2011

A Comparison Of Stimuli Presentation In Advanced Theory Of Mind Tasks For Adolescents With Asperger's Syndrome (as)

Juliet N. Leon
University of Central Florida, leon.juliet@gmail.com

Part of the Communication Sciences and Disorders Commons

This Masters Thesis (Open Access) is brought to you for free and open access by STARS. It has been accepted for inclusion in Electronic Theses and Dissertations, 2004-2019 by an authorized administrator of STARS. For more information, please contact STARS@ucf.edu.

STARS Citation
https://stars.library.ucf.edu/etd/2070
A COMPARISON OF STIMULI PRESENTATION IN ADVANCED THEORY OF MIND TASKS FOR ADOLESCENTS WITH ASPERGER’S SYNDROME (AS)

by

JULIET N. LEON
B.A. Florida State University, 2005

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Communication Sciences and Disorders in the College of Health and Public Affairs at the University of Central Florida Orlando, Florida

Spring Term
2011
ABSTRACT

Individuals diagnosed with Asperger’s Syndrome (AS) have marked impairments in social interaction, including difficulty expressing and perceiving thoughts, emotions, and intentions. This deficit may be due in part to a delayed or underdeveloped Theory of Mind (ToM). The previous research investigating ToM in individuals with AS has been inconclusive. The purpose of this study was to compare three Theory of Mind (ToM) tasks, presented via three different modalities, to evaluate the recognition of complex emotions and mental states in adolescents with AS compared to typically developing adolescents. Participants in this study included twenty adolescents: 10 adolescents with AS and 10 typically developing adolescents matched by age and gender. Participants were administered three ToM tasks differing in mode of stimuli presentation: a visual mentalizing (VM) task; an auditory mentalizing (AM) task; and, a visual+auditory mentalizing (VAM) task. Results were analyzed utilizing a factorial analysis of variance (ANOVA). No significant difference was found between the groups overall, or between the groups by task. A pairwise analysis of the data revealed non-significant differences between visual only (VM) compared to auditory only (AM) presentation of stimuli; however significant differences were found between visual only (VM) stimuli compared to the combination of visual + auditory (VAM) stimuli, and between auditory only (AM) stimuli compared to the combination of visual + auditory (VAM) stimuli. These results indicated that the recognition of complex emotions and mental states increased when the stimuli were presented through the combined visual and auditory channels. Clinical implications of these findings were discussed. Recommendations were made for future research investigating ToM in individuals with AS.
Dedicated to my cousin,
David A. Garcia,
who inspired me and whose presence in my life
was the catalyst for all of this.
ACKNOWLEDGMENTS

I would like to thank the people who contributed to the completion of this study. First I would like to thank my fiancé, Ryan Dewey, for his emotional and financial support. Without his constant encouragement I may not have endured the most challenging moments of this study. I would like to thank my family, especially my mother, Elsa Leon, and my aunt, Angela Garcia, for their fervent search for potential participants. Without their help this study may have taken far longer to complete. I would also like to thank my brother, Paul Leon, for making personal sacrifices to accommodate me and for his show of support.

I would like to give a great thanks to my thesis advisor, Dr. Jamie Schwartz, for her never failing positive outlook and encouragement. Your guidance and thorough critiques instilled me with confidence in the quality of this thesis. I would like to give a special thanks to Dr. Daly, my thesis committee member from outside the department, for her contribution in conjunction with the University of Central Florida Center for Autism and Related disabilities (UCF CARD). Without your involvement the completion of this study would not have been possible. I would also like to thank the rest of my committee, Dr. Jane Lieberman and Dr. Barbara Ehren, who contributed their time and expertise. Thank you for holding me to such a high standard.

A special thanks is given to Dr. M.H. Clark, who contributed her time and statistical knowledge. Thank you for helping me perform the appropriate analysis of the data and for taking the time to explain it. Your guidance allowed me to feel confident in the results and in my understanding of them.
Lastly, and most importantly, I would like to thank all the parents and participants included in this study. Thank you to many of you for inviting me into your homes and for your hospitality. Without your involvement none of this would have been possible. I would like to give a special thanks to the participants with Asperger’s Syndrome and their parents. Your appreciation of this research is what made it all worth it. It was a pleasure working with all of you.
TABLE OF CONTENTS

LIST OF TABLES ........................................................................................................................................... x

CHAPTER ONE: INTRODUCTION .................................................................................................................. 1

  Importance of the Study ................................................................................................................................. 1
  Statement of the Problem ............................................................................................................................... 4
  Subproblems .................................................................................................................................................. 4
  Limitations .................................................................................................................................................... 5
  Assumptions .................................................................................................................................................. 5
  Hypotheses .................................................................................................................................................... 6

CHAPTER TWO: LITERATURE REVIEW ......................................................................................................... 7

  Asperger’s Syndrome ................................................................................................................................. 7
  Asperger’s Syndrome (AS) vs. High Functioning Autism (HFA) ............................................................ 13
  Learning Styles ........................................................................................................................................... 20
  Theory of Mind (ToM) ................................................................................................................................. 21
  ToM Measures ........................................................................................................................................... 24
  Conclusion ................................................................................................................................................... 34

CHAPTER THREE: METHODOLOGY ........................................................................................................... 36

  Participants ................................................................................................................................................ 36
  Theory of Mind (ToM) Tasks ......................................................................................................................... 40
  Piloting ToM Tasks .................................................................................................................................... 42
  Procedure ................................................................................................................................................... 44
Data Analysis ......................................................................................................................... 47

CHAPTER FOUR: RESULTS ......................................................................................................... 49

Hypothesis 1, Adolescents with AS Will Perform Differently on the Visual Mentalizing (VM), Auditory Mentalizing, and Visual + Auditory Mentalizing Tasks when Compared to Age Matched Typically Developing Adolescents ........................................................................... 49

Hypothesis 2, Adolescents with AS Will Perform Differently on Tasks Based on the Type of Stimuli, Compared to Typically Developing Adolescents ........................................................................... 51

Hypothesis 3, ToM Profiles that Are Compiled Will Show Clear Distinctions Between the ToM Abilities of Adolescents with AS vs. the ToM Abilities of Typically Developing Adolescents ........................................................................... 53

CHAPTER FIVE: SUMMARY, DISCUSSION, AND CONCLUSIONS .............................................. 54

Summary .................................................................................................................................. 54

Discussion ................................................................................................................................. 55

Conclusion ............................................................................................................................... 60

Limitations ............................................................................................................................... 61

Suggestions For Future Research ............................................................................................ 62

APPENDIX A: IRB OUTCOME LETTERS .................................................................................. 64

APPENDIX B: CASE HISTORY FORM ....................................................................................... 67

APPENDIX C: RECRUITING FLYERS ....................................................................................... 70

APPENDIX D: LETTER TO PARENTS ....................................................................................... 73

APPENDIX E: CONSENT FORMS ............................................................................................. 75

APPENDIX F: PERMISSION LETTER ....................................................................................... 82
APPENDIX G: VM TASK STIMULI........................................................................................................... 84
APPENDIX H: AM TASK PHRASES ........................................................................................................ 114
APPENDIX I: PILOT DATA...................................................................................................................... 116
APPENDIX J: DEFINITIONS SHEET ....................................................................................................... 118
APPENDIX K: INSTRUCTIONS AND ANSWER KEY ............................................................................ 121
APPENDIX L: CODING FORM ................................................................................................................. 124
LIST OF REFERENCES............................................................................................................................. 126
LIST OF TABLES

Table 1  Participant information for experimental and control groups ................................................................. 39
Table 2  Individual raw scores, range of raw scores, means, and standard deviations for the experimental and control groups (N = 10 respectively) ........................................................................................................... 50
Table 3  Results of group effect, group and task interaction effect, and task effect from factorial ANOVA ........................................................................................................................................................................... 51
Table 4  Task Means for experimental and control groups combined ........................................................................ 52
Table 5  Pairwise comparisons between VM, AM, and VAM tasks ........................................................................... 53
Table L1  Number correct and percentage correct for typically developing participants from Pilot Study ........................................................................................................................................................................... 117
Table L2  Response times for typically developing participants from Pilot Study ........................................ 117
Table L3  Number correct, percentage correct, and response times for female with AS from Pilot Study ........................................................................................................................................................................... 117
CHAPTER ONE: INTRODUCTION

Importance of the Study

Asperger’s Syndrome (AS) is a pervasive developmental disorder characterized by impairments in social interaction, including difficulties in social communication and the ability to express and perceive thoughts, emotions, and intentions (American Psychiatric Association [APA], 2000; Gillberg & Gillberg, 1989; Gillberg, 1991). Additional symptomatology may include social isolation, narrow interests, obsessive routines, repetitive behaviors, motor clumsiness, and egocentricity (APA, 2000; Gillberg & Gillberg, 1989; Gillberg, 1991). These individuals typically demonstrate stronger verbal skills (e.g., extensive vocabulary) than non-verbal skills (i.e., expressing and perceiving non-verbal communication) (APA, 2000). The disorder is detrimental to the individual’s ability to readily engage in social communicative interactions, worsening over time. A diagnosis of AS typically cannot be made confidently until after the age of five years and is often not made until the child has been in school for some time (Gillberg, 2002). Asperger’s Syndrome (AS) is typically found in 2 to 5 out of every 1,000 individuals and is five times more common in males than females (APA, 2000; Ozonoff, Dawsom, & McPartland, 2002).

Impairments in social understanding and interactions with others, commonly exhibited in individuals with AS, may be the result of an underdeveloped Theory of Mind (Bowler, 1992). Theory of Mind (ToM) refers to the ability to infer another’s mental states, such as desires, motivations, beliefs, and intentions without being directly told (Baron-Cohen, 1995; Baron-Cohen, 2001; Baron-Cohen, 2008). These skills are important for normal communication and
social functioning. ToM has been documented as emerging in typically developing children as early as three years of age (Wellman, 1990). Individuals with AS, however, have been reported to be delayed in developing a ToM and as a result they have difficulty interpreting other’s emotions or predicting what someone might be thinking (i.e., mentalizing) (Baron-Cohen, 2008; Bowler, 1992).

In an effort to evaluate an individual’s ToM, various tasks have been developed by a number of researchers. Some tasks that have been used to investigate ToM in individuals with autism spectrum disorder (ASD) are first and second order false-belief tasks. The false-belief task evaluates an individual’s understanding that other people may have a belief that is not true (i.e., false) and may act on that false belief (Van Cleave & Gauker, 2010). These tasks also have been used to evaluate ToM in individuals with AS. Results of studies investigating ToM by using these tasks on individuals with AS have been inconclusive. In some instances there are non-significant differences between the performance of individuals with AS when compared to typically developing individuals (Ozonoff, Rogers, & Pennington, 1991; Bowler, 1992; Tager-Flusberg, 2007); however, newer versions of ToM tasks (i.e., ‘advanced’ ToM tasks) have found significant differences between individuals with AS and typically developing individuals (Heavey, Phillips, Baron-Cohen, & Rutter, 2000; Rutherford, Baron-Cohen, & Wheelwright, 2002). In an effort to make ToM tasks more effective at distinguishing between individuals with AS and typically developing individuals, more ‘advanced’ tests of ToM, have been developed using more complex stimuli and contexts that require interpretation of complex emotions and perception of mental states. On many of these advanced ToM tasks individuals with AS have evidenced impairments compared to typically developing individuals (Golan, Baron-Cohen, Hill,
& Rutherford, 2007; Heavey, et al., 2000; Kaland, Moller-Nielsen, Smith, Mortensen, Callesen, & Gottlieb, 2005; Rutherford, et al., 2002). These findings have been interpreted as being indicative of a ToM impairment in individuals with AS and have demonstrated that advanced ToM tasks have potential for use in the evaluation of individuals with AS.

The advanced ToM tasks have typically presented stimuli via either a visual or auditory modality. Visual ToM tasks have used static photographs of a man or woman’s entire face, rectangular cut outs of a man or woman’s eye region, or video recordings of a person performing or making an expression intended to represent complex emotions or mental states. Auditory ToM tasks have used audio recordings of men and/or women stating short phrases with an inflection meant to represent complex emotions and mental states. Few previous studies have combined the visual and auditory modalities in the presentation of stimuli and few have evaluated performance across tasks where only the mode of stimuli presentation varies. Therefore, there is a need for more research focusing on ToM tasks that examines the ability of individuals with AS to understand complex emotions (e.g., interested) and mental states (e.g., thinking about something sad) through different modalities (i.e., visual, auditory, visual + auditory) (Lindner & Rosen, 2006).

Commercially available diagnostic tools for AS are currently limited to parent questionnaires, rating scales, and observation schedules that must be completed by a parent, teacher, or a professionally trained individual (e.g., neurologist, psychologist, psychiatrist). Due to the need for diagnostic tools that can be used to directly evaluate individuals with AS, and the potential ToM tasks have for use with individuals with AS, there is a concomitant need for research that provides a more in depth understanding of the nature of ToM tasks. In addition,
there is a need both for AS diagnostic tools that can be directly administered to identify an individual with AS as well as evaluate their strengths and weaknesses with regard to preferred modalities of learning. This information would valuable in planning effective speech and language intervention as well as interventions to improve social skills in individuals with AS that may be provided by other professionals (e.g., psychologists).

Statement of the Problem

The predominant deficit in individuals with Asperger’s Syndrome (AS) centers on social interaction and socialization skills. Their deficit may be due to an impaired or underdeveloped Theory of Mind (ToM), making ToM assessment a potentially useful tool in the evaluation of individuals with AS. Currently, ToM tasks are not commonly used in the diagnostic process for clients with AS. This may be due to their recent development, but more importantly, this may be due to the lack of research evaluating which types of tasks are most effective with specific populations. Therefore the purpose of this study was to compare three Theory of Mind (ToM) tasks, presented via three different modalities (i.e. visual, auditory, visual + auditory), to evaluate the recognition of complex emotions and mental states in adolescents with Asperger’s Syndrome (AS) compared to typically developing adolescents.

Subproblems

Three subproblems were identified in this study, including:
1. Determining whether adolescents with AS perform differently than age and gender matched typically developing adolescents on ToM tasks.

2. Determining whether visual, auditory, or visual + auditory tasks are differentially effective in assessing ToM in adolescents with AS.

3. Determining whether a general and/or individual ToM profile for adolescents with AS ToM can be compiled based on the results of these tasks.

**Limitations**

Three primary limitations were identified in this study, including:

1. Participants from the experimental group were matched with participants from the control group based on chronological age and gender only.

2. Participants were referred from the University of Central Florida Center for Autism and Related Disorders (UCF CARD) or were recruited through word of mouth in both central and south Florida.

3. Replication of previously used ToM tasks was not possible, since words and recordings needed to be changed for dialectal/semantic appropriateness as well as age appropriateness.

**Assumptions**

Five assumptions underlie the methodology of this study. They include:

1. Participants received an accurate diagnosis of AS.
2. All tasks were reliably administered across participants.

3. Response to case history forms provided by parents, guardians, and participants were accurate and reliable.

4. The visual mentalizing (VM), auditory mentalizing (AM), and visual + auditory mentalizing (VAM) tasks were viable and equivalent measures of recognition of complex emotions and mental states in adolescents with AS.

5. ToM profiles based on performance on the VM, AM, and VAM tasks will distinguish between adolescents with AS and typically developing adolescents.

Hypotheses

This study is based on the following three hypotheses:

1. There is a significant difference in performance on the visual mentalizing (VM), auditory mentalizing, and visual + auditory mentalizing tasks between adolescents with AS compared to age and gender matched typically developing adolescents.

2. There is a significant difference in performance on tasks based on the type of stimuli presentation: a) visual vs. auditory, b) visual vs. visual + auditory, c) auditory vs. visual + auditory, between adolescents with AS compared to age and gender matched typically developing adolescents.

3. The ToM profiles will distinguish performance between adolescents with AS and age and gender matched typically developing adolescents.
CHAPTER TWO: LITERATURE REVIEW

This literature review consists of three sections. The first section defines and describes the characteristics of Asperger’s Syndrome, the second provides a brief explanation of Theory of Mind (ToM), and the final section describes ToM tasks.

Asperger’s Syndrome

Asperger’s Syndrome (AS), also referred to as Asperger’s Disorder (AD), is a relatively young disorder that became more widely known approximately 30 years ago. In fact, AS was not included in the Diagnostic and Statistical Manual of Mental Disorders (DSM) and International Classification of Diseases (ICD) until the 1990s. The estimated prevalence of AS varies between 0.2 and 0.5% (2-5 individuals in 1,000) of the school-aged population, and is at least five times more common in males than females (American Psychiatric Association [APA], 2000; Ozonoff, Dawson, & McPartland, 2002). An established genetic link has not been identified; however, there often is an increased frequency of AS among family members of individuals with AS (APA, 2000).

Children with AS often have grammar, pronunciation, and vocabulary skills within normal limits for their age, although their vocabulary often has been described as “adult like” (Baron-Cohen, 2008; Ozonoff, et al., 2002; Szatmari, Bartolucci, Brenner, Bond, & Rich, 1989). Individuals with AS often have obsessive and narrow interests, repetitive behaviors, a preference for solitude, hypersensitivity to sounds/textures/tastes/smells/ temperature, problems with motor skills (e.g., clumsiness), and difficulty with change, (Baron-Cohen, 2008; Ozonoff, et al., 2002;
Szatmari, et al., 1989). Their primary deficiencies, with regard to communication, are their impaired pragmatics, difficulty perceiving nonverbal cues, and difficulty with the act of socializing (APA, 2000; Twachtman-Cullen, 1998). Other issues regarding communication include a literal understanding of speech, lack of turn-taking skills, atypical eye contact, speech that is not appropriate for the context, difficulty reading social cues (including emotional expressions), problems reacting appropriately to the behavior of others, and understanding that there can be multiple perspectives on topics (APA, 2000; Baron-Cohen, 2008; Ozonoff, et al., 2002; Szatmari, et al., 1989). These communication deficiencies are often due to a lack of social reciprocity typically manifested by an eccentric and/or one-sided social approach to others (e.g., pursuing a conversational topic regardless of others’ reactions, lack of give and take in conversation) rather than being entirely indifferent to emotions and disinterested in the act of socializing, as one might observe in individuals with Autistic Spectrum Disorder (ASD) (APA, 2000). The early communication and social difficulties are commonly not perceived, by the parent or caregiver, to be of concern until the child enters preschool or interacts with same-age peers (APA, 2000). Social awkwardness and isolation from peers or even family members typically worsens and becomes increasingly apparent over time. By adolescence some individuals with AS may compensate for areas of weakness (e.g., rote verbal skills) with their strengths (e.g., extensive vocabulary); however, these individuals’ extensive verbal skills may be perceived by teachers as defiant or stubborn behavior, especially during adolescence (APA, 2000). Additionally, because adolescents with AS become increasingly self-aware, depression and anxiety also may develop during young adulthood.
Many diagnostic tools are available for use in the diagnosis of AS. Some assessments designed specifically for AS are the Gilliam Asperger’s Disorder Scale (GADS; Gilliam, 2001), the Asperger Syndrome Diagnostic Scale (ASDS; Myles, Bock, & Simpson, 2001), the Krug Asperger’s Disorder Index (KADI; Krug & Arick, 2003), the Childhood Asperger Syndrome Test (CAST; Scott, Baron-Cohen, Bolton, & Brayne, 2002), and the Autism Spectrum Screening Questionnaire (ASSQ; Ehlers, Gillberg, & Wing, 1999). According to a study by Campbell (2005) the KADI presents with the strongest psychometric properties and most thorough item selection when compared to the GADS and ASDS. In addition, Campbell (2005) indicated that the ASSQ and CAST showed potential for use as the CAST had good predictive validity and the ASSQ had sound reliability. However, use of one or more of the aforementioned assessment tools is not mandatory for screening for or determining a diagnosis of AS. In addition, a diagnosis of AS should include a combination of the following: evaluating a child’s developmental history, making observations of the child, providing a speech/language evaluation, and administering a cognitive test (e.g., IQ test) (Ozonoff, et al., 2002). Finally, a diagnosis can be made based on the clinical judgment of a professional (i.e., psychologist, psychiatrist, neurologist, pediatrician, or another professional who is trained in the identification of individuals with AS).

According to the DSM-IV-TR (APA, 2000) a diagnosis of Asperger’s Disorder (i.e., Asperger’s Syndrome) must include:

A. **Qualitative impairment in social interaction, as manifested by at least 2 of the following:**

1. **marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction**
2. failure to develop peer relationships appropriate to developmental level
3. lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)
4. lack of social or emotional reciprocity

B. Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least 1 of the following:
   1. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal in intensity or focus
   2. apparently inflexible adherence to specific, nonfunctional routines or rituals
   3. stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
   4. persistent preoccupation with parts of objects

C. The disturbance causes clinically significant impairment in social, occupational or other areas of functioning.

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

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

F. Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia, (p. 84).
In addition to the DSM-IV criteria, Gillberg and Gillberg’s (1989) diagnostic criteria also has been commonly used to diagnose individuals with AS. Gillberg and Gillberg’s criteria align most closely with Hans Asperger’s (for whom the disorder is named) original criteria (as cited in Gillberg, 2002). Based on Gillberg and Gillberg’s diagnostic criteria an individual must meet all of the following six criteria to receive a diagnosis of AS:

1. **Social impairment (at least two of the following):**
   
   a. difficulties interaction with peers  
   b. indifference to peer contacts  
   c. difficulties interpreting social cues  
   d. socially and emotionally inappropriate behavior.

2. **Narrow interest (at least one of the following):**
   
   a. exclusion of other activities  
   b. repetitive adherence  
   c. more rote than meaning (most interests lack meaning).

3. **Compulsive need for introducing routines and interests (at least one of the following):**
   
   a. which affect the individual’s every aspect of everyday life  
   b. which affect others

4. **Speech and language peculiarities (at least three of the following):**
   
   a. delayed speech development  
   b. superficially perfect expressive language  
   c. formal pedantic language  
   d. odd prosody, peculiar voice characteristics
e. impairment of comprehension including misinterpretations of literal/implied meanings.

5. Non-verbal communication problems (at least 1 of the following):
   a. limited use of gestures
   b. clumsy/gauche body language
   c. limited facial expression
   d. inappropriate facial expression
   e. peculiar, stiff gaze.


Considerable overlap exists between these two diagnostic classification systems but an important distinction that likely contributes to disagreement is that between the speech and language criteria (#4 on both sets of diagnostic criteria). Gillberg’s 4th criterion is in direct contradiction with the DSM-IV’s 4th criterion regarding speech and language. For example, speech and language professionals would consider impairments in prosody and comprehension significant deficits in language development, but an individual would not qualify as having AS using the DSM-IV guidelines if they presented with these impairments. An individual with prosody and comprehension deficits may receive a diagnosis of High Functioning Autism (HFA) rather than AS based on the DSM-IV criteria. However, if the same professional was using Gillberg’s criteria the same individual would receive a diagnosis of AS.
Asperger’s Syndrome (AS) vs. High Functioning Autism (HFA)

The term Asperger’s Syndrome (AS) is often considered a higher functioning version of autism so the term is often used interchangeably with the term high functioning autism (HFA). Although somewhat controversial, a distinction does exist between HFA and AS. The DSM-IV-TR (APA, 2000) currently categorizes Asperger’s Disorder (i.e., Asperger’s Syndrome) as a distinctly separate condition from autistic disorder (i.e., autism or autism spectrum disorder).

HFA refers to higher functioning individuals on the spectrum of autistic disorder, which involves significantly impaired development of socialization skills, verbal communication, non-verbal communication, and awareness of others (APA, 2000). Additional symptoms of autistic disorder include grossly restricted interests, lack of interest in establishing friendships, and a sustained impairment in reciprocal social interaction (APA, 2000). Asperger’s Syndrome (AS), high functioning autism (HFA), and autistic disorder are all considered pervasive developmental disorders (PDDs), (APA, 2000, Bogdashina, 2006). The similarities in some characteristics of individuals with AS and those with HFA may be the cause for confusion in diagnosis. Both disorders are more common in males vs. females, both have repetitive interests, and both evidence impairments in social interaction as well as communication. However, many differences exist as well in terms of the severity of presenting symptoms (e.g., HFA is typically more severe than AS), quality of characteristics (e.g., how the repetitive interests manifest themselves), cognitive skills (e.g., individuals with HFA may have impaired cognitive skills) and language ability (e.g., social communication impairments) (APA, 2000; Baron-Cohen, 2008; Bogdashina, 2006; Ozonoff, Dawson, & McPartland, 2002; Szatmari, 1998).
Several primary distinctions between a diagnosis of AS vs. HFA include: individuals with AS do not present with a language delay, have an average or above average Intelligence Quotient (IQ) level, and have a better prognosis than individuals with HFA (APA, 2000; Baron-Cohen, 2008). These distinctions, as well as additional less consistent ones, will be discussed in more detail below.

Language Delay

In contrast to individuals with AS, individuals with HFA typically demonstrate a significant delay in the development of speech and language (APA, 2000 and Baron-Cohen, 2008). According to Fitzgerald and Corvin (2001) an attempt to separate AS from HFA based on presence or absence of language delay is artificial. Fitzgerald and Corvin (2001) state that the distinction is artificial because it may or may not exist depending on the criteria used to make the diagnosis (i.e., DSM vs. Gilberg’s Criteria). However, the distinction is important to note as it is documented in the DSM-IV-TR diagnostic criteria for Asperger’s Disorder (see diagnostic criteria in previous section). A study by Szatmari, Bryson, Boyle, Streiner, and Duku (2003) compared 21 children with AS to 47 children with HFA by measuring language skill when the children were 4-6 years of age and measuring outcomes when they were 6-8 and 10-13 years of age. The findings indicated that language delay was a distinguishing factor for outcomes between children with AS and children with HFA. Language delay was found to affect outcome for the children with HFA; however, language delay did not have an effect on outcome for the children with AS (i.e., it was not impactful to work on language with the AS group, but working on language improved performance in the HFA group). Individuals with AS appear to improve over
time, achieving developmental milestones, whereas the individuals with HFA do not appear to do so without intervention (Szatmari, 1998; Szatmari, et al., 2003).

Cognitive Differences

Another criterion that is important to consider, that can be used to distinguish AS from HFA, is Intelligence Quotient (IQ) level. Both individuals with AS and HFA commonly have an IQ above 85 (commonly considered average IQ), although it is only required for the diagnosis of AS (Baron-Cohen, 2008). In addition, the DSM-IV-TR notes that mental retardation can sometimes be observed in Autistic Disorder but is rarely observed in Asperger’s Disorder (APA, 2000). Differences also exist when performance IQ and verbal IQ are compared. Individuals with AS typically attain a higher verbal IQ than performance IQ, and in contrast it is the reverse in individuals with HFA (i.e. individuals with AS communicate verbally more than individuals with HFA) (Fitzgerald & Corvin, 2001). A recent study by Noterdaeme, Wriedt, and Hohne (2010) evaluated differences in IQ for children with AS and children with HFA. The study included 57 children with AS and 55 children with HFA ranging in age from 6.1 to 19.9 years of age. Results indicated that the subjects with AS had a higher mean full-scale-IQ and a higher mean verbal-IQ than the subjects with HFA; however, differences between groups on the performance-IQ was not significant. In addition, results indicated that for individuals with AS performance on all subtests related to verbal-IQ were superior to the performance of individuals with HFA. This study also found more deficits in expressive and receptive language, as well as increased frequency of echolalia and pronominal reversal in the children with HFA when compared to children with AS. However, motor problems were found in both groups. The DSM-IV-TR
indicates that individuals with AS generally present with extensive vocabulary skills. This is consistent with the findings of the aforementioned research indicating that individuals with AS present with a higher verbal IQ than individuals with HFA.

In another study by Sahyoun, Soulieres, Belliveau, Mottron, and Mody (2009) linguistic and visuospatial processing during pictorial reasoning was compared in adolescents with AS and adolescents with HFA. The authors concluded that their results indicated that there are different cognitive profiles across the autistic spectrum (Sahyoun, et al., 2009). The study included three groups of 21 individuals each (a group of individuals with AS, a group of individuals with HFA, and a control group of typically developing individuals) that were age matched across groups and ranged in age from 12-30 years. The study’s aim was to determine the presence of cognitive differences in pictorial reasoning between individuals with HFA and individuals with AS. Results indicated a significant difference in response times evidencing a preference for visuospatial stimuli in the HFA group. In addition, HFA participants took longer on the semantic condition; however, AS participants evidenced no difference from the control group.

Prognosis

The distinction based on prognosis is another very important difference between individuals with AS and those diagnosed with HFA. Individuals with AS have, what is likely considered, a better prognosis. The prognosis for individuals with AS is that they will likely be independent eventually, where as there is a higher likelihood that the individual with HFA will be dependent on their guardian or require assistance for the entirety of his/her life (APA, 2000). In a study by Szatmari, Bryson, Streiner, Wilson, Archer, and Ryerse (2000) preschool children with
AS evidenced better outcomes after two years when compared to preschool children diagnosed with autism. A significant difference between groups was found at follow up that paralleled differences between groups at the start of the study. These results point to a significant difference between AS and autism that continues through development. This study did not distinguish between low functioning and high functioning children with autism (HFA); however, children with HFA were included in the autism group.

**Pragmatics and Socialization**

Another consistent distinction with regards to communication is the predominately isolated impairment of pragmatics and socialization skills in individuals with AS (APA, 2000; Twachtman-Cullen, 1998). The DSM-IV-TR indicates that one of the primary deficiencies attributed to AS is their impaired pragmatics which is often due to a lack of social reciprocity typically manifested by an eccentric and/or one-sided social approach to others (e.g., pursuing a conversational topic regardless of others’ reactions, lack of give and take in conversation). The DSM-IV-TR goes on to note that in contrast to individuals with HFA individuals with AS are not completely indifferent to emotions and the act of socializing as they typically are with Autistic Disorder (APA, 2000). In other words, individuals with AS and HFA may both have impaired pragmatics; however, the individuals with AS demonstrate a desire to socialize or appear to concern themselves with socializing more so than individuals with HFA (APA, 2000) who appear indifferent to concerning themselves with emotions and/or engaging in social activities.
Restricted Interests

Another subtle difference that was noted in the DSM-IV-TR pertains to the characteristic of both AS and HFA presenting with restricted, repetitive, and stereotyped interests and activities. Although this characteristic is often present in both disorders the quality of the characteristic is different in individuals with AS compared to individuals with HFA. Individuals with HFA present with “motor mannerisms, preoccupation with parts of objects, rituals, and marked distress in change, where as in Asperger’s Disorder these are primarily observed in the all-encompassing pursuit of a circumscribed interest involving a topic to which the individual devotes inordinate amounts of time amassing information and facts” (APA, 2000, p. 82). Again, the difference is subtle but noteworthy. The subtlety of these distinctions has resulted in much controversy of whether a distinction between AS and HFA should exist, and more importantly the subtly and/or inconsistency of the differences between individuals with AS and individuals with HFA may lead to confusion in diagnosis. Often this confusion can lead to late diagnosis of AS that ultimately may impact an individual’s quality of life.

The confusion over the distinction between AS and HFA has only been exacerbated by recent reports that the DSM-V, to be released in 2013, will likely group Asperger’s Syndrome with Autism Spectrum Disorder (American Psychiatric Association [APA]: DSM-5 Development, n.d.). Despite much opposition, the term “Asperger’s Syndrome/Disorder” is projected to become obsolete and individuals will simply be given a severity level on the spectrum of autism disorder. Many individuals, including professionals, such as Dr. Temple Grandin (professor diagnosed with AS) and Tony Attwood (author of the Complete Guide to Asperger’s Syndrome, 2007), are openly opposed to the elimination of the AS distinction
indicating that it will lead to a decrease in these individuals receiving any diagnosis because they may not meet the requirements of HFA (Frith, 2004; Wallis, 2009). Those for AS becoming part of ASD argue that this may give individuals with AS more benefits and lead to more accurate diagnoses of AS (Wallis, 2009). Results of a recent study by Campbell (2010) that evaluated school psychologists’ ability to make the distinction between AS and ASD in order to make an accurate diagnosis, indicated a lack of agreement among participants on selection of criteria to base a diagnosis for both AS and ASD, as well as uncertainty on proper use of the diagnostic tools available to make a diagnosis of AS. Uncertainty regarding proper use of diagnostic tools was likely due to lack of formal training as only 37.3% of the sample reported that they received formal training. These results indicated that professionals found it difficult to diagnose AS, and/or make the distinction between AS and HFA. Since the difficulty psychologists face is not the result of a lack of distinction being documented, as the distinction is noted in the DSM-IV-TR, the difficulty psychologist are encountering appears to be due to a lack of training or experience with diagnostic tools designed to diagnose AS and knowledge of the documented differences between AS and HFA.

In summary, documented criteria exist that distinguish AS from HFA. However, some professionals diagnosing AS may not be knowledgeable about the distinction between the two or in the use of available diagnostic tools to make an accurate diagnosis of AS. In addition, it is important to note that the distinction between individuals with AS and those with HFA is not always made in research studies creating confusion as to which assessments and/or interventions are appropriate for which population of individuals (e.g., Baron-Cohen, O’Riordan, Stone, Jones, & Plaisted, 1999; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Kaland, Callesen,
Moller-Nielsen, Mortensen, & Smith, 2008; Rutherford, Baron-Cohen, & Wheelwright, 2002). In the following section learning styles are described that have been observed in individuals with AS and individuals with HFA.

**Learning Styles**

Individuals with AS may have some individual differences with regard to their preferred method of learning new material; however, “visual learning strengths” have been noted for students with AS in conjunction with a need for repeated imitation when targeting social skills (National Research Council, 2001). However, the aforementioned documentation is in reference to both individuals with AS as well as individuals with ASD as an entire group. It has been noted that individuals with ASD commonly think more in visual images rather than verbally and rely on visual images for understanding in conversation; however, the transient nature of language, whether it is presented visually or aurally, may make language more difficult to follow for an individual with ASD, which may contribute to their social and communicative impairments (Baron-Cohen, 2008; Quill, 2000). Overall, individuals with ASD may learn better when stimulus is presented visually; however it is undetermined whether this is simply a result of being able to study visual stimuli longer than auditory stimuli, which is fleeting. In addition, it remains uncertain whether this learning style preference applies specifically to Theory of Mind (ToM) acquisition in individuals with AS.
The concept of Theory of Mind (ToM) can be defined as the ability to infer mental states, such as beliefs, desires, intentions, emotions, and imagination, or the ability to reflect on the contents of one’s own and other’s minds (Baron-Cohen, 1995; Baron-Cohen, 2001; Baron-Cohen, 2008). A ToM allows an individual to make sense of or predict another person’s behavior. This act is referred to as mentalizing (i.e., mind-reading) (Baron-Cohen, 2001; Baron-Cohen, 2008; Morton, Frith, & Leslie, 1991) and is important for normal communication and social functioning. ToM begins to develop as early as three years of age in typically developing children (Wellman, 1990). These children were documented as being able to indicate when something was in the mind and not real (i.e., mental-physical distinction), understand beliefs/desires, and understand the representational nature of the mind. However, children demonstrated more consistent abilities to make a mental-physical distinction at the ages of four and five years, (Wellman, 1990). In addition, before the age of 5 years, joint attention can be a predictor and important building block for the development of social skills including ToM (Baron-Cohen, 2008). The importance of ToM with regard to individuals with AS is its role in the mindblindness theory.

The mindblindness theory proposes that individuals with AS (and ASD) are delayed in developing a ToM (Baron-Cohen, 1995; Baron-Cohen, 2008). If ToM is the way by which typically developing individuals predict and make sense of other individuals’ behaviors then individuals with AS may be confused by other people’s actions because other people’s behavior seems unpredictable, because they cannot use a ToM to interpret other’s emotions or anticipate what people might be thinking of doing (Baron-Cohen, 2008). Individuals with AS may be left a
step behind typically developing individuals because they cannot anticipate or interpret other’s intentions in verbal (e.g., metaphors) or gestural communication (e.g., head nod towards something intended to call someone’s attention to it), which may result in confusion, frustration, and/or a literal translation of the information (Baron-Cohen, 2008). Before one can understand the delayed development of ToM in individuals with AS its important to understand the typical development of ToM.

ToM involves several distinctions: mental-physical (e.g., thoughts are different than physical things), appearance-reality, first-order false belief, seeing leads to knowing, recognizing mental state words, understanding the functions of the brain, production of spontaneous pretend play, understanding complex causes of emotion, understanding deception/jokes/sarcasm/pragmatics, etc. (Baron-Cohen, 2001). These distinctions are important with regard to the development of ToM (Baron-Cohen, 2008):

(a) Joint attention develops around 14 months of age or earlier; however, the child with AS will display reduced frequency of joint attention;

(b) The typical 24 month child will engage in pretend play; however, children with AS display less pretend play or their pretend play follows a pre-determined format (e.g., following the rules of a pretend world seen in a movie);

(c) Typically children around the age of at least 3 years can pass the seeing leads to knowing test (McGregor, Whiten, & Blackburn, 1998), which involves determining that the individual who saw something is the only one who knows what it is (e.g., In a picture, one person is looking into a box and one is not, and the test taker must determine who knows what is in the box); however, children with AS pass this test at a delay age;
(d) At approximately 4-years-of-age typically developing children pass the first-order false-belief test (e.g., A story is read to the child where a girl/boy puts a rock somewhere but then someone moves the rock without the girl/boy knowing, and the child must indicate where the girl/boy thinks the rock is) and understand deception. Children with AS typically fail these false-belief tasks and demonstrate delayed understanding of deception by being gullible in their assumption that what others say is always true;
(e) By 6-years-old typically developing children pass second-order false-belief tasks (e.g., In continuation of the example of first-order false-belief tasks, the girl/boy observed the person moving the rock, and the child must explain that the person who moved the rock thinks that the girl/boy didn’t see the person move it); however, individuals with AS evidence delay in when they are able to pass this test;
(f) Lastly, at 9-years-of-age children can typically recognize faux pas (i.e., know what may hurt someone’s feelings) and interpret other individuals expressions through their eyes alone (e.g., Reading the Mind in the Eyes Test; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Baron-Cohen, Wheelwright, Spong, Schahill, & Lawson, 2001); however, individuals with AS are commonly delayed approximately 3 years in being able to recognize a faux pas (i.e., this skill develops around the age of 12 in individuals with AS), and children with AS demonstrate great difficulty with identification of emotions using only the eyes of a person that extends through adulthood, (Baron-Cohen, 2008).

The development of ToM has been linked to social maturity, independent of age and verbal maturity (Peterson, Slaughter, & Paynter, 2007), indicating that social development is not necessarily linked to verbal skills, but is intertwined with ToM development. Children with AS
(including individuals with ASD) typically have deficiencies in ToM (Baron-Cohen, 2001; Senju, Southgate, White, & Frith, 2009; Tager-Flushberg, 2007). Including an assessment of ToM ability may be important during the diagnostic process for the identification of children with AS.

**ToM Measures**

Very few usable diagnostic tools exist that target underlying cognitive processes (i.e., mentalizing, reading facial expressions, detecting emotion in the voice) that facilitate the development of socialization skills and pragmatics. Mentalizing (i.e., mindreading) refers to making sense of another person’s behavior, understanding other minds’, or accurately predicting what others are thinking (Baron-Cohen, 2001; Morton, Frith, & Leslie, 1991). One study by Young, Diehl, Morris, Hyman, & Bennetto (2005) attempted to identify pragmatic difficulties in children with ASD, using a traditional language assessment (e.g., the *Clinical Evaluation of Language Fundamentals - 3; CELF-3*; Semel, Wiig, & Secord, 1995) to evaluate language skills, as well as the *Test of Pragmatic Language (TOPL)*, and the *Strong Narrative Assessment Procedure (SNAP)*. Participants included in this study were 17 males and females with ASD that had verbal IQ and standard language skills of 85 or above. These participants were matched with 17 typical developing individuals on age, gender, language, and verbal IQ. Participant ages ranged from 6 to 14 years of age. The results of this study indicated that the *TOPL* differentiated between children with ASD, but the *SNAP* did not. Although the *SNAP* did not show a significant difference between groups, the ASD group demonstrated increased difficulty with demonstrating insight into the reactions and mental states of the actors in the story (Young, et al., 2005). The authors noted that more research is needed to develop pragmatic language assessments that target
higher-level language comprehension, inferential thinking, and understanding the mind of others (i.e., mentalizing). As a result of this need ToM assessments have more recently received a great deal of attention for their potential use in the evaluation of individuals with ASD; and, more importantly, those with a predominant impairment in the area of socialization, such as individuals with AS.

It is believed that a cognitive transition occurs in children around age four that is marked by the development of ToM. The notion is that after age four children are able to process false beliefs, understand functions of the brain (e.g., dreaming, imagining, wanting), and distinguish between appearances and reality demonstrating that ToM is developing (Baron-Cohen, 2001). Children diagnosed with AS may undergo this transition at a delayed rate or might need to be explicitly taught these skills.

This being the case, children with ASD should have great difficulty with false-belief tasks, which require the use of ToM skills (e.g., inferencing and mindreading); however, some children with ASD have been documented passing false-belief tasks, (Tager-Flusberg, 2007). Children on the autism spectrum who pass ToM assessments typically have received a diagnosis of AS or HFA. In addition, an important distinction that has been documented is a difference in performance on ToM tasks within an AS/HFA group. In a study by Ozonoff, Rogers, and Pennington (1991) participants within a group that consisted of individuals with AS and individuals with HFA were compared to evaluate whether there was a difference between performance of individuals with AS compared to individuals with HFA. The comparison showed that individuals with HFA performed at a poorer level on ToM tasks than the individuals with AS.
and typically developing individuals. These results support the need for clear descriptions of study participants’ characteristics, or to separate individuals with AS from individuals with HFA.

A number of both simple and more challenging ToM measures have been developed that use visual stimuli, auditory stimuli, or a combination of both auditory and visual stimuli. ToM measures evaluate an individual’s performance on activities that require application of ToM skills such as tests of pragmatics, understanding metaphors/jokes/sarcasm/irony, false-belief tasks, and understanding mental states (Baron-Cohen, 2001). Advanced ToM measures have been developed to be more challenging, and perhaps more appropriate, for children with AS since they have been reported to pass more simplistic measures of ToM (e.g., facial expression recognition tasks and first-order false belief tasks).

Advanced ToM Measures

A number of advanced ToM assessments have been developed that are research based (e.g., Faux Pas Recognition task [Baron-Cohen, O’Riordan, Stone, Jones, & Plaisted, 1999]; Reading the Mind in the Voice Test-Revised [Golan, Baron-Cohen, Hill, & Rutherford, 2007]; Reading the Mind in the Eyes Test-Revised [Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001]; The Awkward Moments Test [Heavey, Phillips, Baron-Cohen, & Rutter, 2000]; The Strange Stories Test [Kaland, Moller-Nielsen, Smith, Mortensen, Callesen, & Gottlieb, 2005]; Reading the Mind in the Films Task [Golan, Baron-Cohen, & Golan, 2008]) and theoretically provide a more appropriate measure of ToM in individuals with AS as well as other individuals with HFA that may be able to successfully complete more basic ToM measures (Baron-Cohen, et al., 1999; Baron-Cohen, Wheelwright, Hill, et al., 2001; Golan, et al., 2008; Golan, et al., 2007;
Heavey, et al., 2000; Kaland, et al., 2005). In addition modifications have been made to traditional false-belief tasks (i.e., altering the focus to inferencing of psychological states) in an attempt to make them more appropriate for the population of individuals with AS (and HFA) (Silliman, Diehl, Bahr, Hnath-Chisolm, Zenko, & Friedman, 2003). Two ToM measures have been documented to be appropriate for use with individuals with AS, the Reading the Mind in the Eyes Test – Revised (Baron-Cohen, Wheelwright, Hill, et al., 2001), and the Reading the Mind in the Voice test (Rutherford, Baron-Cohen, & Wheelwright, 2002). A summary of research studies evaluating the appropriateness of these tests for individuals with AS will follow.

Reading the Mind in the Eyes Test – Revised (Baron-Cohen, Wheelwright, Hill, et al., 2001)

Two versions of the Reading the Mind in the Eyes Test – Revised (RME-R) have been created: one designed for older individuals (adults) with AS/HFA (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) and the second designed for children with AS/HFA (Baron-Cohen, Wheelwright, Spong, Schahill, & Lawson, 2001). For this task individuals with AS were asked to identify an emotion seen in a rectangle shaped cut out of a photograph of a person’s eyes with four printed emotion word choices that are read to the individual. Emotions represented by the eyes on this task reflect more complex mental states (e.g., serious, ashamed, scared, confused) (Baron-Cohen, Wheelwright, Hill, et al., 2001). A study by Baron-Cohen, Wheelwright, Hill, et al. (2001) investigated ToM using the adult version of the Reading the Mind in the Eyes Test – Revised. Four groups were compared: (1) 15 males with AS/HFA, (2) 88 general population controls, (3) 103 undergraduate students, and (4) 14 individuals matched to the AS/HFA group for IQ. Ages of participants ranged from 15.2 to 63.4. The results indicated a significant
difference in the ability to identify emotions reflected in visual stimuli (i.e., “eyes”) between the AS/HFA group when compared to the other groups. Another study by Baron-Cohen, Wheelwright, Spong, et al. (2001) evaluated the children’s version of the Reading the Mind in the Eyes Test - Revised (Baron-Cohen, Wheelwright, Hill, et al., 2001) by administering it to a group of 15 males diagnosed with AS (or HFA) ranging in age from 8 to 14 years-of-age, and a group of 53 typically developing children (male and female) ranging in age from 6 to 10 years-of-age. The 28 items on the children’s version also reflected more complex emotions than used on the original Reading the Mind in the Eyes (RME) test (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997). Results indicated a significant difference between the AS group and the typically developing children. That is, the older typically developing children (8 to 12 years-of-age) scored significantly higher than the AS group and the younger (6 to 8 years-of-age) typically developing children on the visual task.

A more recent study by Kaland, Callesen, Moller-Nielsen, Mortensen, and Smith (2008) evaluated the validity of both the adult and child versions of the Reading the Mind in the Eyes – Revised (RME-R) test and speculated that it does not require the individual to form internal representations of the images that would force the individual to use ToM skills. In essence, an individual could simply learn to associate certain facial expressions with words that are used to describe these emotions rather than demonstrating ToM ability. The study included 21 individuals with only a diagnosis of AS ranging in age from 10.2 to 20.4 years-of-age, and 20 typically developing individuals ranging in age from 9.6 to 20.9 years-of-age. The diagnosis of AS was made by at least two diagnosticians that were experienced psychologists or child psychiatrists. Although this study found that the AS group’s performance was below the control
group’s performance for both tasks, the difference was statistically significant for only the child version of the RME-R test (Kaland, et al., 2008). It is important to note that the adult and child versions of the RME-R test used in this study were translated to Danish; however, this translated version was piloted three times before determining that the translated emotion words were appropriate for a Danish speaking population.

Another study by Baron-Cohen, Wheelwright, and Jolliffe (1997) compared a task similar to the RME test (i.e., stimuli used was rectangular cut outs of photographs of a person’s eye region) to a general facial recognition task. Findings indicated that subjects with AS were less impaired compared to normal subjects on a facial recognition task than the eyes alone task. This supports the notion that the eyes alone task creates a more complex scenario that may demand more ToM skills when compared to the simple identification of facial expressions. However, it remains plausible that the identification of facial expressions and eye expression, both being observable, could be taught to individuals. If so, a learning curve might be observed in the performance of older children/adolescents when compared to the performance of younger children. Mere consistent attentiveness may result in an increased familiarity with facial expressions that could result in the increase of performance that is seen in older individuals with AS on facial recognition tasks.

The RME test has been used in multiple studies, most of which resulted in findings indicating potential for use with individuals diagnosed with AS (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen, Wheelwright, Hill, et al., 2001; Baron-Cohen, Wheelwright, Spong, et al., 2001; Baron-Cohen, Wheelwright, & Jolliffe, 1997; Kaland, et al., 2008). In the aforementioned study by Kaland, et al. (2008) a significant difference was found
between an AS group and a typically developing group for the children’s version but the difference between groups for the adult version failed to achieve statistical significance. Overall, the child version of the RME-R test remains the only task of its kind that allows for presentation of visual-only stimuli, and has been repeatedly effective in demonstrating a significant difference between individuals with AS and typically developing children.

**Reading the Mind in the Voice Test (Rutherford, et al., 2002)**

The Reading the Mind in the Voice (RMV) test was designed for use with adults with HFA/AS, since most traditional ToM tasks were not sensitive enough to measure the more subtle deficits typically seen in adults with AS/HFA (Rutherford, Baron-Cohen, & Wheelwright, 2002). In contrast with the aforementioned Reading the Mind in the Eyes (RME) tests visual stimuli are not included in this task. A study by Rutherford et al. (2002) investigating performance on the RMV test included a group of 19 adults (17 males and 2 females) with AS/HFA ranging in age from 16 to 59 years-of-age, a group of 78 adults (38 males and 40 females; age not provided) recruited from a university, and a group of 20 adults (17 males and 3 females) ranging in age from 18 to 53 years-of-age who were neurologically normal but were not university graduates or students. The task involved playing audio clips from dramatic performances associated with particular feelings/emotions, and asking the participant to choose the most appropriate adjective to describe the emotion out of two possible choices. The recording paused for three seconds between items, but if more time was needed it was provided. Participants were asked prior to the task to look over the answer choices and indicate if they were unfamiliar with any terms. No one indicated unfamiliarity with any items. Administration of the task took approximately 11
minutes. Results showed a significant difference between the experimental group (adults with AS/HFA) and the control group (typically developing adults) suggesting that the RMV test has potential for use with individuals with AS/HFA.

In an attempt to improve the sensitivity of this task it was revised and evaluated in a study by Golan, Baron-Cohen, Hill, and Rutherford (2007). The original study (Rutherford, et al., 2002) involved asking the participant to select an answer from two choices (50/50 chance). Modifications to the RMV task in this study included: (1) playing the recording through headphones, (2) increasing the clarity of recordings using digital recordings, (3) providing a definitions handout in advance, (4) pausing the recording for however long the individual needed to respond, and (5) providing four answer choices. In addition to these modifications the test was slightly shortened to 37 items, as opposed to the original 40 items in the original task. This study included an experimental group of 50 individuals diagnosed with AS/HFA and a control group of 22 individuals matched for age, verbal IQ, performance IQ, education and employment status. Participant ages ranged from 17 to 51. In this study the Reading the Mind in the Voice Test-Revised (RMV-R) was compared to the revised version of the Reading the Mind in the Eyes task (RME-R) (Baron-Cohen, Wheelwright, Hill, et al., 2001). Both tasks resulted in significantly lower performance scores for the AS/HFA group compared to the control group. In addition, test-retest reliability was calculated for a group of 24 participants from the RMV-R experimental group (i.e., AS/HFA group), resulting in a test-retest correlation of $r = 0.8$ (Golan, et al., 2007). These results indicated that the modifications made to the RMV-R test have created a more efficient and effective ToM task with increased validity and reliability. In addition, the RMV and RMV-R tests are the only ToM assessments that allow for auditory-only stimuli presentation.
**Advanced ToM Battery**

To date, very few ToM assessment batteries exist. To this researcher’s knowledge only two exist, the *Cambridge Mindreading (CAM) Face-Voice Battery* (Golan, Baron-Cohen, & Hill, 2006) and *ToM Storybooks* (Blijd-Hooogewys, van Geert, Serra, & Minderaa, 2008), which evaluate various ToM components or distinctions. Out of these two ToM batteries only the *CAM Face-Voice Battery* is an advanced ToM battery that has been used to evaluate individuals with AS.

The *CAM Face-Voice Battery* was designed for use on adults with AS who have been known to pass more basic ToM tasks (e.g., false-belief tasks, basic emotion recognition in faces tasks). The *CAM* targets recognition of complex emotions and mental states in the face and the voice (Golan, et al., 2006). In a study by Golan, et al. (2006) the *CAM Face-Voice Battery* was used to evaluate the recognition of specific emotions/mental states, overall performance, recognition of complex emotions/mental states using films of faces rather than still pictures, and recognition of the two perceptual channels (visual and auditory) separately. The study included an experimental group of 21 adults with the specific diagnosis of AS ranging in age from 17.9 to 49.9 years of age, and a control group of 17 typically developing individuals ranging in age from 17.6 to 51.2 years of age. Participants in the control group were matched to the experimental group by chronological, verbal, and nonverbal mental age. Twenty complex emotions were targeted using two instruments: a face recognition and a voice recognition task. Participants were provided with a definitions sheet, including definitions for the twenty complex emotions, which participants could access if they did not know the meaning of any of the targeted emotions.
Results indicated that adults with AS had more difficulty recognizing mental states from faces as well as voices when compared to the control group. Results also indicated that there was a non-significant difference between performance on the visual modality (i.e., face recognition task) compared to the auditory modality (i.e., voice recognition task) among the groups, and a non-significant interaction of group by modality. A strong negative correlation of the CAM scores with the participants Autism Spectrum Quotient (AQ) score was observed, which the authors indicated demonstrated relevance of emotion/mental state recognition difficulty in individuals with AS. Sex differences were found when performance of female participants was compared to the performance of male participants. Results indicated that females with AS performed significantly higher in recognizing emotions in faces than males with AS. Results from the Golan, et al. (2006) study also indicated that males with AS performed significantly higher than females on the voice recognition task which involved audio recordings. Lastly, since the participants with AS were matched to the controls by chronological, verbal, and nonverbal mental age, the results suggested that individuals with AS have difficulty recognizing complex emotions/mental states regardless of IQ, language, central coherence, or executive function (Golan, et al., 2006).

As aforementioned, at this time the CAM Face-Voice Battery exists as the only ToM task that evaluates ToM skills using multiple modes to present stimuli (i.e., visual and auditory modalities) to individuals with AS. However, a dearth of research exists on how a ToM task using a combination of modalities (e.g., visual + auditory) to present stimuli compares to tasks using only one mode of stimuli presentation (e.g., only visual or only auditory modalities) when administered to individuals with AS compared to typically developing individuals.
Conclusion

The most prominent deficit individuals with AS present with, and struggle to overcome, is their limited ability to connect with others. This deficit affects socialization, communication (pragmatics) and ultimately quality of life. The research presented in this literature review indicates the potential importance of ToM assessments for individuals diagnosed with AS. Previous studies have indicated that a major contributor, and possibly the source of this deficit, may be an impaired or underdeveloped ToM in individuals with AS (Baron-Cohen, 2001; Baron-Cohen, 2008; Senju, et al., 2009; Tager-Flushberg, 2007). This being the case, ToM assessment would be a necessary component of the diagnostic process for individuals with AS, given that for these individuals this is where the majority of their impairment appears to lie.

Overall, previous studies have shown impaired ToM skills in children and adults with AS when compared to typically developing children and adults when complex emotions/mental states are included as stimuli (Baron-Cohen, O’Riordan, Stone, Jones, & Plaisted, 1999; Baron-Cohen, Wheelwright, Hill, et al., 2001; Baron-Cohen, Wheelwright, Spong, et al., 2001; Golan, et al., 2007; Zalla, Sav, Stopin, Ahade, & Leboyer, 2009). Thus far, evidence has indicated that many ToM assessments demonstrate potential for use as a diagnostic tool for assessing ToM impairment in individuals with AS. This evidence, however, is limited and more current research has indicated the need for comprehensive instruments (e.g., ToM battery) that assess ToM functioning from various aspects (e.g., in response to visual, auditory, and a combination of both visual and auditory stimuli) (Blijd-Hoogewys, et al., 2008). In addition, evidence is limited on the perceptual channels themselves and their role in assessment of ToM.
This study will investigate the performance of AS and typically developing adolescents on three ToM tasks involving recognition of complex emotions and mental states. The ToM tasks included a visual mentalizing (VM) task, an auditory mentalizing (AM) task, and a visual + auditory mentalizing (VAM) task. The three tasks differ only in mode of stimuli presentation, as the complex emotions and mental states represented are the same across tasks. The tasks will be administered to adolescents with AS and typically developing adolescents matched for chronological age and gender.
CHAPTER THREE: METHODOLOGY

The purpose of this study was to compare three Theory of Mind (ToM) tasks, presented via three different modalities (i.e. visual, auditory, visual + auditory), to evaluate the recognition of complex emotions and mental states in adolescents with Asperger’s Syndrome (AS) compared to typically developing adolescents. Participants and procedures are described in greater detail in the sections that follow. University of Central Florida Internal Review Board (UCF IRB) approval was obtained prior to conducting the study (see Appendix A for IRB approval documentation).

Participants

For this study participants included an experimental group of 10 adolescent males diagnosed with AS and a control group of 10 age and gender matched typically developing adolescents (see Table 1 for participant characteristics). Adolescents with AS were diagnosed by a psychologist, a neurologist, or a neuropsychologist. Diagnoses were based on the results of an Autism Diagnostic Observation Schedule (ADOS; Lord, et al., 1989, or ADOS-G; Lord, et al., 2000) and/or an AS questionnaire/rating scale such as one or more of the following: the Gillam Asperger’s Disorder Scale (GADS; Gilliam, 2001), the Krug Asperger’s Disorder Index (KADI; Krug & Arick, 2003), the Childhood Asperger Syndrome Test (CAST; Scott, Baron-Cohen, Bolton, & Brayne, 2002), and the Asperger Syndrome Diagnostic Scale (ASDS; Myles, Bock, & Simpson, 2001). The ADOS is more commonly used by professionals and is considered the “gold standard” for use in diagnosing Autism and related disabilities. All other instruments used
to diagnose the participants with AS in this study (i.e., GADS, KADI, CAST, & ASDS) were research validated instruments, with the KADI being the most reliable and valid (Campbell, 2005). See Table 1 for specific instruments used to diagnose participants with AS as well as comorbidities and regular medication(s). Ages of the participants with AS ranged from 13.7 to 17.4 years, and grade level ranged from 7 to 12 (see Table 1 for participant characteristics).

Participants with AS were referred from the UCF CARD or recruited through word of mouth. A video explaining the study to potential participants with AS and their families was created and posted on YouTube (www.youtube.com/watch?v=H3qiy_73-fk). The link to this video was sent to parents of potential participants via e-mail, so that it could be used to explain the study to their child.

The control group consisted of 10 typically developing individuals that were age and gender matched to the participants in the experimental group. The chronological ages (CA) for participants in the control group were within 6 months of the matched child with AS and grade level ranged from 7 to 12 (See Table 1 for participant characteristics). Control group participants were restricted to individuals who had not received a diagnosis, or received services for any psychological, developmental, language, or learning disorder/delay as per parent responses on the case history form (see Appendix B). This was to ensure that each age and gender matched participant in the control group most closely resembled the typical development for adolescents of that age and gender. The participants in the control group were recruited using flyers (see Appendix C) that were distributed to individuals familiar to the primary researcher in the central and south Florida regions. Individuals were given multiple flyers and encouraged to pass on a flyer to anyone interested in participating in the study. Control group participants were primarily
recruited by word of mouth. All participants were restricted to adolescents whose first language was English to ensure equal understanding of spoken instructions and auditory stimuli. Participants from both the treatment and control groups were eligible to receive two community service hours from the UCF CARD in exchange for participation in the study.

Once potential participants were identified, letters explaining the study, consent forms, and case history forms were sent home to parents and participants (see Appendix D, E, and B respectively). Following receipt of parental consent, only individuals who met the aforementioned criteria for the experimental and control groups were selected for inclusion. In addition, all potential participants were required to present with vision and hearing within normal limits and were able to read at least at the 5th grade level as reported by parents on the case history form.

Information provided by parents relative to potential participants who were not eligible for inclusion in the study were destroyed immediately once it was confirmed that they did not meet inclusion criteria. Parents were informed if their child did not meet inclusion criteria. All documents containing information about participants or linking them to the study were kept safe in a locked filing cabinet at the researcher’s home. Once the assessments were scored the results were recorded as alphabetic representations (i.e., A, AA, B, BB, etc.) for each participant in the experimental group and the corresponding participant in the control group as well as for each participant in the pilot group. Upon completion of the study and publication of the final product, any documents directly linking participants to the study will be destroyed to ensure participants’ confidentiality; however, nonspecific participant data may be retained for 5 to 6 years in accordance with the UCF IRB requirements.
Table 1
Participant information for experimental and control groups

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Grade</th>
<th>Ethnicity</th>
<th>AS Dx Tool</th>
<th>Comorbidity</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AA-E</td>
<td>16.1</td>
<td>10</td>
<td>C</td>
<td>GADS</td>
<td>NR</td>
<td>Risperdal</td>
</tr>
<tr>
<td>BB-E</td>
<td>13.7</td>
<td>8</td>
<td>C, AA, PI</td>
<td>ADOS, GADS</td>
<td>ADHD</td>
<td>NR</td>
</tr>
<tr>
<td>CC-E</td>
<td>13.10</td>
<td>7</td>
<td>C</td>
<td>GADS</td>
<td>NR</td>
<td>Concerta</td>
</tr>
<tr>
<td>DD-E</td>
<td>14.8</td>
<td>9</td>
<td>C</td>
<td>ASDS</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>EE-E</td>
<td>17</td>
<td>10</td>
<td>C</td>
<td>GADS</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>FF-E</td>
<td>16.8</td>
<td>10</td>
<td>H</td>
<td>ADOS, GADS</td>
<td>ADHD, Anxiety</td>
<td>Concerta, Lexapro</td>
</tr>
<tr>
<td>GG-E</td>
<td>17.4</td>
<td>12</td>
<td>C</td>
<td>GADS</td>
<td>ADHD, Anxiety, OCD, Executive Functions Disorder</td>
<td>Concerta, Lexapro</td>
</tr>
<tr>
<td>HH-E</td>
<td>14.11</td>
<td>9</td>
<td>C</td>
<td>GADS</td>
<td>NR</td>
<td>Concerta</td>
</tr>
<tr>
<td>II-E</td>
<td>15.2</td>
<td>10</td>
<td>C</td>
<td>KADI</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>JJ-E</td>
<td>16.1</td>
<td>10</td>
<td>C</td>
<td>CAST</td>
<td>Seizure Disorder</td>
<td>Seroquel, Celex</td>
</tr>
<tr>
<td><strong>Control Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AA-C</td>
<td>16.6</td>
<td>11</td>
<td>H</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BB-C</td>
<td>13.2</td>
<td>7</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CC-C</td>
<td>13.9</td>
<td>8</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DD-C</td>
<td>14.6</td>
<td>9</td>
<td>H</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EE-C</td>
<td>17.3</td>
<td>12</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FF-C</td>
<td>17</td>
<td>12</td>
<td>H</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GG-C</td>
<td>17.10</td>
<td>12</td>
<td>H</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HH-C</td>
<td>15.3</td>
<td>10</td>
<td>H</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>II-C</td>
<td>15.4</td>
<td>9</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>JJ-C</td>
<td>16.3</td>
<td>11</td>
<td>H</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. Data not included for the control group did not apply; E = Experimental; C = Control; NR = None Reported; AA = African American; C = Caucasian; H = Hispanic; PI = Pacific Islander; ADOS = Autism Diagnostic Observation Schedule; GADS = Gillam Asperger’s Disorder Scale; ASDS = Asperger Syndrome Diagnostic Scale; KADI = Krug Asperger’s Disorder Index; CAST = Childhood Asperger Syndrome Test; ADHD = Attention-Deficit/Hyperactivity Disorder; OCD = Obsessive-Compulsive Disorder
Theory of Mind (ToM) Tasks

Three tasks measuring Theory of Mind (ToM) ability, via identification of complex emotions and mental states, were developed for this study. The three tasks included a visual mentalizing (VM), auditory mentalizing (AM), and visual+auditory mentalizing (VAM) task. The complex emotions and mental states represented by the stimuli across all tasks were: scared, kind, sad, friendly, upset, making somebody do something, worried, interested, remembering, thinking about something, not believing, hoping, serious, made up her mind, a bit worried, thinking about something sad, not pleased, sure about something, nervous, and happy. Twenty-eight items representing these complex emotions and mental states were used across the three tasks. The targeted complex emotions and mental states used in this study were taken from the original stimulus items reported in the Reading the Mind in the Eyes – Revised (RME-R) test for children (Baron-Cohen, Wheelwright, Spong, et al., 2001). Permission was obtained from the first author of the child version of the RME-R test to use and modify the original stimuli as specified below (see Appendix F).

Visual Mentalizing (VM) Task:

The visual mentalizing (VM) task was used to determine the recognition of complex emotions and mental states based on visual stimuli alone. The VM task was adapted from the Reading the Mind in the Eyes-Revised (RME-R) test for children, http://www.autismresearchcentre.com/tests/eyes_test_child.asp, (Baron-Cohen, Wheelwright, Spong, et al., 2001). The RME-R included complex emotion words appropriate for speakers of British-English. One
word in the RME-R, *cross*, was changed to *displeased*, a synonym more commonly used by
American-English speakers (see Appendix G for VM task stimuli).

The VM task included a practice item and 28 scored items. The visual stimuli included a
pair of eyes expressing a complex emotion or mental state. Each item included an approximately
2.5 by 6 inch rectangular cut out of a black and white photograph of only the eyes of a male or
female actor representing a complex emotion or mental state. The participants were presented
with a picture of eyes with 4 emotion word choices in lower case on each corner of the rectangle
(see Appendix G).

Auditory Mentalizing (AM) Task

The Auditory Mentalizing (AM) task was used to determine the recognition of complex
emotions and mental states based on auditory stimuli alone. The AM task was modeled after the
format of the Reading the Mind in the Voice-Revised (RMV-R) task by Golan, et al. (2007),
which has been used to assesses ToM abilities in adults. In this study original phrases and
recordings were created based on those used in Golan, et al. (2007), but were deemed more
appropriate for American-English speaking adolescents (e.g., “I am afraid he is gone out, sir.” or
“Keep the damn thing!” vs. “I’m going to the park now.” or “I can’t believe you drove that far!”)
(see Appendix H). Phrases were created to coincide with, and stated in a manner that
corresponded with, the targeted emotions and mental states reflected in the VM task for stimuli
consistency across tasks. Phrases for each item were recited by professional actors and digitally
recorded with a Sony ICD-P520 Digital Voice Recorder for use in this task. The AM task
included one practice item and 28 test items. The recordings were played for participants through
headphones using an Apple Inc. MacBook. Headphones were sanitized after each use. Answer choices were presented around a blank white rectangle similar in size to the ‘eyes’ stimulus described above.

Visual + Auditory Mentalizing (VAM) task

The visual + auditory mentalizing (VAM) task was used to determine the recognition of complex emotions and mental states based on visual and auditory stimuli presented simultaneously. Therefore, the VAM task used a combination of the VM and AM task materials. This task involved presentation of the visual stimuli from the VM task while the matching emotion/mental state recording from the AM task was played. Answer choices were initially presented around a blank white rectangle as they were in the AM task. Once the researcher began playing the audio recording for an item, the blank white rectangle was removed so that the visual “eyes” stimulus was visible to the participant. Each participant was allowed to view the visual stimulus from the VM task only while the audio recording from the AM task was presented (i.e., the blank white rectangle was placed back on top of the visual stimulus once the audio recording was complete) to ensure that exposure to each stimulus modality was as equal and simultaneous as possible.

Piloting ToM Tasks

To ensure that the procedures and stimuli for the VM, AM, and VAM tasks were appropriate for the potential participants, they were piloted to determine viability. The three tasks
were administered to 8 typically developing male adolescents ranging in age from 13.5 to 17.10 years and one adolescent female with AS, age 16.7 years. The typically developing participants in the pilot group were recruited using the same flyer (see Appendix C) to recruit participants for the control group as well as through word of mouth. The female participant with AS was recruited through referrals from the University of Central Florida Center for Autism and Related Disabilities (UCF CARD). An individual with AS was included in the pilot group to provide an indication of how appropriate the procedures were for individuals with AS. Parental consent was obtained prior to administration of any tasks (see Appendix D for letter to parents and Appendix E for parental consent form).

The purpose of piloting the material was to confirm the viability of the tasks and item stimuli. Determination of viability of the stimuli required more than 50% of the typically developing participants pass more than 9 items (above chance). These criteria were consistent with the criteria used in the original study involving the child version of the RME-R test, (Baron-Cohen, Wheelwright, Spong, Schahill, & Lawson, 2001). For each of the tasks (VM, AM, VAM), the researcher determined the number correct and percentage correct (see Appendix I) for the typically developing participants in the pilot study. One hundred percent of participants passed over 16 items indicating that all task stimuli were viable for use in the study (see Appendix I for data).

In addition, the researcher completed an item analysis to determine whether any item needed to be removed due to lack of clarity or excessive difficulty. The widely used minimum criterion of .20 for item difficulty (p = .20, where p = item difficulty) was used, which lies just below the floor p-value of .25 for a four-option test (Haladyna, 2004). It was determined that a
stimulus item must fall at or below the .20 criterion level across all tasks to be eliminated. Stimulus items 1 and 2 fell below the acceptable criterion level on at least one task; however, no item was below criterion for all tasks. Therefore, the stimulus items administered to the experimental and control groups consisted of the original 28 piloted items.

Lastly, the results from the female participant with AS did not reveal that any elements of the tasks were inappropriate for use with individuals with AS. Additionally, there was no indication that individuals with AS would be restricted by the time constraints of the tasks. Her performance on the VM and AM tasks was below the mean average for the eight typically developing participants in the pilot study. However, her score on the AM task was within the range of scores for the typically developing participants. The VM task was the only task where her performance was lower than the range of scores from the typically developing participants. Her scores on the VAM task were comparable to the mean score for the typically developing participants (see Appendix I for data).

Procedure

The VM, AM, and VAM tasks were administered to both the experimental and control groups in counter-balanced order. In addition, stimulus items were randomized within each task across participants to reduce any potential order effect. Directly prior to the administration of each of the three tasks, a definitions sheet was provided that included child-friendly definitions (Beck, McKeown, & Kucan, 2002) for all of the complex emotions and mental states included in the tasks (see Appendix J for definitions sheet). At this point the examiner informed the participant that if he was unfamiliar with a word, the definition was
available on the definitions sheet. Participants were allowed access to the definitions sheet at any time during all tasks. After the examiner confirmed that the participant understood the purpose of the definitions sheet, and that it was available at anytime, the examiner read the task’s directions (see Appendix K).

Sessions were recorded using a Sony digital voice recorder so that response times for each item could be calculated after the session(s). The test administrator started the recorder before administration of the practice item for each task and verbally indicated the start of each item (i.e., said “item 1,” “item 2,” etc., when presenting the stimulus). Participants verbally responded to each item.

Answer choices were read to the participants prior to presentation of the stimulus for the AM and VAM tasks, and were read simultaneously while presenting the stimulus for the VM task (see Appendix K for exact instructions and Appendix G for VM task stimulus items). One answer choice was printed on each corner of an approximately 2.5 x 6 inch rectangle that was either blank or contained a photo of an individual’s eyes depending upon which task was being administered.

For the VM task the participants were asked to choose the emotion word that was most closely represented by the eyes in each of the pictures during the VM task. For the AM task a recording of one phrase was played through headphones (see Appendix H for phrases). While the recording played, participants were allowed to look at the answer choices that surrounded the blank rectangle described above. Responses were orally stated after listening to the complete recording. If the participant did not respond within 15 seconds, the recording was repeated once. Participants could request that the recording be played again, for a maximum of two times. For
the VAM, task each participant was allowed to view the visual “eyes” stimulus from the VM task only while the auditory recording from the AM task played. If the participant did not respond within 15 seconds of the completion of the recording, it was played once more with the visual stimulus visible while the recording played.

On all tasks the participants were allowed a total of 30 seconds per item to provide an answer. Once the 30 seconds expired, the examiner asked the participant for the answer. If no answer was provided, “no response (NR)” was recorded on the coding form. If a response was not provided, the item was scored as wrong. Participants’ verbal responses were recorded by the researcher on a coding form developed for this study (see Appendix L).

The researcher administered all tasks. Competency in test administration involved being able to recite instructions, supply participants with the definitions sheet, take voice recordings of each sessions, and record responses with 100% consistency across five typically developing practice participants. The researcher was competent in the administration of all tasks prior to evaluation of the experimental and control groups. In addition, the researcher scored all tasks.

The participants were tested in a quiet room with the participant positioned so that they were not facing a window or any items that may have been potentially distracting (e.g., television, computer, stereo, or phone). Tasks were administered to the experimental and control groups in a quiet room either at the participant’s home or at the UCF Communication Disorders Clinic. All tasks were administered in one session; however, if the participant had exhibited the need for a second session (e.g., fatigue, illness, etc.) it would have been provided. Short 5 to 10 minute breaks were taken between tasks except when participants requested to immediately continue to the next task. If a participant requested a break during the administration of a task,
the participant would have been encouraged to complete the current task, if possible, before the break was taken to prevent disruption of task continuity. All participants were able to complete each task without a break. Each task took no more than 30 to 40 minutes each to complete or approximately 1.5 to 2 hours to complete all tasks (depending upon whether breaks between tasks were taken).

Data Analysis

Results will include the following comparisons: experimental (AS) group vs. control (typical) group; experimental group vs. control group for each task; visual (VM) task vs. auditory (AM) task, visual (VM) task vs. visual + auditory (VAM) task, and auditory (AM) task vs. visual + auditory (VAM) task. A factorial analysis of variance (ANOVA) was used to analyze the results. A comparison was made between performance of the AS group and the control group to determine if a significant difference between groups was present. Interaction between group and task was analyzed to determine if differences were present between the performance of the experimental and control groups when the scores from each group were compared per task.

If a significant difference between groups were found, that descriptive information would have been used to compile ToM profiles for the participants, including a general ToM profile for both groups.

It was not possible to determine latency of response for all participants due to either a participant requesting not to be recorded, or because of the unexpected loss of battery life for the digital recorder. Since not all participants’ latency of response was recorded, and given that AS
participants responded immediately for approximately all items there was no objective reason to determine latency of response.
CHAPTER FOUR: RESULTS

This study was conducted to provide a comparison of the effect of different modes of stimuli presentation (i.e., visual, auditory, and visual + auditory) in advanced ToM tasks assessing recognition of complex emotions and mental states for adolescents with AS. Adolescents with AS and typically developing adolescents were compared to investigate performance on three tasks designed to differ only by mode of stimuli presentation. Descriptive statistics are presented for each group along with comparative statistics generated through a factorial analysis of variance (ANOVA). The IBM Statistical Package for the Social Sciences (SPSS) Statistics version 19 software of SPSS Inc. was used to analyze data for the twenty individuals who participated in this study, including ten participants with AS (experimental group) and ten typically developing participants (control group). Groups were matched on chronological age and gender, and were analyzed as paired groups. The assumption of sphericity was met for the factorial ANOVA. The significance level used was $p < .05$. This chapter will present findings for a between group comparison, an analysis of interaction between group and task, and a between task comparison for all participants.

Hypothesis 1, Adolescents with AS Will Perform Differently on the Visual Mentalizing (VM), Auditory Mentalizing, and Visual + Auditory Mentalizing Tasks when Compared to Age Matched Typically Developing Adolescents

To test this hypothesis, the data were submitted to a factorial analysis of variance (ANOVA). Both descriptive and comparative statistics are presented in the following sections.
Descriptive Statistics

The individual raw scores, means, standard deviations (SD), and ranges of performance on the VM, AM, and VAM tasks are presented in Table 2. The means for each group are identical between groups for the VM and AM tasks. Although, a between group mean difference was found for the VAM task (see Table 2) the difference was not significant. Standard deviations were also comparable between groups for VM and AM tasks; however, the standard deviation for the experimental group was much smaller than the standard deviation for the control group for the VAM task.

Table 2
Individual raw scores, range of raw scores, means, and standard deviations for the experimental and control groups (N = 10 respectively)

<table>
<thead>
<tr>
<th>Participant</th>
<th>VM Task</th>
<th></th>
<th>AM Task</th>
<th></th>
<th>VAM Task</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E</td>
<td>C</td>
<td>E</td>
<td>C</td>
<td>E</td>
</tr>
<tr>
<td>AA</td>
<td>15</td>
<td>22</td>
<td>19</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>BB</td>
<td>24</td>
<td>14</td>
<td>20</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>CC</td>
<td>16</td>
<td>15</td>
<td>16</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>DD</td>
<td>21</td>
<td>19</td>
<td>19</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>EE</td>
<td>19</td>
<td>18</td>
<td>18</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>FF</td>
<td>19</td>
<td>24</td>
<td>22</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>GG</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>19</td>
<td>24</td>
</tr>
<tr>
<td>HH</td>
<td>19</td>
<td>23</td>
<td>23</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>II</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>JJ</td>
<td>22</td>
<td>18</td>
<td>20</td>
<td>23</td>
<td>22</td>
</tr>
</tbody>
</table>

| Mean       | 19.4    | 19.4   | 20      | 20      | 21.3    | 22.4  |
| SD         | 2.633   | 3.273  | 2.108   | 2.708   | 1.636   | 3.134 |

Note. E = Experimental Group; C = Control Group; VM = Visual Mentalizing; AM = Auditory Mentalizing; VAM = Visual + Auditory Mentalizing; SD = standard deviation
Comparative Statistics

The comparative statistics used to evaluate between group differences are presented based on results of a factorial ANOVA. The group effect analysis, which determined whether a significant difference between groups existed, did not yield a significant difference between groups: \( F(1,9) = 0.163 \) and \( p = 0.696 \). In addition, the analysis of interaction between group and task indicated that there was a non-significant difference between groups by task: \( F(2,18) = 0.367 \) and \( p = 0.698 \). Therefore, an individual analysis of differences between groups for each task was not necessary. The results of the task effect analysis, which compared between task differences without considering differences between groups, however, yielded a significant difference between tasks: \( F(2,18) = 11.197 \) and \( p = 0.001 \).

Table 3
Results of group effect, group and task interaction effect, and task effect from factorial ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Between groups df</th>
<th>Within groups df</th>
<th>F</th>
<th>Sig.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Effect</td>
<td>1</td>
<td>9</td>
<td>0.163</td>
<td>0.696</td>
<td>20</td>
</tr>
<tr>
<td>Group and Task Interaction</td>
<td>2</td>
<td>18</td>
<td>0.367</td>
<td>0.698</td>
<td>20</td>
</tr>
<tr>
<td>Task Effect</td>
<td>2</td>
<td>18</td>
<td>11.197</td>
<td>0.001</td>
<td>20</td>
</tr>
</tbody>
</table>

Hypothesis 2, Adolescents with AS Will Perform Differently on Tasks Based on the Type of Stimuli, Compared to Typically Developing Adolescents

A non-significant difference was found between groups for the VM, AM, or VAM tasks \( (F(2,18) = 0.367 \) and \( p = 0.698 \)). Due to the lack of significant differences between groups, the experimental and control groups were combined (i.e., \( N=20 \)) to test for overall differences in performance based on the type of task. Thus, further analyses of differences between tasks did
not include distinctions between groups. Descriptive statistics are presented along with comparative statistics generated through a factorial ANOVA.

Descriptive Statistics

The means for all participants (experimental and control groups combined) for each task are presented in Table 4. These means were used to evaluate differences between tasks for all participants using a factorial ANOVA.

Table 4
Task Means for experimental and control groups combined

<table>
<thead>
<tr>
<th>Task</th>
<th>Mean</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM</td>
<td>19.4</td>
<td>20</td>
</tr>
<tr>
<td>AM</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>VAM</td>
<td>21.85</td>
<td>20</td>
</tr>
</tbody>
</table>

Note. VM = Visual Mentalizing; AM = Auditory Mentalizing; VAM = Visual + Mentalizing.

Comparative Statistics

The comparative statistics used to test for differences between modes of stimuli presentation (i.e., differences between tasks) are presented through a factorial ANOVA. Results of the factorial ANOVA indicated an effect for task: $F(2,18) = 11.197$ and $p = 0.001$ (see Table 3). Further analysis of that effect with pairwise comparisons revealed no significant difference between scores for the VM task and the AM task ($p = 0.228$); however, significantly higher scores were found for the VAM task compared to the VM task ($p = 0.004$) as well as for the
VAM task compared to the AM task ($p = 0.005$). Table 5 (significant results in bold) presents results for the pairwise comparisons.

Table 5
Pairwise comparisons between VM, AM, and VAM tasks

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Significance</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM – AM</td>
<td>.228</td>
<td>20</td>
</tr>
<tr>
<td>VM – VAM</td>
<td><strong>.004</strong></td>
<td>20</td>
</tr>
<tr>
<td>AM – VAM</td>
<td><strong>.005</strong></td>
<td>20</td>
</tr>
</tbody>
</table>

Note. VM = Visual Mentalizing; AM = Auditory Mentalizing; VAM = Visual + Mentalizing.

Hypothesis 3, ToM Profiles that Are Compiled Will Show Clear Distinctions Between the ToM Abilities of Adolescents with AS vs. the ToM Abilities of Typically Developing Adolescents

Due to the lack of significant differences between groups on the factorial ANOVA a distinct pattern of performance could not be found to enable composition of an AS profile of performance. The small sample size may have contributed to the lack of significant differences in performance between groups.
CHAPTER FIVE: SUMMARY, DISCUSSION, AND CONCLUSIONS

Summary

The primary aim of this study was to determine whether differences in mode of stimuli presentation of ToM tasks resulted in significant differences in performance between adolescents with AS and typically developing adolescents. Additionally, if significant differences in performance were found between groups, a profile of performance across task modalities would have been developed to illustrate strengths and weaknesses regarding the mode of presentation of ToM stimuli for individuals with AS. This information would have been useful for understanding modality specific deficits in individuals with AS when attempting to perceive information that would require use of ToM skills (e.g., interpreting body language, facial expressions, and/or tone of voice).

Twenty male participants ranging in age from 13.2 to 17.10 years of age were included in the study: ten participants diagnosed with AS and ten typically developing participants. Participants in the control group were age and gender matched with the participants in the experimental group. All participants completed three ToM tasks that varied in mode of stimuli presentation: visual, auditory, and visual + auditory. Administration of tasks was counterbalanced and stimulus item order was randomly varied within each task for each participant.

Results indicated non-significant differences between the adolescents with AS and the typically developing adolescent by group and task (i.e., VM, AM, VAM). However, there was a significant difference by task type. Since there was no significant difference between groups in performance on the tasks, the two groups were combined to determine if there was a difference
in task performance based on modality of task presentation. Results of the factorial ANOVA with groups combined (N=20) revealed a significant difference between scores on the VAM task and the VM task as well as between scores on the VAM task and the AM task. These results indicated significantly higher scores on the task that included a combination of stimuli (visual + auditory) when compared to either task that included presentation of stimuli via only one mode (visual or auditory).

Discussion

Individuals with AS primarily demonstrate deficiencies, with regard to communication, in the area of pragmatics with difficulty perceiving nonverbal cues, and difficulty with the act of socializing (APA, 2000). This impairment is likely due to a delay in the development of ToM skills, which is supported by the mindblindness theory (Baron-Cohen, 2008). This theory proposes that individuals with AS are delayed in developing a ToM, which may result in confusion and/or frustration due to an inability to interpret the emotions of others and anticipate mental states (Baron-Cohen, 2008). Advanced ToM tasks have been designed to evaluate ToM skills, defined as the ability to infer mental states, such as beliefs, desires, intentions, emotions, and imagination, or the ability to reflect on the contents of one’s own and other’s minds (Baron-Cohen, 1995; Baron-Cohen, 2001; Baron-Cohen, 2008), in individuals with AS as well as individuals with HFA. For the current study the visual mentalizing (VM) task was adapted from an advanced ToM test, Reading the Mind in the Eyes-Revised (RME-R) test for children (Baron-Cohen, Wheelwright, Spong, et al., 2001). Results of the current study specifically related to visual mentalizing were inconsistent with results of previous research. Results from a study
conducted by Baron-Cohen, Wheelwright, Spong, et al. (2001) indicated statistically significant differences between a group of 15 children with AS or HFA and a control group of typically developing children. Interestingly, this study did not provide information indicating whether or not participants were on medication(s). In a related study by Kaland, et al. (2008) implementing the RME-R test for children (Baron-Cohen, Wheelwright, Spong, et al., 2001) a statistically significant difference was found between children and young adults diagnosed with AS and a control group of children and young adults of comparable ages. In this study participants were reported to not be on medication of any kind at the time the study was conducted. In both the Baron-Cohen, Wheelwright, Spong, et al. and the Kaland, et al. studies significant differences in performance were found between individuals with AS and typically developing individuals on a visual mentalizing task (i.e., RME-R test for children) regardless of whether or not individuals were on medication at the time of the testing.

Results of the present investigation substantially differed from the results of both the Baron-Cohen, Wheelwright, Spong, et al. (2001) study and the Kaland, et al. (2008) study in that no significant difference was found between groups on the visual mentalizing (VM) task, a task nearly identical to the one used in the previous research. The inconsistency of the results may be due to the inclusion of participants with HFA or inconsistency of professional diagnoses (Campbell, 2010) as the previous research was conducted in countries other than the United States. The inconsistency in findings might also be due to the fact that almost half of the participants in this study were on medication at the time this study was conducted. The medications taken by participants in this study include antipsychotics (e.g., Seroquel and Risperdal), antidepressants (Celex and Lexapro), and a mild stimulant (Concerta). These
medications can improve concentration, attention, mood, and energy level as well as decrease 
repetitive behaviors, irritability, anxiety, and hyperactivity, all of which could improve 
performance on the three tasks administered to the participants. The participants who were not on 
medication, however, obtained comparable results to the participants on medication. This 
indicates that regardless of the influence of medication, the results of the VM task did not 
distinguish between adolescents with AS and typically developing adolescents. The inconclusive 
findings on the VM task merit further research on this type of task, perhaps with a larger sample 
size, and evaluation of differences in performance between individuals with AS on medication as 
opposed to individuals with AS off medication.

The auditory mentalizing (AM) task was designed by this researcher based on the 
Reading the Mind in the Voice-Revised (RMV-R) task by Golan, et al., (2007). The AM task was 
formatted so that it would differ from the VM task only in how the stimuli were presented (e.g., 
stimuli presented aurally as opposed to visually as in the VM task). Previous research on the 
RMV-R task with adults diagnosed with AS indicated a significant difference between adults 
with AS/HFA and typically developing adults (Golan, et al., 2007; Rutherford, et al., 2002). 
There was no indication whether or not the participants in these studies were on medication.

Results of the present study indicated a non-significant difference between the 
experimental and control groups on the AM task. These results are not consistent with previous 
findings for ToM tasks that used auditory only stimuli as well (Golan, et al., 2007; Rutherford, et 
al., 2002). Again the inconsistent findings may be due to differences between the participants in 
the previous studies and the participants in this study, which included age differences (i.e., adults 
vs. adolescents) as well as the inclusion of individuals diagnosed with HFA. Including
participants with HFA may have contributed to decreased performance on the AM task for the experimental groups in previous studies.

The visual + auditory mentalizing (VAM) task was designed to be comparable to both the VM and AM tasks differing in only that both visual and auditory stimuli were presented simultaneously. The visual stimulus was only presented while the participant was exposed to the auditory stimulus. This task was designed to be more similar to inter-personal communication that requires simultaneous interpretation of visual and auditory stimuli. The VAM task was created by the researcher for the purpose of this study and, to her knowledge, no previous research exists implementing a task of this type combining visual and auditory stimuli simultaneously. One study, however, incorporated visual and auditory stimuli representing complex emotions and mental states via video recordings (the Reading the Mind in the Films task by Golan, Baron-Cohen, & Golan, 2008). In the Golan, et al. (2008) study, the Reading the Mind in the Films (child version) task showed a significant difference between a group of children with ASD and a group of typically developing children. Although the Golan, et al. (2008) findings are interesting, a direct comparison with the results of the current study cannot be made because they differ substantially in the type of stimuli used in the tasks (i.e., static images of eyes vs. videos of the entire face or person).

Findings from the current study that indicated a non-significant difference between participants’ (N = 20) performance on the visual only (VM) task compared to the auditory only (AM) task are consistent with previous findings from a study that evaluates the performance of individuals with AS using a ToM battery, the Cambridge Mindreading (CAM) Face-Voice Battery, of assessments including evaluation of complex emotions and mental states with stimuli
presented via visual and auditory modalities (Golan, et al., 2006). The study by Golan, et al. (2006) showed a significant difference between a group of adults with AS and a group of typically developing adults on both the auditory and visual tasks included in the CAM Face-Voice Battery, which is not consistent with the finding from this study; however, the study also found a non-significant difference between performance on their auditory only task compared to their visual only task. Their findings indicating non-significant differences between modalities are consistent with the findings from the current study.

Since no significant differences were found between the experimental and control groups, the groups were combined (N=20) and differences between tasks were analyzed. To this researcher’s knowledge, no previous research exists that compares performance across the three modalities of stimulus presentation used in this study (visual, auditory, and visual + auditory) for advanced ToM tasks. Results of the comparison between tasks for the present study showed no significant difference between the scores of the VM and AM task, indicating no difference when stimuli were presented via visual stimuli only as opposed to stimuli presented via the auditory channel only. A significant difference between the scores for the VAM task compared to the VM task, as well as between the scores for the VAM task compared to the AM task was demonstrated. These results indicated that when a combination of both visual and auditory stimuli were presented, performance was superior to when stimuli were presented via only one modality, regardless of which modality (visual or auditory). These differences suggest that the mode by which stimuli are presented in ToM tasks is important to consider as modality of stimuli may significantly increase or decrease an individual’s performance.
Conclusion

Advanced ToM tasks have been the focus of research studies regarding their potential for use in the AS diagnostic process. Currently, research points to use of advanced ToM assessments in a battery of tests for children, adolescents, and/or adults who have been diagnosed with AS. Previous research primarily has been concentrated on evaluation of a particular ToM task or comparisons of multiple ToM tasks without evaluation of the components of those tasks, such as whether changing the modality of presentation of the stimuli effects participant performance. To this point, there continues to be little research on why one task might be more effective than another task with consideration of differences in the modality of each task. Thus, there is a need for more research to “examine children’s abilities to understand emotion through verbal content, prosody, or and integration of modalities” (Lindner & Rosen, 2006, p.770).

This study targeted visual stimuli, auditory stimuli, and the integration of both visual and auditory stimuli in ToM tasks focusing on the identification of emotions and complex mental states for adolescents with AS in an effort to understand whether differences in modalities have an effect on participant performance. The results of this study indicated that the modality by which complex emotions and mental states are presented in ToM tasks should be strongly considered as it has been demonstrated here to effect overall performance. If complex emotions and mental states are presented via a combination of both visual and auditory stimuli, the participant’s performance will likely be superior to when emotions and mental states are presented through only one modality. It remains uncertain, however, if stimuli with moving images (e.g., video, face to face interactions) would result in findings similar to that found in this study incorporating static photos.
Limitations

There were several limitations inherent in this study that may impact generalizability of the results. A major limitation of this study was the small number of participants in both the experimental and control groups. Recruiting participants for the study was extremely challenging regardless of expanding to surrounding counties and the protracted time spent on recruiting. Although there was a potential pool of 40 to 50 participants with AS referred by the UCF CARD, only 20 could be reached and out of those 20 only 15 agreed to participate in the study. An additional 5 participants withdrew at the start of the study either because the adolescent with AS declined to participate, the family’s schedule was too busy, or for unexplained reasons. Since recruiting participants with AS was so challenging, this study was limited to participants of convenience, which did not allow for random sampling.

Another potential limitation was that it could not be determined with one hundred percent certainty that the study only included individuals with AS. Although criterion was established a priori to ensure as accurate a diagnosis as possible, Campbell (2010) indicated that many professionals are unclear about proper use of AS diagnostic tools as well as differences between AS and HFA. As a result the sample may include individuals with inaccurate diagnoses.

Finally, another potential limitation of the study was that only static photos of eyes were used in both the visual mentalizing and visual + auditory mentalizing tasks. In conjunction with the static photos, a time limitation was imposed for viewing the visual stimulus. The visual stimulus might parallel the auditory stimulus more, however, if it were presented in a moving/changing state as would be encountered in a video recorded version of a visual +
auditory task. In addition, a video recording that depicted complex emotions and mental states would more closely parallel real life social encounters.

Suggestions For Future Research

There are several avenues that might be investigated in future research studies. Future studies should include larger sample sizes. Findings from small sample sized studies are underpowered and hence cannot be generalized beyond individuals included in the study. Collaborations with other centers serving individuals with autism spectrum disorders, school districts, or other professionals will increase the potential participant pool and in turn potentially increase the sample size. Also, recruiting participants who were diagnosed by the same psychologist(s) or neurologist(s) as well as consistent use of valid and reliable assessment measures will help to ensure increased consistency of diagnoses across individuals. In addition studies with larger sample sizes also might allow analysis of other variables such as age.

The use of video recordings should be considered in future studies investigating complex emotions and mental states. Although several studies have incorporated video presentations of stimuli (e.g., Golan, et al., 2008; Golan, et al., 2006), additional investigations are warranted using this method of stimulus presentation.

Results of this study found that the adolescents with AS demonstrated ease with interpreting complex emotions and mental states in still photos and brief audio recordings. Parents of most participants from this study reported that their children continue to have great difficulty reading facial expressions and body language as well as interpreting tone of voice in conversation. These behaviors are indicative of ToM deficits and point to a breakdown that may
occur more within the context of active conversation. Further investigation using stimuli that emulate the context of active conversation, such as that seen in tasks using videos (e.g., the Reading the Mind in the Films task or the CAM Face-Voice Battery) (Golan, et al., 2008; Golan, et al., 2006), is needed to elucidate at what level or perceptual channel the specific breakdown occurs for adolescents with AS. Similarly, future studies should attempt to evaluate performance of individuals with AS in social contexts with other people. The tasks used in this study were not sensitive enough to detect differences between adolescents with AS and typically developing adolescents regardless of obvious impairments in socialization observed by the researcher (e.g., intense eye contact, lengthy handshakes, or irrelevant comments). Future studies of AS assessments should consider tasks that evaluate performance in the context of interpersonal communication.

Lastly, future research should include groups of individuals with Attention-Deficit Hyperactivity Disorder (ADHD), Obsessive-Compulsive Disorder (OCD), and/or anxiety disorders as about half of the participants in this study reported co-morbidity with AS, consistent with previous literature (Gillberg, 2002; Ozonoff, et al., 2002). Many of these participants also took medication for these disorders, so future research that evaluates individuals with these disorders should consider splitting participants into a medicated and un-medicated group to evaluate differences in performance with and without medication(s).
APPENDIX A: IRB OUTCOME LETTERS
Approval of Human Research

From: UCF Institutional Review Board #1
FWA00000351, IRB00001138

To: Juliet N. Leon

Date: September 10, 2010

Dear Researcher:

On 9/10/2010, the IRB approved the following human participant research until 9/9/2011 inclusive:

- **Type of Review:** Submission Response for UCF Initial Review Submission Form
- **Project Title:** Profiling Theory of Mind (ToM): A Comparison of Stimuli Presentation in Advanced Theory of Mind Assessment on Adolescents with Asperger Syndrome (AS)
- **Investigator:** Juliet N. Leon
- **IRB Number:** SBE-10-07099
- **Funding Agency:**
- **Grant Title:**
- **Research ID:** N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu.

If continuing review approval is not granted before the expiration date of 9/9/2011, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 09/10/2010 02:20:24 PM EDT

IRB Coordinator
Approval of Human Research

From: UCF Institutional Review Board #1
FWA00000351, IRB00001138

To: Juliet N. Leon

Date: October 22, 2010

Dear Researcher:

On 1/22/2010, the IRB approved the following minor modification to human participant research until 09/09/2011 inclusive:

- **Type of Review:** IRB Addendum and Modification Request Form
- **Modification Type:** Addition of a recruiting video to supplement the recruiting flyer used to recruit adolescent participants to the research study.
- **Project Title:** Profiling Theory of Mind (ToM): A Comparison of Stimuli Presentation in Advanced Theory of Mind Assessment on Adolescents with Asperger Syndrome (AS)
- **Investigator:** Juliet N. Leon
- **IRB Number:** SBE-10-07099
- **Funding Agency:** N/A
- **Grant Title:** N/A
- **Research ID:** N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at [https://iris.research.ucf.edu](https://iris.research.ucf.edu).

If continuing review approval is not granted before the expiration date of 09/09/2011, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in IRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 10/22/2010 01:06:51 PM EDT
APPENDIX B: CASE HISTORY FORM
Case History Form

Identifying and Family Information:

Child’s Name: _____________________    Birthdate: ___________    Sex: M / F

Father’s Name: _____________________    Daytime Phone: ___________
Address: ___________________________    Cell Phone: ___________
E-mail: ____________________________

Mother’s Name: _____________________    Daytime Phone: ___________
Address: ___________________________    Cell Phone: ___________
E-mail: ____________________________

Child’s race/ethnic group: (circle all that apply)

Caucasian    Non-Hispanic    Hispanic    African-American
Native American    Asian or Pacific Islander    Other: ___________

Is there a language other than English spoken in the home?(circle one:) Yes No
If yes, which one?
Does the child speak the language? Yes No
Does the child understand the language? Yes No
Which language does the child prefer to speak at home? _________________________

Has your child been diagnosed with a speech, language, or psychological delay/disorder, or received special services from the public or private school system ?(circle one) Yes No
If yes, please describe. ________________________________________________________________
_______________________________________________________

Has your child been diagnosed with Autism Spectrum Disorders or Asperger Syndrome? Yes No

If your child has been diagnosed with Asperger Syndrome, was this diagnosis made by a licensed physician?(circle one) Yes No
If no, who made the diagnosis? ____________________________

What diagnostic tool(s) was used to make this diagnosis?(Circle from the following:)

1. Autism Diagnostic Observation Schedule (ADOS)
2. Krug Asperger's Disorder Index (KADI)
3. Gilliam Asperger's Disorder Scale (GADS)
4. Asperger's Syndrome Diagnostic Scale (ASDS)
5. Other: ___________________________________________________________________________
Has he/she ever had a speech evaluation/screening?  **Yes**  **No**
If yes, where and when? _______________________________________________________
What were you told?  ______________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Has he/she ever had a hearing evaluation/screening?  **Yes**  **No**
Has he/she ever had a vision evaluation/screening?  **Yes**  **No**
If yes, where and when? _______________________________________________________
What were you told?  ______________________________________________________________________
____________________________________________________________________________________

Has your child ever had speech therapy?  **Yes**  **No**
If yes, where and when? _______________________________________________________
What was he/she working on?  ______________________________________________________________________

Has your child received any other evaluation or therapy (physical therapy, counseling, occupational therapy, etc.)?  **Yes**  **No**
If yes, please describe.____________________________________________________________________
____________________________________________________________________________________

Is your child currently (or recently) under a physician’s care?  **Yes**  **No**
If yes, why? ______________________________________________________________________
____________________________________________________________________________________

Please list any medications your child takes regularly:
____________________________________________________________________________________
____________________________________________________________________________________

Name of school and grade in school: ______________________________________________________

Has your child repeated a grade?  **Yes**  **No**
If yes, which grade? ______________________________________________________________________

Can your child read?  **Yes**  **No**
If yes, at what level? ______________________________________________________________________
APPENDIX C: RECRUITING FLYERS
Control Group Recruiting Flyer:

**Study of Perspective Taking Skills in Adolescents**

This study presents an opportunity to take part in a research project that I am conducting for my Masters thesis in the Department of Communication Sciences and Disorders at the University of Central Florida (UCF). I will be evaluating 3 perspective taking assessments. The assessments will take, at the most, 2 hours to complete. Your individual performance on the assessments will remain confidential. Results will be used to compare each assessment’s ability to discriminate perspective taking skills.

Participants will be eligible to receive **Community Service hours** that can be used toward Bright Futures Scholarships for their participation.

To participate in the study you or your child must meet the following requirements:

- **Male between the ages of 13-18**
- **No history of a delay or disorder of any kind.**
- **Has not received special services from the public or private school system.**
- **Live near the Orlando, Daytona, Jacksonville or Ft. Lauderdale, FL. areas, or can commute to these areas.**

If you meet these requirements and are interested or know someone who is interested please contact me at jleon@knights.ucf.edu, or contact my faculty supervisor, Dr. Jamie Schwartz, at (407) 823-4807 or by e-mail at jschwart@mail.ucf.edu.
Study of Perspective Taking Skills in Adolescents with Asperger’s Syndrome

This study presents an opportunity to take part in a research project that I am conducting for my Masters thesis in the Department of Communication Sciences and Disorders at the University of Central Florida (UCF). I will be evaluating the ability to identify emotions using three different assessment tasks that can be directly administered to an individual identified as having Asperger’s Syndrome. These assessments allow for direct assessment of an individual rather than completing a parent questionnaire or taking part in lengthy observations. The three tasks will be administered to your adolescent directly and will take, at the most, 2 hours to complete in a one-time session that can be completed at your home, or at the UCF Communication Disorders Clinic on research parkway. Your adolescent’s individual performance on the assessments will remain confidential. Results will be used to compare group performance on the assessment tasks.

Participants will be eligible to receive Community Service hours that can be used toward Bright Futures Scholarships for their participation.

To participate in the study your adolescent must meet the following requirements:

- Male between the ages of 13-18 years with a diagnosis of Asperger’s Syndrome.
- No uncorrected visual or hearing impairments.
- Live near the central Florida, south Florida, or Jacksonville, FL. areas, or can commute to these areas.

If your adolescent meets these requirements and may be interested in the study or you know someone who may be interested please contact Juliet Leon at (954) 907-3040 or by e-mail at jleon@knights.ucf.edu, or contact my faculty supervisor, Dr. Jamie Schwartz, at (407) 823-4798 or by e-mail at jschwart@mail.ucf.edu.
APPENDIX D: LETTER TO PARENTS
Dear (parent(s)/caregiver name),

Your child has been selected for possible inclusion in a research opportunity that will contribute to the current research on adolescents with Asperger’s Syndrome (AS). The study will include children with AS as well as typically developing children from 13 to 18 years of age. If you choose to provide consent for your child to participate in this research opportunity you will need to complete the case history form included in this envelope and sign the included consent form. The research opportunity will involve the completion of three tasks that will take no more than 30 minutes each, for a total of 1.5 to 2 hours depending on whether breaks are required. Each task will include specific stimuli (visual only, auditory only, and visual + auditory stimuli). Tasks will involve presentation of a picture of eyes, presentation of brief recordings of common phrases, or a combination of both pictures and recordings. Sessions will be held at the University of Central Florida (UCF) Communication Disorders Clinic, or, if it is not possible for you to bring your child to the clinic, arrangements can be made to conduct home sessions. I look forward to hearing back from you and appreciate the contribution you or your child may make to this research project.

Sincerely,

Juliet Leon, B.A.

jleon@knights.ucf.edu or Dr. Jamie Schwartz may be contacted at (407) 823-4807 or by e-mail at jschwartz@mail.ucf.edu.
APPENDIX E: CONSENT FORMS
Profiling Theory of Mind (ToM): A Comparison of Stimuli Presentation in Advanced Theory of Mind Assessment on Adolescents with Asperger Syndrome (AS)

Informed Consent from a Parent for a Child

Principal Investigator: Juliet Leon, BA.

Faculty Supervisor: Jamie B. Schwartz, Ph.D.

Investigational Site(s): UCF Communication Disorders Clinic

How to Return this Consent Form: Please return the signed consent form by bringing it to the first session conducted. If consent will not be provided please contact the principal investigator at jleon@knights.ucf.edu, or the faculty supervisor at (407) 823-4807 or by e-mail at jschwart@mail.ucf.edu.

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being asked to allow your child to take part in a research study which will include 40 children from the counties surrounding UCF. Your child is being invited to take part in this research study because he/she is a typically developing adolescent whose age and gender matches that of an individual with Asperger Syndrome (AS) who is participating in this study, or is an adolescent who has been identified as having AS.

The person doing this research is a graduate student, Juliet Leon, from the University of Central Florida, Department of Communication Sciences and Disorders (DCSD). Because the researcher is a masters student she is being guided by Dr. Jaime Schwartz, an Associate Professor in the DCSD. Undergraduate students in the DCSD may assist the principal investigator with this study as part of the research team. If undergraduate students assist in this study their names will be disclosed to you.

What you should know about a research study:
- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should allow your child to take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you or your child.
- Feel free to ask all the questions you want before you decide.
Purpose of the research study: The purpose of this research study is to evaluate whether differences exist between various methods of stimuli presentation of a task that targets perception of complex emotions and mental states in individuals with Asperger Syndrome (AS). Previous studies have not evaluated differences in participant performance with different stimuli using this type of task. Furthermore, previous studies that are comparable to this study have not used adolescents specifically, and have not included American-English speaking individuals. This study attempts to evaluate the appropriateness of this task for American-English speaking adolescents with AS and whether stimuli presentation of the task affects participant performance.

What your child will be asked to do in the study: Tasks will be administered to the participant by the primary investigator or a trained undergraduate student. The research will be conducted between the months of September to December of 2010 during daytime hours at the UCF Communication Disorders Clinic, or at the participant's home if prior arrangements are made to do so. The experimental procedures will include looking at rectangular cut outs of photographs of people's eyes, and listening to brief recordings of individuals saying a common phrase. The participant will then choose an emotion that corresponds with what they see and/or hear. Three tasks will be administered in 1-3 sessions depending on the preference of the participant. Each task will be administered once. The responsibilities of the participant will include listening to the instructions provided by the researcher, answering each item, and completing the task once it has begun.

Location: Sessions will be held at the UCF Communication Disorders Clinic. Prior arrangements may be made to conduct sessions in the participant's home if it is not feasible for the participant to go to the UCF Communication Disorders Clinic.

Time required: We expect that your child will be in this research study for 1.5 to 2 hours. The number of sessions required to complete the tasks may vary from 1 to 3 depending on the number, and length, of breaks requested between tasks. Each task will take no more than 30 minutes. A short break will be taken between tasks. However, participants will be allowed to request longer breaks or request an additional session if fatigued. If the participant does not require additional breaks all tasks may be completed in only one session.

Audio taping: Your child will be audio taped during this study. If you do not want your child to be audio taped, your child will still be able to participate in the study. Please notify the principal investigator or faculty supervisor if you do not wish your child to be audio taped. If your child is audio taped, the tape will be kept in a locked filing cabinet. The tape will be erased or destroyed after the completion of the study.

Benefits: We cannot promise any benefits to you, your child, or others from your child taking part in this research. However, possible benefits include learning more about the research process, and contributing to the body of research on adolescents with Asperger Syndrome (AS).

Compensation or payment: Compensation for your child's participation will be the receipt of 2 community service hours provided by the UCF Center for Autism and Related Disabilities (CARD). If your child completes any part of the study, your child will receive community service hours for the time your child spent in the study.

Confidentiality: We will limit your personal data collected in this study. You and your child's personal information will be limited to individuals who have a need to review this information (i.e., the principal investigator and faculty supervisor). However, we cannot promise complete anonymity as your information may be reviewed by the UCF Institutional Review Board (IRB) or other official representatives of UCF.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, or think the research study has hurt your child contact: Juliet Leon, Graduate Student, Department of Communication Sciences and Disorders, by email at jleon@knights.ucf.edu or Dr. Jaime Schwartz. Associate Professor, Department of Communication Sciences and Disorders at (407) 823-4807 or by email at j schwartz@mail.ucf.edu.
IRB contact about you and your child’s rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Withdrawing from the study:
You may decide not to have your child continue in the research study at any time without it being held against you or your child. If you decide to have your child leave the study, he or she may receive the community service hours commensurate with their participation. If you decide to have your child leave the study, please contact the principal investigator so that any information gathered about your child can be deleted.

Additionally, the principal investigator can remove your child from the research study without your approval. Possible reasons for removal include the child not meeting previously established criteria for inclusion in either the experimental or control group, or for failure to follow instructions of the research staff. We will tell you and your child about any new information that may affect your choice to have your child continue in the study.

Your signature below indicates your permission for the child named below to take part in this research.

DO NOT SIGN THIS FORM AFTER THE IRB EXPIRATION DATE BELOW

Name of participant

Signature of parent or guardian

Date

☐ Parent

☐ Guardian (See note below)

Printed name of parent or guardian

Child obtained

Note on permission by guardians: An individual may provide permission for a child only if that individual can provide a written document indicating that he or she is legally authorized to consent to the child’s general medical care. Attach the documentation to the signed document.
Informed Consent from Adult

Principal Investigator: Juliet Leon, BA.

Faculty Supervisor: Jamie B. Schwartz, Ph.D.

Investigational Site(s): UCF Communication Disorders Clinic

How to Return this Consent Form: Please return the signed consent form by bringing it to the first session conducted. If consent will not be provided please contact the principal investigator at jleon@knights.ucf.edu, or the faculty supervisor at (407) 823-4807 or by e-mail at jschwartz@mail.ucf.edu.

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being asked to take part in a research study which will include 40 adolescents from the counties surrounding UCF. You are being invited to take part in this research study because you are a typically developing adolescent whose age and gender matches that of an individual with Asperger Syndrome (AS) who is participating in this study, or you are an individual who has been identified as having AS.

The person doing this research is a graduate student, Juliet Leon, from the University of Central Florida, Department of Communication Sciences and Disorders (DCSD). Because the researcher is a masters student she is being guided by Dr. Jaime Schwartz, an Associate Professor in the DCSD. Undergraduate students in the DCSD may assist the principal investigator with this study as part of the research team. If undergraduate students assist in this study their names will be disclosed to you.

What you should know about a research study:
- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

University of Central Florida IRB
IRB NUMBER: SBE-10-07099
IRB APPROVAL DATE: 9/18/2010
IRB EXPIRATION DATE: 9/9/2011
Purpose of the research study: The purpose of this research study is to evaluate whether differences exist between various methods of stimuli presentation of a task that targets perception of complex emotions and mental states in individuals with Asperger Syndrome (AS). Previous studies have not evaluated differences in participant performance with different stimuli using this type of task. Furthermore, previous studies that are comparable to this study have not used adolescents specifically, and have not included American-English speaking individuals. This study attempts to evaluate the appropriateness of this task for American-English speaking adolescents with AS and whether stimuli presentation of the task affects participant performance.

What you will be asked to do in the study: Tasks will be administered by the primary investigator or a trained undergraduate student. The research will be conducted between the months of September to December of 2010 during daytime hours at the UCF Communication Disorders Clinic, or at the participant's home if prior arrangements are made to do so. The experimental procedures will include looking at rectangular cut outs of photographs of people's eyes, and listening to brief recordings of individuals saying a common phrase. You will then choose an emotion that corresponds with what they see and/or hear. Three tasks will be administered in 1-3 sessions depending on your preference. Each task will be administered once. Your responsibilities will include listening to the instructions provided by the researcher, answering each item, and completing the task once it has begun.

Location: Sessions will be held at the UCF Communication Disorders Clinic. Prior arrangements may be made to conduct sessions in the participant's home if it is not feasible for the participant to go to the UCF Communication Disorders Clinic.

Time required: We expect that you will be in this research study for 1.5 to 2 hours. The number of sessions required to complete the tasks may vary from 1 to 3 depending on the number, and length, of breaks requested between tasks. Each task will take no more than 30 minutes. A short break will be taken between tasks. However, participants will be allowed to request longer breaks or request an additional session if fatigued. If the participant does not require additional breaks all tasks may be completed in only one session.

Audio taping: You will be audio taped during this study. If you do not want to be audio taped, you will still be able to participate in the study. Please notify the principal investigator or faculty supervisor if you do not wish to be audio taped. If you are audio taped, the tape will be kept in a locked filing cabinet. The tape will be erased or destroyed after the completion of the study.

Benefits: We cannot promise any benefits to you or others from taking part in this research. However, possible benefits include learning more about the research process, and contributing to the body of research on adolescents with Asperger Syndrome (AS).

Compensation or payment: Compensation for your participation will be the receipt of 2 community service hours provided by the UCF Center for Autism and Related Disabilities (CARD). If you complete any part of the study, you will receive community service hours for the time you spent in the study.

Confidentiality: We will limit your personal data collected in this study. Your personal information will be limited to individuals who have a need to review this information (i.e., the principal investigator and faculty supervisor). However, we cannot promise complete anonymity as your information may be reviewed by the UCF Institutional Review Board (IRB) or other official representatives of UCF.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, or think the research study has hurt you contact: Juliet Leon, Graduate Student, Department of Communication Sciences and Disorders, by email at jleon@knights.ucf.edu or Dr. Jaime Schwartz, Associate Professor, Department of Communication Sciences and Disorders at (407) 823-4807 or by email at jschwart@mail.ucf.edu.
IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Withdrawing from the study:
You may decide not to continue in the research study at any time without it being held against you. If you decide to leave the study, you may receive the community service hours commensurate with your participation. If you decide to leave the study, please contact the principal investigator so that any information gathered about you can be deleted.

Additionally, the principal investigator can remove you from the research study without your approval. Possible reasons for removal include not meeting previously established criteria for inclusion in either the experimental or control group, or for failure to follow instructions of the research staff. We will tell you about any new information that may affect your choice to continue in the study.

________

Your signature below indicates your permission to take part in this research

DO NOT SIGN THIS FORM AFTER THE IRB EXPIRATION DATE BELOW

________

Signature of participant

Date

________

Printed name of participant

University of Central Florida IRB
IRB NUMBER: SBE-10-07099
IRB APPROVAL DATE: 9/10/2010
IRB EXPIRATION DATE: 9/9/2011

3 of 3
APPENDIX F: PERMISSION LETTER
Re: RME-R protocol [via ARC website]

From: Dr S. Baron-Cohen (sb205@hermes.cam.ac.uk) on behalf of Professor Simon Baron-Cohen (sb205@cam.ac.uk)
Sent: Sat 5/01/10 9:51 AM
To: jleon@knights.ucf.edu

dear juliet,

of course. good luck with your research. best wishes, simon bc

On Apr 26 2010, jleon@knights.ucf.edu wrote:

> Hi Dr.Baron-Cohen,

> I'm a graduate student doing my masters thesis at the University of Central Florida. I would like to request your permission to use and slightly modify the child version of your RME-R task. The modifications I will be making will be to make some of the terminology used appropriate for American-English speaking children. I will also be making a version of the task that uses auditory stimuli to represent the same emotions targeted in the RME-R task. I look forward to hearing back from you.

> Thank you,

> Juliet Leon

Simon Baron-Cohen, FBA
Professor of Developmental Psychopathology,
Director,
Autism Research Centre,
Cambridge University,
Douglas House, 18B Trumpington Rd,
Cambridge CB2 8AH, UK.
Tel 01223 746057 Fax 01223 746033,
www.autismresearchcentre.com

83
APPENDIX G: VM TASK STIMULI
practice

jealous          scared

relaxed          hate
hate

surprised

kind

displeased
unkind

surprised

displeased

sad
friendly
sad

surprised
worried
feeling sorry  making somebody do something

joking  relaxed
hate  unkind

worried  bored
feeling sorry  bored

interested  joking
remembering happy

friendly angry
annoyed       hate

surprised       thinking about something
kind shy

not believing sad
bossy  hoping

angry  disgusted
confused

joking

sad

serious
thinking about something

upset

excited

happy
happy thinking about something

excited kind
not believing

friendly

wanting to play

relaxed
made up her mind

joking

surprised

bored
angry

unkind

friendly

a bit worried
thinking about something sad

angry

bossy

friendly
kind  
surprise

not pleased  
excited
interested  joking

relaxed  happy
playful

kind

surprised

thinking about something
surprised  sure about something

joking  happy
serious 

ashamed

confused 

surprised
shy
guilty
daydreaming
worried
joking

relaxed

nervous

sorry
ashamed    excited
not believing    pleased
APPENDIX H: AM TASK PHRASES
<table>
<thead>
<tr>
<th></th>
<th></th>
<th><strong>Auditory Mentalizing (AM) Task Phrases:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>P</td>
<td>“I'm going to the park now.”</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>“The way to the mall is down that street.”</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>“I just found out about the job.”</td>
</tr>
<tr>
<td>M</td>
<td>3</td>
<td>“Do you need anything else?”</td>
</tr>
<tr>
<td>M</td>
<td>4</td>
<td>“I have a birthday party to go to.”</td>
</tr>
<tr>
<td>M</td>
<td>5</td>
<td>“Can you help me with that?”</td>
</tr>
<tr>
<td>M</td>
<td>6</td>
<td>“How long is that going to take?”</td>
</tr>
<tr>
<td>M</td>
<td>7</td>
<td>“That looks like it took a long time to make.”</td>
</tr>
<tr>
<td>M</td>
<td>8</td>
<td>“Oh, that was so long ago.”</td>
</tr>
<tr>
<td>F</td>
<td>9</td>
<td>“He was short or about average height.”</td>
</tr>
<tr>
<td>M</td>
<td>10</td>
<td>“Do you think he meant to come here?”</td>
</tr>
<tr>
<td>M</td>
<td>11</td>
<td>“That will be a nice house when it's done.”</td>
</tr>
<tr>
<td>M</td>
<td>12</td>
<td>“The funeral is this Friday at the church.”</td>
</tr>
<tr>
<td>F</td>
<td>13</td>
<td>“That costs only one dollar.”</td>
</tr>
<tr>
<td>M</td>
<td>14</td>
<td>“I'm pretty sure that my vacation is this weekend.”</td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>“You're not free this weekend?”</td>
</tr>
<tr>
<td>F</td>
<td>16</td>
<td>“I am going to the comedy show.”</td>
</tr>
<tr>
<td>F</td>
<td>17</td>
<td>“You're going to driving home now!”</td>
</tr>
<tr>
<td>M</td>
<td>18</td>
<td>“Can you pass me the bread please?”</td>
</tr>
<tr>
<td>F</td>
<td>19</td>
<td>“I can't believe you drove that far.”</td>
</tr>
<tr>
<td>M</td>
<td>20</td>
<td>“So we're going to Disney World.”</td>
</tr>
<tr>
<td>F</td>
<td>21</td>
<td>“Did you win a lot of money when you went?”</td>
</tr>
<tr>
<td>F</td>
<td>22</td>
<td>“I used to go there as well back when I was a child.”</td>
</tr>
<tr>
<td>F</td>
<td>23</td>
<td>“The show is this Friday at 12 O'clock noon.”</td>
</tr>
<tr>
<td>M</td>
<td>24</td>
<td>“I can only stay until night fall.”</td>
</tr>
<tr>
<td>M</td>
<td>25</td>
<td>“I think it's starting to get cloudy.”</td>
</tr>
<tr>
<td>F</td>
<td>26</td>
<td>“So, that outfit you're wearing is very nice.”</td>
</tr>
<tr>
<td>M</td>
<td>27</td>
<td>“How long have you been here?”</td>
</tr>
<tr>
<td>M</td>
<td>28</td>
<td>“I have lived here forever.”</td>
</tr>
</tbody>
</table>
APPENDIX I: PILOT DATA
Table L1
Number correct and percentage correct for typically developing participants from Pilot Study

<table>
<thead>
<tr>
<th>Participant</th>
<th>Number Correct</th>
<th>Percent Correct</th>
<th>Response Times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VM</td>
<td>AM</td>
<td>VAM</td>
</tr>
<tr>
<td>A</td>
<td>21</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>C</td>
<td>18</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>D</td>
<td>24</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>E</td>
<td>21</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>F</td>
<td>20</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>G</td>
<td>21</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>H</td>
<td>17</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td>Averages:</td>
<td>20</td>
<td>20.875</td>
<td>22.375</td>
</tr>
</tbody>
</table>

Table L2
Response times for typically developing participants from Pilot Study

<table>
<thead>
<tr>
<th>Participant</th>
<th>VM</th>
<th>AM</th>
<th>VAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>C</td>
<td>4.3</td>
<td>6.03</td>
<td>7.76</td>
</tr>
<tr>
<td>D</td>
<td>2.67</td>
<td>10</td>
<td>8.25</td>
</tr>
<tr>
<td>E</td>
<td>3.38</td>
<td>8.07</td>
<td>7.58</td>
</tr>
<tr>
<td>F</td>
<td>7.05</td>
<td>10.22</td>
<td>10.1</td>
</tr>
<tr>
<td>G</td>
<td>2.42</td>
<td>7.69</td>
<td>7.46</td>
</tr>
<tr>
<td>H</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Averages:</td>
<td>3.964</td>
<td>8.402</td>
<td>8.23</td>
</tr>
</tbody>
</table>

Table L3
Number correct, percentage correct, and response times for female with AS from Pilot Study

<table>
<thead>
<tr>
<th>Participant</th>
<th>Number Correct</th>
<th>Percent Correct</th>
<th>Response Times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VM</td>
<td>AM</td>
<td>VAM</td>
</tr>
<tr>
<td>I</td>
<td>15</td>
<td>18</td>
<td>23</td>
</tr>
</tbody>
</table>
**Definitions:**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jealous</td>
<td>When you want or desire something that someone else has in a bad way.</td>
</tr>
<tr>
<td>Scared</td>
<td>When you are very afraid.</td>
</tr>
<tr>
<td>Relaxed</td>
<td>When you feel calm or are at rest.</td>
</tr>
<tr>
<td>Hate</td>
<td>When you strongly do not like something or someone.</td>
</tr>
<tr>
<td>Surprised</td>
<td>When you feel shocked or don't expect something.</td>
</tr>
<tr>
<td>Kind</td>
<td>When you are helpful or considerate.</td>
</tr>
<tr>
<td>Displeased</td>
<td>When you are annoyed or not satisfied.</td>
</tr>
<tr>
<td>Unkind</td>
<td>When you are cruel or not considerate of others.</td>
</tr>
<tr>
<td>Sad</td>
<td>When you are not happy.</td>
</tr>
<tr>
<td>Friendly</td>
<td>When you are pleasant or show that you like someone.</td>
</tr>
<tr>
<td>Worried</td>
<td>When you are thinking about problems.</td>
</tr>
<tr>
<td>Upset</td>
<td>When you feel bothered or disturbed.</td>
</tr>
<tr>
<td>Excited</td>
<td>When you feel very happy.</td>
</tr>
<tr>
<td>Feeling</td>
<td>When you have an emotion about something or someone.</td>
</tr>
<tr>
<td>Sorry</td>
<td>When you feel like you should not have done something.</td>
</tr>
<tr>
<td>Making somebody do something</td>
<td>When you are forcing someone to do some action.</td>
</tr>
<tr>
<td>Joking</td>
<td>When you are not being serious and trying to make someone laugh.</td>
</tr>
<tr>
<td>Bored</td>
<td>When you are not interested.</td>
</tr>
<tr>
<td>Interested</td>
<td>When something or someone is keeping your attention.</td>
</tr>
<tr>
<td>Remembering</td>
<td>When you think of someone or something again.</td>
</tr>
<tr>
<td>Happy</td>
<td>When you feel satisfied or pleased.</td>
</tr>
<tr>
<td>Angry</td>
<td>When you are very bothered or annoyed.</td>
</tr>
<tr>
<td>Annoyed</td>
<td>When you feel irritated or bothered.</td>
</tr>
<tr>
<td>Thinking about something</td>
<td>When you bring to mind a thing.</td>
</tr>
<tr>
<td>Shy</td>
<td>When you are nervous about being around people.</td>
</tr>
<tr>
<td>Not believing</td>
<td>When you don't think something is true.</td>
</tr>
<tr>
<td>Bossy</td>
<td>When you want to give people orders.</td>
</tr>
<tr>
<td>Feeling</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hoping</td>
<td>When you think something will happen that you want to happen.</td>
</tr>
<tr>
<td>Disgusted</td>
<td>When you feel extremely bothered by something and not at all interested.</td>
</tr>
<tr>
<td>Confused</td>
<td>When you do not understand.</td>
</tr>
<tr>
<td>Serious</td>
<td>When you really mean something and are not at all joking.</td>
</tr>
<tr>
<td>Wanting to play</td>
<td>When you want to do something that is fun.</td>
</tr>
<tr>
<td>Made up her mind</td>
<td>When she is sure about something.</td>
</tr>
<tr>
<td>A bit worried</td>
<td>When you are only thinking a small amount about problems.</td>
</tr>
<tr>
<td>Thinking about some sad thing</td>
<td>When you bring to mind something that does not make you happy.</td>
</tr>
<tr>
<td>Daydreaming</td>
<td>Thinking about things that distract you from what is happening now.</td>
</tr>
<tr>
<td>Not pleased</td>
<td>When you are not satisfied.</td>
</tr>
<tr>
<td>Playful</td>
<td>Wanting to have fun and joke around.</td>
</tr>
<tr>
<td>Sure about something</td>
<td>When you have decided on something.</td>
</tr>
<tr>
<td>Ashamed</td>
<td>When you feel embarrassed.</td>
</tr>
<tr>
<td>Guilty</td>
<td>When you are responsible for something bad.</td>
</tr>
<tr>
<td>Pleased</td>
<td>When you feel happy and satisfied.</td>
</tr>
<tr>
<td>Disgust</td>
<td>Feeling extremely bothered by something and not at all interested.</td>
</tr>
</tbody>
</table>
**Visual Mentalizing (VM) Task Instructions:**

“In this folder I have lots of pictures of people’s eyes. Each picture has four words around it. I want you to look carefully at the picture and then choose the word that best describes what the person in the picture is thinking or feeling. Let’s try this one (practice item). Look at this person. Do you think he is feeling jealous, scared, relaxed or hate (point to words as they are read)?” Make sure child picks one of the options and give encouraging feedback without revealing whether they are right or wrong. “OK, let’s try the rest of them. You might find some of them quite easy and some of them quite hard, so don’t worry if it’s not always easy to choose the best word. I’ll read all the words for you so you don’t need to worry about that. If you really can’t choose the best word, you can guess.” Proceed with the test items in exactly the same way as the practice item.

**Auditory Mentalizing (AM) Task Instructions:**

“I’m going play a recording of someone saying something. I want you to listen carefully to the person and then choose the word that best describes what the person on the recording is thinking or feeling. It’s important to listen to how the person sounds rather than what he or she is saying. Let’s try this one (practice item). Listen to this person. (Play recording) Do you think he/she is feeling jealous, scared, relaxed or hate (point to words as they are read)?” If the child does not respond within 15 seconds say, “I’m going to play the recording again.” (Play the recording once more). Make sure the child picks one of the options and give encouraging feedback without revealing whether they are right or wrong. “OK, let’s try the rest of them. You might find some of them quite easy and some of them quite hard, so don’t worry if it’s not always easy to choose the best word. I’ll read all the words for you so you don’t need to worry about that. If you really can’t choose the best word, you can guess.” Proceed with the test items in exactly the same way as the practice item.

**Visual + Auditory Mentalizing (VAM) Task Instructions:**

“I’m going play a recording of someone saying something while showing you a picture of their eyes. I want you to listen carefully to the person while looking at the eyes, and then choose one word that best describes what the person is thinking or feeling. Let’s try this one (practice item). Listen to the person while looking at the eyes. (Play recording. When it stops cover the eyes) Do you think he/she is feeling jealous, scared, relaxed or hate (point to words as they are read)?” If the child does not respond within 15 seconds say, “I’m going to play the recording while showing you the picture again.” (Play the recording once more while uncovering eyes. When the recording stops cover the eyes). Make sure the child picks one of the options and give encouraging feedback without revealing whether they are right or wrong. “OK, let’s try the rest of them. You might find some of them quite easy and some of them quite hard, so don’t worry if it’s not always easy to choose the best word. I’ll read all the words for you so you don’t need to worry about that. If you really can’t choose the best word, you can guess.” Proceed with the test items in exactly the same way as the practice item.
### Answers

<table>
<thead>
<tr>
<th>M</th>
<th>P</th>
<th>Feeling</th>
<th>Emotion 1</th>
<th>Emotion 2</th>
<th>Emotion 3</th>
<th>Emotion 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>1</td>
<td>Jealous</td>
<td>Scared</td>
<td>Relaxed</td>
<td>Hate</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>Hate</td>
<td>Surprised</td>
<td>Kind</td>
<td>Displeased</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>3</td>
<td>Unkind</td>
<td>Displeased</td>
<td>Surprised</td>
<td>Sad</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>4</td>
<td>Friendly</td>
<td>Sad</td>
<td>Surprised</td>
<td>Worried</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>5</td>
<td>Relaxed</td>
<td>Upset</td>
<td>Joking</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>6</td>
<td>Feeling sorry</td>
<td>Making somebody do something</td>
<td>Worried</td>
<td>Bored</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>7</td>
<td>Feeling sorry</td>
<td>Unkind</td>
<td>Interested</td>
<td>Joking</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>8</td>
<td>Remembering</td>
<td>Happy</td>
<td>Friendly</td>
<td>Angry</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>9</td>
<td>Annoyed</td>
<td>Hate</td>
<td>Surprised</td>
<td>Thinking about something</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>10</td>
<td>Kind</td>
<td>Shy</td>
<td>Not believing</td>
<td>Sad</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>11</td>
<td>Bossy</td>
<td>Hoping</td>
<td>Angry</td>
<td>Disgusted</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>12</td>
<td>Confused</td>
<td>Joking</td>
<td>Sad</td>
<td>Serious</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>13</td>
<td>Thinking about something</td>
<td>Upset</td>
<td>Excited</td>
<td>Happy</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>14</td>
<td>Happy</td>
<td>Thinking about something</td>
<td>Excited</td>
<td>Kind</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>Not believing</td>
<td>Friendly</td>
<td>Wanting to play</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>16</td>
<td>Made up her mind</td>
<td>Joking</td>
<td>Surprised</td>
<td>Bored</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>17</td>
<td>Angry</td>
<td>Friendly</td>
<td>Unkind</td>
<td>A bit worried</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>18</td>
<td>Thinking about something</td>
<td>Angry</td>
<td>Bossy</td>
<td>Friendly</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>19</td>
<td>Thinking about something sad</td>
<td>Daydreaming</td>
<td>Sad</td>
<td>Interested</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>20</td>
<td>Kind</td>
<td>Surprise</td>
<td>Not pleased</td>
<td>Excited</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>21</td>
<td>Interested</td>
<td>Joking</td>
<td>Relaxed</td>
<td>Happy</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>22</td>
<td>Playful</td>
<td>Kind</td>
<td>Surprised</td>
<td>Thinking about something</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>23</td>
<td>Surprised</td>
<td>Sure about something</td>
<td>Joking</td>
<td>Happy</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>24</td>
<td>Serious</td>
<td>Ashamed</td>
<td>Confused</td>
<td>Surprised</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>25</td>
<td>Shy</td>
<td>Guilty</td>
<td>Daydreaming</td>
<td>Worried</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>26</td>
<td>Joking</td>
<td>Relaxed</td>
<td>Nervous</td>
<td>Sorry</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>27</td>
<td>Ashamed</td>
<td>Excited</td>
<td>Not believing</td>
<td>Pleased</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>28</td>
<td>Disgust</td>
<td>Hate</td>
<td>Happy</td>
<td>Bored</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX L: CODING FORM
<table>
<thead>
<tr>
<th>Item #</th>
<th>VM Answers</th>
<th>AM Answers</th>
<th>VAM Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Correct: [Blank]
LIST OF REFERENCES


