinds of light or sound (Wing, 1991). For instance, being in a room with intense fluorescent lighting, which is often the normal lighting environment for schools and other buildings, may be very uncomfortable for an individual with autism. Returning to the example of the fascination with a dangled piece of string, this is also thought to be related to an abnormal sensory experience, which makes fixation on the string pleasurable or very stimulating in some sensory mode. These peculiarities in sensory experience have great variability and can range from simple aversions to touch and loud sounds, to some accounts of individuals actually having their sensory channels crossed, in other words seeing a certain color actually elicits a taste or hearing sounds causing a visual color experience, and so on (Williams, 1992).

Generally, symptoms appear in the first three years of life and persist throughout life. Although through support services, such as special education and behavioral therapy, many symptoms can be drastically improved. Autism affects males much more than females, with some early research even doubting if some variants of autism were possible in girls (Wing, 1991). The predominately male prevalence has been theorized to be the result of genetic information passed from the mother on the X chromosome. Males have an X and Y chromosome whereas, females have two X chromosomes. When there is a mutation or problem in a gene on the X chromosome in a female the properly working gene from the other X is used, a bit like a genetic fail-safe for females, making inherited serious genetic problems less likely. In contrast, males only have the single X chromosome so when there is a problem gene it has no backup gene. This is why many developmental disorders affect males more than females.

The wide range of possible symptoms is what makes autism a "spectrum" disorder (Watson, Lord, Schaffer, & Schopler, 1989; Wing, 1991). Individuals with autism are often characterized in terms of functioning level to better describe their symptoms, especially in the area of communication. There is no universal system for defining high- and low-functioning, so the labels are merely qualitative. In addition to the impairments associated with autism there is also a high occurrence of mental retardation with autism. However, at least 20-25% of individuals with autism will not show this comorbid diagnosis (Courchesne, 1992). The cause of autism is unknown and complicated by the variable severity and constellation of symptoms possible.

Etiology of Autism Spectrum Disorders

The search for the cause of autism has lead to numerous explanations, yet no defined answer has been reached. Historically, autism was first noted by Leo Kanner in 1943, in his account of eleven children with peculiar abnormal behavior he termed "early infantile autism" (Wing, 1991). The children showed many of the autism symptoms discussed previously, an aversion or lack of social relatedness, strange repetitive behaviors, and severe impairment in both verbal and nonverbal communication abilities. The behavioral patterns of these children did not match any other diagnoses, hence the new autism label. In 1944, a thesis with the topic "autistic psychopathy" was published by Hans Asperger (Frith, 1991). Asperger wrote about a disturbance in children similar to Kanner's description, yet less severe in symptoms, primarily with regard to communication and repetitive behaviors. What is surprising is both Kanner and Asperger described very similar disturbances and both labeled them as "autistic" completely unaware of each other's work initially (Frith). Their arrival at the same label is not surprising as "autism" was a concept in schizophrenia coined by Bleuler. It referred to "a fundamental disturbance of contact" according to Asperger (Asperger, 1944). The root word for autism is the Greek word "autos", which can be roughly defined as being oneself detached from the rest of the world. Their recognition of the condition makes both Leo Kanner and Hans Asperger the pioneers in recognizing autism as a disability (Frith).

Previous to Kanner's work and Asperger's publications, autism was simply labeled as schizophrenia and other disorders (Wing, 1991). The search for the cause of autism began slowly, as the disorder was still regarded as largely obscure and rare, leaving many professionals stumped when they encountered it. As more and more cases were noted, theories over the etiology, or cause, of autism began to arise, many from a biological or neurobiological basis. Although currently most research focuses on a biological or neurological cause for autism, some past beliefs about autism's etiology have been radically different. Bruno Bettleheim considered a mother's lack of attention or coldness towards her child the cause of autism. He coined the term "refrigerator mother" to describe the personality of these mothers and placed blame for their child's disorder on them. His work was damaging for the field as it directed research in the wrong direction and also blamed parents, mothers in particular, who were innocent in terms of their child's autism. A biological basis for autism came out several decades ago (Wing).

Van Krevelen's work (1971) examined the initial descriptions made by Kanner and Asperger and compared early infantile autism and autistic psychopathy, in detail. Van Krevelen noted the similarities and differences between the two syndromes, concluding that Kanner's early infantile autism to be more severe in symptoms, while Asperger's autistic psychopathy was more a personality problem. Kanner's syndrome is what is today labeled as autism. In contrast, the Asperger's label is seen as a less severe diagnosis and recognized as Asperger's Disorder by the DSM-IV (APA, 2000). Both autism and Asperger's disorder are classified as pervasive developmental disabilities, and Asperger's is generally recognized as being "in the autism spectrum". The cardinal difference between autism and Asperger's disorder is the criterion that there be "no clinically significant delays in early language" and as a result Asperger's disorder is often not recognized until later in development, sometimes not until high school or even college, unlike autism (APA). This is because individuals with Asperger's are often seen as being awkward socially. Also in contrast, there is no cognitive impairment or mental retardation with Asperger's and less likelihood of any significant learning disability. The same deficits in social interaction are evident in Asperger's though, as are the repetitive behaviors, which are more often observed as a preoccupation with a topic of interest (APA). For the purposes of this study a diagnosis of Asperger's disorder is categorized as autism.

Van Krevelen also noted the potential for a familial cause for autism on the male side i.e. from the father. Inheriting the father's affected genes would lead to Asperger's autistic psychopathy, whereas Kanner's early infantile autism resulted from the combination of the father's genes and some organic brain damage (Wing, 1991). By the 1980's there was a growing understanding that autism existed as a continuum from Kanner's severe or low-functioning autism to Asperger's high-functioning autism, both syndromes (autism and asperger's syndrome) were recognized as disorders by the DSM-III at that point as well (Wing). This autism continuum is the same as the functioning spectrum noted earlier with Asperger's only including high-functioning individuals whereas autism can extend from low- to high-functioning levels.

Theory of Mind

Recent research in the areas of executive functioning, Theory of Mind (ToM), and Weak Central Coherence seeks to find a single universal psychological cause for autistic symptoms (Best, Moffat, Power, Owens, & Johnstone, 2008). These new theories take advantage of the notion that autism has a complex neurobiological etiology. Executive functioning is related to decision making and includes skills of planning and organizing. These areas require the aggregation and interpretation of past and present information to plan and make correct decisions. Weak Central Coherence, relates to executive functioning as it refers to attention to what is relevant. A good decision is based on large amounts of pooled information, i.e. context. If coherence at this central decision-making process is weak, attention would not be directed to relevant areas or would not be context based, but rather haphazard, which is typically the case in autism (Happé, 1991). Research in this area is almost always directly tied to ToM as the two concepts are related. ToM requires central-coherence to understand other individual's beliefs, thoughts, and predicted actions.

Theory of Mind (ToM) originated in the 1980's, from Alan Leslie, as a new theory of cognitive development (Frith, 1991). His theory related heavily to pretend play, as it reflected when a child had the ability to form and process internal memory representations of mental states and keep them separate from reality (Frith). In pretend play a child may often pretend an object is actually something else, such as a banana being a pretend phone, yet the child still knows what real bananas and real phones do (Frith). The same abilities are necessary to understand another's beliefs or perspective. ToM refers to the ability to evaluate the behavior of other people on the basis of their mental states, such as their goals, emotions, and beliefs (Tager-Flusberg, 2007). In other words understanding that another person's thoughts, beliefs, and feelings may not match reality (e.g. someone having a false or incorrect belief) (Colle, Baron-Cohen, & Hill, 2007; Porter, Coltheart, & Langdon, 2008). ToM ability is therefore seen as a developmental milestone in children.

Measuring Theory of Mind

The hallmark task for tapping mental-state understanding is a false-belief task, where a child has to distinguish between the world as it is and the way it may be represented (incorrectly) in the mind of another person (Tager-Flusberg, 2007; Colle, et al., 2007; Call & Tomasello, 1999; Porter et al., 2008). The classic false-belief task, called the Sally-Anne task, involves the child being told the following story, accompanied by visual aids: Sally places her ball in a basket and goes out to play; while she is gone, Anne takes the ball from the basket and hides it in a box. The child is then asked where Sally will look for the ball when she comes back to play with it. The correct response is Sally will look in the basket where she believes her ball still is (Tager-Flusberg; Frith, 1991).

Typical children can pass tasks that tap mental-state understanding by age four and are attributed with having adequate ToM (Tager-Flusberg, 2007). Baron-Cohen and his colleagues introduced ToM over two decades ago to explain the main behavioral symptoms of autism. Initially, studies of individuals with autism with mental and verbal abilities beyond a 4-year-old level failed the Sally-Anne task (Tager-Flusberg), demonstrating a lack of ToM. These findings are not all too surprising considering the social interaction deficits of autism, which often include difficulty identifying and reciprocating others' emotions. Inability in understanding another's emotional state is parallel to not understanding another's beliefs. Many symptoms of autism fit well with the ToM hypothesis, such as individuals with autism acting as if they are in a shell, which would be justifiable if they do not understand what others think and feel about their actions. Although ToM is well supported as being a deficit in autism it is not without limitations (Tager-Flusberg). ToM does an excellent job with regard to elucidating communicative and social functioning, but lacks a clear connection to the restricted and repetitive behaviors seen in individuals with autism (Tager-Flusberg). There is also little connection with some characteristic strengths of individuals with autism, such as superior visual-attention skills (Tager-Flusberg). Considering these limitations it is clear that ToM does not fully explain autism, but it does represent a valuable method of evaluating individuals with autism. When individuals with autism do try to infer mental states they do not use the same neurocognitive systems as individuals without autism. According to Tager-Flusberg, for children without autism, performance on classic ToM tasks reflects intuitive social insight or knowledge of mental states coupled with verbal processing, memory of key narrative events, and inhibition of spontaneous responses, whereas children with autism treat the task as a logical-reasoning problem, which relies primarily on language and other nonsocial cognitive processes. Performance on these ToM tasks can also account for some of the severity of the social and communicative symptoms that define autism (Tager-Flusberg).

Even the Sally-Anne task itself has limitations as individuals with autism can be anywhere along the spectrum ranging from able to verbally communicate to some degree, nonverbally communicate to some degree, to lacking any intelligible communication.

Children with little to no verbal language with autism have gone largely untested for theory of mind (ToM) ability. This is due to the verbal nature of most ToM tasks, especially false belief tasks, such as the Sally-Anne task, which rely heavily on linguistic instructions and narratives (Colle et al., 2007; Call & Tomasello, 1999; Porter et al., 2008). Differences in ToM, as a function of false belief understanding in individuals with autism, may be revealed when utilizing a procedure that requires little verbal ability.

However, there are limitations in using the ToM tasks. Contradictory findings have been found where individuals with autism pass ToM tasks while individuals with other disorders fail them (Tager-Flusberg, 2007). Many of these discrepant findings are thought to be the result of outside variables that were not controlled, such as general intellectual functioning, language abilities, and age which strongly correlate with later ToM task performance (Tager-Flusberg; Porter et al., 2007; Colle et al., 2007). These findings may also be related to the level of intervention or support the individual has received. This can be evident in profoundly deaf children who have not been exposed to sign language early in life failing false-belief tasks, whereas deaf children who have experienced signing early on pass false-belief tasks at the same time as normally developing children (Colle, et al.). For children without autism, performance on ToM tasks reflects knowledge of other's mental states and general cognitive skills of verbal processing, memory of narrative events, and inhibition of spontaneous responses. Whereas, studies with children with autism suggest they treat ToM tasks as logical-reasoning problems and rely primarily on nonsocial cognitive processes (Tager-Flusberg). This supports the social interaction deficit in individuals with autism as they appear to ignore the social aspect of the task entirely.

An alternative nonverbal False-Belief task was developed by Call & Tomasello (1999) to investigate ToM in chimpanzees, orangutans, and young children. Their methods were later modified by Colle et al. (2007), for children with autism and specific language impairment. They examined if any ToM deficit was present in children with autism when the verbal component, of the false-belief task, was minimized.

The new task was a modified version of the classic Sally-Anne task with the verbal narratives removed. The Sally-Anne task focuses on a location change e.g. Sally's marble being moved from one location to another. By preserving this component, while removing the verbal narratives the task can become nonverbally oriented. According to Colle et al. (2007), the task requires two experimenters a "communicator" and a "hider" who work with a child one-on-one. The first goal is to show that the communicator intends to help the child and to demonstrate the method of communication, pointing. Using two identical boxes the hider places a treat under a box in view of both the hider and the communicator, at which point the hider asks the communicator, "Where is the treat?". Then, the communicator points at the correct box, while the child watches. The hider then asks the child "Where is the treat?" The child has to repeat this task and point correctly on three successive trials to pass this pre-test phase. This task structure is then modified by having the communicator leave after the treat is placed under a box. At which point the hider switches the boxes around while the child watched. When the communicator returns the hider asks the communicator to point to the box with the treat, then asks the child to point to the box with the treat. The child should pick correctly and ignore the communicator's incorrect pointing. This is considered the false belief trial, because the child must ignore the communicator's false belief. The true belief trials are identical to the pre-test phase trials noted previously. Finally, there is a control condition where there is no switch while the communicator is away, which verifies the child is not simply choosing the opposite box of the communicator when he leaves the room.

This alternative minimally verbal task has many similarities to the classic Sally-Anne task. Although the communicator does not hide the object initially, he or she is absent during the switch by the hider who is similar to Anne. The biggest distinction between the two tasks is that the child is never asked in the alternative task where the communicator or Sally will look. Instead, the communicator points and then the child is asked. This removes the direct inquiry to check for the child's ToM ability, that is, the understanding that the communicator will choose falsely. Previous research has shown that performance on this non-verbal task correlates with the classic ToM task (Colle et al., 2007). Colle et al. also confirmed a ToM deficit in individuals with low-functioning autism, when compared to typically developing peers, which is consistent with the early studies by Baron Cohen and Frith.

Study Rationale and Hypothesis

The purpose of this study was to expand on the findings of Colle et al. (2007) who investigated differences in children with autism, specific language impairment, and normally developing children. However, their study did not investigate differences in ToM ability within the autism spectrum i.e. functioning levels. Previous research focused on comparing different groups of children, but failed to look for differences within the autism population (Tager-Flusberg, 2007; Colle et al., 2007). This failure to examine differences was mostly due to the verbal nature of many ToM tasks, making them unsuitable for low-functioning individuals with autism. Likewise, the rarity and variability of individuals with autism has made much research focus on group differences. Any differences uncovered may better define levels of functioning in the autism spectrum and may offer valuable predictive or screening information (Best, Moffat, Power, Owens, & Johnstone, 2007). The system behind why some children with autism are able to pass False Belief tasks, the "linguistically mediated Theory of Mind" (Tager-Flusberg) may also be better understood. It is still not understood why some individuals on the autism spectrum develop ToM ability, while others do not. The proposed study may uncover information about the ToM development process.

This study examined the differences within a group of children with autism, by utilizing the *Childhood Autism Rating Scale* (CARS) as an estimate of functioning level. ToM ability was examined using the nonverbal false-belief task methods specified in the study by Colle et al. (2007). This comparison only yielded the relative difference between children with autism, so a control group of normally developing children was also utilized. This allowed comparisons to normal or the expected ToM abilities in the children. Based on previous ToM research a deficit in the autism group was expected in comparison to the normally developing children on the belief tasks. Differences were also expected on the ToM task based on functioning level, as measured by the CARS score. Past research had found some high-functioning individuals with autism passed False-Belief tasks, however those tasks were the traditional Sally-Anne task. Previous research had found both variants of the False Belief task were correlated so it was predicted that the children with autism would show low ToM in comparison to the typically developing peers (control group), and that functioning level would be correlated to False-Belief task scores.

Method

Participants

Eighteen elementary and middle school students (9 with autism and 9 typically developing children; M_{age} = 9.73, *SD* = 1.95 years) from schools in Vermillion county were recruited. Parents who agreed to the study gave written informed consent for their child's participation. All participants (autism and typically developing) were given the Matrix Reasoning subtest of the *Wechsler Abbreviated Scale of Intelligence* (WASI) to obtain an estimate of nonverbal intelligence. To compensate for the absence of matching between the autistic and typically developing groups, the IQ and age of the children were used as covariates during the statistical analyses.

Children with autism. The children with autism ($N = 9$; M_{age} = 10.08, *SD* = 2.26 years) were selected on the basis of a special education eligibility of autism. An estimate of functioning level was provided by the *Childhood Autism Rating Scale* (CARS). The child's teachers and classroom or personal aides completed the CARS.

Typically developing children. Typically developing children ($N = 9$; M_{age} = 9.37, *SD* = 1.64 years) were recruited from the area schools.

Materials

Materials consisted of two identical opaque boxes (approx. 13 cm x 4.8 cm x 4.8 cm). The reward for participation was candy each child chose beforehand. A cardboard barrier to prevent the child from observing the hiding process was also used (see Figures 1 and 2 on the next page).

Figure 1. Testing Materials Without the Barrier.

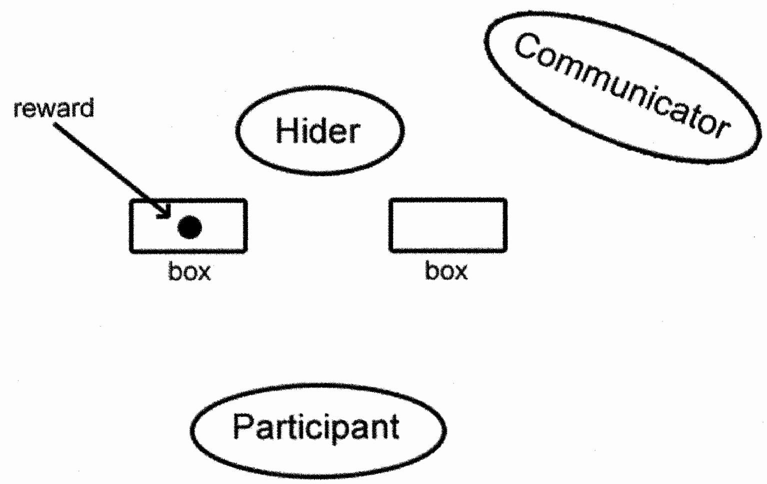
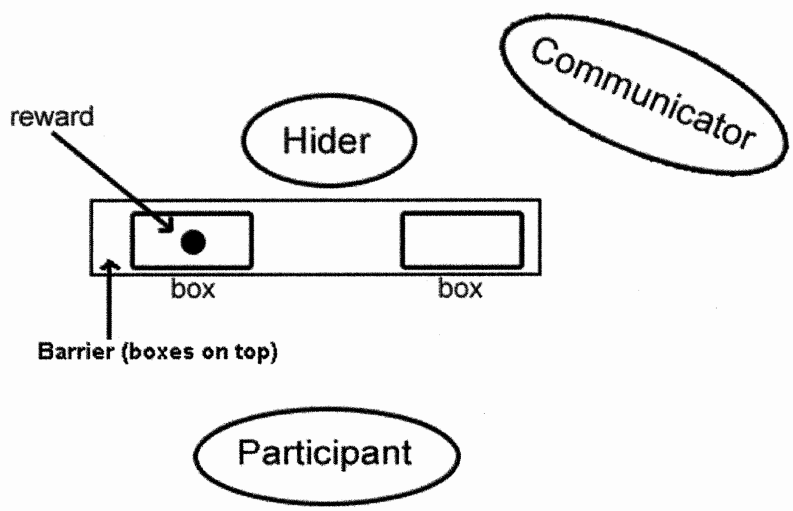


Figure 2. Testing Materials With Barrier.



Procedure

Each participant was brought into the experiment room or area within the child's classroom where two experimenters showed the participant the available treats, and encouraged the child to choose some he or she would want. The experimenters consisted of a combination of the following: this researcher, a teacher, or an aide (personal or classroom). All experimenters were trained on task administration prior to the trails. The treats chosen were used as the stimuli during the trials. Once the treats were chosen, one experimenter (the hider) sat opposite to the child (see Figure 1). The hider showed the participant the two empty boxes. The child was then told they have to find the sweet in one of the two boxes, and that they would be helped by the other experimenter (the communicator), but that the communicator would not always be right.

The communicator sat between the child and the hider in such a way that he or she could see where the treat was hidden and communicated with the child. The communicator then indicated to the child which container he or she saw thought the treat was in. The trials of each task and the treat location were decided by a random numeric strings generated from random.org. The experiment was divided into three parts: pre-test, screening tests, and belief tests almost identical to Call and Tomasello's (1999) and the Colle et al. (2007) studies. Each child received some candy at the end of the experiment for their participation, regardless of performance.

Pre-test. The goal of the first part of the experiment was to demonstrate that the communicator was trying to help the child. For each trial the hider manipulated both containers without the cardboard barrier, placing a treat inside one of them. The treat starting location for each trial was predetermined using a random binary number string (random.org). During the hiding the communicator watched intently where the treat was being hidden. The communicator occasionally needed to get the child's attention during the hiding process. This was necessary to assure that the child saw the communicator observing the hiding process. The hider then asked the communicator "Where is the treat?". Then the communicator indicated the correct box by pointing for two seconds, while again ensuring the child was watching (e.g. making a comment to the child). The hider then turned to the child and asked "Where is the treat?". The child got to keep the treat for choosing correctly. The hider then proposed they try again. After three successive correct responses the child continued on to the Screening Tasks. If three successive correct responses were not reached in ten trials the participant was excluded.

Screening tests. These tests confirmed the child had the necessary abilities to complete the false belief tasks. These prerequisites included: the ability to follow the treat as it was moved from one box to another, *visible displacement*; to follow the treat when the box it was in was moved, *invisible displacement*; and the ability to ignore the communicator when he or she was clearly false, *ignoring the communicator*.

Visible displacement. While the communicator was gone the hider opened the box with the sweet and moved it to the other box in view of the child. The communicator then returned to the room. The child was then asked where the treat was. The communicator leaving was irrelevant but done for consistency. The goal was for the child to show he or she had the ability to find the treat after it was visibly displaced.

Invisible displacement. After the communicator had left both boxes were opened to show the child the location of the treat. The boxes were then closed and their positions were switched. In this method the treat was again displaced, but not visibly as the boxes were moved closed. This was comparable to Piaget's (1963) object permanence test.

Ignore the communicator. In this final task, the hider hid the treat in the view of the communicator, who then left the room without indicating which box contained the treat. While the communicator was still absent the hider opened the boxes and moved the treat from one box to the other (identical to the visible displacement). The communicator then returned and the hider asked him where the treat was. He chose incorrectly because he did not witness the switch. Immediately after, the hider asked the child to find the sweet. The child had to demonstrate the ability to ignore the communicator's incorrect choice.

Each participant was given three attempts at each type of screening test (nine total trials). The order of the trials and treat starting locations were determined using a random number string generated by random string generator (random.org). Participants had to respond correctly on two out of three of each of the tests to move on to the Belief tests.

Belief tests. Participants were given three *false* belief, three *true* belief tasks, and three control tasks as specified in the Colle et al. (2007) experiment. In all three conditions the treat was hidden behind the barrier out of the view of the child, but not out of view of the communicator. Therefore, the child had to rely on the communicator's indication in order to make the correct choice consistently. The order of the nine trials and treat starting locations were determined using a random number string generated by random string generator (random.org).

False belief. Once the communicator left the room, the hider switched the positions of the two identical boxes on top of the barrier. The child watched the switch, but never saw inside either box. When the communicator returned and was asked, by the hider, where the treat was he gave an incorrect indication, as he did not witness the switch. After this incorrect indication, the participant was asked to locate (point to) the box that contained the sweet. The correct answer was the box not indicated by the communicator.

True belief. In this condition the boxes were switched on top of the barrier in front of both communicator and participant. After the switch the communicator was asked to point to the box containing the treat, and then the participant was asked. In this condition the communicator always gave the correct response, as he witnessed the switch. The purpose of this condition was to assure the child was not assuming the communicator's response was always incorrect as in the False Belief condition.

Control condition. In the control condition there was no switch while the communicator was absent. In this condition the communicator always gave the correct response, as the boxes were never switched while on top of the barrier. The purpose of this condition was to verify that the child did not assume that when the communicator left his indication was always wrong.

Results

The number of correct responses on the belief trials was recorded for each participant. The belief trials were categorized into the three ToM tasks: True Belief, False Belief, Control Condition. The first set of analyses examined if autistic and typically developing children differed in their performances across the various ToM tasks. In these analyses, the independent (predictor) variable was the child grouping (autistic vs. typically developing). Additionally, chronological age and performance on the Matrix Reasoning subtest of the WASI were used as covariates. The dependent (predicted) variables were the various ToM task scores (False Belief, True Belief, and Control Condition), each ranging in score from 0 to 3 correct trials. Out of the eighteen participants, two children in the autism group were excluded from the statistical analyses for failure in the screening tasks.

Differences in False Belief Scores

To examine any difference in Theory of Mind ability between the autism (N = 7;M = 1.00, SD = .82) and control (N = 9; M = 1.56, SD = .53) groups, an analysis of covariance was conducted on the ToM False Belief task scores with chronological age (in months) and the Matrix Reasoning scaled score as covariates. It was expected that the control group would perform better than the autism group. The False Belief task represented the best approximation of the classic verbal Sally Anne Theory of Mind task. At an alpha level of .05, the covariate, participant's age, was significantly related to False Belief task score, $F(1,12) = 6.92$, $p = .02$. The relationship suggested older children performed better on the False Belief task. However the covariate, Matrix Reasoning scale score, was not significantly related to False Belief, $F(1,12) = .18$, $p = .68$ (Table 1). Results further indicated that the observed difference in performance on the False Belief task between the autism and control groups after controlling for the effects of age and nonverbal intelligence was marginally significant, $F(1, 12) = 4.66$, $p = .052$ (See Table 1 on next page).

Table 1

ANCOVA: Group Differences (Autism vs. Control) in False Belief Score

Sources of Variance	*SS*	*df*	*MS*	*F*	*p*	η_p^2	*Power*
Chronological Age	2.27	1	2.27	6.915	.02	.37	.68
Matrix Reasoning Scaled Score	.06	1	.06	.18	.68	.02	.07
Group	1.53	1	1.53	4.66	.05	.28	.51
Within Groups	3.93	12	.33				
Total	35.00	16					

Differences in True Belief Scores

To further examine any difference in Theory of Mind ability between the autism ($N = 7; M = 1.86, SD = .69$) and control ($N = 9$; $M = 2.11$, $SD = .93$) groups, an analysis of covariance was conducted on the ToM True Belief task scores using chronological age (in months) and the Matrix Reasoning scaled score as covariates. It was expected that the control group would perform better on this task than the autism group. At an alpha level of .05, neither participant's age nor Matrix Reasoning score were significantly related to True Belief score, $F(1,12) = .70$, $p = .80$ and $F(1,12) = .01$, $p = .93$, respectively. Similarly, results indicated that the autism and control group did not differ significantly on True Belief task performance, $F(1,12) = .16$, $p = .70$ (See Table 2 on next page).

Table 2

ANCOVA: Group Differences (Autism vs. Control) in True Belief Score

Sources of Variance	*SS*	*df*	*MS*	*F*	*p*	η_p^2	*Power*
Chronological Age	.57	1	.57	.07	.80	.01	.06
Matrix Reasoning Scaled Score	.01	1	.01	.01	.93	.001	.05
Group	.13	1	.13	.16	.70	.01	.07
Within Groups	9.67	12	.81				
Total	74.00	16					

Differences in Control Condition Scores

The control condition scores were also examined for any difference in Theory of Mind ability between the autism (N = 7;M = 1.71, SD = .76) and control (N = 9; M = 1.44, SD = .88) groups, an analysis of covariance was conducted on the ToM Control Condition task scores using chronological age (in months) and the Matrix Reasoning scaled score as covariates. Again, it was expected that the control group would perform better than the autism group on the task. At an alpha level of .05, neither participant's age nor Matrix Reasoning score were significantly related to Control Condition score, $F(1,12) = .02$, $p = .90$ and $F(1,12) = .16$, $p = .69$, respectively. Likewise, results indicated that the autism and control group did not differ significantly on Control Condition task performance $F(1,12) = .15$, $p = .71$ (See Table 3 on next page).

Table 3

ANCOVA: Group Differences (Autism vs. Control) in Control Condition Score

Sources of Variance	*SS*	*df*	*MS*	*F*	*p*	η_p^2	*Power*
Chronological Age	.57	1	.57	.07	.80	.01	.06
Matrix Reasoning Scaled Score	.01	1	.01	.01	.93	.001	.05
Group	.12	1	.12	.15	.71	.01	.07
Within Groups	9.67	12	.81				
Total	49.00	16					

Differences in Total ToM Scores

The overall ToM score (sum of False Belief, True Belief, and Control Condition scores) was examined for any difference in Theory of Mind ability between the autism (N = 7;M = 4.57, SD = .98) and control (N = 9; M = 5.11, SD = 1.45) groups. The overall score was examined as it provided an estimate of both true and false belief understanding. An analysis of covariance was conducted on the ToM Total Score using chronological age (in months) and the Matrix Reasoning scaled score as covariates. It was expected that the control group would perform better than the autism group overall on the ToM tasks. At an alpha level of .05, neither participant's age nor Matrix Reasoning score were significantly related to the Total ToM score, $F(1,12) = .75$, $p = .40$ and $F(1,12) = .001$, $p = .98$. Similarly, results indicated that the autism and control group did not differ significantly on Total ToM task performance $F(1,12) = .88$, $p = .37$ (See Table 4 on next page).

Table 4

ANCOVA: Group Differences (Autism vs. Control) in Total Theory of Mind Scores

Sources of Variance	*SS*	*df*	*MS*	*F*	*p*	η_p^2	*Power*
Chronological Age	1.33	1	1.33	.75	.40	.06	.13
Matrix Reasoning Scaled Score	.001	1	.001	.001	.98	.00	.05
Group	1.56	1	1.56	.88	.37	.07	.14
Within Groups	21.16	12	1.76				
Total	404.00	16					

Relationship between ToM Scores and CARS for Autism Group

One of the goals of this study was to examine the relationship between functioning level and Theory of Mind abilities in children with autism. Scores from the *Childhood Autism Rating Scale*, an estimate of functioning level, were collected from two raters whenever possible. The first group of raters (*N* = 7; *M* = 33.79, *SD* = 7.16), was made up of individuals who had more contact with the child (e.g. personal aides) whereas the second group of raters (*N* = 5; *M* = 33.70, *SD* = 10.52) were individuals with less contact (e.g. classroom teachers). For some children only one rater was provided as they had no personal aide and remained with the same teacher throughout the school day. In those cases the single rating was placed in the first group (labeled as CARS 1 in Table 5). It was expected that task performance would be inversely related to the CARS scores, as higher CARS scores meant more severe symptoms of autism (i.e. lower CARS rating, better performance). Examination of the bivariate relationships between the two sets of raters' CARS scores and performance on the various belief tasks showed no statistically significant correlations with one another (using Pearson's *r* correlations). Although not statistically significant ($p = .13$), a trend was observed indicating that children who exhibited higher functioning (e.g. lower CARS score) tended to perform better on the true belief task. (See Table 5 below).

Table 5

Correlations Between CARS Scores and Theory of Mind Task Scores in the Autism Group

Theory of Mind Tasks	CARS 1 ($n = 7$)	CARS 2 ($n = 5$)
False Belief	.39 ($p = .39$)	.30 ($p = .62$)
True Belief	.36 ($p = .42$)	-.76 ($p = .13$)
Control Condition	-.46 ($p = .30$)	.54 ($p = .35$)
Total	.22 ($p = .63$)	.15 ($p = .81$)

Discussion

This study examined the relationship between functioning level, as measured by the *Childhood Autism Rating Scale*, and performance on nonverbal Theory of Mind (ToM) belief tasks in a sample of children with autism. Additionally, differences in performance on the ToM tasks between the children with autism and normally developing peers were also examined.

The methodology of this study was based on previous research (Colle et al., 2007) that found differences between individuals with autism and individuals with specific language impairment in performance on the nonverbal measure. However, this study was unable to reproduce or support any group differences between the autism and control groups of children on the nonverbal task. Limitations of this study's participant sample may have contributed to these unsupportive findings. The small sample size utilized in this study lowered the probability of obtaining statistically significant results and made analysis difficult, as assumptions of a normally distributed sample may have not been met. It is recommended that further research attempt to gather a larger sample and also from a more diverse geographic area to provide conclusions that can be generalized to the population.

Theory of Mind in Autism and Control Groups

While examining group differences, this study attempted to statistically control age and nonverbal intelligence as suggested in previous research (Tager-Flusberg, 2007; Colle et al., 2007). This study did show, albeit weakly, that age does impact performance on the belief tasks. Older children tended to perform better on the belief tasks. This finding was not surprising given literature on ToM that suggests that those abilities are developed from social experience and are not innate in individuals. Although nonverbal intelligence (Matrix Reasoning subtest) did not prove to be predictive of ToM, this may have been due to the brief measure chosen. Previous research utilized comprehensive intelligence testing for both estimates on verbal and nonverbal abilities, providing a more valid estimate of abilities. The use of a single subtest from the *Wechsler Abbreviated Scale of Intelligence* (WASI) may not be adequate and valid. This limitation was the result of the availability of testing materials and the practicality of conducting research within the school environment. Future study should utilize a more comprehensive measure for nonverbal abilities.

Relationship between Functioning Level and Theory of Mind Ability

The main goal of this study was to examine how functioning level (*CARS*) related to ToM abilities. This study, however, found no significant relationship between functioning and performance on the belief tasks within the autism group. ToM involves social and communication skills to understand another's point of view and make decisions accordingly. If this study's results are valid, it may suggest that functioning level is not predictive of ToM abilities or that the CARS was not an adequate estimate of functioning, or that the CARS ratings were not reliable. Although the CARS has been shown to be an effective screener for autism by rating functioning on various areas, it may not be adequate in estimating level of functioning in an individual with autism. Much like the subtest from the WASI, the CARS was utilized in the interest of time and practicality in the school environment. A comprehensive rating of adaptive behavior or a more specific diagnostic observation system for autism may provide a better estimate of functioning for future study. On the latter issue, of the CARS ratings not being reliable, it is likely that any differences were due to inconsistencies in the observation setting (e.g. varying length of time spent with the child, changes in environment, etc.) rather than inaccurate ratings, as the raters were trained on the CARS administration prior to the rating. This study also utilized different experimenters and raters to provide a more familiar or comfortable experience for the children with autism, as well as, operate more fluidly in the school settings. However, this can result in inconsistency of ratings. Providing consistent and well-trained raters for the autism group (i.e. systematically observe for a period of days then complete the ratings) may be an alternative solution. Reliability estimates can also be calculated.

Considerations for Future Study

Until recently the use of nonverbal estimates of ToM were not possible. The location change procedure used in the belief tasks offers a systematic method to estimate ToM. This study did not support its validity in doing so, but given the limitations in sample size and selection of measures the procedure should not be discounted. It is still unclear how ToM ability varies in the autism spectrum, and replication studies should be conducted to better understand the relationship. Doing so may offer the means to construct interventions to directly teach ToM skills bother verbally and nonverbally. Replication with a larger more representative sample of children is recommended, both in terms of overall number, age range, and geographic area. As noted previously, more comprehensive measures of intelligence and functioning level may provide more robust results. Additionally, replication in a more controlled environment outside of school may provide clearer effects and should be considered.

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Appendix A

Example Hider and Communicator Script

PRETEST #XXX HIDER SCRIPT DATE:

YOUR NAME: STUDENT'S NAME:

Say: "**We are going to play a hiding and finding game. You need to try to find the treat in one of these two boxes.**" *(show boxes to child by opening and closing each, then positioning on the table)*

(gesture to communicator when saying) **"___(communicator)___ will help you find the treat, *but* ___(communicator)___ is not always right, so choose carefully."**

*******STOP when child gets 3 correct responses in a row; move onto Screening Trials*******

1	Hide treat in: **LEFT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2nd, then close boxes. Say: **"Let's hide another!"**			

2	Hide treat in: **RIGHT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2nd, then close boxes. Say: **"Let's hide another!"**			

3	Hide treat in: **RIGHT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2nd, then close boxes. Say: **"Let's hide another!"**			

4	Hide treat in: **LEFT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2^{nd}, then close boxes. Say: **"Let's hide another!"**			

5	Hide treat in: **RIGHT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2^{nd}, then close boxes. Say: **"Let's hide another!"**			

6	Hide treat in: **RIGHT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2^{nd}, then close boxes. Say: **"Let's hide another!"**			

7	Hide treat in: **LEFT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2^{nd}, then close boxes. Say: **"Let's hide another!"**			

8	Hide treat in: **RIGHT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2^{nd}, then close boxes. Say: **"Let's hide another!"**			

9	Hide treat in: **LEFT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct) open 2^{nd}, then close boxes. Say: **"Let's hide another!"**			

10	Hide treat in: **LEFT** box	*Turn to communicator, say:* **"Where is the treat?"** *Communicator points for 3sec.*	*Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐

If the child did not get three correct in a row, do **not** continue. Give the student whatever treats he or she would have gotten if he or she responded correctly.

NOTES:

PRETEST #XXX Communicator Script DATE:

YOUR NAME: STUDENT'S NAME:

HIDER says: "**We are going to play a hiding and finding game. You need to try to find the treat in one of these two boxes.**"
"**___(communicator)___ will help you find the treat, *but* ___(communicator)___ is not always right, so choose carefully.**"

*******STOP when child gets 3 correct responses in a row; move onto Screening Trials*******

1	Watch the hiding <u>intently</u>	When asked point for 3 seconds to: **LEFT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

2	Watch the hiding <u>intently</u>	When asked point for 3 seconds to: **RIGHT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

3	Watch the hiding <u>intently</u>	When asked point for 3 seconds to: **RIGHT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

4	Watch the hiding <u>intently</u>	When asked point for 3 seconds to: **LEFT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

5	Watch the hiding <u>intently</u>	When asked point for 3 seconds to: **RIGHT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

6	Watch the hiding <u>intently</u>	When asked point for 3 seconds to: **RIGHT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

7	Watch the hiding intently	When asked point for 3 seconds to: **LEFT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

8	Watch the hiding intently	When asked point for 3 seconds to: **RIGHT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

9	Watch the hiding intently	When asked point for 3 seconds to: **LEFT** box	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

10	Watch the hiding intently	When asked point for 3 seconds to: **LEFT** box	**Student Correct?** ☐

If the child did not get three correct in a row, do **not** continue. Give the student whatever treats he or she would have gotten if he or she responded correctly.

NOTES:

SCREENING #XXX Hider Script DATE:

YOUR NAME: STUDENT'S NAME:

Say: "**We are going to play a hiding and finding game. You need to try to find the treat in one of these two boxes.**" *(show boxes to child by opening and closing each, then positioning on the table **behind barrier) "No peeking"***

(gesture to communicator when saying) "**___(communicator)___ will help you find the treat, *but* ___(communicator)___ is not always right, so choose carefully.**"

*****ALL NINE TRIALS MUST BE GIVEN*****

<table>
<tr><td rowspan="3">1</td><td rowspan="2"><u>Behind</u> Barrier
Hide treat in:
LEFT box</td><td rowspan="2">• Place Boxes <u>on top</u> of barrier
• Wait for Comm. to leave
• Open boxes and show child
• Close boxes and switch box positions on top of barrier.</td><td rowspan="2">After communicator returns, ask the child:
"Where is the treat?"
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: "Let's hide another one!"</td></tr>
</table>

<table>
<tr><td rowspan="3">2</td><td rowspan="2"><u>Behind</u> Barrier
Hide treat in:
LEFT box</td><td rowspan="2">• Place Boxes <u>on top</u> of barrier
• Wait for Comm. to leave
• Open box with treat, move treat to RIGHT box; close boxes</td><td rowspan="2">After communicator returns, ask the child:
"Where is the treat?"
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: "Let's hide another one!"</td></tr>
</table>

3	Behind Barrier Hide treat in: **LEFT** box	• Place Boxes on top of barrier • Wait for Comm. to leave • Open box with treat, move treat to **RIGHT** box; close boxes.	*After communicator returns, ask **the communicator**:* **"Where is the treat?"** *Communicator points for 3sec.* *Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

4	Behind Barrier Hide treat in: **LEFT** box	• Place Boxes on top of barrier • Wait for Comm. to leave • Open box with treat, move treat to **RIGHT** box; close boxes	*After communicator returns, ask **the child**:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

5	Behind Barrier Hide treat in: **LEFT** box	• Place Boxes on top of barrier • Wait for Comm. to leave • Open box with treat, move treat to **RIGHT** box; close boxes	*After communicator returns, ask **the child**:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

<table>
<tr><td rowspan="3">6</td><td rowspan="2"><u>Behind</u>
Barrier
Hide treat in:
RIGHT box</td><td rowspan="2">Place Boxes <u>on top</u> of barrier
Wait for Comm. to leave
Open box with treat, move treat to LEFT box; close boxes.</td><td rowspan="2">After communicator returns, ask the communicator:
"Where is the treat?"
Communicator points for 3sec.

Turn to the child, say:
"Where is the treat?"
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: "Let's hide another one!"</td></tr>
</table>

<table>
<tr><td rowspan="3">7</td><td rowspan="2"><u>Behind</u> Barrier
Hide treat in:
RIGHT box</td><td rowspan="2">Place Boxes <u>on top</u> of barrier
Wait for Comm. to leave
Open boxes and show child
Close boxes and switch box positions on top of barrier.</td><td rowspan="2">After communicator returns, ask the child:
"Where is the treat?"
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: "Let's hide another one!"</td></tr>
</table>

<table>
<tr><td rowspan="3">8</td><td rowspan="2"><u>Behind</u> Barrier
Hide treat in:
RIGHT box</td><td rowspan="2">Place Boxes <u>on top</u> of barrier
Wait for Comm. to leave
Open boxes and show child
Close boxes and switch box positions on top of barrier.</td><td rowspan="2">After communicator returns, ask the child:
"Where is the treat?"
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: "Let's hide another one!"</td></tr>
</table>

<table>
<tr><td rowspan="3">9</td><td rowspan="2"><u>Behind</u>
Barrier
Hide treat in:
LEFT box</td><td rowspan="2">Place Boxes <u>on top</u> of barrier
Wait for Comm. to leave
Open box with treat, move treat to RIGHT box; close boxes.</td><td rowspan="2">After communicator returns, ask the communicator:
“Where is the treat?”
Communicator points for 3sec.

Turn to the child, say:
“Where is the treat?”
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.</td></tr>
</table>

Need at least two correct in each of the following sets to continue:
(1 7 8) (2 4 5) (3 6 9)

NOTES:

SCREENING #XXX Communicator Script DATE:

YOUR NAME: STUDENT'S NAME:

HIDER says: "**We are going to play a hiding and finding game. You need to try to find the treat in one of these two boxes.**" *(show boxes to child by opening and closing each, then positioning on the table* ***behind barrier****)* ***"No peeking"***

(gesture to communicator when saying) "**__(communicator)__ will help you find the treat,** ***but*** **__(communicator)__ is not always right, so choose carefully.**"

1	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier Leave Room for 20 seconds. Return to seat.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

2	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier Leave Room for 20 seconds. Return to seat.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

3	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **LEFT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

4	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier Leave Room for 20 seconds. Return to seat.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

5	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier Leave Room for 20 seconds. Return to seat.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

			Student Correct?
6	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **RIGHT** box for 3 seconds.	☐
	Hider opens boxes, and sets up for next trial.		

			Student Correct?
7	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier Leave Room for 20 seconds. Return to seat.	☐
	Hider opens boxes, and sets up for next trial.		

			Student Correct?
8	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier Leave Room for 20 seconds. Return to seat.	☐
	Hider opens boxes, and sets up for next trial.		

			Student Correct?
9	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **LEFT** box for 3 seconds.	☐
	Hider opens boxes, and sets up for next trial.		

Need at least two correct in each of the following sets to continue:
(1 7 8) (2 4 5) (3 6 9)

NOTES:

BELIEF #XXX Hider Script DATE:

YOUR NAME: STUDENT'S NAME:

Say: "**We are going to play a hiding and finding game. You need to try to find the treat in one of these two boxes.**" *(show boxes to child by opening and closing each, then positioning on the table **behind barrier**)* ***"No peeking"***

(gesture to communicator when saying) **"__(communicator)__ will help you find the treat, *but* __(communicator)__ is not always right, so choose carefully."**

*****ALL NINE TRIALS MUST BE GIVEN*****

1	Behind Barrier Hide treat in: **RIGHT** box	• Place Boxes on top of barrier • Wait for Comm. to leave • Switch the positions of the boxes	*After communicator returns, ask **the communicator**:* **"Where is the treat?"** *Communicator points for 3sec.* *Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

2	Behind Barrier Hide treat in: **RIGHT** box	• Place Boxes on top of barrier • Switch the positions of the boxes.	*Ask **the communicator**:* **"Where is the treat?"** *Communicator points for 3sec.* *Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

3	<u>Behind</u> Barrier Hide treat in: **RIGHT** box	• Place Boxes <u>on top</u> of barrier • Switch the positions of the boxes.	*Ask **the communicator**:* **"Where is the treat?"** *Communicator points for 3sec.* *Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

4	<u>Behind</u> Barrier Hide treat in: **LEFT** box	• Place Boxes <u>on top</u> of barrier • Wait for Comm. to leave • Switch the positions of the boxes	*After communicator returns, ask **the communicator**:* **"Where is the treat?"** *Communicator points for 3sec.* *Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

5	<u>Behind</u> Barrier Hide treat in: **RIGHT** box	• Place Boxes <u>on top</u> of barrier • Switch the positions of the boxes.	*Ask **the communicator**:* **"Where is the treat?"** *Communicator points for 3sec.* *Turn to the child, say:* **"Where is the treat?"** *Repeat as needed*	**Student Correct?** ☐
	Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier. Say: **"Let's hide another one!"**			

<table>
<tr><td rowspan="3">6</td><td rowspan="2"><u>Behind</u> Barrier
Hide treat in:
RIGHT box</td><td rowspan="2">• Place Boxes <u>on top</u> of barrier
• Wait for Comm. to leave</td><td rowspan="2">After communicator returns, ask the communicator:
“Where is the treat?”
Communicator points for 3sec.

Turn to the child, say:
“Where is the treat?”
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: “Let’s hide another one!”</td></tr>
</table>

<table>
<tr><td rowspan="3">7</td><td rowspan="2"><u>Behind</u> Barrier
Hide treat in:
LEFT box</td><td rowspan="2">• Place Boxes <u>on top</u> of barrier
• Wait for Comm. to leave</td><td rowspan="2">After communicator returns, ask the communicator:
“Where is the treat?”
Communicator points for 3sec.

Turn to the child, say:
“Where is the treat?”
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: “Let’s hide another one!”</td></tr>
</table>

<table>
<tr><td rowspan="3">8</td><td rowspan="2"><u>Behind</u> Barrier
Hide treat in:
LEFT box</td><td rowspan="2">• Place Boxes <u>on top</u> of barrier
• Wait for Comm. to leave</td><td rowspan="2">After communicator returns, ask the communicator:
“Where is the treat?”
Communicator points for 3sec.

Turn to the child, say:
“Where is the treat?”
Repeat as needed</td><td>Student Correct?</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.
Say: “Let’s hide another one!”</td></tr>
</table>

<table>
<tr><td rowspan="3">**9**</td><td rowspan="2">Behind
Barrier
Hide treat in:
RIGHT box</td><td rowspan="2">• Place Boxes on top of barrier
• Wait for Comm. to leave
• Switch the positions of the boxes</td><td rowspan="2">*After communicator returns, ask **the communicator**:*
“Where is the treat?”
Communicator points for 3sec.

Turn to the child, say:
“Where is the treat?”
Repeat as needed</td><td>**Student Correct?**</td></tr>
<tr><td>☐</td></tr>
<tr><td colspan="4">Open chosen box (give treat if correct); open 2nd box (take treat out if wrong); place boxes behind barrier.</td></tr>
</table>

NOTES:

BELIEF #XXX Communicator Script DATE:

YOUR NAME: STUDENT'S NAME:

Say: "**We are going to play a hiding and finding game. You need to try to find the treat in one of these two boxes.**" *(show boxes to child by opening and closing each, then positioning on the table **behind barrier**)* "***No peeking***"

(gesture to communicator when saying) "**___(communicator)___ will help you find the treat, *but* ___(communicator)___ is not always right, so choose carefully.**"

1	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **RIGHT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

2	Watch the hiding <u>intently</u>	When asked point to the **RIGHT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

3	Watch the hiding <u>intently</u>	When asked point to the **RIGHT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

4	Watch the hiding <u>intently</u>	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **LEFT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

5	Watch the hiding <u>intently</u>	When asked point to the **RIGHT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

6	Watch the hiding intently	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **RIGHT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

7	Watch the hiding intently	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **LEFT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

8	Watch the hiding intently	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **LEFT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

9	Watch the hiding intently	After the boxes are placed on the barrier • Leave Room for 20 seconds. • Return to seat. • When asked Point to **RIGHT** box for 3 seconds.	**Student Correct?** ☐
	Hider opens boxes, and sets up for next trial.		

NOTES:

Appendix B

Parent Informed Consent Form

CONSENT TO PARTICIPATE IN RESEARCH

Relationship between Theory of Mind Performance in a Nonverbal Task and Functioning Level of Children with Autism

Your child is invited to participate in a research study conducted by Mr. Michael Grenda, School Psychology Intern, Eastern Illinois University.
Your participation in this study is entirely voluntary. Please ask questions about anything you do not understand, before deciding whether or not to consent to your child's participation.

You have been asked to participate in this study because your child meets the criteria for participation either based on a special education eligibility of autism recognized by your public school, or based on his or her age for participation in the control group.

PURPOSE OF THE STUDY

Theory of Mind (ToM), the ability to evaluate and understand another person's beliefs, perspectives, or metal state, is thought to be deficient in individuals with autism to some extent. This study will examine the differences in ToM skills in children with Autism based on their functioning level. Results may benefit instruction on social interaction skills to children with Autism.

PROCEDURES

If you volunteer your child to participate in this study, he or she will be asked to:

Complete a short nonverbal task of intelligence, administered by a school psychologist or school psychology intern, which may utilize blocks or pictures. This task will take approximately 5-10 minutes.

Parents or guardians of children with Autism will complete an Autism rating scale (sent home or completed at school at their convenience).

The child will be brought to an available classroom or office and shown the available treats, and encouraged to choose some they would want. The treats chosen will be used as the incentives during the study tasks.

One experimenter (the hider) sits on the floor or at a chair and asks the child to sit opposite them. The other experimenter (the communicator) sits between the child and the hider in such a way that he/she could see where the treat will be hidden and can communicate with the child.

The hider then shows the child two, identical opaque, empty boxes. The child is told they have to find the treat in one of the two boxes. Various situations of the treat being moved always in view of the child, but not always in view of the communicator take place. Each trial always ends with the child being asked where the treat is. These tasks are estimated to take 10-20 minutes.

The following tasks are used:

- **Pretest** – The treat will be placed in one box in full view of the child and communicator. The communicator is then asked and points where the treat is. Then the child is asked "where is the treat?" *3 successive correct trials are required to continue on.*
- **Screen Tests** – (A) The treat will be hidden, communicator leaves, the treat will be moved to the other box, the communicator then returns, and child is asked where the treat is. (B) The treat will be hidden, communicator leaves, the boxes switch positions, the communicator returns, the chills is asked where the treat is. (C) Same as task A except the communicator is asked where the treat is before the child. *3 trials of each task presented randomly, all 9 trials must be correct to continue.*
- **Belief Tests** – (D) Treat hidden, communicator leaves, boxes switch positions, communicator returns and responds incorrectly to where the treat is, the child is asked where the treat is. (E) The boxes switch positions in view of the communicator and the child, the communicator is asked and responds correctly to where the treat is, the child is then asked. (E) Treat hidden, communicator leaves, no switch, communicator returns, communicator asked, child asked. *3 trials of each task randomly.*

POTENTIAL RISKS AND DISCOMFORTS

This research project poses no physical, social, legal, or other risks to the participants. Students will take part in the study individually during school. Missing a small portion of the school day will be unavoidable. Due to the short duration of the experiment (approx. 20min), this is not deemed to be a serious risk. Additionally, effort will be made to ensure participants do not miss essential instruction or assessment at school.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

Society may expect to benefit from this research in that it will add to the empirical literature on autism and Theory of Mind (ToM). Further, the results of this study may prove useful to the decision-making process for implementing interventions and curriculum for social skills training for children with autism.

INCENTIVES FOR PARTICIPATION

Participants will receive a small incentive for participating in the study that they select as a reward for use in the trials. This incentive will be offered at withdrawal or exclusion of any potential participants as well.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you or your child will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by coding participant data and removing any identifying information from data tables, charts, or graphs. Only the principal investigator (Michael Grenda) will have access to identifying information. This information will be destroyed after a period of three years.

PARTICIPATION AND WITHDRAWAL

Participation in this research study is voluntary and not a requirement or a condition for being the recipient of benefits or services from Eastern Illinois University or any other organization sponsoring the research project. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits or services to which you are otherwise entitled.

The investigator may withdraw your child from this research if circumstances arise which warrant doing so, such as: Failure not to meet pretest requirements or when no further participants are needed in the study.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about this research, please contact:

Michael Grenda, *Principal Investigator*
Vermilion Association for Special Education
15009 Catlin-Tilton RD – Suite B
Danville, IL 61834
(217) 443-8273 ext, 1116
mjgrenda@eiu.edu

RIGHTS OF RESEARCH SUBJECTS

If you have any questions or concerns about the treatment of human participants in this study, you may call or write:

Institutional Review Board
Eastern Illinois University
600 Lincoln Ave.
Charleston, IL 61920
Telephone: (217) 581-8576
E-mail: eiuirb@eiu.edu

You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with EIU. The IRB has reviewed and approved this study.

CHECK ONE OF THE FOLLOWING AND RETURN TO SCHOOL

I hereby **do not** consent to the participation of _______________________________________, my child in the investigation herein described nor do I grant access to my child's records for the purposes of this research study.

I hereby consent to the participation of _______________________________________, my child in the investigation herein described. I also consent the principal investigator, Michael Grenda, to access my child's school records for the purpose of gathering only the following: demographic information (date of birth, gender, etc.) and special education eligibility/evaluation results if appropriate. I understand that I am free to withdraw my consent and discontinue my child's participation at any time.

_______________________________________   ______________________

Signature of Child's Parent or Guardian   Date

I, the undersigned, have defined and fully explained the investigation to the above subject.

Signature of Investigator

Date

Appendix C

Participant Assent Script

PARTICIPANT ASSENT SCRIPT

We are helping with a project here at school and want to know if you would like to help out with it.

We will show you two boxes and hide a treat in one of them, all you have to do is find it when we ask you where it is.

All you have to do is watch us and tell us where you think the treat is! There are no wrong answers and you will get to have your treats at the end no matter what.

Later on, Mr. Grenda will ask you to come with him during class to work with some blocks or pictures for a little bit. Once you are finished you get to go back to class.

Oh, I forgot to tell you, if you ever want to quit or leave, you will not get in any trouble. You would even get the treat you picked out.

So what do you think? Would you like to help out? Remember you will miss some class-time to help out.

***answer any questions and concerns for the participant**