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Teaching Children with an Autism Spectrum Disorder to Recognize and

Predict Emotions in Others
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Chapter I

Review of the Literature

*Autism*

Autism Spectrum Disorders (ASD) are identified in the DSM-IV-TR (2000) as Pervasive Developmental Disorders and include Autistic Disorder, Asperger's Disorder, Rett's Disorder, Childhood Disintegrative Disorder and Pervasive Developmental Disorder- NOS. Wing (1998) coined the term “Autism Spectrum Disorder” (ASD) to reflect the view that the Pervasive Developmental Disorders lie on a continuum of severity and disability. The term became widely accepted fairly quickly, and both clinicians and researchers prefer to use the term “ASD” today. ASD effects children of all races and socioeconomic status but occur up to four times more commonly in boys than girls (Yeargin-Allsopp, 2003). Today there are more than one half million people in the United States living with an ASD (Yeargin-Allsopp). It is now the third most common developmental disability and is more common than Down syndrome (Yeargin-Allsopp).

Diagnostic criteria for ASD include abnormal and/or delayed social interaction and restricted repetitive and stereotyped behaviors or interests (APA, 2000). Communication impairment is also significant, although the exact nature of that impairment depends on the disorder. Age of onset also varies with disorder but symptoms are typically present in the first years of life (Yeargin-Allsopp, 2003). ASDs are often associated with varying degrees of Mental Retardation, and a variety of medical conditions and complications (APA).

*Theory of mind*
Currently, Theory of Mind is a primary theory directing our understanding of ASD, especially in regard to the social deficits that individuals with ASD encounter. Theory of Mind (ToM) is the notion of being able to know about one’s own and others’ mental states (Baron-Cohen, 2001). ToM allows us to infer what others are thinking or feeling and it allows us to reflect upon our own thoughts and feelings. How young children come to understand the mental states of self and others is a question that remains unanswered despite a recent explosion of research on ToM (Baron-Cohen, 1991; Hadwin, Baron-Cohen, Howlin & Hill, 1997; Heavey, Phillips baron-Cohen & Rutter, 2000; Jolliffe & Baron-Cohen, 1999; Klin, 2000; Mayes, Klin & Cohen, 1994; Moore & Macgillvray, 2004). ToM reasoning can be separated into two components: (1) detecting others’ mental states based on immediately available information, and (2) reasoning about such mental states to explain or predict others’ actions (Tager-Flusberg, 2001). The ability to detect mental states relies heavily on social information such as eye gaze, facial expression, or body posture. Utilizing mental state reasoning involves a more complex aspect of ToM. An example of such skills includes distinguishing jokes from lies (Sabbagh, 2004).

Beliefs, desires, and intentions are three categories of mental states widely studied related to ToM. Children as young as 2½ years are able to infer both situationally based and perceptually displayed emotion. Determining a child is sad because he wanted ice cream and did not get it is based on situation. Determining that same child is sad based on facial expression is perceptually based.
Most researchers use first- and second-order false belief tasks as a means for assessing ToM. First-order beliefs develop earlier in individuals than second-order beliefs and represent the idea that beliefs are connected to desires. For example, one might desire an ice cream cone because he believes it will taste good. First-order beliefs are typically developed between the ages of 3 and 4½ years old (Silliman et al., 2003).

Second-order beliefs are more complex and typically develop in the late preschool and early elementary school years. Second-order beliefs require children to think about their own thinking in regard to others' thoughts or beliefs. They also need to determine what they think others think about their thoughts. When completing second-order belief tasks, the child is required to successfully coordinate multiple perspectives about what two characters are thinking in a given situation. Conflicting beliefs of the two characters are known to the child completing the task, but not to the characters in the situation. A popular second order false belief task is the Sally-Anne task (Wimmer & Perner, 1983). In this location change task, Sally has a box and Anne has a basket. Sally puts a marble into her box and then goes out for a walk. While she is out, Anne takes the marble from Sally's box and puts it in her basket. Sally comes back and wants to play with her marble. When asked where she will look, a typically developing 4 year-old easily answers in her box, because she thinks it is there.

ToM development is typically fulfilled by early childhood, leaving children with a necessary tool they can use when engaging in social interactions. ToM allows us to interpret cues given by others that provide an endless amount of information. Most people can decipher within a few moments how a person is feeling and what they are likely thinking, which can help assist in making judgments such as whether they are
enjoying an interaction or would rather end it. Without ToM, individuals do not appreciate that the listener is not interested in the conversation topic, or that the listener would like to end the conversation, for example.

Theory of mind in autism spectrum disorder

It is widely agreed that individuals with ASD have difficulty understanding others' minds and their own (e.g., Baron-Cohen, 1991, Frith & Happe, 1999). They either fail to develop a ToM or they develop the skills much later than is typical. Most typically developing children show indications of a developing ToM by age three or four. Those individuals with an ASD who develop a ToM do so during adolescence or early adulthood and after a great deal of intervention (Frith & Happe, 1999). However, studies have shown that ToM can develop as a result of intervention (e.g., Frith & Happe, 1999; Silver & Oakes, 2001).

Individuals who have not had normal ToM development are at risk for having social interaction problems. As mentioned, ToM allows us to engage others in interactions appropriately and successfully. Without being able to engage others, friendships fail to develop. When children are without friends, they grow up to have a lower self-esteem and are at risk for developing psychological problems such as anxiety and depression. Children also tend to access an enormous amount of information about themselves and the world in which they live via their friends. Therefore, failure to develop friends can mean a depleted learning environment (Rutter & Garmezy, 1983). Numerous studies have shown that children who have difficulty forming friendships are at risk to have a lower self-esteem, poorer attitudes and performance in school, and psychological problems such as depression and anxiety.
Because having a developed ToM is thought to be essential to social functioning, many studies have aimed to teach ToM to individuals (e.g., Baron-Cohen, 1991; Frith & Happe, 1999). Some studies have used ToM tasks to teach ToM, assuming that the individuals would be able to apply those skills to assist in social interactions. Unfortunately, individuals with ASD were able to successfully complete ToM tasks, but they failed to generalize ToM to other situations (Hadwin, Baron-Cohen, Howlin, & Hill, 1997). Using a different approach, Silver & Oakes (2001) taught social-emotional skills (emotion recognition and prediction) to individuals with ASD. These individuals were able to generalize what they learned to other situations, and were able to successfully complete ToM tasks they had failed prior to the intervention. It is currently unknown why the individuals were able to generalize from social skills learned to ToM tasks but were unable to generalize learned ToM tasks to their social skills.

Krasny et al. (2003) suggested breaking social skills down to small, teachable elements. The ability to recognize and predict emotions is a skill crucial to maintaining social interactions, yet are typically lacking in individuals with an ASD, perhaps as a result of ToM. Teaching children to recognize and predict these emotions behaviorally via discrete trial learning and ABA has been shown to be effective, but typically requires one-on-one therapy, a process that is expensive and time-intensive.

Theory of Mind in High Functioning Autism and Asperger’s Disorder

There is continuing debate over whether high functioning autism and Asperger’s Disorder are separate disorders. Experts (i.e. Prior et al., 1998; Jolliffe & Baron-Cohen, 1999; Dyck et al., 2001) have used ToM as one way of looking at possible differences between the two populations. Such researchers have found that individuals with high
functioning autism perform worse on ToM tasks compared to individuals with Asperger’s Disorder. However, individual’s with Asperger’s Disorder were also found to have ToM deficits, as they consistently perform worse than control samples.

Theory of Mind in Anti-social Individuals

There have been suggestions that ToM deficits may lead to bullying and other anti-social behavior (Crick & Dodge; 1994, Feshbach, 1987). Feshbach (1987) argued that individuals with impaired ability to role-play (requiring an individual to take on that role’s mental state) should be less likely to empathize and, therefore, more likely to elicit anti-social behaviors. Hughes, Dunn & White (1998) found indication of ToM impairment in “hard to manage” preschoolers. However, ToM is not fully developed at this time, which could account for this finding. Two studies (Wisdom; 1978, Blair, Sellars, Strickland, Clark, Williams, Smith et al., 1996) investigating ToM impairment in psychopathic adults failed to find evidence of such impairment. Richell, Mitchell, Newman, Leonard, Baron-Cohen, and Blair (2003) investigated the ability of psychopathic individuals to interpret cues (determining emotion by reading someone’s eyes) and found no impairment of ToM in this respect.

Sutton, Smith and Swettenham (1999) posit that it would make sense that anti-social individuals would have excellent social skills and thus excellent ToM ability. Anti-social behavior and certainly anti-social personality disordered individuals manipulate others in such a way that they must coordinate beliefs, desires, thoughts and feelings, which requires well developed ToM. For example, a bully must know if he calls a particular child a less than favorable name, that child will believe he is less than perfect and feel sad. Sutton, Smith and Swettenham (1999) make the distinction between ToM
and empathy. They offer as a hypothesis that an individual may understand an emotion but not share it, and therefore, lacks empathy. This hypothesis remains untested; however, the idea that ToM is intact but that an individual just cannot relate to the emotion being elicited is an enticing idea.

Social skill development in typically developing children

Normal social skill development is an area that is rarely studied. Most researchers focus on populations at risk for social skill impairment such as children with ASD, low socioeconomic backgrounds, minorities, and children exhibiting anti-social behaviors. However, text books tend to provide some information about the developmental course of social skills (Rubin, Coplan, Nelson, & Legace-Seguin, 1999).

Children become increasingly competent at initiating and sustaining social interactions as they grow older. Traditionally, it has been accepted that infants under 6 months of age are relatively oblivious to each other’s presence, but more recent literature suggests otherwise. Eckerman (1979) found that 2 month old infants engage in mutual gaze. During the first six months, infants also exhibit other social skills such as smiling, vocalizing, and reaching for others (Field, 1979; Fogel, 1979). Infants begin directing vocalizations, gaze, and smiles towards others between six and nine months of age, and often infants are reciprocating such gestures at this same time (Hay, Pederson, & Nash, 1982; Vandell & Mueller, 1995).

Throughout the first year of life, these pro-social behaviors steadily increase. An infants tendency to respond to social overtures dramatically increases in the latter part of the first year (Jacobson, 1981). An important social skill infants begin to master is imitating the actions of others. Brownell (1990) and Howes (1988) found that toddlers
begin adjusting their own behavior in response to others’ characteristics. Toddlers also learn to take turns during the second year of life (Howes).

Between ages 2 and 4 years, pretend play emerges and children learn to take on complimentary roles. The time spent engaged in social play is increasing, and the roles, rules, themes, and exchanges become increasingly complicated (Goncu, 1993). Although children have made many social advances by toddler-hood, these children are still spending the majority of their time in solitary play. During the preschool years, children are also showing evidence of their developing ToM and exhibiting the associated social skills such as considering others’ beliefs, desires, and feelings. They learn to show empathy and monitor their own behaviors. At this point children are also showing signs of developing social-emotional skills. These skills are specific to emotion and include monitoring behavior and emotions and then responding by making appropriate adjustments.

Remarkably, normal social skill development during middle childhood has rarely been studied. However, descriptions of this period generally state children continue to improve on the skills they acquired during the first few years of life, and that peer relationships become increasingly important. The majority of preschoolers are involved in mutual friendships and by adolescence those who have mutual friends, including one or two best friends, comprises all but about ten percent of peer groups (Hartup & Stevens, 1999).

**Teaching social skills to typically developing children**

The term “social skills” is both a descriptive term (a reference to particular skills society has deemed necessary for effective social interactions) and a generic term applied
Evaluation of an In-Home Approach to a behavioral approach (Godfrey & Shum, 2000). This approach places importance on the role of reinforcement and argues that a lack of social skills would imply that particular pro-social behaviors have not been properly reinforced. When used descriptively, the term encompasses a variety of skills including: social initiation, sharing, turn-taking, active listening, helping others, complimenting others, staying on task, waiting, empathy, and communicating clearly.

Webster-Stratton and Reid (2004), among others, have identified social-emotional skills as particularly important in the successful development of children. Social-emotional skills are a particular subset of social skills that enable people to regulate their own emotions and behaviors. Included in this group of skills are: the ability to recognize emotions in one's self and in others, the ability to predict emotions in one's self and in others, and self regulating behavior. These skills are seen as so fundamental to development that social-emotional skills are being taught in schools with increasing frequency (e.g., Walker et. al, 1998). Social-emotional curricula aim to reduce risk factors for academic and social problems and foster positive social and academic behaviors (Joseph & Strain, 2003). The intention of these manualized curricula is to teach appropriate social and emotional skills to children (especially children considered high-risk for developing problems later) at a young age before they develop academic and social problems.

Joseph & Strain (2003) conducted a literature review and analysis of all empirically based social-emotional curricula for children age six and younger. They developed nine indicators, each of which represents a level of evidence for a successful program and then rated the program based on how many indicators of evidence they had.
The curricula vary in setting, time commitment and teaching instruction. A description of the top three programs as assessed by Joseph and Strain follows.

First Step to Success (Walker, 1998) combines a home and school based approach in preventing anti-social behavior and is unique from other programs in that it utilized proactive universal screening of all kindergartners to identify children at risk for developing serious anti-social behavior patterns as determined by the aggression and withdrawn subscales of the Child Behavior Checklist (CBCL; Achenbach, 1991) and behavioral observations. The program requires 2-3 months to complete and is an individual program. The intervention included the participation of teachers, peers and the target child. Home intervention included parent training focusing on positive adult support of the child’s adjustment. The program was found to be effective in increasing adaptive skills and academic engagement and decreasing aggressive behavior in a kindergarten classroom at post-test using four teacher-rated measures including the Early Screening Project (ESP; Walker et al., 1994) adaptive and maladaptive behavior rating Scales, the CBCL Withdrawn and Aggression Scales and academic engaged time (AET) which is a duration recording of the child’s approximate proportion of time spent attending to teacher-led, structured activities.

Webster-Stratton (1990) evaluated 4-7 year olds with conduct problems who completed the Incredible Years Series: Dinosaur School program. The program, implemented for 22 two-hour sessions with 5-6 children in a group, focuses on teaching social and problem-solving skills via video modeling, role-plays, activities and puppets. The program was found to be effective in increasing parent-child interactions, conflict management and problem solving skills and in decreasing problem behaviors at home.
and in school. Treatment effects in regard to problem behaviors were evaluated by parent and teacher report measures of child behavior using the CBCL (Achenbach, 1991), Eyberg Child Behavior Inventory (ECBI; Robinson, Eyeberg, & Ross, 1980), the Parenting Stress Index (PSI; Abidin, 1983) and the Behar Preschool Behavior Questionnaire (BPQ; Behar, 1977). Effects of treatment on social problem-solving skills were assessed using the Wally Child Social Problem-Solving Detective Game (WALLY; Webster-Stratton, 1990). Treatment effects in regard to parent-child interaction were measured using the Dyadic Parent-Child Interactive Coding System-Revised (DPICS-R; Robinson & Eyberg, 1981) which was developed specifically for recording behaviors of conduct-problem children and their parents. Changes in conflict management were measured using the Peer Problem-Solving-Interaction Communication-Affect Rating System (PPS-I CARE) which derives from Gottman’s MACRO and MICRO friendship observation measures (Gottman, 1986).

In 1994 Kusche investigated the effectiveness of the Promoting Alternative Thinking Strategies (PATHS) program with deaf and hearing impaired first through sixth graders in both general and special education classes. The program is taught three times per week for 20-30 minutes using systematic, developmentally based lessons and materials. The program aims to teach emotional literacy, self-control, social confidence and positive peer relations and interpersonal problem solving skills. The program was found effective in increasing self-control and the ability to tolerate frustration, understanding and recognition of emotions, as measured by the Kusche Emotional Inventory (KEI; Kusche, 1984). The program was also effective in increasing effective conflict resolution strategies, as measured by a revised procedure of the Social Problem
Situation Analysis Measure (SPSAM; Elias et al., 1978 (as cited in Greenberg & Kusche, 1993, pp. 112-114)) and thinking and planning skills, as measured by the Perdue Elementary Problem-Solving Inventory (PEPSI; Feldhusen et al., 1972 (as cited in Greenberg & Kusche, 1993, pp. 114)). PATHS was also effective in decreasing symptoms of anxiety and depression, conduct problems and symptoms of sadness, as measured by the CBCL, ECBI, The Walker Behavior Problem Identification Checklist (WBPIC; Walker, 1976 (as cited in Greenberg & Kusche, 1993, pp. 117)) and the Meadow-Kendall Social-Emotional Assessment Inventory for Deaf and Hearing-Impaired Children (MKSEAI; Meadow, 1983 (as cited in Greenberg & Kusche, 1993, pp. 116)).

*Teaching Social Skills to Children with ASD*

Although researchers have been working on improving quality of life for children with an ASD, the work has primarily focused on changing discrete problem behaviors such as attending to stimuli, and stereotypical, self stimulatory, and self injurious behaviors. In 1974, Strain and Timm first began evaluating social behaviors in individuals with an ASD. Their first study demonstrated that adult mediated prompting and social reinforcement effected the social behavior of both the individual with ASD and the peers with whom they were interacting. Clinicians used this research to decide what social skills to teach by identifying social deficits (Strain, 2001). Therefore, if a child was unable to end a conversation effectively, that skill would be taught. If a child is unable to follow a specific direction, this skill would be taught. Several curricula have aimed to teach discrete skills such as eliciting appropriate body gestures (Buffington, Krantz, McClannah, and Poulson, 1998), how to maintain appropriate conversations...
(Charlop-Christy & Kelso, 2003), peer imitation (Garfinkle & Schwartz, 2002), and Theory of Mind (Hadwin, Baron-Cohen, Howlin & Hill, 1997). However, this model is lacking in that there are innumerable social skills necessary for effective social interaction. Thus, children with significant deficits in social skill development, such as those with ASD, would need to be taught most, if not all, of the social skills. Also, social skills need to be applied flexibly to a variety of situations. Implementing curricula that address these issues involves a considerable amount of time, effort, and money on the part of all involved.

Socialization deficits are particularly worrisome for those with an ASD. These children typically have difficulty initiating and maintaining interpersonal interactions on a daily basis, resulting in the children being social isolated and unresponsive to others’ social initiations. Leading experts in the field (e.g., Attwood, 2000, Bauminger, 2002, Krasny et al, 2003) have identified difficulties with socialization as one of the most debilitating aspects of ASD. Although the need for intervention programs directed at social skill development is clear, the available treatment programs are expensive, time consuming, and minimally effective.

Attwood (2000) suggested some strategies to encourage the integration of social skills among children with Asperger’s Disorder. Like Krasny, Williams, Provencal and Ozonoff (2003), he identified opportunities to interact with typically developing peers as potentially helpful. Teaching Theory of Mind (ToM) skills and utilizing both social stories and comic strip conversations were all suggested as techniques that may be helpful in assisting children recognize and predict events and emotions. Making use of
social skills groups, teaching and practicing imitation skills and teaching and practicing specific emotions are also recommended.

Krasny et al. (2003) and Hurth, Shaw, Izeman, Whaley, and Rogers (1999) each outlined essentials to developing and implementing social skills training programs for children with ASD. Krasny et al. emphasized the need to break down complex social skills into concrete steps that can be memorized and then practiced several times across various settings. Following this guideline allows abstract concepts to become more concrete in nature through visual and tangible activities. They further added that providing multiple opportunities to teach the skill is essential and the child must practice the skill on a near daily basis for treatment to be effective. Krasny et al. also supported the use of social skills groups, as these offer the child an opportunity for social interaction, something that is lacking for most of these children. Encouraging parents and teachers to work on skills outside of the intervention will also increase the likelihood that the child will acquire the desired skill and then generalize the skill into everyday use.

Hurth et al. (1999) investigated commonalities among nationally known, validated programs for young children with ASD and outlined the core aspects that these programs shared. They emphasized the need for early intervention, which allows for better outcomes and increases the likelihood that the child will be learning developmentally appropriate skills. Systematic teaching and individualized programs are also helpful in that they are specific to a particular child’s needs and build towards meaningful goals. Children with ASD also benefit from specialized curricula aimed at targeting characteristics specific to ASD, such as self-stimulatory behavior and language development. In addition, an intensive program which requires the child to remain
engaged and actively learning is also recommended, and finally, programs which encourage family involvement are thought to be one contributing factor of later success.

Although many children have experienced success in learning new skills, a large proportion of these children fail to generalize these skills to new situations without intensive programming designed to encourage generalization (i.e., Charlop-Christy & Kelso, 2003).

As one can imagine, implementing this method for the acquisition of even one skill can be expensive and time consuming. There are a limited number of social skills groups in the area that are able to provide social skills programs like those suggested by Krasny et al. (2003), leaving most parents to implement social skills programs themselves. In addition, most children with ASD already participate in several different treatments such as Occupational Therapy and Speech Therapy, which poses scheduling challenges for parents. For this reason, a treatment that can be provided in the home is helpful.

Social skills are necessary for daily interaction and have been linked to quality of life. A key social skill (and one that is absent in children with ASD) is the ability to recognize and predict emotions both in one's self and in others. This skill is crucial in allowing an individual to monitor behavior. It is with this skill that one is able to adapt behaviors to be appropriate to a given situation. This is a fundamental social skill, which affects the quality of the social interaction. Research has suggested that social skills are operant behaviors that can be environmentally manipulated, influenced and learned. This puts remediation of skills within reach.

Need for services
It is clear that children with ASD are underserved. Many studies have documented rising prevalence of autism around the nation and world (Bertrand, et al., 2001; Blacher, 2002; Prior, 2003; Yeargin-Allsopp, 2003). Only one decade ago autism prevalence rates were estimated to be approximately 4 per 10,000. However, current estimates are nearly 60 or 70 per 10,000 (Bryson, Rogers & Frombonne, 2003). There is no consensus whether autism prevalence rates are truly rising or if professionals are getting better at diagnosing ASD. Either way, the need to provide services to children with ASD has risen faster than most communities can accommodate. One study claimed an average 21% increase in the prevalence of children with autism in public schools around the nation, and experts (Blacher, 2002; Bryson, et al, 2003) agree that children with ASD are underserved.

Due to both expense and a lack of adequately trained teachers, school systems are not typically able to provide state of the art services for these children with ASD, which creates another way in which these children are underserved. The treatment of choice, and the only treatment with scientific research to support it, is applied behavior analysis (ABA), as demonstrated by Lovaas in 1987. The treatment uses ABA to help decrease unwanted behaviors and increase desired behaviors using positive reinforcement (Heflin & Alberto, 2001a; Heflin & Alberto, 2001b). ABA programs are individually tailored and typically recommended to involve 40 hours per week of one-on-one therapy. On average this intervention costs $40,000 to $60,000 per year, an amount that few parents and school districts are able to afford (Blacher, 2002). Some families are able to contract with a consultant and run a home-based program, but they bear much of the tremendous cost and they must find enough therapists to run a 40 hour per week program. Often
times, treatment is delayed due to a lack of enough therapists to work on a daily basis with their children. Lovaas (1987) recommended a two year program but many children require treatment for years thereafter. Because early intervention has proven critical for these children, action must be taken to increase the likelihood that these children will receive the services they need when they need them. Families and professionals are constantly searching for new tools that assist in teaching children with ASD new skills in a convenient and cost effective manner.

Baron-Cohen (2000) and Silver & Oakes (2001) have attempted to relieve these problems by developing computer programs to help children with ASD recognize and predict emotions in others. The program uses discrete trial learning, which has traditionally been combined with ABA to help teach various curricula. They have used multimedia effects in their programs to help make them fun and reinforcing for the children using them. Computers also have the added advantage of being able to collect data on a user's progress. Computers also allow the teacher to remove other environmental demands (such as unwanted visual and auditory stimuli that the child may find distracting) that are typically placed on the child. Such demands often inhibit learning and are particularly distracting for individuals with an ASD. Once the skills are learned, environmental demands typically encountered can be added to increase generalization of the skills.

Like all programs, each has its limitations. Graduate students have tried to use the Baron-Cohen program but found it extremely difficult to use; the experience is apparently not uncommon (Kroeger, personal communication), making it unlikely that the program can be used by a child or parents. In addition, there have been no studies documenting the
efficacy of the program. The Silver and Oakes program has been found to be effective in teaching children with an ASD to recognize and predict emotions in others when used in schools for children with ASD, but it has not been used as an in-home program. Perhaps because it was developed in the UK, American professionals generally are unaware of its availability.
Chapter II
Rationale and Hypotheses

The nature of ASD leaves affected children with limited social skills, and affected children report feeling unfairly isolated. Treatment of social skills deficits among children with ASD has taken a back seat to interventions for other features of the disorder, such as development of language skills. However, it has become clear that development of other skills will have limited meaning for children with ASD if they are unable to develop relationships with others. The ability to recognize and predict what another is feeling is a fundamental skill necessary to develop meaningful social relationships.

Many experts believe that failure to develop Theory of Mind (ToM) underlies the social skills deficits among children with ASD, and many experts speculate that teaching ToM will allow for the successful development of social skills. Although it is unknown how typically developing children develop ToM, some experts suggest it is the result of repeated exposure to mental state talk, which occurs when parents and children share with each other what they are thinking and how they are feeling.

Krasney et al. (2003) suggest that breaking down skills into teachable parts and repeatedly teaching those skills in a variety of settings through multiple modes is helpful in teaching skills to children with ASD. Silver & Oakes (2001) found significant gains on an advanced ToM measure after participants used a recently developed computer-based program, the Emotion Trainer.

The Emotion Trainer provides a relatively quick and inexpensive means of teaching children with ASD to recognize and predict emotions in others and has been
designed for that specific purpose. Parents would be able to use the program in the convenience of their own homes, thus avoiding another trip out to see a therapist. The program also is beneficial in that, because it is a computer program, it does not contain the subtle distractions that direct social interaction would entail. This makes it easier for children who are just learning these skills to acquire them.

The purpose of this study is to determine whether the same gains that were found by children with ASD who used the Emotion Trainer program as part of their school program will be replicated when used in the homes of children with ASD. Response to the program will be measured by the error tracking system built in to the Emotion Trainer, and by related tasks that will be administered before and after participation in the three-week Emotion Trainer program. In light of the above, the following hypotheses proposed:

H1: The number of errors committed during the last exposure to a section of the Emotion Trainer is significantly less than the number of errors committed during the first exposure of that section.

H2: There is a significant increase in the score on the Happe’s Strange Stories test from pre-intervention to post-intervention.

H3: There is a significant increase in the score on the Facial Expression Photographs task from pre-intervention to post-intervention.

H4: There is a significant decrease in the error score on the Emotion Recognition Cartoons task from pre-intervention to post-intervention.
H5: There are significant correlations between the number of Emotion Trainer lessons successfully completed and scores on the Happe's Strange Stories test, the Facial Expression Photographs, and the Emotion Recognition Cartoons at post-intervention.

The null forms for all hypotheses will be rejected at the $p = 0.05$ level of significance.
Chapter III
Method

Participants

Participants will be 30 children between the ages of 10 and 18 with an Autism Spectrum Disorder whose parents agree to allow their children to participate. Each child will have received a diagnosis of Asperger’s Disorder or Autistic Disorder according to DSM-IV criteria from an independent agency. Diagnoses will be verified by accessing medical records, whenever possible. Children will be invited to participate if they have a primary diagnosis of Asperger’s Disorder or Autistic Disorder. Children diagnosed with an ASD and who are between the ages of 10 and 18 will only be excluded if they have not received a verbal age score of at least 7 years on a standardized measure. Children of all races and SES will be eligible to participate.

Design and Power Analysis

This study is a within subjects, multiple baseline design. Prior to the beginning of the study, participants will be administered pre-intervention measures to allow for a baseline measurement. Ten participants will begin the intervention at that time. Approximately four weeks following the baseline assessment, ten more participants will be administered the pre-intervention measures again and will begin the intervention at that time. Approximately eight weeks following the baseline assessment, the remaining ten participants will be administered the pre-intervention assessment and will begin the intervention at that time. Following the end of each three week intervention period, post-intervention measures will be administered. Silver & Oakes (2001) conducted a similar study resulting in a large effect size. Assuming this study will obtain a similar effect,
Cohen (1992) suggests a minimum sample size of 26. This study will include 30 participants. The dependent variables are scores on the Happe’s Strange Stories tasks, Emotion Recognition Cartoons, Facial Expression Photographs, and the number of errors committed on the Emotion Trainer.

**Measures**

*Happe’s Strange Stories*  Happe’s Strange Stories was developed by Happe (1994, see Appendix A) and is an advanced Theory of Mind (ToM) test consisting of 24 short vignettes, which are read to the child. Each is accompanied by two test questions: the comprehension question asks “Was it true what X said?” and the justification question asks “Why did X say that?” There are 12 different types of stories with two examples of each type. The 12 story types are as follows: Lie, White Lie, Joke, Pretend, Misunderstanding, Persuade, Appearance/Reality, Figure of Speech, Sarcasm, Forget, Double Bluff, and Contrary Emotions. This study will include 16 of the original stories. The 16 stories will be divided into two sets (set A and set B), each containing eight stories with one each of eight different story types represented. The sets will be counterbalanced for pre- and post- intervention assessments. Responses to stories are transcribed and scored from -3 to +3 according to how much understanding of the story characters’ mental states the child demonstrates. Using 8 stories per set, scores will range from -24 to +24. Silver & Oakes developed a scoring system that is designed to pick up subtle changes that may occur as a result of intervention (see Appendix B), and were able to demonstrate good inter-rater reliability for their scoring system ($p = 0.97, n = 22, p < .0005$).
**The Facial Expression Photographs** The Facial Expression Photographs from Spence (1995) is a set of 24 black and white photographs of facial expressions (see Appendix C). The individual is asked to point to the photograph that best depicts the emotion named by the examiner. Scores range from 0 to 24. Spence states that her measure has been cleared for acceptable inter-rater reliability and validity, but was unable to provide this information when asked (personal communication, 2004).

**Emotion Recognition Cartoons** The Emotion Recognition Cartoons (see Appendix D) are two sets (set A and set B) of 22 cartoons designed by Howlin et al. (1996). For each set, cartoons for eight situation-based, six desire-based, and eight belief-based emotions will be used and administered following the procedures of Hadwin et al. (1996, see Appendix E). The sets will be counterbalanced for pre- and post-intervention assessments. An error score of one point will be given for each cartoon a participant does not give a reasonably correct feeling. All cartoons are worth one point with the exception of the belief-based emotions which contain two emotion questions per cartoon. The total number of errors across all cartoons will be summed to give a possible score of 0 to 30.

**Program Parent Satisfaction Survey** Parents will be asked to complete a short parent satisfaction questionnaire at the close of the study (Appendix F).

**Intervention**

The Emotion Trainer was developed by Silver (2000) and is a multimedia computer program consisting of five sections. A digital photograph of either a face, scene or object is shown, along with a short text question and two to four response buttons. The user must complete 20 items in each section correctly to pass that section and move on to the next section. Items are randomized, as are the response buttons to
minimize the chances of a user seeing the same screen twice. Correct responses are reinforced with a "well done" message and animated colored balls bouncing across the screen. Incorrect responses are immediately followed by a "try again" message and a hint to the correct response. A second incorrect response is followed by another "try again" message along with a direct hint of the correct response. This is repeated until the user selects the correct response. When the user successfully completes a section a "well done you have completed the section" message along with an animation of an airplane, car, and hot air balloon traveling across the screen is given.

The five sections of Emotion Trainer provide instruction in increasingly complex features of emotional recognition. In section one of Emotion Trainer, the user is shown photographs of facial expressions and asked to choose whether the person looks happy, sad, angry, or afraid. This section is intended to allow the user to become familiar with many examples of how basic emotions look as human facial expressions.

In section two the user is shown photographs accompanied by captions referring to a person in a situation that is likely to trigger an emotion. The user is asked whether the situation would make the person feel happy, sad, angry, or afraid. This section is intended to teach that situations and events can trigger emotional responses.

In section three the user is shown a picture of what a character wants and another picture of what the character gets, and is then asked to select whether this would make the character happy or sad. This section is intended to teach that getting what you want tends to make you happy and not getting what you want tends to make you sad.

Section four is much like section two, with the exception that mental states rather than situations are described. The user is asked to decide whether the belief would make
the character feel happy, sad, angry, or afraid. This section is intended to teach the user that mental states can provoke an emotional response, even if the event does not occur in reality.

In section five an illustration of an object or event is shown that the character is said to either like or dislike. Accompanied with the illustration is a caption which states whether the object or event occurred. The user is asked whether this would make the character pleased or disappointed. This section is intended to teach the user that the absence of disliked event or objects and the presence of liked events or objects is pleasing, whereas the absence of liked objects or events and the presence of disliked objects or events is disappointing.

Each time the participant uses the Emotion Trainer, he or she will begin with section one. The participant will progress to each subsequent section when 20 questions are correctly answered within the section. It is anticipated that some participants may not progress through all subsequent sections.

The Emotion Trainer collects data during each use as to the items presented, which section the user progressed to, the number of errors made on each item presented, and the date and time spent with the program for each session. The number of errors made on each item within each section will be collected. To assess progress on the Emotion Trainer, the data will be used to compute an error score, representing the mean number of errors committed within each specific section of the Emotion Trainer.

The treatment sessions will take place in each child’s home on a laptop computer provided by the experimenter. Parents will be asked to ensure that each participating child spends a minimum of one half hour per day, five days per week for three weeks.
working with the computer program. Because program success has been shown to vary with time used, the participants will be allowed to spend more time with the program if desired. The parents will be asked to ensure that a chaperone be present with the participant to ensure the participant is spending time working with the program. The parents will be told that the participant should not receive help from the chaperone in deciding on answers.

Procedure

After the project is approved by the Institutional Review Boards (IRBs) of Cincinnati Children's Hospital Medical Center and Xavier University, participant recruitment will begin. Children will be identified from archival diagnostic documents from the Kelly O'Leary Center for Autism Spectrum Disorders, in the Division of Developmental Disabilities, which is affiliated with the Cincinnati Children's Hospital Medical Center (CCMHC). With permission of the director of the Kelly O'Leary Center, a letter with a description of the study will be mailed to parents with a child who meets the criteria described above (see Appendix G). Interested parents will return a postcard and will be contacted by the principle investigator. Once families have agreed to participate in the computer intervention program, informed consent will be obtained from parents of the participating children (see Appendix H). The first 30 children enrolled meeting study inclusion criteria and documenting consent to participate will be included in the study.

Pre-intervention measures (Happe’s Strange Stories, Facial Expression Photographs, and Emotion Recognition Cartoons) will be administered in the home to all children during the first week. Following these administrations, the 10 children chosen to
participate during the Time 1 intervention period will be provided with the laptop computer and the intervention, the Emotion Trainer. A trained graduate student will administer the measures and transcribe all answers provided by the participant. The graduate student will then set up the computer and show the family how to access and use the program. Parents will be asked to have their child use the computer intervention for one half hour per day, five days per week for three weeks (a total of 15 half hour long sessions). Following the intervention period, the children will be given post-intervention measures. The data obtained from pre- and post- measures will be removed from the home and all identifying information will be removed before the data are scored. A participant number will be assigned at this time. A trained graduate student will score the data obtained. Pre- and post- intervention measures will be counter-balanced to control for administration ordering differences. The data collect by the Emotion Trainer will be stored in a password-protected database. At the end of the intervention period, post-measures will be administered as described above. The computer and program will be removed from the home, downloaded into a separate file and erased from the computer. Parents will be asked to complete a short parent satisfaction questionnaire at the close of the study. At Time 2 the second set of ten children will be given the pre-intervention measures again and will be provided with the laptop computer and intervention. Following the intervention period, post-intervention measures will be administered as described. At Time 3, the third set of ten children will be given the pre-intervention measures again and will be provided with the laptop computer and intervention. Following intervention, post-intervention measures will be administered.
Chapter IV

Proposed Analyses

The number of errors made on each item within each section of the Emotion Trainer will be collected. The data will be used to compute an error score, representing the mean number of errors committed within each specific section of the Emotion Trainer. Paired Samples T-tests will be conducted to test the hypothesis that there will be a difference in the number of errors committed during the first exposure of each section of the Emotion Trainer when compared to the number of errors committed during the last exposure of each section.

Pre- and post- intervention data will be collected for the Happe's Strange Stories task, Emotion Recognition Cartoons, and Facial Expression Photographs. Paired Samples T-tests will be conducted to test the hypotheses that there will be a difference in scores obtained pre-intervention compared to scores obtained post-intervention.

A Bonferroni correction for Type I error will not be applied in an effort to avoid Type II error. Thus findings will be measured at the $p<.05$ significance level.
References


Blacher, J. (2002). Autism rising: Delivering services without draining parents and school


from each other and from non-spectrum disorders on emotion recognition tests?

*European Child & Adolescent Psychiatry, 10,* 105-116.


between a behaviorally disordered preschool child and her classroom peers.

*Journal of Applied Behavior Analysis, 10,* 289-298.


Appendix A

Happe’s Strange Stories Appendix A

Happe’s Strange Stories

See for details:

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Set A:

2. Appearance/reality

Jane and Sarah are best friends. They both entered the same painting competition. Now Jane wanted to win this competition very much, but when the results were announced it was her best friend Sarah who won, not her. Jane was very sad she had not won, but she was happy for her friend, who got the prize. Jane said to Sarah, “Well done, I’m so happy you won!” Jane said to her mother, “I’m sad I didn’t win that competition!”

Q. Is it true what Jane said to Sarah?
Q. Is it true what Jane said to her mother?
Q. Why does Jane say she is happy and sad at the same time?

3. Irony

Sarah and Tom are going on a picnic. It is Tom’s idea, he says it is going to be a lovely day for a picnic. But just as they are unpacking the food, it starts to rain, and soon they are both soaked to the skin. Sarah is irritated. She says, “Oh yes, it is a lovely day for a picnic!”
Q. Is it true, what Sarah says?
Q. Why does she say that?

4. Figure of speech
Emma has a cough. All through lunch she coughs and coughs and coughs. Father says, "Poor Emma, you must have a frog in your throat!"

Q. Is it true, what Father says to Emma?
Q. Why does he say that?

5. Joke
Today James is going to Claire's house for the first time. He is going over to visit, and he is looking forward to seeing Claire's dog, which she talks about all the time. James likes dogs very much. When James arrives at Claire's house, Claire runs to open the door, and her dog jumps up to greet James. Claire's dog is huge, it's almost as big as James! When James sees Claire's huge dog he says, "Claire, you haven't got a dog at all. You've got an elephant!"

Q. Is it true, what James says?
Q. Why does James say this?

7. Lie
One day, while she is playing in the house, Anna accidentally knocks over her mother's favorite crystal vase. Oh dear, when mother finds out she will be very angry! So when Anna's mother comes home and sees the broken vase and asks Anna what happened, Anna says, "The dog knocked it over, it wasn't my fault!"

Q. Was it true, what Anna told her mother?
Q. Why did she say this?
8. Pretend

It is Halloween, and Chris is going to a costume party. He is going as a ghost. He wears a big white sheet with eyes cut out to see through. As he walks to the party in his ghost costume, he bumps into Mr. Brown. It is dark, and Mr. Brown says, “Oh! Who is it?” Chris answers, “I’m a ghost, Mr. Brown!”

Q. Is it true, what Chris says?
Q. Why does Chris say this?

13. White Lie

One day Aunt Jane came to visit Peter. Peter loves his aunt very much, but today she is wearing a new hat; a new hat which Peter thinks is very ugly. Peter thinks his aunt looks silly in it, and much nicer in her old hat. But when Aunt Jane asks Peter, “How do you like my new hat?”, Peter says, "Oh, its very nice".

Q. Was it true what Peter said?
Q: Why does he say that?

15. Misunderstanding

Late one night old Mrs. Peabody is walking home. She doesn't like walking home alone in the dark because she is always afraid that someone will attack her and rob her. She really is a very nervous person! Suddenly, out of the shadows comes a man. He wants to ask Mrs. Peabody what time it is, so he walks towards her. When Mrs. Peabody sees the man coming towards her, she starts to tremble and says, "Take my purse, just don't hurt me please!"

Q: Was the man surprised at what Mrs. Peabody said.
Q: Why did she say that, when he only wanted to ask her the time?
Set B:

11. Lie
Brian is always hungry. Today at school it is his favorite meal - hotdogs and french-fries. He is a very greedy boy, and he would like to have more hotdogs than anybody else, even though his mother will have made him a big dinner when he gets home! But everyone is allowed two hotdogs and no more. When it is Brian's turn to be served, he says, "Oh, please can I have four hotdogs, because I won't be having any dinner when I get home!"

Q: Is it true, what Brian says?
Q: Why does he say that?

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

Q: Is it true, what Helen said?
Q: Why did she say this?

16. Misunderstanding
A burglar who has just robbed a store is making his getaway. As he is running home, a policeman on his beat sees him drop his glove. He doesn't know the man is a burglar, he just wants to tell him he dropped his glove. But when the policeman shouts out to the burglar, "Hey, you! Stop!", the burglar turns round, sees the policeman and gives himself up. He puts his hands up and admits that he did the break-in at the local store.
Q: Was the policeman surprised by what the burglar did?
Q: Why did the burglar do this, when the policeman just wanted to give him back his glove?

18. Pretend
On Christmas Eve Alice’s mother takes her to the big department store in town. They go to look in the toy department. In the toy department Mr. Brown, Alice’s next-door neighbor, is dressed up as Santa Claus, giving out candy to all the children. Alice thinks she recognizes Mr. Brown, so she runs up to him and asks, “Who are you?” Mr. Brown answers, “I’m Santa Claus!”

Q: Is it true what Mr. Brown says?
Q: Why does he say this?

19. Figure of speech
William is a very untidy boy. One day his mother comes into his bedroom, and it is even more messy than usual! There are clothes, toys, and comics, everywhere. William’s mother says to William, “This room is a pig sty!”

Q: Is it true that William keeps pigs in his room?
Q: Why does William’s mother say this?

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

Q: Is it true, what Ann’s mother says?
Q: Why does Ann's mother say this?

21. Appearance/reality
Today, Katy wants to go on the swings in the playground. But to get to the playground she knows she has to pass old Mr. Jones' house. Mr. Jones has a nasty, mean dog, and every time Katy walks past the house the dog jumps up at the gate and barks. It really scares Katy, and she hates walking past the house because of the nasty dog. But Katy does so want to play on the swings. Katy's mother asks her, "Do you want to go out too the playground?" Katy says, "No".

Q: Is it true what Katy says?
Q: Why does she say she doesn't want to go to the playground, when she
So wants to go on the swings that are there?

23. Joke
Mark and Adam are having great fun! They have turned the kitchen table upside down and they are sitting in it, paddling along with rolled up newspapers. When their mother comes in she laughs. "Whatever are you two doing?, she asks. "This table is a pirate ship", says Adam, "And you had better get in too before you sink – because you are standing in the sea!

Q: Is it true what Adam says?
Q: Why does he say this?
Appendix B
Scoring Hierarchy for Strange Stories

Scoring criteria from Silver & Oakes (2001).
-3 for an answer showing clear misunderstanding of mental states
-2 for an answer with partial or implied misunderstanding of mental states
-1 for answers making errors about physical events in the story
0  for refusing to answer or saying “I don’t know”
+1 for a correct answer that does not mention or imply mental states
+2 for an answer showing partial or implied understanding of mental states
+3 for an answer showing good understanding of mental states
Appendix C

Facial Expression Photographs

Due to copyright laws, the Facial Expression Photographs were not able to be reproduced and included herein. For additional information regarding the Facial Expression Photographs, please contact the principal investigator.

The Facial Expression Photographs from Spence (1995) is a set of 24 black and white photographs of facial expressions. The individual is asked to point to the photograph that best depicts the emotion named by the examiner. Scores range from 0 to 24. Spence states that her measure has been cleared for acceptable inter-rater reliability and validity, but was unable to provide this information when asked (personal communication, 2004).
Appendix D

Emotion Recognition Cartoons

Due to copyright laws, the Emotion Recognition Cartoons were not able to be reproduced and included herein. For additional information regarding the Emotion Recognition Cartoons, please contact the principal investigator.

The Emotion Recognition Cartoons (see Appendix D) are a set of 22 cartoons designed by Howlin et al. (1996). Cartoons for eight situation-based, six desire-based, and eight belief-based emotions will be used and administered following the procedures of Hadwin et al. (1996, see Appendix E). An error score of one point will be given for each cartoon a participant does not give a reasonably correct feeling. All cartoons are worth one point with the exception of the belief-based emotions which contain two emotion questions per cartoon. The total number of errors across all cartoons will be summed to give a possible score of 0 to 30.

Set A items include:

<table>
<thead>
<tr>
<th>Eight Situation:</th>
<th>Two Sad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Afraid</td>
<td>Two Sad</td>
</tr>
<tr>
<td>#1 pp.31</td>
<td>#25 pp.55</td>
</tr>
<tr>
<td>#4 pp.34</td>
<td>#27 pp.57</td>
</tr>
<tr>
<td>Two Happy</td>
<td>Two Angry</td>
</tr>
<tr>
<td>#19 pp.49</td>
<td>#40 pp.70</td>
</tr>
<tr>
<td>#22 pp.52</td>
<td>#44 pp.74</td>
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<td>#1A pp.136</td>
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<td>#2A pp.138</td>
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<td>#1B pp.160</td>
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<td>#2B pp.162</td>
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<tr>
<td>#2A pp.83</td>
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</tr>
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Set B items include:

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<th>Eight Situation:</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>#2 pp.32</td>
</tr>
<tr>
<td>#3 pp.33</td>
</tr>
</tbody>
</table>
Two Happy
#15 pp.45
#16 pp.46

Two Angry
#39 pp.69
#43 pp.73

Eight Belief:

#3A pp.140
#6A pp.146
#3B pp.164
#5B pp.168

#3C pp.188
#6C pp.194
#3D pp.212
#9D pp.224

Six Desire:

#3A pp.84
#5A pp.86
#8A pp.89

#1B pp.106
#13B pp.118
#22B pp.127
Appendix E

Administration Procedures for Emotion Recognition Cartoons
from Hadwin et al. (1997)

"To assess children's understanding of belief, both were split into five developmental levels, in which Level 1 was the simplest level of understanding, and Level 5 the most complex. Assessment of emotion and belief understanding started at Level 1 and progressed up to Level 5. Assessment stopped when children failed two consecutive levels. For each level, children were required to demonstrate a satisfactory understanding of the concept being tested. This involved passing four tasks in a row on Levels 3 and 5, and three tasks in a row on Levels 1, 2, and 4."

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Appendix F

Parent Satisfaction Survey

Please circle the following responses.

I would consider my child’s social skills before participating in this study as:

1 2 3 4 5 6 7
Absent Well developed

I would consider my child’s social skills after participating in this study as:

1 2 3 4 5 6 7
Absent Well developed

I expected to be how satisfied with this program before participating in this study:

1 2 3 4 5 6 7
Not satisfied Highly satisfied
at all                      Satisfied

I feel how satisfied now that my child has participated in this program:

1 2 3 4 5 6 7
Not satisfied Highly satisfied
at all                      Satisfied

Additional information, comments, and recommendations:
Appendix G

Participant Recruitment Letter

Date

Dear Families,

We would like to announce a new research study at the Kelly O’Leary Center and to be able to offer you the opportunity to participate in this research study. I am writing on behalf of a graduate student, Heather L. Johnson, M.A., at Xavier University. Heather is in the process of conducting her doctoral dissertation work and has chosen to implement and evaluate a social skills program designed for children diagnosed with autism or Asperger’s Disorder. Please be aware that this is a research study.

If you should decide to participate, your child will be asked to use a computer intervention in your home on a provided laptop computer. You will be asked to encourage your child to use the program for ½ hour per day five days a week for three consecutive weeks. The study will take place beginning this spring and throughout this coming summer of 2005. In addition, you will be asked to fill out a few relatively short questionnaires before the groups begin and after the groups end. Your child will be asked to complete three short social skills tasks both before and after the intervention period.

While your child is not guaranteed to make beneficial gains in social skills, the intention of the social skills program is of course to help your child make gains in specific social skills that are typically troublesome to children with Autism Spectrum Disorders. However, there will be no charge or fee for the program. It is free to you and your child in return for your time and commitment. If you wish to enroll your child in this social skills research study, or if you have any further questions or concerns, contact Heather Johnson at 745-3157, or e-mail her at hllmrj@yahoo.com.

Sincerely,

Patricia Manning-Courtney, M.D.
Director, The Kelly O’Leary Center for Pervasive Developmental Disorders
Appendix H

CHILDREN'S HOSPITAL MEDICAL CENTER
Consent to Participate in a Research Study

An Evaluation of Social Skills Groups for Young Children with Autism

Before agreeing that my child or I will participate in this study, it is important that I read and understand the following explanation. It describes in words that can be understood by a lay person, the purpose, procedures, benefits, risks, and discomforts of the study and the precautions that will be taken. It also describes the alternatives available and the rights to withdraw from the study at any time. It is important to understand that no guarantee or assurance can be made as to the results of the study. It is also understood that refusal to participate will not influence the availability of standard medical treatment.

I ___________________________ of ____________________________

Patient or Parent/Guardian Street Address

________________________, ________, ________ have been asked for myself/my child

City State Zip code

________________________, __________ to participate in a research study.

Name Age

The purpose of the study is to evaluate the effectiveness of a social skills group program developed for young children with an Autism Spectrum Disorder. The program has been designed to teach social skills to children diagnosed with autism in a computerized format.
Project Title: Evaluation of an In-Home Computer Intervention: Teaching Children to Recognize and Predict Emotions in Others

Protocol Number: 00-00-00

PROCEDURES

I have been asked to consent for my child to participate in a research study of a computerized social skills program for children with Autism Spectrum Disorders. I understand that my child is being asked to use the program for ½ hour per day five days per week for three weeks.

I am aware that I will be asked to fill out two short questionnaires at the beginning and end of my child’s participation in the study. This paperwork will take approximately 10 minutes. I understand that I will be asked to encourage my child to use the computer program for ½ hour per day five days per week for three weeks. I also understand that I being asked to ensure my child is supervised while working with the computer to minimize any damage to the computer. However, I also understand that I cannot be held responsible for any damage to the computer and will not be held responsible should damage result.

POTENTIAL BENEFITS

I understand that there may not be any direct benefits to my child from participating in this study. Participation may improve his/her social skills.
RISKS, DISCOMFORTS, AND PRECAUTIONS

I understand that there are no foreseeable risks or dangers related to my child’s participation in this study. I am aware that there could be a potential risk as a result of increased behavior problems in children with Autism Spectrum Disorders who are engaging in unfamiliar tasks.

I understand that my child will be completing the study in our home by utilizing a computerized program five times a week for three weeks and that this may be a discomfort or inconvenience for me.

ALTERNATIVES

I understand that I can choose not to have my child participate in this study. This will not in any way affect the care my child or his/her sibling(s) receives at the Children’s Hospital Medical Center, the Cincinnati Center for Developmental Disorders, or the Kelly O’Leary Center for Pervasive Developmental Disorders.

CONFIDENTIALITY OF RECORDS

Every effort will be made to maintain the confidentiality of my child’s study records. Personal identifiers will be removed, and only a study code number will identify all information. Records and will be kept in a locked file at Xavier University. Data will be stored in a password protected database.
A qualified representative of the Institutional Review Boards of the Children’s Hospital Medical Center is eligible to review all research records as part of his/her responsibility to protect human subjects in research.

**AVAILABILITY OF INFORMATION**

I understand that I can get any information I need about the study from the researchers. I can contact them at any time regarding the study.

Heather L. Johnson, M.A. Patricia Manning-Courtney, M.D.
Graduate Student Director, TKOC
Xavier University The Kelly O’Leary Center

3800 Victory Parkway 3333 Burnet Avenue
Cincinnati, OH 45207 Cincinnati, OH 45229
Voice: 513.678.6420 Voice: 513.636.5340
Email: hllmrj@yahoo.com Email: patty.manning@cchmc.org

For information regarding a research subject’s rights I can contact Dr. Irwin Light, Chairman of the Children’s Hospital Institutional Review Board at (513) 636-8039.

**RIGHT TO WITHDRAW**

I understand that I may withdraw my child from this study at any time. This will not affect the care my child will receive at the Children’s Hospital Medical Center, the Cincinnati Center for Developmental Disorders, or the Kelly O’Leary Center for Pervasive Developmental Disorders.
COSTS

I understand that this research study will be conducted at no cost to me or my child. I understand that I/my child will not be reimbursed for the out of pocket expenses related to my child’s participating in this research project.

WITNESSING AND SIGNATURES

Based on the information provided above and having the opportunity to discuss any concerns with the investigator and his/her designee, I voluntarily consent for myself/my child to participate in this research study.

________________________________________
Parent or Legal Guardian

________________________________________
Investigator of specific individual who has been designated to obtain consent

________________________________________
Witness as to voluntary signature

________________________________________
Date
Basic Elements of Informed Consent

The HHS and FDA Policies on Protection of Human Subjects list the basic elements of informed consent as follows:

1. A statement that the study involves research, an explanation of the purposes of the research and the expected duration of the subjects’ participation, a description of the procedures to be followed and identification of any experimental procedures.

2. A description of reasonably foreseeable risks and discomforts.

3. A description of any benefits to the subject or others that can reasonably be expected from the research.

4. A disclosure of appropriate alternative procedures of courses that might be advantageous to the subject.

5. A statement describing the extent, if any, to which confidentiality of records identifying the subject will be maintained.

6. An explanation of whom to contact for answers to pertinent questions about the research and research subject’s rights and whom to contact in the event of a research related injury to the subject.

7. A statement that participation is voluntary, that refusal to participate will not involve loss of benefits and that subjects may discontinue participation at any time without loss of benefits.

8. An explanation as to whether any compensation and medical treatment is available if injury occurs. (This statement is required only for studies that are classified as “more that minimal risk.”)

This study and consent form have been reviewed and approved by the Children’s Hospital Medical Center Institutional Review Board (Chairman’s office telephone number is 636-8039).
The Emotion Trainer, a computer-based social skills intervention, was implemented in the homes of twenty-nine 10-to 17-year-old children and adolescents diagnosed with autism or Asperger’s Disorder. Each participant used the Emotion Trainer for 3 weeks. Significant gains were noted on two of five sections of the Emotion Trainer, and on the Emotions Recognition Cartoons, a distant generalization task. Based on the current findings, it appears that the Emotion Trainer shows promise in teaching children with autism and Asperger’s specific skills related to recognizing and predicting emotions in others. Future research matching participants on diagnosis and assessment measure baseline performance may prove helpful in teasing out variables that influence treatment success.
Evaluation of an In-Home Computer Intervention: Teaching Children with Autism Spectrum Disorder to Recognize and Predict Emotions in Others

Socialization deficits are particularly problematic for children with Autism Spectrum Disorder (ASD). These children typically have difficulty initiating and maintaining interpersonal interactions on a daily basis, resulting in the children being socially isolated and unresponsive to others’ social initiations. Leading experts in the field (e.g., Attwood, 2000; Bauminger, 2002; Krasny, Williams, Provencal & Ozonoff, 2003) have identified difficulties with socialization as one of the most debilitating aspects of ASD.

Webster-Stratton and Reid (2004), among others, have identified social-emotional skills as particularly important in the successful development of all children. Social-emotional skills are a particular subset of social skills that enable people to regulate their own emotions and behaviors. Included in this group of skills are: the ability to recognize emotions in one’s self and in others, the ability to predict emotions in one’s self and in others, and self regulating behavior. These skills are seen as so fundamental to development that social-emotional skills are being taught in schools with increasing frequency (e.g., Walker, Kavanagh, Stiller, Golly, Severson, & Feil, 1998).

Krasny, et al. (2003) suggested that teaching social skills is most effective if they are broken down to small, teachable elements. One such element is the ability to recognize and predict emotions, which is a skill crucial to maintaining social interactions, yet is typically lacking in individuals with ASD. Teaching children to recognize and predict these emotions behaviorally via discrete trial learning and Applied Behavior
Analysis (ABA) has been shown to be effective, but it typically requires one-on-one therapy, a process that is expensive and time-intensive.

Although researchers have been working to improve the quality of life for children with ASD, in the past the work has primarily focused on changing discrete problem behaviors such as attending to stimuli, and stereotypical, self stimulatory, and self injurious behaviors. In 1974, Strain and Timm first began evaluating social behaviors in individuals with ASD. Their first study demonstrated that adult mediated prompting and social reinforcement affected the social behavior of both the individual with ASD and the peers with whom they were interacting. Clinicians used this research to decide what social skills to teach by identifying social deficits (Strain, 2001). Therefore, if a child were unable to end a conversation effectively, that skill would be taught. If a child were unable to follow a specific direction, this skill would be taught. Several curricula have aimed to teach discrete skills such as eliciting appropriate body gestures (Buffington, Krantz, McClannahan, & Poulson, 1998), maintaining appropriate conversations (Charlop-Christy & Kelso, 2003), and peer imitation (Garfinkle & Schwartz, 2002). However, this model is lacking in that there are innumerable social skills necessary for effective social interaction. Thus, children with significant deficits in social skill development, such as those with ASD, would need to be taught most, if not all, of the social skills. Also, social skills need to be applied flexibly to a variety of situations, and that cognitive flexibility is neither common among individuals with ASD nor amenable to ABA situations. Additionally, although many children with ASD have experienced success in learning new skills, a large proportion of these children fail to
generalize these skills to new situations without intensive programming designed to encourage generalization (i.e., Charlop-Christy & Kelso).

Implementing the recommended intensive behavioral programming (i.e., ABA) for the acquisition of even one skill can be expensive and time consuming. In most communities, there are a limited number of social skills groups that are able to provide social skills programs like those suggested by Krasny et al. (2003). In addition, most children with ASD already participate in several different treatments such as Occupational Therapy and Speech Therapy, which poses scheduling challenges for parents. For this reason, a treatment that can be provided in the home is helpful.

A key social skill (and one that is absent in children with ASD) is the ability to recognize and predict emotions both in one’s self and in others. This skill is crucial in allowing an individual to monitor behavior. It is with this skill that one is able to adapt behaviors to be appropriate to a given situation, which affects the quality of the social interaction. Research has suggested that social skills are operant behaviors that can be environmentally manipulated, influenced and learned. This puts remediation of skills within reach.

Currently, Theory of Mind is a primary theory directing our understanding of Autism Spectrum Disorder (ASD), especially in regard to the social deficits that individuals with ASD encounter. Theory of Mind (ToM) is the ability to know about one’s own and others’ mental states (Baron-Cohen, 2001). It is widely agreed that individuals with ASD have difficulty understanding others’ minds and their own (e.g., Baron-Cohen, 1991; Frith & Happe, 1999). Individuals with ASD either fail to develop ToM or they develop the skill much later than is typical. Most typically developing
children show indications of a developing ToM by age three or four. Those individuals with an ASD who develop ToM do so during adolescence or early adulthood and after a great deal of intervention (Frith & Happe, 1999). Studies have shown that ToM can develop earlier as a result of intervention (e.g., Frith & Happe, 1999; Silver & Oakes, 2001); however even early development for an individual with ASD would be considered delayed compared to their typically developing peers.

ToM allows us to engage others in interactions appropriately and successfully, by providing us with information about how others are reacting to an interaction they are currently experiencing or how they may respond to a future. Individuals then use this information to adjust their own behaviors accordingly. Therefore, individuals who have not had normal ToM development are at risk for having limited social interactions. Because children tend to access an enormous amount of information about themselves and the world in which they live via interactions with their friends, failure to develop friends can result in a depleted learning environment (Rutter & Garmezy, 1983).

Many studies have attempted to teach ToM to individuals (e.g., Baron-Cohen, 1991; Frith & Happe, 1999), so as to provide individuals with that tool which is considered essential to social functioning. Some studies have used ToM tasks to teach ToM, assuming that the individuals would be able to apply those skills to new situations such as social interactions. Unfortunately, the individuals with ASD in these studies were able to learn to successfully complete ToM tasks, but they failed to generalize ToM to other situations (Hadwin, Baron-Cohen, Howlin, & Hill, 1997). Using a different approach, Silver & Oakes (2001) taught social-emotional skills (emotion recognition and prediction) to individuals with ASD without using ToM tasks. These individuals were
able to generalize what they learned to other situations, and were able to successfully complete ToM tasks that they had failed prior to the intervention. It is currently unknown why the individuals were able to generalize from the social skills they learned to ToM tasks, when others failed to generalize in the other direction (i.e., from what was learned from the ToM tasks to their social skills).

Golan & Baron-Cohen (2006) and Silver & Oakes (2001) have attempted to provide alternative approaches to social skill acquisition by developing computer programs to help children with ASD recognize and predict emotions in others. The programs use discrete trial learning and other ABA techniques to help teach these skills. The programs also use multimedia effects to help make them fun and reinforcing for the children using them. Computers also have the added advantage of being able to collect data on a user's progress. Presenting lessons via computer removes other environmental demands (such as unwanted visual and auditory stimuli that the child may find distracting) that are typically present in real life situation. Such demands often inhibit learning and are particularly problematic for individuals with an ASD. Once the skills are learned, environmental demands typically encountered can be added to increase generalization of the skills.

Golan and Baron-Cohen (2006) evaluated the effectiveness of their computer intervention, Mind Reading (Baron-Cohen, Golan, Wheelwright, & Hill, 2004). Mind Reading is an interactive, systematic guide to emotions and mental states. The program has the capacity to teach 412 emotions that are systematically categorized into 24 groups and six developmental levels. Users can access information via video clips, audio clips, and brief stories. They evaluated their program in two phases. The first phase compared
a group of adults (n = 19) with Asperger's Syndrome or High Functioning Autism (AS/HFA) who used the software at home for 10 – 15 weeks to two groups: a group of adults (n = 22) with AS/HFA who did not receive intervention and a general population control group (n = 24). Participants judged emotion recognition in voices (via voice recordings) in faces (via computer screen). The second phase compared a group of adults with AS/HFA (n = 13) who used the software at home and met in a group with a tutor on a weekly basis against two matched control groups (n = 13 for each control group): a group of adults with AS/HFA attending a social skills group and to a general population control group. Golan and Baron-Cohen found the intervention group improved significantly on what they called “close generalization” tasks, which included faces and voices that had been presented in the intervention program but were presented on different software and with more challenging multiple choice answers when used as the dependent measure. The intervention group did not improve significantly on distant generalization tasks.

Silver and Oakes (2001) evaluated the Emotion Trainer, a much less complex program compared to Mind Reading. It aims to teach only four basic emotions (happy, sad, angry, afraid) presented via digital photographs of children, adults, and objects. In their study, they were able to demonstrate the intervention group improved significantly more on distant generalization tasks including those designed to assess emotion recognition and ToM. They provided the Emotional Trainer to 11 children (12-18 year olds) with autism or Asperger's Disorder at two schools. One group used the Emotion Trainer for 10 half hour sessions over a two week time period; the other group served as a control and did not receive the computer intervention. After two weeks of treatment, the
The intervention group made significant gains compared to the control group on the Emotion Recognition Cartoons, Happe’s Strange Stories., and Sections 2 and 4 of the Emotion Trainer.

The aim of the current study was to determine whether children using the Emotion Trainer as a home-based program would derive benefit in the skills taught and on ToM tasks. Response to the program was measured by the error tracking system built into the Emotion Trainer, and by related tasks that were administered before and after participation in the three-week Emotion Trainer program.

**Method**

**Participants**

The participants were 30 children (25 boys and 5 girls) between the ages of 10 and 17.2 (M = 13.48, SD = 1.96), recruited from the Kelly O’Leary Center, an ASD diagnostic and treatment clinic at the Cincinnati Children’s Hospital Medical Center. All participants met criteria listed in the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition- TR (DSM-IV-TR, 2000) for either Autistic Disorder (n=18) or Asperger’s Disorder (n= 12), based on diagnoses by outside agencies and clinicians prior to enrollment in the study. All participants provided documentation from their school’s Multi-factored Evaluation (MFE) of having a verbal age score of at least 7 years (M = 12.02, SD = 3.77). There was one African-American female participant; the
remaining participants were Caucasian. See Table 1 for a complete description of demographic information.

*Design*

The study was a within subjects, multiple baseline design. Prior to the beginning of the study, all 30 participants completed pre-intervention measures to establish a baseline performance. Ten participants began the intervention at that time. Approximately four weeks following the baseline assessment, ten more participants completed the pre-intervention measures again and began the intervention at that time. Approximately eight weeks following the initial baseline assessment, the remaining ten participants completed the pre-intervention assessment for a second time and they began the intervention at that time. Immediately following the end of the three week intervention period, each participant completed post-intervention measures. Progress with the program was measured by both the pre- and post-intervention measures (described below) and the number of errors committed on the Emotion Trainer during the course of the three week intervention period.

*Measures*

*Happe's Strange Stories.* Happe's Strange Stories were developed by Happe (1994, see Appendix A, p. 35) as an advanced ToM test consisting of 24 short vignettes. The vignettes are read to the child, followed by two test questions. The comprehension question asks “Was it true what X said?” and the justification question asks “Why did X say that?” There are 12 different types of stories with two examples of each type: Lie, White Lie, Joke, Pretend, Misunderstanding, Persuade, Appearance/Reality, Figure of
Evaluation of an In-Home Speech, Sarcasm, Forget, Double Bluff, and Contrary Emotions. This study included 16 of the original 24 vignettes; the 16 stories were divided into two sets (set A and set B), each containing eight stories that represented a different story type. Sets A and B were counterbalanced across participants for pre- and post- intervention assessments.

Responses to stories were transcribed and scored from -3 to +3 according to how much understanding of the story characters’ mental states the child demonstrates, using criteria described by Silver and Oakes (2001). This scoring system was designed to detect subtle changes that may occur as a result of intervention (see Appendix B, p. 41). Silver and Oakes demonstrated good inter-rater reliability for their scoring system ($r = .97, p < .01$); in the present study, the inter-rater reliability was $r = .93, p = .001$. Using 8 stories per set, scores could range from -24 to +24.

The Facial Expression Photographs. The Facial Expression Photographs (Spence, 1995) are a set of 24 black and white photographs of facial expressions (see Appendix C, p. 42). The individual is asked to choose the emotion from a list of six choices that best describes each photograph. Scores range from 0 to 24. Spence states that her measure has acceptable inter-rater reliability and validity, but she was unable to provide specific information when it was requested (Spence, personal communication, 2004).

Emotion Recognition Cartoons The Emotion Recognition Cartoons (see Appendix D, p. 43) are two sets (set A and set B) of 22 cartoons designed by Howlin et al. (1999). For each set, cartoons for eight situation-based, six desire-based, and eight belief-based emotions were administered following the procedures described by Hadwin et al. (1996,
see Appendix E, p. 45). The order of the sets was counterbalanced across participants for pre- and post- intervention assessments. Respondents are assigned 1 point for each cartoon to which the child describes a "reasonably" correct feeling (Silver and Oakes, 2001, p. 304). Correct responses to situation-based and desire-based cartoons are scored one point; belief-based cartoons have two emotion questions, each of which can earn 1 point. The total number of assigned points across all cartoons is summed to give a possible score range of 0 to 30.

Parent Satisfaction Survey. Parents were asked to complete a short parent satisfaction questionnaire at the close of the study (Appendix F, p. 46). The survey was borrowed from Kroeger, Schultz, and Newsom (in press).

Intervention

The Emotion Trainer was developed by Silver (2000) and is a multimedia computer program consisting of five sections. A digital photograph of either a face, scene or object is shown, along with a short text question and two to four response buttons. The user must correctly complete 20 items in each section to proceed to the next section. Presentation of the items and the response buttons is randomized to minimize the chances of a user seeing the same screen twice. Correct responses are reinforced with a "well done" message and animated colored balls bouncing across the screen. Incorrect responses are followed by a "try again" message and a hint to the correct response. A second incorrect response is followed by another "try again" message along with a direct hint of the correct response. This is repeated until the user selects the correct response. When the user successfully completes a section a, "well done you have completed the
section” message along with an animation of an airplane, car, and hot air balloon traveling across the screen is given.

The five sections of Emotion Trainer provide instruction in increasingly complex features of emotional recognition. Section One allows the user to become familiar with how basic emotions are displayed as human facial expressions. Section Two is intended to teach that situations and events can trigger emotional responses. Section Three attempts to display the causal relationship between events and emotional experiences. For example, that getting what you want tends to make you happy and not getting what you want tends to make you sad. Section Four is intended to teach the user that mental states can provoke an emotional response, even if an event does not occur in reality. Section Five is intended to teach the user that the absence of disliked events or objects and the presence of liked events or objects is pleasing, whereas the absence of liked objects or events and the presence of disliked objects or events is disappointing. (See Silver and Oakes (2001) for a more detailed description of the sections of the Emotion Trainer). Each time the participant uses the Emotion Trainer, he or she begins with Section one. The participant progresses to each subsequent section when 20 questions are correctly answered within the section.

The Emotion Trainer program records information about each participant’s responses during each session. This includes: to which section the user progressed, the number of errors made on each item presented, and the date and amount of time spent with the program for each session. For the purposes of the current study, the number of errors made on each item within each section served as the measure for progress.
Specifically, an error score was computed to represent the mean number of errors committed across all exposures within each section of the Emotion Trainer.

The treatment sessions took place in each child's home on a laptop computer provided by the experimenter. Parents were asked to ensure that each participating child spend a minimum of one half hour per day, five days per week for three consecutive weeks. The parents were asked to monitor their child’s use, but not to provide assistance in answering items.

Procedure

Possible participants were identified from archival diagnostic documents at the Kelly O’Leary Center for Autism Spectrum Disorders, in the Division of Developmental and Behavioral Pediatrics, within the Cincinnati Children’s Hospital Medical Center (CCMHC). Both the CCHMC and Xavier University Institutional Review Boards granted approval for this study (See Appendices A & B). A letter with a description of the study was mailed to parents with a child who meets the criteria described above (see Appendix G, p. 47). Interested parents then contacted the principle investigator. Once families had agreed to participate in the computer intervention program, informed consent was obtained from parents of the participating children (see Appendix H, p. 48). The first 30 children who contacted the principle investigator and met study inclusion criteria were included in the study.

Pre-intervention measures (Happe’s Strange Stories, Facial Expression Photographs, and Emotion Recognition Cartoons) were administered in the home to all children during the first week by the principle investigator. The order of all intervention measures was counter-balanced to control for possible order effects. Following these
administrations, the 10 children chosen to participate during the Time 1 intervention period were provided with the laptop computer on which the Emotion Trainer had been installed. The principle investigator then set up the computer and demonstrated to the family how to access and use the program. Parents were asked to have the child use the computer intervention for one half hour per day, five days per week for three weeks (a total of 15 half hour long sessions). Following the intervention period, the Time 1 children were given post-intervention measures, and parents were asked to complete a short parent satisfaction questionnaire at the close of the study. At Time 2 (four weeks after the administration of the pre-intervention measures) the second set of ten children were given the pre-intervention measures again and were provided with the laptop computer and intervention. Following the intervention period, post-intervention measures were administered as described. At Time 3 (eight weeks after initial contact) the third set of ten children were given the pre-intervention measures again and were provided with the laptop computer and intervention. All post-intervention measures were administered within one week of completing the Emotion Trainer for all participants.

Results

The purpose of this study was to examine the effectiveness of the Emotion Trainer in teaching social skills to children with ASD when used in their homes. Data were analyzed for 29 of the 30 children who started the program; one child opted not to complete the study. Before performing the primary analyses, baseline and secondary baseline data were compared. First, we conducted One-way ANOVAs to determine whether groups performed differently at each baseline for each of the assessment
measures. Table 2 presents the means, standard deviations and ANOVA results for the Happe’s Strange Stories, Emotion Recognition Cartoons, and Facial Expression Photographs at each baseline period. Scores between groups at each assessment time were not significantly different. In addition, we compared the children’s performance across the baseline periods. Table 3 presents the results of paired samples t-tests for Groups 2 (whose 2nd baseline assessment occurred 3 weeks after the initial testing) and 3 (whose 2nd baseline assessment occurred 6 weeks after initial testing). As can be seen, although the mean scores on all of the dependent measures increased for Group 2, these changes were not significant from 1st to 2nd baseline. Likewise, the mean scores for all of the dependent measures increased for Group 3, but the increase was significant only for the Emotion Recognition Cartoons. Given the overall trend of these findings (i.e., that scores did not change significantly), data for all children were analyzed together for Happe’s Strange Stories and the Facial Expression Photographs; pre- post analyses were conducted separately by Group for the Emotion Recognition Cartoons.

Paired samples t- tests were used to compare performance on all assessment measures at pre- intervention (1st baseline) and post intervention. The Bonferroni correction for experiment-wise error was not applied, as the small sample size necessitates a rather large effect size to reach significance and reducing the requirement for significance may result in real effects being missed (Silver, 2001). Table 4 presents the means, standard deviations and t-test results for all assessment measures. As can be seen, scores for Happe’s Strange Stories and Facial Expression Photographs did not change significantly from pre- to post-intervention, but the Emotion recognition Cartoons scores did increase significantly. When analyzed separately by group, the increase in
performance was significant for Groups 2 and 3, but not Group 1. A graph demonstrating changes in scores at pre- and post- intervention can be found in Figure 1. Given that the Emotion Recognition Cartoons scores for Group 3 increased significantly before intervention, we examined the pre-post intervention Emotion Recognition Cartoons scores separately by baseline group.

Paired Samples t-tests were also conducted to examine the number of errors committed during the first exposure of each section of the Emotion Trainer compared to the number of errors committed during the last exposure of each section. Table 5 presents the means, standard deviations, and t-test results for each section. There were statistically significant improvements on two of the five sections when comparing first and last sessions attempted. Those sections reaching statistical significance were Sections 1 ($t = 4.49, p = .001$) and 4 ($t = 2.133, p = .04$). Figure 2 graphically depicts changes in errors committed on the Emotion Trainer at pre- and post- intervention. Notably, participants' exposure to each section of the program varied widely from 3 to 81 sessions ($M = 16.86, SD = 13.89$). Individual participant scores on all measures at pre- and post intervention are available in Table 6.

Post-hoc analyses were conducted to examine the effects of demographic variables on pre-post assessment measure performance. One way repeated measures ANCOVAs (one for each measure and section of the Emotion Trainer), with intervention group, diagnosis, race, and sex as covariates revealed that performance was related to diagnosis on the Facial Expression Photographs ($F = 5.60, p = .03$), Happe's Strange Stories ($F = 9.16, p < .007$), and Sections 2 ($F = 5.39, p = .03$) and 4 ($F = 10.62, p =...
of the Emotion Trainer. Performance was related to race on Section 5 of the
Emotion Trainer. There was a Group x Sex interaction ($F = 9.64, p < .006$) on
performance on Happe's Strange Stories. Specifically, children with autism had greater
improvement in performance compared to children with Asperger's Disorder on the
assessment measures and on Section 2 of the Emotion Trainer. Children with Asperger's
Disorder had greater improvements in performance on Section 4 of the Emotion Trainer.
Table 7 presents means, standard deviations, and paired sample t-test results for pre- and
post- intervention measures computed separately by diagnosis. As can be seen, the
children with Autism demonstrated significant improvement on the Emotion Recognition
Cartoons and on Section 1 of the Emotion Trainer. Children with Asperger's Disorder
demonstrated significant improvement on Sections 1 and 3 of the Emotion Trainer, but no
significant changes on the assessment measures. For continuous variables of
chronological age, verbal age, and number of intervention sessions completed, linear
regressions were performed and revealed that these were unrelated to changes in
performance. The African-American participant had greater improvements on Section 5
of the Emotion Trainer compared to Caucasian children.

As can be seen in Table 6, 16 of the 29 participants did not complete the
minimum 15 sessions with the Emotion Trainer intervention. Additional post-hoc
analyses were conducted to examine whether removing participants with fewer than 10
exposures to the intervention would produce different results. Table 8 presents the
means, standard deviations and paired-sample t-test results for all measures of the 23
participants who completed the Emotion Trainer. As can be seen, only the children's
scores on the Emotion Recognition Cartoons improved significantly at post-intervention
(t = -2.96, p = .007), which is similar to the findings for the entire group. A graph demonstrating changes in scores at pre- and post-intervention can be found in Figure 3. Regarding the number of errors committed during the first exposure of each section of the Emotion Trainer compared to the number of errors committed during the last exposure of each section, there was statistically significant improvement on only Section 1, which is consistent with the findings for the entire group. A graph demonstrating changes in errors committed on the Emotion Trainer at pre- and post-intervention is available in Figure 4.

Original post-hoc analyses were re-conducted to examine the effects of demographic variables on improvement in assessment measure performance for participants who had completed 10 or more intervention sessions. One way repeated measures ANCOVAs with intervention group, diagnosis, race, and sex as covariates revealed that diagnosis was related to performance on Happe’s Strange Stories (F = 11.54, p < .003) and Section 4 of the Emotion Trainer (F = 6.28, p = .02). The remaining covariates were unrelated to performance on any of the assessment measures or the Emotion Trainer. More specifically, children with Asperger’s Disorder made significantly greater gains in performance compared to children with autism on both measures. Improvement in performance on the remaining assessment measures were not related to group, diagnosis, race, and sex. Linear regressions were performed and revealed that chronological age, verbal age and number of intervention sessions completed were unrelated to performance on all measures except that performance on Happe’s Strange Stories was found to be related to the number of intervention sessions completed (F = 6.22, p = .02), suggesting participants’ scores on Happe’s Strange Stories
improved when they completed more computer intervention sessions. However, upon further investigation, it was noted that when the participant who completed 81 intervention sessions was removed from this analysis, it was no longer significant.

Paired-samples t-tests were conducted to examine results from the Parent Satisfaction Survey, comparing parental perceptions of their child’s social skills pre- and post-intervention and parental expectations prior to participating in the study and whether those expectations were met. Overall parents felt their child’s social skills improved significantly ($t = -4.94, p = .001$). Parent satisfaction levels after participating were not significantly different from how satisfied parents had expected to be prior to beginning the study ($t = -1.86, p = .08$). Overall, parents reported fairly high satisfaction with the Emotion Trainer ($M = 5.07; SD = 1.33$; out of a scale of 1-7).

**Discussion**

The aim of the current study was to examine the effectiveness of the Emotion Trainer when used in children’s homes in teaching children with autism or Asperger’s Disorder how to recognize and predict emotions in others. A similar study (Silver and Oakes, 2001) examined the Emotion Trainer’s effectiveness at teaching these skills to children in schools and found that using the Emotion Trainer resulted in significant gains on the Emotion Recognition Cartoons and Happe’s Strange Stories, in addition to fewer errors on Sections 2 and 4 of the Emotional Trainer. Participants in the present study did not make significant gains on Section 2, but did make significant gains on Section 4. Section 4 asks the user to predict how one might feel based on situational information with the presentation of mental states. Section 4 is similar in their presentation to some
of the tasks in the Emotion Recognition Cartoons, which may explain why the children in the current study improved significantly on both tasks. It is promising that the children were able to generalize what they had learned on Section 4 to the Emotion Recognition Cartoons, as skill generalization, even to “close generalization” tasks, has traditionally been difficult for individuals with ASD.

The current study also was able to demonstrate significant gains Sections of the Emotional Trainer, and on the Emotion Recognition Cartoons, but not on Happe’s Strange Stories. Three studies utilizing the HSS reported mean percent correct scores for children, adolescents and adults ranging from 84 – 85% (Silver and Oakes, 2001, Jolliffe and Baron-Cohen, 1999, Kaland, Moller-Nielsen, Smith, Mortensen, Callesen, and Gottlieb, 2005). One study reported mean percent correct scores at 40.5% (Brent, Rios, Happe, and Charman, 2004). Children participating in the current study had a mean percent correct score of 37.38%, a score much lower than those typically presented. It is possible that the children’s skill deficits in this area were so low they hindered the ability to make significant gains in a relatively short period of time.

Participants in the current study also made significant gains on Section 1, a section designed to teach users to recognize emotions based on facial presentation. In light of these improvements, it is striking that these skills were not generalized to performance on the Facial Expression Photographs. Silver and Oakes (2001) were also unable to establish significant gains on a version of these photographs, and recommended the use of a newer version for future research. The present study used the newer version, but did not find different results. However, 14 out of 29 participants received a baseline score of 20 or
greater (out of a possible 24 points) and the mean was 18.39) on the Facial Expression Photographs. It appeared that the baseline mean score for the Facial Expression Photographs was too high to allow for significant improvements post-intervention.

Participants obtaining a baseline score of 19 or below out of 24 (n=15) were re-examined in an effort to examine this theory more closely. This subset of participants improved significantly on the Facial Expression Photographs ($t = -2.64$, $p = .02$) after intervention.

As a result of these findings (i.e., that participants with lower scores at baseline made significant gains), we re-examined participants with Happe’s Strange Story scores of 19 or below at baseline. Again, this subset of participants made significant gains ($t = -2.86$, $p = .009$).

Other features of Happe’s Strange Stories seem worthy of note. Three studies utilizing the HSS reported mean percent correct scores for children, adolescents, and adults ranging from 84% to 85% correct (Jolliffe & Baron-Cohne, 1999; Kaland, Moller-Neilsen, Smith, Mortensen, Callesen, & Gottlieb, 2005; Sliver & Oakes, 2001). One study reported mean percent correct scores at 40.5% (Brent, Rios, Happe, & Chapman, 2004). Current participants had a mean percent correct of 37.38%, a score much lower than seen in most of the previous studies. It is possible that the children’s skill deficits in this area were so great that it hindered their ability to make significant gains in the relatively short period of time in this program.

Demographic variables were examined to determine if results were related to change in performance, or the ability to learn the social skills targeted. This is important since previous studies have shown that some children with ASD benefit from treatment
interventions more than others. Although IQ and the presence of speech have been listed as predictors of future success for individuals with ASD, it is unknown what other factors contribute to treatment success. In the present study, diagnosis was related to making gains in the acquisition of targeted skills. Children with autism made significant gains on the Emotion recognition Cartoons and on Section 1 of the Emotion Trainer whereas children with Asperger’s made significant gains on Sections 1 and 4 of the Emotion Trainer. When comparing mean scores between diagnoses, children with Asperger’s scored higher than children with autism on assessment measures at baseline, leaving them less room for improvement. For example, the baseline mean scores on the Emotion Recognition Cartoons were 23.71 and 27.67 out of a possible 30 points for children with autism and Asperger’s, respectively. Again, some of the participants began the intervention with high scores on the outcome measures, which means that it was difficult to show improvement. Results also suggested race (being African-American) is related to obtaining higher gains in performance on Section 5 of the Emotion Trainer; however, this represents the performance of only one African-American female and cannot be generalized to others.

Based on the current findings, it appears that the Emotion Trainer shows promise in the ability to teach children with autism and Asperger’s specific skills related to recognizing and predicting emotions in others in both school (Silver and Oakes, 2001) and home settings. However, performance on these skills varied, as did generalization to similar tasks. Based on the current findings, the Emotion Trainer may be more successful in teaching children with more significant social skills compared to those children with better developed social skills. Silver and Oakes (2001) demonstrated significant gains on
Happe's Strange Stories, an advanced ToM task. Gains were also made on this task in the current study although they did not reach statistical significance. The Silver and Oakes' finding is surprising since the Emotion Trainer is not designed to teach ToM. Traditionally, clinicians and researchers have attempted to teach ToM by repeating ToM tasks with individuals. They hoped that learning ToM would facilitate social skill development and implementation. Perhaps, improved performance on Happe's Strange Stories following use of the Emotion Trainer suggests social skill development facilitates ToM development.

Study limitations include a homogenous sample and short intervention period. Although female representation reflects the proportion of females in the ASD population, Caucasians were over-represented, a trend that is common in the ASD literature (e.g., Luyster, R., Richler, J., Risi, S., Wan-Ling, H., Dawson, G., et al, 2005). The current study included only one African-American. It is unknown why minority groups were under-represented in this study, as those children served through the recruitment site are fairly diverse.

The intervention period for this study was only 3 weeks, a relatively short amount of time. It is possible that the children would have performed differently had they been given more time with the intervention. In a related vein, a limitation of any home intervention is the lack of control over whether the individual is actually receiving the intervention. As previously mentioned, the majority of the children did not complete the 15 sessions asked of them. Although parents were asked to provide supervision to ensure proper intervention use, many parents reported not knowing how much their child
actually used the program and some reported being concerned that their child did not attend to the program when using it, but rather guessed at answers to finish quickly.

The Emotion Trainer itself is flawed in that the user is able to correctly complete entire sections without learning the skill it is aiming to teach. For example, in Section 3 the user need only attend to the digital photographs (i.e., are the same or different) or one word in the text (i.e., is “but” or “and” present) to determine which answer to choose. This is likely why users made very few errors on this section in both the current study and in the Silver and Oakes (2001) study. In the current study, 90% participants made between 0 and 3 errors on the first presentation of this section, which means that they had already mastered what was required to correctly complete this task before intervention was provided. As mentioned, we are not confident that high scores on this section reflect mastery of the skill that is being measured, just mastery of the computer task. We feel that adjustments to the nature and difficulty of this task would be helpful in future editions of the Emotional trainer. For example, adding a feature that allows the user to see how many question he or she answered correctly on the first try may serve as motivation for those participants who tended to rush through the Emotion Trainer to slow down and attend to the program.

The current study did not examine whether skills learned generalized to more distant tasks (i.e., social interactions). This would be an interesting question for future research, as the participants were able to demonstrate skill generalization to a closer generalization task (i.e., Emotion Recognition Cartoons) in two studies. Matching participants on diagnosis and assessment measure baseline performance may prove helpful in teasing out variables that influence treatment success.
References


Jolliffe, T., & Baron-Cohen, S. (1999). The strange stories test: A replication with high-


### Table 1

**Participant Demographic Information**

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Table 2
Means, Standard Deviations, and F-tests for and between group analyses

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<th>1&lt;sup&gt;st&lt;/sup&gt; Baseline</th>
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<th>p</th>
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<td>M (SD)</td>
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Note: HSS = Happe's Strange Stories, FEP = Facial Expression Photographs, ERC = Emotion Recognition Cartoons

<sup>1</sup>This occurred 3 weeks after 1<sup>st</sup> baseline. <sup>2</sup>This occurred 6 weeks after baseline. <sup>3</sup>This is the ANOVA comparing group performance at 1<sup>st</sup> baseline. <sup>4</sup>This is the ANOVA comparing group performance at 2<sup>nd</sup> baseline.
Table 3
Means and Standard Deviations of pre-test measures for groups at each baseline. ANOVA results compare the groups at each baseline period.

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Note: HSS = Happe’s Strange Stories, FEP = Facial Expression Photographs, ERC = Emotion Recognition Cartoons

<sup>1</sup>This occurred 3 weeks after 1<sup>st</sup> baseline.  <sup>2</sup>This occurred 6 weeks after baseline.
Table 4

Means, Standard Deviations and t-test results for Pre- and Post- Intervention Assessment Measures

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Table 6

*Pre- and Post-Intervention Emotion Trainer Error Scores by Participant and Section*

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Table 7

Means, standard deviations and Paired-Samples t-test results by diagnosis

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Note: FEP¹ = Facial Expression Photographs; ERC² = Emotion Recognition Cartoons; HSS³ = Happe’s Strange Stories; ET⁴ = Emotion Trainer and its corresponding section
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Means, Standard Deviations and t-test results for Pre- and Post- Intervention Measures for Children with 10 or More Intervention Sessions (n = 23)
Figure Caption

*Figure 1. Effect of time (pre-intervention scores versus post-intervention scores) on the Facial Expression Photographs, Emotion Recognition Cartoons, and Happe’s Strange Stories mean scores.*
Changes in Assessment Measures

![Graph showing changes in assessment measures](image-url)

- Facial Expression Photographs
- Emotion Recognition Cartoons
- Happe's Strange Stories

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Figure Caption

*Figure 2.* Effect of time (pre-intervention error scores versus post-intervention error scores) on Sections One Through Five of the Emotion Trainer mean error scores.
Evaluation of an In-Home Number of Errors on the Emotion Trainer

Pre-Intervention and Post-Intervention

- Emotion Trainer Section Two
- Emotion Trainer Section Three
- Emotion Trainer Section Four
- Emotion Trainer Section Five
- Emotion Trainer Section One
Figure 3. Effect of time (pre-intervention error scores versus post-intervention error scores) on Facial Expression Photographs, Emotion Recognition Cartoons, and Happe’s Strange Stories mean scores for children with 10 or more intervention sessions.
Changes in Assessment Measures for Children with 10 or More Intervention Sessions

- Facial Expression Photographs
- Emotion Recognition Cartoons
- Happe's Strange Stories

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Figure Caption

*Figure 4.* Effect of time (pre-intervention error scores versus post-intervention error scores) on Sections One Through Five of the Emotion Trainer mean error scores for children with 10 or more intervention sessions.
Number of Errors on the Emotion trainer for Children with 10 or More Intervention Sessions

Time

Number of Errors

Emotion Trainer Section One
Emotion Trainer Section Two
Emotion Trainer Section Three
Emotion Trainer Section Four
Emotion Trainer Section Five
Appendix A

Cincinnati Children’s Hospital Institutional Review Board Approval

Insert CCHMC IRB Approval Form Here
CINCINNATI CHILDREN'S HOSPITAL MEDICAL CENTER INSTITUTIONAL REVIEW BOARD

NOTIFICATION OF FINAL APPROVAL

PRINCIPAL INVESTIGATOR: Manning-Courteny, Patricia M.D. CHMC PROTOCOL: 05-01-49

TITLE OF STUDY: EVALUATION OF AN IN-HOME COMPUTER INTERVENTION: TEACHING CHILDREN WITH AN AUTISM SPECTRUM DISORDER TO RECOGNIZE AND PREDICT EMOTIONS IN OTHERS

( ) Full Review ( ) Expedited Review

The protocol and consent form for this study have been approved by the Children's Hospital Medical Center Institutional Review Board.

Meeting Date: April 05, 2005
Protocol Approval Date: April 05, 2005
Consent Form Approval Date: April 05, 2005
Expiration Date: April 04, 2006

1. The IRB has determined that this is a minimal risk study with potential direct benefit.
2. ( ) Assent must be obtained from participating subjects 11 years of age and over.
3. ( ) Assent need not be obtained from participants.
4. ( ) For this study, one parent must give permission for inclusion of the child (unless the parent is dead, incompetent, unknown, not reasonably available, or if only one has legal responsibility) if the subject is under 18 years of age.
5. ( ) Both parents must give permission for inclusion in this study.
6. ( ) Consent must be obtained for subjects 18 years of age and older.

This approval is granted with the following requirements:

1. The investigator is responsible for reporting adverse events to the Children's Hospital Medical Center Institutional Review Board:
   a). Deaths and life-threatening problems must be reported to the Children's Hospital Medical Center Institutional Review Board within two working days (48 hours) and documented in writing within 10 working days.
   b). All serious or unanticipated significant adverse events must be reported in writing within 10 working days.
   c). Minor adverse events can be reported in summary form at the time of submission of the continuing review (Progress Report) or upon completion of the study, whichever comes first.
   d). The investigator may also be responsible for reporting to the sponsor, other agencies, and the Children's Hospital Medical Center Pharmacy and Therapeutics Committee.
2. The investigator is responsible for submitting a Progress Report for continuing review by the IRB
   a). This must be submitted prior to the termination date as long as the study is active
   or
   b). Upon termination of the study
3. There may be no change or additions to the protocol or consent form, without prior approval of the IRB.
4. Approval by the IRB does not indicate approval by other committees of the Medical Center, (e.g., CRC Scientific Advisory Committee, Radiation Safety Committee, College of Medicine Institutional Review Board).
5. It is the responsibility of the investigator to keep copies of the approved protocol, consent form and all correspondence and all changes pertaining to the study or consent form

DHHS Assurance #FWA00002988

Chairman, Institutional Review Board
Children's Hospital Medical Center
Cincinnati, Ohio

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Appendix B

Xavier University Institutional Review Board Approval

June 21, 2005

Heather Johnson, M.A.
Xavier University
Department of Psychology
ML 3124

Dear Ms. Johnson:


Approval expires 6/21/06. A progress report must be filed with XU’s IRB by the expiration date. A form is enclosed for your convenience and is also available at www.xu.edu/IRB/IRBforms.htm.

If there are any adverse events or modifications to the research, please notify the IRB immediately.

We wish you every success in your research.

Sincerely,

Robert C. Baumiller, S.J.
IRB Chair and Administrator

RCB: nm

cc: Dr. Kathleen Hart, ML 6411

Enclosure: Progress Report Form
Approved Informed Consent