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The Way We Say Sorry

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THE WAY WE SAY SORRY

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THE WAY WE SAY SORRY

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ABSTRACT

THE WAY WE SAY SORRY

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People living with autism struggle with social interaction, social play, and communication. Over the last decade, technology-based interventions have been used as a way of teaching social skills to children with autism. To investigate these issues more thoroughly, three topics were the focus of this research: (a) the development of autism, (b) theory of mind, and (c) technology-based interventions. The information gained from studying these topics was used to create a technology-based intervention called *The Way We Say Sorry* (TWWSS). This intervention was created to help children with autism better understand the way sorry is used in the English language. Individuals with autism frequently experience difficulty appropriately recognizing and responding to nonverbal cues and communication. *The Way We Say Sorry* uses varying examples of facial expressions, gestures, and speech tone to increase awareness of how the word sorry is used in the English language. The researcher also created a possible research guide to test the validity of the game. This dissertation is available in open access at AURA, http://aura.antioch.edu/ and Ohio Link ETD Center, https://etd.ohiolink.edu/etd.

Keywords: autism, theory of mind, technology-based interventions

Dedication

This dissertation is dedicated to Alex and Aaron Igra, who continually give me inspiration, laughter, and remind me of the importance of play.

To Nancy Simon and Mark Igra for giving me the best job and letting me be part of their family.

I would also like to dedicate this dissertation to Melanie and Jim Everard for their consistent love and support throughout my life. Thank you for encouraging me to be myself and to follow my dreams, no matter where they take me. You are my teacher, my rock, and always my inspiration.

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Introduction

Individuals with autism spectrum disorder (ASD) exhibit significant difficulties with communication, empathy, emotion recognition, repetitive behavior, rigidity, and social skills (American Psychiatric Association, 2013). Effectively navigating social interactions can be very difficult for individuals with ASD. They are frequently overwhelmed by the complexity of social settings and emotional interactions (Quill, 1997). When conflict arises, individuals with ASD often utilize coping strategies that are considered socially inappropriate (i.e., tantrums and severe withdrawal). However, this challenging behavior is not meant to be a challenge but a form of communicating distress (Autism Speaks, 2012). Social impairments impede the process of building relationships, succeeding educationally and occupationally, and facilitating community involvement. The acquisition of emotional awareness and social skills is critical to social and educational success (Beeger, Koot, Rieffe, Meerum, & Stegge, 2008). Thus, it is imperative to identify and institute strategies to assist individuals with ASD in developing interpersonal skills.

Background

Autism

Autism is a neurological disorder that is thought to impact the developmental of social interactions, communication, and social play (Brady et al., 2014; Landa, 2007). ASD has an early onset, often presenting in the first five years of child development. The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association [APA, 2013]), describes autism spectrum disorder as,

> (a) Persistent deficits in social communication and social interaction across multiple contexts; (b) restricted, repetitive patterns of behavior, interests, or activities; (c)

> symptoms that are present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies later in life); (d) symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning; and (e) these disturbances are not better explained by intellectual disability or global developmental delay. (American Psychiatric Association, 2013, p. 50)

In the last 12 years, there has been a marked increase in the number of children diagnosed with ASD (Center for Disease Control [CDC], 2014). The most recent reports from the Autism and Developmental Disabilities Monitoring (ADDM) Network, established by the CDC, estimated that 1 child in 68 is diagnosed with ASD (CDC, 2014). Boys are diagnosed more often, with 1 in 42 reported versus 1 in 189 for girls. In 2000, the CDC (2014) estimated that 1 child in 150 was diagnosed with autism.

Autism is a spectrum disorder. Thus, the severity of symptoms, levels of impairment or disability, and skills acquisition lie on a continuum and vary case by case. Individuals with high functioning autism (HFA) exhibit average to above average intelligence and vary greatly in their expression of social competence. On the other side of the autism spectrum are individuals with co-morbid intellectual disabilities. These individuals, despite years of rigorous interventions, will need continual support.

The etiology of ASD is still unknown and widely debated. Research into genetics and environmental factors is ongoing. Although the specific etiology is unclear, research has shown that early interventions can greatly affect the developmental course of ASD (Ben Itzchak & Zachor, 2011; Lovaas, 1987; Wong & Kwan, 2010). Ben Itzchak and Zachor (2010) reported that after one year of early intervention, children with ASD had significantly improved in their

verbal and nonverbal skills, and children with HFA showed the greatest gains in cognitive abilities. Improvements in cognitive ability were primarily influenced by severity of ASD symptoms, age of child *and* mother (advanced maternal age resulted in better outcomes), and education.

Emotional Regulation/Social Intelligence

Individuals with ASD frequently experience difficulty appropriately recognizing and responding to nonverbal cues and communication (Golan & Baron-Cohen, 2006). Numerous studies have indicated that children and adolescents with HFA have little deficit in recognizing *basic* emotions (joy, sadness, anger, surprise, disgust, fear) from pictures or films (Baron-Cohen, Golan, Wheelwright, & Hill, 2004; Beeger et al., 2008; Golan & Baron-Cohen, 2006; Golan, Baron-Cohen, & Hill, 2006). By school age, children with ASD can often recognize and name emotions, understand emotional contexts, and perceive how the emotional state of another can affect their own emotional state (Beeger et al., 2008). There is greater impairment, however, in (a) processing and understanding multi-faceted, dynamically displayed facial expressions of emotion; (b) understanding mixed emotions (such as concurrent anger and sadness); and (c) recognizing more complicated emotions, such as embarrassment, shame, and pride (Dawson, Webb, & McPartland, 2005; Golan et al., 2006).

Important information about a person's emotional state is commonly displayed in facial expression, tone of voice, posture, gesture, and other nonverbal forms of expression (Ekman, 1993). Individuals with ASD have limited ability perceiving and understanding emotional cues---skills vitally imperative to social functioning. Emotion is a principal method of communication during infancy and directly influences interpersonal relationships throughout the lifespan; thus,

emotions and social competence are deeply interconnected (Beeger et al., 2008; Salisch & Saarni, 2001). As Salisch and Saarni (2001) noted,

> Frequency, duration, and intensity of emotional expressions are shaped in the face-to-face interactions between children and their significant others, and the dual role played by expressive behaviour as both an indicator of an (underlying) emotional state and a social signal is acquired in interpersonal exchange. (p. 289)

Emotions regulate and define social interactions, and emotional competence directly influences social competence (Beeger et al., 2008). These social competencies can impact future development in relationships (Boily, Kingston, & Montgomery, 2017).

Theory of Mind

Two main cognitive skills are closely related to the development of emotional and social competence: the development of imagination and theory of mind (ToM; Beeger et al., 2008; Happe, 1994). ToM is the concept that an individual can understand what another individual might be thinking based on the surrounding social situation. As the concept of this dissertation is to help children on the autism spectrum better navigate language used in social situations, ToM is an important topic. Researchers have been exploring the development of children's ToM for over 30 years and have generally accepted that ToM attributes transform and/or are transformed by the interpersonal relationships children form (Hughes & Leekam, 2004). In this dissertation, ToM's theoretical history, developmental stages, and relationship with ASD will be explored.

The original definition of ToM referred to an individual's capability to attribute the mental state (thoughts, beliefs, and desires) of himself or herself and that of another (Permack & Woodruff, 1978). Can the individual recognize that perspectives other than his or her own exist? However, the definition transformed when Baron-Cohen, Leslie, and Frith (1985) created a

litmus test to understand if children could separate their own understanding of a situation from another individual's understanding of a situation. This "false belief test" assessed whether a child could understand that another child held a different and incorrect belief from his or her own. The test is used for clinically normal preschoolers, for children with HFA, and for children with Down syndrome. The mean mental age of the children with autism was higher than that of the preschoolers and of the children with Down syndrome. During the test, each child was placed in a room with two dolls: Sally and Anne. Experimenters acted out Sally's and Anne's movements. Sally placed her marbles into a basket and then left the room. Anne then hid the marbles in a box. When Sally returned to the room, the experimenter asked the child, "Where will Sally look for the marbles?" The preschoolers and the children with Down syndrome were able to answer correctly, pointing to where Sally would think the marbles were, thus showing that they understood that the knowledge they held was different from that of the dolls. They were able to understand the doll's false belief. However, most of the children with autism would point to where the marbles were moved, indicating that they were unable to differentiate their own personal knowledge from that of the doll, thus not passing the false-belief test (Baron-Cohen et al., 1985).

False belief comprehension is vital for young children to be able to adapt to their social world (Hughes & Leekam, 2004). There is a perplexing contrast in the difference between 3-year-olds' success on false belief tasks. Three-year-olds often successfully convey everyday social communications, yet they frequently fail the false-belief tasks (Hughes & Leekam, 2004). This contrast raised the question: does ToM have any central meaning for a child's social competencies (Astington, 2001)? This question prompted researchers to develop a much wider definition for ToM, one that encompassed a broader range of mental states, including cognition,

emotions, perception, and intention. Baron-Cohen (1995) expanded the original definition of ToM to include awareness of social stimuli and attention to joint activities. The newly developed definitions considerably expanded the range of ToM research (Hughes & Leekam, 2004; Tager-Flusberg, 2001).

Inside this wider framework are two types of definitions for ToM (Tager-Flusberg, 2001). First, there is an emphasis on formal *propositional knowledge*, unified principles that explain how the *mental world* works. Second, there are socio-perceptual skills that provide an understanding of social "know-how", allowing individuals the ability to connect interpersonally on mental levels. These alternate definitions predict very different developmental courses for ToM.

Infants are social partners. They not only appear to be driven to engage with others, but they also invite others to engage with them. This raises the question: to what degree does the ability for engagement come from developmental ToM? From the age of six months, infants can recognize that animate objects are self-propelled (Spelke, Phillips, & Woodward, 1995). They can also distinguish between mechanical movement and biological movement (Woodward, 1998). This enables the infant to respond to behavior and to observe events from another's viewpoint. At ten months of age, an infant begins examining the intention of another's actions (Baldwin, Baird, Saylor, & Clark, 2001). However, as Hughes and Leekam (2004) noted,

> parsing action on the basis of intention is not the same as knowing the *content* of an intention; nor does it allow us to conclude that 10-month-old infants *intend* to parse actions in this way. Nevertheless, recognizing actions as intentional is an important foundation for children's social and communicative development. (p. 593)

There is a significant amount of research on pretend play and toddlerhood. Pretend play influences toddlers' social relationships through imaginative play, which is exciting and engaging. This frequently acts as a motivator for this age group to engage and sustain social contact (Hughes & Leekam, 2004).

Emotional regulation in toddlers has received far less attention through the ToM perspective. Studies that involve a frustrating task for a toddler, such as having the toddler wait for a reward, have shown that there are marked individual differences in toddlers' rapidly changing emotions. This difference in emotional lability is highly connected to individual differences in parenting styles and can result in problems in peer relations later in life (Calkins, Gill, Johnson, & Smith, 1999).

By the time most children reach preschool age, they have developed a complex understanding of their mental states, particularly emotions. Older preschoolers can often identify a variety of emotions in themselves and others. This includes understanding that people might present an emotion that is different than how they really feel, can simultaneously experience two or more conflicting emotions at one time, and can express emotional affect to a situation that is influenced by their current or previous mood. This emotional development creates a greater understanding and awareness of others and allows for stronger social interactions (Flavell & Miller, 1998). Preschoolers can also understand that human behavior is not only affected by shifting mental states but also by individual personality.

By the age of four, most children are able to understand when they have made mistakes in their beliefs about themselves and others. This awareness begets new, more advanced social interactions and allows for jokes, deception, and tricks. Also by that time, many children possess the understanding that the word *know*, spoken by oneself or another, indicates a greater certainty

than saying *guess* or *think* (Flavell & Miller, 1998). This development in social knowledge allows the child to become a more advanced social companion. Studies show that there is a correlation between the ability to connect interpersonally through conversation and collaborative play and the ability to identify a false belief (Slomkowski & Dunn, 1996; Youngblade & Dunn, 1995).

The development of play changes during the preschool years for most children. During this time, children no longer rely on the adult or older child to help them engage in conversation or play with a peer their own age who shares similar ability to use humor or interest (Dunn, 1994). This is considered a development in ToM, because the child is able to decide with whom the child wants to play and how the child wants to play (Hughes & Leekam, 2004).

Development of mental representations further increases after the age of four, including interpretation of ambiguous events, moral dilemmas, increased awareness of mixed emotions and the nuances of social deception, and the knowledge of bias in affecting expectations (Hughes & Leekam, 2004). By school age, development in ToM can lead to increased sensitivity to outside criticism, which can lead to issues with anxiety and low self-esteem (Cutting & Dunn, 2002). This higher level in development of ToM brings with it difficulties of social interactions, so children need to build a new repertoire of skills to help them avoid embarrassment or distress. With this comes the learned skill of being able to explain or conceal individual motives in order to manipulate a social situation (Tremblay et al., 1999).

Language Acquisition and Precursors to Theory of Mind

Researchers are investigating potential precursors to the development of ToM. Some theorists have proposed that joint attention, imitation, social referencing, communicative language, gesturing, and pretend play are important precursors to ToM (Baldwin & Moses, 1994;

Camaioni, 1992; Charman et al., 2000; Dunn, 1999; Leslie, 1987, 1994; Rogers & Pennington, 1991). Joint attention has been hypothesized as both a precursor to the development of ToM *and* language skills (Charman et al., 2000). Joint attention refers to the shared focus of two individuals, wherein one individual (using pointing, eye movement, and other verbal and non-verbal cues) directs another individual's attention towards an object and then back towards each other (such as a parent directing a child's attention to a toy and then back to the parent; Akhtar & Gernsbacher, 2007; Charman et al., 2000). Researchers have explored the relationship between joint attention tasks and later development of language as a possible indicator of the speed and efficacy of ToM.

There are two known populations in whom the development of ToM is delayed: children with ASD and deaf children with hearing parents. For deaf children with hearing parents, the delay stems from postponed exposure to accessible language (Gale, de Villiers, de Villiers, & Pyers, 1996; Peterson & Siegal, 1995; Pyers & Senghas, 2009; Schick, de Villiers, de Villiers, & Hoffmeister, 2007). Language plays an important role in false-belief task performance in children with ASD. Research shows that higher vocabulary correlates to positive results in the performance of the false-belief task (Happe, 1995). Children who understood words such as *think* or *believe* did better on the false-belief task. Children without a vocabulary containing embedded clause structure (a group of words that include a subject and verb, usually added to enhance or provide more information) tended to do worse (Tager-Flusberg & Joseph, 2005).

Both groups did poorly in joint attention tasks, which had a great impact on their later language development and subsequently their rate of development of ToM. Although both groups performed poorly on joint attention tasks, there was an inherent

difference as to the reason for the poor performance. Deaf children of hearing parents were delayed due to the *parents'* inability to communicate with the child, whereas the *children with ASD* were unable to communicate with their caregiver. Over time, the parents of deaf children will acquire signing skills and increase their ability to communicate with their child, allowing the child greater potential in development of ToM and the ability to communicate with language (Shield et al., 2016). Most deaf children with hearing parents were able to master the false-belief task and acquire other ToM skills later in childhood or adulthood (Wellman, Fang, & Peterson, 2011). Children with ASD can acquire ToM, but the timeframe is often extended.

Theory of Mind and Autism

For most neurotypical children, ToM is commonly developed between the ages of three and five (Hughes & Leekam, 2004). However, children with autism or other severe sensory impairments do not always reach the achievements of ToM. Children with HFA often have difficulties with day-to-day tasks such as small talk, conversation, and interactive social ability (Kelly, Garnett, Attwood, & Peterson, 2008). These difficulties impact everyday interactions that require the ability to recognize other people's different point of views, and they can be problematic because they limit the ability to converse about personal emotions and the emotions of other people (Peterson et al., 2008).

The hypothesis that autism affected a child's development of ToM was formed in the mid-1980s when Baron-Cohen et al. (1985) demonstrated that children on the autism spectrum failed the false-belief test. This research allowed Leslie (1987) to develop the first proposal relating ToM and autism. Leslie stated that the main features of autism, communicative functioning and impairment in social function, were best explained by a particular cognitive

deficit in one's ability to form meta-representation: the ability to recognize that another person could have multiple reactions to a singular interaction and have the ability to adjust accordingly.

Research revealed that children with autism showed deficits in understanding jokes, deception, lies, white lies, irony, and double bluffs, some of the core developing traits in ToM at that developmental age (Happe, 1994; Leekam & Prior, 1994; Sodian, 1991). Impairments associated with practical language competency and ToM were also discovered (Eisenmajer & Prior, 1991).

Children with ASD often present as being very literal, which can impair their ability to lie, deceive, and interpret jokes (Leekam & Prior, 1994). Deception is a first order mental state, whereas lies and jokes are considered a second order mental state (Leekam & Prior, 1994). In a first order mental state, an individual can represent another person's thoughts about the world (Sally thinks the marbles are in the basket). In a second order mental state, an individual can represent a belief about another person's mental state (Sally thinks Ann knows the marbles are in the basket). Ozonoff, Rogers, and Pennington (1991) suggested that verbal IQ might be a factor in the ability to pass secondary false-belief tasks. Happe (1991) believed that this might explain why individuals with HFA are able to pass second order reasoning.

Many parents of children with ASD reported that their child rarely lied, and if they did, they would admit to the lie very soon after (Leekam & Prior, 1994). Parents reported that their child's ability to use humor was often limited to slapstick humor, and often the child's jokes did not make sense. The children were able to understand some humor but were unable to recreate jokes. This indicates that children with ASD might understand the *difference* between a joke and a lie but might not be able to effectively *tell* a joke or lie in everyday life. However, children

with higher verbal skills were able to attribute both first and second order mental states and were able to make jokes, tell lies, and make appropriate social judgments (Leekam & Prior, 1994).

Language has also been studied in relation to understanding ToM and autism. Most studies indicate that the more advanced the language ability in children with autism, the more likely they are to pass the false-belief test (Dahlgren & Trillingsgaard, 1996; Happe, 1995). Ungerer and Sigman (1981) stated, "Autistic children with high language comprehension demonstrated more functional and symbolic play and longer sequences of meaningfully integrated play acts than autistic children with low comprehension" (p. 318). While exploring how children with autism play, researchers discovered that children with poor false-belief scores were unable to engage in spontaneous imaginative play (Jarrold, Boucher, & Smith, 1996). However, higher functioning children with autism were able to engage in play when prompted (Lewis & Boucher, 1988).

Researchers have discovered that children with autism who are able to pass the false-belief test have milder diagnostic symptoms of autism (Frith, Happe, & Siddons, 1994; Hughes et al.,1997; Prior et al., 1998). This indicates that ToM difficulties are inherently related to a key feature in autism: the failure to have social relationships. The specific relationship between ToM impairment and social competence is not categorical but rather dimensional. The study participants with high functioning autism who were able to pass the false-belief tasks were noted to have fewer and milder social impairments (Frith et al., 1994; Hughes et al., 1997; Prior et al., 1998).

Technology-Based Intervention

Within the last decade, there has been a marked increase in research studies and publications addressing innovative, technology-based approaches to teaching social skills to

individuals with ASD (DiGennaro Reed, Hyman, & Hirst, 2011; Goldsmith & LeBlanc, 2004; Grynszpan, Weiss, Perez-Diaz, & Gal, 2014; Moore & Calvert, 2000; Parsons & Mitchell, 2002; Wainer & Ingersoll, 2011). This dissertation will include an in-depth survey of the growing empirically supported research into the benefits of technology-based interventions for children with autism. What are technology-based interventions? DiGennaro et al. (2011) defined technology as,

> the use of an electronic or mechanical apparatus which can be programmed by the practitioner to automatically deliver visual, auditory or proprioceptive cues, discriminative stimuli, or to display the modeling of desired behaviors in the context of social skills training interventions. (p. 1005)

Technology-based interventions designed for individuals with ASD often provide alternative and engaging methods of acquiring emotional, social, and educational skills.

Although technology-based interventions allow for visual instruction along with repeatable reply, they often have less demanding social interaction than other types of social skill learning. As a result, people who create these interventions need to be aware of the possibility of increased isolation rather than desired interaction (Joosten & Wilkes-Gillan, 2016).

Numerous comparative studies indicate that individuals with ASD prefer and benefit from technology-based learning environments, showing that they have achieved positive results such as increased attention and motivation and decreased inappropriate behaviors (Golan & Baron-Cohen, 2006; Goldsmith & Lelllanc, 2004; Moore, McGrath, & Thorpe, 2000; Parsons & Mitchell, 2002). As Goldsmith and Lelllanc (2004) noted, “Individuals with autism often need external stimulus prompts to initiate, maintain, or terminate a behavior” (p. 166). Technology-

based interventions provide necessary external stimuli and are beneficial for a number of reasons.

First, technology-based interventions allow for low-stress learning environments wherein individuals are free to learn at their own pace and level of understanding and within their own time frame. Lack of time limits and social pressure can support increased learning potential by offering individuals control over the learning experience (Golan & Baron-Cohen, 2006). Second, technology-based interventions involve repetition to increase understanding, and lessons can be repeated until mastery is achieved. Third, the programs are predictable; the user with ASD is often soothed by the clearly defined and consistent tasks that require specific focused attention (Grynszpan et al., 2014). Fourth, programs can provide instant direct feedback, allowing the user to immediately correct or adjust. Fifth, skills and tasks can be presented in an engaging manner that promotes continued interest and utilizes visually cued instructions, which are highly recommended for interventions in ASD (Quill, 1997). Further motivation can be achieved through varied, individually selected, computerized rewards.

There has been a significant increase in research and development for technology-based instructional programming in the past two decades (Wainer & Ingersoll, 2011). The literature review will include an examination of the available studies that have addressed using technology to teach social skills and emotional affect to individuals with ASD.

There are numerous programs currently in development and existence. In 2001, Silver and Oakes explored the efficacy of a multimedia software program called *Emotion Trainer* in which photographs and animated emotional expressions were combined with feedback, prompting, and reinforcement to assist individuals with ASD in recognizing and predicting the emotions of others. Also in 2001, Bernard-Opitz, Sriram, and Nakhoda-Sapuan designed a

multimedia computer program that utilized animation, audio recordings, and visual stimuli to teach problem solving and conflict resolution to children with ASD. In 2002, Bolte et al. published their research findings regarding the computerized intervention they developed to teach basic facial affect skills. The researchers utilized 500 photographs, with both audio and visual components, and provided immediate feedback and reinforcement. In 2004, Baron-Cohen et al. developed *Mind Reading: The Interactive Guide to Emotions*. The program uses audio, visual, and written text to introduce and teach a broad spectrum of emotions. In 2008, Beaumont and Sofronoff developed the Junior Detective Training Program to assist children with HFA in decoding the emotional states of others. The game combined computer-based learning (with human and computer animated characters) with parent and teacher involvement, in vivo groups, and group therapy sessions. Recent research has indicated that parent-delivered social intervention "led to (a) increases in [the ASD child's] use of eye contact, directed positive affect, and verbal initiations, (b) increases in parent positive affect and synchronous engagement, and (c) generalized increases in parent and child behaviors" (Vernon et al., 2012, p. 2702).

Computer programs have been effectively utilized to teach vocabulary, communication skills, and specific social scripts to children with ASD. Some study findings have illustrated that children with ASD enjoy learning more when taught by a computer than by a teacher and respond favorably to fixed visual cues such as pictures or written words (Bernard-Opitz et al., 2001; Heimann, Nelson, Tjus, & Gillberg, 1995; Quill, 1997). Computer programs can encourage, motivate, and engage the attention of children with HFA in a cost-effective manner (Moore & Calvert, 2000).

Objectives

The purpose of this dissertation was to design an interactive computer game for young high functioning children with ASD and their parents. This game was created to help the user better navigate the way the word *sorry* is used in the English language. This game included five fully working levels; details of the levels are below in the Methodology section. Combined, the five levels included an introduction and then either of the following matching games: sorry variant to visual image, sorry variant to definition, sorry variant to example, or definition to example. The game had the ability to read aloud the written text on the screen when the READ button was pushed. The game also had the ability to keep track/score of the player progress. This score allowed the user to move from one level to the next. Furthermore, the game had the ability to save the user's progress, so the user could come back to where the user left off.

The programming for this computer game was outsourced to a computer programmer. The programmer worked directly with me to make sure each level was as I originally designed. Together we created a prototype that eventually became the finished product of this dissertation. The layout of the game and the levels are explained in detail below in the Methodology section.

This dissertation does not include any beta test, and the game itself was not tested on children. The dissertation includes the design of the game but does not include the beta testing.

Methodology

The Way We Say Sorry (TWWSS) was originally created for two young boys, ages five and seven. The 7-year-old boy was diagnosed with HFA. The concept of this game was developed from an incident that happened to boy with autism. One day when he was at school, he was told to apologize to another student. When he did, he said "sorry" in a rude tone of voice. Although he had followed the instruction, he got in trouble for being rude. He was confused by a

second reprimand, because he had followed the initial instruction. It was easy to understand his confusion, and more importantly, his frustration. He was told *to* apologize but not *how* to apologize. I began to think about how often sorry is used in the English language and how the meaning of sorry changes depending on the social situation. I started to understand how confusing that might be to someone who does not pick up the social context of the situation where the word is being used.

When I originally created TWWSS, it was played verbally. I thought of six distinct sorry variants I believed were used in everyday social situations. I then created names for these six sorry variants. Then I created definitions and slightly dramatic examples. I first taught the boys the names of six sorry variants and the definitions I created. Each example I created was overly dramatic and would be said in a specific tone of voice that would help differentiate one from the other. For example, the rude sorry was said in a way that sounded dramatically rude, and I would often make a grimace. The goal was to help clearly differentiate the one sorry variant from another.

In the process of trying to convert this verbal game into a computer game, I needed to make sure that I kept the integrity of my idea intact. I wanted to create a game that would introduce the player to the six sorry variants, give the player a definition, and follow the definition with an example. I realized that one of the key components to my game was the way in which the sorry was said. I realized that the game would need to be able to speak to the user to better teach the user the verbal social cue that went with the sorry variant. Multiple individuals were recorded reading the script to fit the game. These audio clips were incorporated into the game. I also wanted to incorporate a visual for each sorry variant, one that would clearly separate one sorry variant from the next.

My original intention was to create a two-person game. Research has shown that parents who engaged in their children's treatment were more likely to report lower levels of stress, higher levels of competency, and greater levels of affect than parents who did not (Brookman-Frazee, 2004; Connell, Sanders, & Markie-Dadds, 1997; Keen, Couzens, Muspratt, & Rodger, 2010; Koegel, Bimbela, &Schreibman, 1996). However, while creating the scoring section, I realized that having it be a two-person game created problems. I was worried that the adult would understand the concept of the game faster than the child would. My concern was that if this happened, the adult would score higher than the child. This might have created frustration and competition for the child. My fear was that if the game created more emotional outburst for the child, then the parent and child would not want to play the game, thus creating conflict rather than a positive intervention. I did not want to create any type of competition between the child and the adult; instead, I wanted to create a supportive learning opportunity for the child with the support of an adult. The game encourages both the child and adult to play as a team. By working as a team, both child and adult learned the sorry variants, and the adult could support the child if needed. Further thought allowed me to create my age range and criteria for the user. The ideal user is a child with HFA who is ten -twelve years of age or older and who is playing with an adult, ideally a parent or caregiver. This age range would ideally be determined in beta testing. Age twelve was chosen because it was the reading level that the game was created at.

To make the game more exciting, I wanted to incorporate a scoring system. This part was more difficult because the original game did not keep score. Because the original game was created to get harder as the children were able to progress in their sorry skill set, I decided that the computer game would also be built on that model, which allowed me to create a scoring system.

Before the game started, there was a home screen. This page had all five levels ordered from Level 1 on the top down to Level 5 on the bottom. Each level had three grey stars under it. These stars indicated the mastery of each level. This is explained in greater detail below.

When the player first started the game, the home page showed Level 1 in black and the other levels in grey. Grey levels were considered locked and were only able to be unlocked after the player passed the previous level. Each level had six matches, one for each sorry variant. The player was unable to move to the next level until the player was able to get at least four correct matches out of six.

If the player succeeded in matching, the grey stars turned yellow under that level of the main home page, indicating that the player had mastered the level. If the player was only able to match five correctly, then two yellow stars were received. And if the player was only able to match four correctly, then one yellow star was received. This was meant to encourage the user to go back to each level and try to get three stars.

On the home page next to the three stars was a number score. This score indicated if the player was able to match each question correctly on the first attempt. The highest score for each level was 30. Each time the player was given a match to complete, the player was able to score points. If the player got the answer correct on the first try, five points were earned. If the player got the answer correct on the second try, three points were earned. If the player was unable to correctly answer, one point was given.

This scoring system was set to encourage the player to not only get three stars under each level but also to get the top score for each level. The game had three different types of completion. The first was being able to unlock each level by getting four out of six matches correct. Once the player did this, the game congratulated the player on the success of unlocking

all levels. The game then encouraged the player to go back and try for second level mastery, getting three stars on each level. Once the player was able to get three stars for each level, the player completed mastery level. From there, the game encouraged the player to go back and get complete domination by receiving the highest score possible for each level, a total of 120 points.

Each time the player went back to work on a new level of mastery, the examples of the sorry variant changed. This was to eliminate memorization and to create a more fun and complex game. See Appendix A for multiple examples.

The Game Layout and Level Examples

The first level of the game is really an introduction to the six sorry variants, the facial imagery, the definition, and the example. Level 1 is unlocked once the player is introduced to the six sorry variants and hits the "Let's Play" button. If the player needs more time going over the six sorry variants, the player can hit the button that says "Let's Go Over This Again!". After each sorry variant has been introduced, the player is able to decide when to continue forward. The first level does not keep track of score; however, when the player is ready to move on, three stars appear under Level 1. The player is always able to go back to the first level for a refresher on the six sorry variants.

First level. Each level of TWWSS builds on the previous level, creating greater complexity. The first level of the game included an introduction to six different ways the word sorry is used. A definition of the particular type of sorry and an example of how it might be used in a social setting is shown on the screen (see Appendix B). An example is, "*Guilty Sorry: The Guilty Sorry is used when a person is saying sorry because they were caught doing something they were not supposed to do"*. The player, adult partner, or computer can read this definition. There is a "read" button on each screen next to the different written text.

Depending what the player wants to have read, the player will hit the corresponding read button. This is accompanied by either a photograph or cartoon image of a face that was designated to reflect that particular sorry. To help reinforce a visual stimulus connection to the written or spoken word, this image is paired with this definition for the rest of the game.

Following the definition and corresponding image is an example of how this particular sorry might be used in a real social situation. An example is, "*You took a five-dollar bill from your mom's wallet and she noticed. When you say sorry it is not really an apology; it is more a feeling of guilt for getting caught".*

Second level. The second level introduces the concept of a matching game, which is used throughout the remaining levels. The matching begins with a sorry variant and the corresponding definition appearing on the screen. An example is,

> *Rude Sorry: The Rude Sorry occurs when you apologize to someone but you do so in a tone of voice that is not kind. You might also make a rude face or stick out your tongue. When you do this, you are actually re-insulting the person who you are supposed to be saying sorry to.*

The player is then asked to match the sorry variant and definition to one of three faces introduced in the first level. If the player matches the correct face with the definition, he or she is able to move on to the next match. However, if the match is incorrect, the player is encouraged to try again, and the face the player previously chose is no longer on the screen or will be crossed out, leaving the player with two faces from which to choose.

Third level. The difficulty level increases in the third level, as the player is asked to match the sorry variant to a social situation. There is one social setting and of a sorry and three sorry variants to match it with. An example is, *"Social situation- When you have to go to the*

doctors for a shot even though you don't want to". The player must match the social situation to one of the following three types of sorry variants: strict sorry, empathetic sorry, or guilty sorry.

As in the previous level, if the player matches correctly, he or she can move on to the next social situation to match. If the player gets the match incorrect, the player is given encouragement to try again. The player is given another chance to correct the match, and the sorry previously chosen is crossed out or removed from the screen.

Fourth level. In the fourth level, the player matches a sorry variant with an, "I'm sorry statement". The player is provided with one example and three different sorry variants to choose from. An example is, "*Example: I am sorry your grandmother is sick*". The player must match the example to one of the following three types of sorry variants: polite sorry, sincere sorry, or empathetic sorry.

As in the previous level, if the player is able to match the sorry variant with the correct sorry, he or she can move on. If the player matches incorrectly, he or she is given encouragement to try again, and the sorry matched incorrectly is either crossed out or removed from the screen.

Fifth level. The fifth and highest level allows for multiple matches. The match is random and can be set up multiple ways. The player is asked to match the sorry variant with a definition. The screen will display one definition and three sorry variants: An example is, "*Definition: It is a brief moment when you recognize that something has happened and then you continue on your way".* The player must match the definition to one of the following three types of sorry variants: polite sorry, rude sorry, or strict sorry.

As with all other levels, if the player gets the correct match, he or she can proceed to the next match. The next match could be any type of match from the previous levels: matching a

face to a different sorry variant, matching a definition to the example, matching an example to the face, or matching the definition to the sorry. If the player identifies an incorrect match, he or she is given an opportunity to try again.

For the link to TWWSS, go to https://sorry-game.firebaseapp.com/.

Process

For the audio recording, I wanted to include voices that were varied in age and gender. Finding people to participate was relatively easy. Figuring out how to record the audio so that the volume and quality matched was more difficult. I decided that the best way to create a controlled recording would be to rent a recording studio. Although studio time allowed for high quality recordings, it also made flexibility around recording times much more difficult. Fortunately, all my participants were flexible and were able to find time for recording sessions.

In the process of writing out the text that would be recorded, I made an error that I did not notice until after the recording sessions were complete. I forgot to have the sorry definitions recorded without the sorry variants attached. This became an issue when I was setting up my levels. In my proposal, I stated that Level 2 would be matching a sorry variant with its corresponding definition. Because I did not have a recording of the definition without the sorry variant attached, I had to rework my levels.

Level 2 now incorporates the sorry variant and example together to be matched with the visual image. Although this was not the original intention, I found that it works better overall. I think having the visual image in Levels 1 and 2 will help younger people identify and memorize the different sorry variants faster. Levels 3, 4, and 5 continue as written in the original outline.

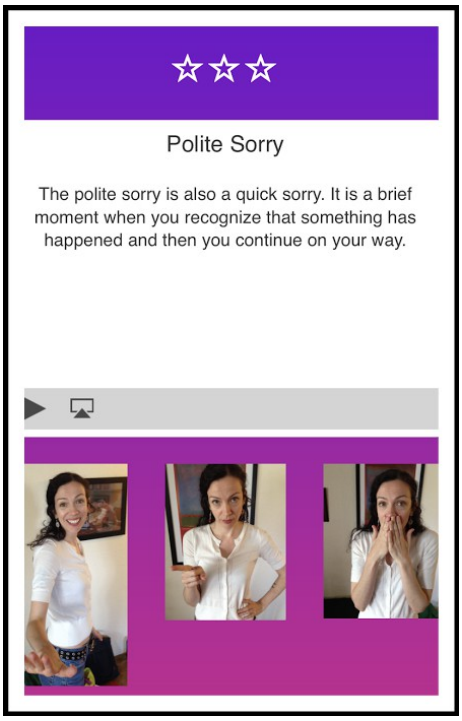

Figure 1. Polite Sorry. This figure is an illustration of the definition of a sorry and the corresponding facial expression.

Because I am not proficient in computer programming, I was not aware of certain technical difficulties in some of my original ideas. I had hoped that the game would allow the recording to play at the same time the words on the screen would be highlighted (like words on a karaoke screen). Within a short time of recording, I realized this would be difficult to accomplish. The speed and inflection of each participant varied greatly. As a result, I decided that highlighted text would be too complicated not only to program but also for the player to follow. I did not want the focus to be on the words as much as on what the words were saying.

Deciding on visual images was also much more difficult than I had anticipated. I spent a significant amount of time considering which type of visual image would be the most useful. Did I want a color or cartoon to help identify the sorry variants? Or did I want an image of an actual person? If I wanted realistic images, how would I locate models, and what kind of permission would I need to use their images?

Initially, I thought the idea of using color would be beneficial, allowing for simple matching. I soon realized that my specific color selections might not make much sense to individuals already struggling with the emotional concepts of sorry. For example, I thought I could make the guilty sorry green, the polite sorry yellow, the strict sorry red, the sincere sorry purple, and the empathetic sorry blue. In my mind, these colors mirrored the emotions of the sorry variants. The issue with this, I soon realized, was that I already understood the sorry variants and why each color might metaphorically or emotionally match. Someone playing this game for the first time, however, might not have a similar emotional reaction to the colors. Although the players would learn to match the colors as they played the game, the colors did not fully support the written text the way I had hoped.

I then thought about using cartoon images to represent the sorry variants. I spent time looking at different cartoons that might represent each sorry variant but was unable to find a cohesive collection that would support the six emotions. At this point, I contacted my brother for advice, and he encouraged me to take photographs to use as placeholders; I could change the photographs out once I found or made what I was looking for. I asked a good friend of mine to help me with the placeholder images. This turned out rather perfectly, because my friend was an actor for many years, is also a therapist, and had spent time helping me edit my proposal. Thus, she understood the nature of the game. While we were photographing the placeholder images, I realized that having one face represent all the sorry variants was helpful. This allowed for the player to see the changes in her face and body language, something that would be difficult to capture in cartoon form (see figure 2.). As a result, my placeholder images became my permanent images.

Figure 2. The Six Sorry Images. This figure illustrates the six sorry images. From left to right, they are strict, empathetic, guilty, polite, rude, and sincere.

Once I had sent all the necessary data to my brother, he was able to create the final version of the game. During months of emailing back and forth, we were able to come up with a game we both agreed made sense and functioned well. My next step was to find participants to play the game to make sure it worked as intended. These volunteers were given the link to the game and were asked to play it and to let me know if they ran into any issues. Some of the errors reported included written text not matching the audio and the correct answer marked as incorrect. I passed the feedback along to my brother, and he made the necessary corrections. After two weeks of game testing, the glitches had been worked out.

Having volunteers test the game was highly beneficial. It allowed me to receive feedback on both the concept and functionality of the game. I received positive feedback from the adults

who played the game. Although they were able to grasp the concept quickly, they enjoyed trying to get a high score.

Results

When the revised game was available, I played it with adolescents, some who had ASD and others who were neurotypical. They also gave me positive feedback and noted that they were able to play the game without much support. Some kids quickly understood the concept and learned the sorry variants, while some kids found the game a little more challenging but were driven to get a perfect score. In time, all the children were able to successfully learn the sorry variants and remember them a week later.

The next step for this project is to determine the game's viability as an intervention. The projected outcome is a player's increased ability to name and define sorry variants after an extended period of time has elapsed since playing the game. At this point in time, there is no set date to move forward with the study.

The population used for this research study will include a group of 10 children, ages 10-12. Each child will have a diagnosis of ASD 1 as identified through DSM-5 diagnostics and neuropsychological evaluations. Evaluations will include IQ testing to look for cognitive deficits (such as visual memory, executive function, attention, visual spatial, language--receptive expressive, and processing speed), which could impact how the child interacted with the game. The 10 selected participants will have relatively similar abilities.

Before the child or parent interacts with the game, the parent will be asked to answer a series of questions, which will be used to help track any possible changes (see Appendix C).

Once the participants have been selected, the game will be given to each participant's parent(s). Parents will be asked to play the game first for 30 minutes. This will allow parents an

opportunity to interact with the game without their child. Then, if the child needs support while playing the game, the parent will be familiar with the game's content and structure.

Once the parent has familiarized himself or herself with the game, it is the child's turn to play. The child will be asked to play the game with the parent first. This is to decrease frustration if the child struggles with the concept. After playing with the parent, the child will be asked to play without the parent four times a week (every other day, if possible) for 30 minutes. This will allow the child time in-between games to see if the child is actually learning the material instead of just memorizing screens.

The parent will be given a worksheet to track the child's progression. At the end of each 30-minute game session, parents will be asked to answer these questions (see Appendix D).

The second week, the child will be asked to play the game four times for 15 minutes. Again the parents will track the child's progression using the questions above. For the third week, the child will be asked NOT to play the game. At the end of that week, the parents will answer this group of questions:

Please answer these questions on a scale of 1 - 5 (1 being *never*, 5 being *always*; see Appendix E).

The child will be asked to meet with the researcher after not playing the game for 5-7 days. The child will be asked if he or she can remember the sorry variants by name without an image. If the child cannot remember them by name, can he or she remember what they represent? If the child still struggles, the images that were used in the game will be shown. This is to determine if the visual images are able to help the child recall the variants. If the child is able to name the sorry variants, the child will then be asked to define them.

The data collected by the parents will then be analyzed to see if the child made progress on the game and to see if the child was able to get farther along each time playing the game. If the child is able to identify the sorry variants one week after playing the game, that will indicate the lessons have entered into explicit memory.

The goal is not to have the child memorize the game but to have the child become more socially aware of when and how sorry is used in social situations.

If the game is successful with children with ASD 1, I would like to see if it could be used for children with ASD 2. I am also curious if this game could be used to help support children who have hearing issues or who use English as their second language.

I believe further research is needed on what impact a parent's understanding of ToM has on their children's development. Would a parent with a strong understanding of ToM be able to help the child more than a parent who does not understand ToM?

I am also interested in research regarding emotion and tone of voice in the technology-based interventions that are being created. How important is tone of voice in a game that is talking about emotions? Does a child perform better when tone of voice is incorporated compared to a game that uses only images to help teach emotions?

Limitations

The Way We Say Sorry has several limitations, including the reading level, cultural considerations, and shortcomings of the supporting research.

Originally, The Way We Say Sorry was intended to include audiences of all ages. However, the reading level of the finished product turned out to be appropriate for children who had the reading skills of a seventh grader or above. The reading level is higher then it was meant to be by accident. Because of the higher reading level, the game is now targeted at children who

are at least 10 to 12 years old. Younger learners may utilize the READ button to help them understand unfamiliar words but may still find that that there are words they have yet to learn. Nevertheless, more advanced younger readers may be able to play the game as successfully as their older peers, so the recommended age range remains a guideline and not an absolute restriction.

The Way We Say Sorry was created in the Pacific Northwest region of the United States. I created these sorry variants from my personal interactions and how I believed the word, "sorry" is used. Therefore, it is important to mention the lack of cultural diversity in this game. The game may need to be modified for different cultures, populations, and geographic location. The visuals in this game also lack diversity, as they are all of a white female. If the game were being recreated for different populations or cultures, I would encourage that the visuals be changed as well.

The research study created for this project was designed to test whether the game could be considered an intervention. If the study was replicated, some modifications are recommended to address the limitations of the research. For instance, a future researcher might want to create some different or additional question for the parents, appendix C, D, and E. While the research in this dissertation could be used as a guideline, developing stronger questions and more rigorous data collection procedures would produce more reliable information on the efficacy of The Way We Say Sorry as an intervention for children with Autism Spectrum Disorder.

Conclusion

People living with ASD might not develop ToM in the same timeframe as neuro-typical children. Without the development of ToM, individuals might have a harder time with everyday interactions, social play, small talk, and perspective-taking. Inability to understand the

deceptively complex nuances of tone and inflection in verbal communication can create social challenges for them in many areas of their lives.

In the last decade, there has been an increase in research on technology-based intervention and ASD. Games and interventions have been developed to teach basic and advanced social skills. Some of the benefits of technology-based interventions are low-stress learning environments, repetitions to increase understanding, and visual interaction and stimulation. Research shows that people with ASD enjoy using technology-based interventions, demonstrating a decrease in negative behaviors and an increased attention span and increased motivation (Golan & Baron-Cohen, 2006; Goldsmith & Lelllanc, 2004; Moore, et al., 2000; Parsons & Mitchell, 2002).

The goal of the present research was to develop a game that can help teach young children with ASD the different ways that sorry can be used in the English language. Through audio text, visual images, and a variety of recordings, the game is able to teach the importance of tone and inflection in a particular situation.

One can imagine multiple possible applications of TWWSS for use in schools, at home, and in clinical practice. Schools might use TWWSS in special education settings and in social skill classes. Parents might use it to increase understanding of how everyone in the house uses the word sorry, and it can offer one-on-one play with the child. Clinicians might use TWWSS to help young children understand that some words can have multiple meanings and that one needs to look at the entire situation rather than just focusing on the words.

References

Akhtar, N., & Gernsbacher, M. A. (2007). Joint attention and vocabulary development: A critical look. *Language and Linguistics Compass*, *1*:195–207. doi:10.1111/j.1749-818X.2007.00014.x.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.

Astington, J. (2001). The future of Theory-of-Mind research: Understanding motivational states, the role of language and real-world consequences. *Child Development, 72,* 685–687. doi.org/10.111/1467-8624.00305.

Autism Speaks, (2012). Why is autism associated with aggressive and challenging behaviors? *Autism Speaks and Autism Speaks It's Time To Listen & Design*. Retrieved from https://www.autismspeaks.org/sites/default/files/section_1.pdf

Baldwin, D., Baird, J., Saylor, M., & Clark, M. (2001). Infants parse dynamic action. *Child Development, 72,* 708–717.

Baldwin, D., & Moses, L. J. (1994). *Early understanding of referential intent and attentional focus: Evidence from language and emotion*. In C. Lewis & P. Mitchell (Eds.), *Children's early understanding of mind: Origins and development* (pp. 133–156). Hove, Sussex: Lawrence Erlbaum Associates.

Baldwin, D. A., & Moses, L. J. (1996). The ontogeny of social information gathering. *Child Development, 67*, 1915–1939.

Baron-Cohen, S. (1995). Mindblindness: An essay on autism and ToM. Cambridge, MA: MIT Press.

Baron-Cohen, S., Golan, O., Wheelwright, S., & Hill, J. J. (2004). *Mind reading: The interactive guide to emotions*. London: Jessica Kingsley Limited.

Baron-Cohen, S., Leslie, A., & Frith, U. (1985). Does the autistic child have a "ToM"? *Cognition, 21*(1), 37–46. doi:10.1016/0010-0277(85)90022-8.

Beaumont, R., & Sofronoff, K. (2008). A multi-component social skills intervention for children with Asperger syndrome: The junior detective training program. *The Journal of Child Psychology and Psychiatry, 49*, 743–753. doi.org/10.1111/j.1469-7610.2008.01920.

Begeer, S.: Koot, H., Rieffe, C.; Meerum, T., & Stegge, H. (2008). Emotional competence in children with autism: Diagnostic criteria and empirical evidence. *Developmental Review*, *28(3)* 342–369. doi:10.1016/j.dr2007.09.001.

Ben Itzchak, E., & Zachor, D. A. (2011). Who benefits from early intervention in autism spectrum disorders? *Research in Autism Spectrum Disorders, 5*(1), 345–350. doi:10.1016/j.rasd.2010.04.018.

Bernard-Opitz, V., Sriram, N., & Nakhoda-Sapuan, S. (2001). Enhancing social problem solving in children with autism and normal children through computer-assisted instruction. *Journal of Autism and Developmental Disorders*, *31*(4), 377–384.

Boily, R., Kingston, S. E., & Montgomery, J. M. (2017). Trait and ability emotional intelligence in adolescents with and without autism spectrum disorder. *Canadian Journal of School Psychology*, *32*(3-4), 282–298.

Bolte, S., Feineis-Matthews, S., Leber, S., Dierks, T., Hubl, D., & Poustka, F. (2002). The development and evaluation of a computer-based program to test and to teach the recognition of facial affect. *International Journal of Circumpolar Health, 61*, 61–68.

Brady, D., Saklofske, D., Schwean, V., Montgomery, J., McCrimmon, A., & Thorne, K. (2014). Cognitive and emotional intelligence in young adults with Autism Spectrum Disorder without an accompanying intellectual or language disorder. *Research in Autism Disorders*, *8*, 1016–1023. doi:10.1016/j.rasd.2014.05.009

Brookman-Frazee, L. (2004). Using parent/clinician partnerships in parent education programs for children with autism. *Journal of Positive Behavior Interventions, 6*(4), 195–213. doi.org/10.1177/10983007040060040201

Calkins, S., Gill, K., Johnson, M. & Smith, C. (1999). Emotional reactivity and emotional regulation strategies as predictors of social behavior with peers during toddlerhood. *Social Development*, *8*, 310–334. doi.org/10.1177/10983007040060040201

Camaioni, L. (1992). Mind knowledge in infancy: the emergence of intentional communication. *Early Development and Parenting, 1,*15–22.

Center of Disease Control and Prevention. (2014). Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years - Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2010. Morbidity and Morality Weekly Report. *Surveillance Summaries, 63*(2), 1–22. Retrieved from https://www.cdc.gov/mmwr/pdf/ss/ss6302.pdf

Charlop-Christy, Le, & Freeman, (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders, 30*, 537–552. doi.org/10.1023/A:1005635326276

Charman, T., Baron-Cohen, S., Swettenham, J., Gillian, B., Cox, A., & Drew, A. (2000). Testing joint attention, imitation, and play as infancy precursors to language and theory of mind. *Cognitive Development*, *15,* 481–498.

Connell, S., Sanders, M. R., & Markie-Dadds, C. (1997). Self-directed behavioral family intervention for parents of oppositional children in rural and remote areas. *Behavior Modification, 21*(4), 379–408.

Cutting, A., & Dunn, J. (2002). The cost of understanding other people: Social cognition predicts young children's sensitivity to criticism. *Journal of Child Psychology and Psychiatry, 43*, 849–860. doi.org/10.1111/1469-7610.t01-1-00047

Dahlgren, S., & Trillingsgaard, A. (1996). ToM in non-retarded children with autism and Asperger's syndrome. A research note. *Journal of Child Psychology and Psychiatry, 37,* 463–479.

Dawson, G., Webb, S. J., & McPartland, J. (2005). Understanding the nature of face processing impairment in autism: Insights from behavioral and electrophysiological studies. *Developmental Neuropsychology, 27*(3), 403–424.

DiGennaro Reed, F., Hyman, S., & Hirst, J. (2011). Applications of technology to teach social skills to children with autism. *Research in Autism Spectrum Disorders, 5*, 1003–1010. doi:10.1016/j.rasd.2011.01.022

Dunn, J. (1994). *Changing minds and changing relationships*. In C. Lewis & P. Mitchell (Eds.), *Origins of an understanding of mind* (pp. 297–310). Hillsdale, NJ: Lawrence Erlbaum Associates.

Dunn, J. (1996). The Emmanuel Miller Memorial Lecture 1995. Children's relationships: Bridging the divide between cognitive and social development. *Journal of Child Psychology and Psychiatry, 37*, 507–518.

Dunn, J. (1999). New directions in research on children's relationships and understanding. *Social Development*, *8*(2), *137–142.* doi:10.1111/1467-9507.00087

Eisenmajer, R., & Prior, M. (1991). Cognitive linguistic correlates of 'ToM' ability in autistic children. *British Journal of Developmental Psychology, 9*, 351–364.

Ekman, P. (1993). Facial expression and emotion. *American Psychologist, 48*, 384–392.

Flavell, J., & Miller, P. (1998). Social cognition. In D. Kuhn & R. Siegler (Eds.), *Cognition, perception, and language* (5th ed.). Handbook of Child Psychology, Volume 2 (pp. 851–898). New York, NY: Wiley.

Frith, U., Happé, F., & Siddons, F., (1994). Autism and ToM in everyday life. *Social Development, 3*, 108–124.

Gale, E., de Villiers, P., de Villiers, J., & Pyers, J. (1996). Language and theory of mind in oral deaf children. In A. Stringfellow, D. Cahana-Amitay, E. Hughes, & A. Zukowsky (Eds.), *Proceedings of the 20th annual Boston University conference on*

language Development (Vol. 1, pp. 213–224). Somerville, MA: Cascadilla Press.

Gergely, G., Nadasdy, Z., Csibra, G., & Biro, S. (1995). Taking the intentional stance at 12 months of age. *Cognition, 56*(2), 165–193.

Golan, O., & Baron-Cohen, S. (2006). Systemizing empathy: Teaching adults with Asperger syndrome or high-functioning autism to recognize complex emotions using interactive multimedia. *Development and Psychopathology, 18*, 591–617. doi:10.1017/S0954579406060305

Golan, O., Baron-Cohen, S., & Hill, J. (2006). The Cambridge Mindreading (CAM) Face-Voice Battery: Testing complex emotion recognition in adults with and without Asperger syndrome. *Journal of Autism and Developmental Disorders, 36*(2), 169–183. doi: 10.1007/s10803-005-0057-y

Goldsmith, T., & LeBlanc, L. (2004). Use of technology in interventions for children with autism. *Journal of Early and Intensive Behavior Intervention, 1*, 166–178. doi.org/10.1037/h0—100287

Grynszpan, O., Weiss, P., Perez-Diaz, F., & Gal, E. (2014). Innovative technology-based interventions for autism spectrum disorders: A meta-analysis. *Autism*, *18*, 346–361. doi:10.1177/1362361313476767.

Happe, F. G.E. (1991) Theory of mind and communication in autism. *Doctoral thesis,* University of London.

Happe, F. G. (1995). The role of age and verbal ability in the theory of mind task performance of subjects with autism. *Child Development, 66*, 843–855.

Happe, F. G. E. (1994). An advanced test of ToM: Understanding of story characters' thoughts and feelings by able autistic, mentally handicapped, and normal children and adults. *Journal of Autism and Developmental Disorders, 24*(2), 129–154. doi:10.1007/BF02172093.

Harris, P. L. (1994). The child's understanding of emotion: Developmental change and the family environment. *Journal of Child Psychology and Psychiatry, 35*, 3–28

Heimann, M., Nelson, K. E., Tjus, T., & Gillberg, C. (1995). Increasing reading and communication skills in children with autism through an interactive multimedia computer program. *Journal of Autism and Developmental Disorders, 25*, 459–479.

Hughes, C., Leboyer, M., & Bouvard, M. (1997). Executive function in parents of children with autism. *Psychological Medicine, 27*(1), 209–220.

Hughes, C., & Leekam, S. (2004). What are the links between ToM and social relations? Review, reflections and new directions for studies of typical and atypical

development. *Social Development, 13*(4), 590–619. doi:10.1111/j.1467-9507.2004.00285.x.

Jarrold, C., Boucher, J., & Smith, P. (1996). Generativity defects in pretend play in autism. *British Journal of Developmental Psychology, 14*, 275–300.

Joosten, A., & Wilkes-Gillan, S. (2016). Technology-based interventions were found to have evidence of effectiveness on range of outcomes, including social problem solving and facial and emotional processing skills for individuals with autism spectrum disorder. *Australian Occupational Therapy Journal, 63(2),* 135–6. doi.org/10.1111/1440-1630.12274

Kelly, A. B., Garnett, M. S., Attwood, T., & Peterson, C. (2008). Autism spectrum symptomatology in children: The impact of family and peer relationships. *Journal of Abnormal Child Psychology 36:1069.* doi.org/10.1007/s10802-008-9234-8

Keen, D., Couzens, D., Muspratt, S., & Rodger, S. (2010). The effects of a parent-focused intervention for children with a recent diagnosis of autism spectrum disorder on parenting stress and competence. *Research in Autism Spectrum Disorders, 4*(2), 229–241. doi:10.1016/j.rasd.2009.09.009

Koegel, R. L., Bimbela, A., & Schreibman, L. (1996). Collateral effects of parent training on family interactions. *Journal of Autism and Developmental Disorders, 26*(3), 347–359.

Lana, R. (2007). Early communications development and interventions for children with autism. *Mental Retardation And Developmental Disabilities Research Review 13:* 16–25.

Leekam, S., & Prior, M. (1994). Can autistic children distinguish jokes and lies? A second look at second-order belief attribution. *Journal of Child Psychology and Psychiatry*, *35*, 901–915.

Leslie, A. M. (1994). Pretending and believing: issues in the theory of ToMM. *Cognition, 50,* 211–238.

Leslie, A. M. (1987). Pretense and representation. *Psychological Review, 94*(4), 412–426. doi:10.1037/0033-295X.94.4.412.

Leslie, A. M., & Thaiss, L. (1992). Domain specificity in conceptual development: Neuropsychological evidence from autism. *Cognition, 43*(3), 225–251. doi:10.1016/0010-0277(92)90013-8.

Lewis, Y., & Boucher, J. (1988). Spontaneous, instructed and elicited play in relatively able autistic children. *British Journal of Developmental Psychology, 6*, 325–339.

Lovaas, O. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3–9.

Meltzoff, A., Gopnik, A., & Repacholi, B. (1999). Toddlers' understanding of intentions, desires and emotions: Explorations of the dark ages. In P. Zelazo, J. Astington, & D. Olson (Eds.), *Developing theories of intention: Social understanding and self-control* (pp. 17–41). Mahwah, NJ: Lawrence Erlbaum Associates.

Moore, M., & Calvert, S. (2000). Brief report: Vocabulary acquisition for children with autism: Teacher or computer instruction. *Journal of Autism and Developmental Disorders, 30*(4), 359–362. doi.org/10.1023/A:1005535602064

Moore, D., McGrath, P., & Thorpe, J. (2000). Computer-aided learning for people with autism - A framework for research and development. *Innovations in Education and Training International, 37*, 218–227. doi: abs/10.1080/13558000050138452

Oznoff, S., Pennington, B., & Rogers, S. (1991). Executive function deficits in high-functioning autistic individuals: Relationship to ToM. *Association for Child Psychology and Psychiatry*, 1081–1105.

Parsons, S. & Mitchell, P. (2002), The potential of virtual reality in social skills training for people with autistic spectrum disorders. *Journal of Intellectual Disability Research, 46*, 430–443. doi.org/10.1046/j.1365-2788.2002.00425.x

Parsons, S., Mitchell, P., & Leonard, A. (2004). The use and understanding of virtual environments by adolescents with autistic spectrum disorders. *Journal of Autism and Developmental Disorders, 34*, 449–466. doi.org/10.1023/B:JADD.0000037421.98517.8d

Peterson, C.C., & Siegal, M. (1995). Deafness, conversation and theory of mind. *Journal of Child Psychology and Psychiatry, 36*, 459–474.

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(4), 515–526.

Prior, M., Eisenmajer, R., Leekam, S., Wing, L., Gould, J., Ong, B., & Dowe, D. (1998). Are there subgroups within the autistic spectrum? A cluster analysis of a group of children with autistic spectrum disorders. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 39*(6), 893–902.

Pyers, J., & de Villiers, P.A. (2013). Theory of mind in deaf children: Illuminating the relative roles of language and executive functioning in the development of social cognition. In S. Baron-Cohen, M. Lombardo, & H. Tager-Flusberg (Eds.), *Understanding other minds: Perspectives from developmental social neuroscience* (3rd ed., pp. 345–363). Oxford, UK: Oxford University Press.

Pyers, J .E., & Senghas, A. (2009). Language promotes false-belief understanding: Evidence from learners of a new sign language. *Psychological Science, 20,* 805–812. doi:10.1111/j.1467-9280.2009.02377.x

Quill, K. (1997). Instructional considerations for young children with autism: The rationale for visually cued instruction. *Journal of Autism and Developmental Disorders, 6*, 696–714.

Rogers, S., & Pennington, B. (1991). A theoretical approach to the deficits in infantile autism. *Developmental Psychology*, *3,* 137–162.

Salisch, M., & Saarni, C. (2001). Introduction to the special section: Emotional development in interpersonal relationships. *International Journal of Behavioral Development, 25(4),* 289. doi.org/10.1080/016502501750210410

Schick, B., de Villiers, P., de Villiers, J., & Hoffmeister, R. (2007).Language and theory of mind: A study of deaf children. *Child Development, 78,* 376–396. doi:10.1111/j.1467-8624.2007.01004.x

Shield, A.,Pyers, J., Martin, A., and Tager-Flusberg, H. (2016), Relations between language and cognition in native-signing children with autism spectrum disorder. *Autism Research*, *9,* 1304–1315.

Silver, M., & Oakes, P. (2001). Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognize and predict emotions in others. *Autism, 5*, 299–316. doi:10.1177/1362361301005003007

Slomkowski, C., & Dunn, J. (1996). Young children's understanding of other people's beliefs and feelings and their connected communication with friends. *Developmental Psychology, 32*, 442–447.

Sodian, B. (1991). The development of deception in children. *British Journal of Developmental Psychology, 9*, 173–188.

Spelke, E., Phillips, A., & Woodward, A. (1995). *Infant's knowledge of object motion and human action*. In D. Sperber, D. Premack, & A. Premack (Eds.), *Causal cognition: A multidisciplinary debate* (pp. 44–78). Oxford, UK: Clarendon Press.

Tager-Flusberg, H. (2001). A re-examination of the ToM hypothesis of autism. In J. Burack, T. Charman, N. Yirmiya, & P. Zelazo (Eds.), *The development of autism: Perspectives from theory and research* (pp. 173–194). Mahwah, NJ: Lawrence Erlbaum Associates.

Tager-Flusberg, H., & Joseph, R. M. (2005). How language facilitates the acquisition of false belief understanding in children with autism. In J. Astington & J. Baird (Eds.), *Why language matters for theory of mind* (pp. 298–318). Oxford, UK: Oxford University Press.

Tomasello, M. (1999). Having intentions, understanding intentions, and understanding communicative intentions. In P. Zelazo, J. Astington, & D. Olson (Eds.), *Developing theories of intention: Social understanding and self-control* (pp. 63–75). Mahwah, NJ: Lawrence Erlbaum Associates.

Tremblay, R., Japel, C., Perusse, D., Boivin, M., Zoccolillo, M., & Montplaisir, J. (1999). The search for the age of 'onset' of physical aggression: Rousseau and Bandura revisited. *Criminal Behavior and Mental Health, 9*, 8–23. doi.10.1002/cbm.288

Ungerer, J., & Sigman, M. (1981). Symbolic play and language comprehension in autistic children. *Child and Adolescent Psychiatry, 20,* 318–337. doi./10.1016/S0002-7138(09)60992-4

Vernon, T. W., Koegel, R. L., Dauterman, H., & Stolen, K. (2012). An early social engagement intervention for young children with autism and their parents. *Journal of Autism Developmental Disorders*, *42 (12),* 2702–2717. doi:10.1007/s10803-012-1535-7.

Von Salisch, M., & Saarni, C. (2001). Introduction to the special section: Emotional development in interpersonal relationships. *International Journal of Behavioral Development, 25(4),* 29. doi:10.1080/016502501750210410.

Wainer, A., & Ingersoll, B. (2011). The use of innovative computer technology for teaching social communication to individuals with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *5,* 96–07. doi:10.1016/j.rasd.2010.08.002

Wellman, H. M., Fang, F., & Peterson, C.C. (2011). Sequential progressions in a theory-of-mind scale: Longitudinal perspectives. *Child Development, 82*, 780–792. doi:10.1111/j.1467-8624.2011.01583.x

Wong, V., & Kwan, Q. (2010). Randomized control trial for early intervention for autism: A pilot study of the 1-2-3 project. *Journal of Autism and Developmental Disorders, 40,* 677–688. doi:10.1007/s10803-009-0916-z

Woodward, A. L. (1998). Infants selectively encode the goal object of an actor's reach. *Cognition, 69,* 1–34. doi.10.1016/S0010-0277(98)00058-4

Why is Autism Associated With Aggressive and Challenging Behavior? (2012, July 25). Retrieved from https://www.autismspeaks.org/.

Youngblade, L. M., & Dunn, J. (1995). Individual differences in young children's pretend play with mother and sibling: Links to relationships and understanding of other people's feelings and beliefs. *Child Development, 66*, 1472–1492.

Appendix A

Multiple Examples for Each Sorry

Empathetic Sorry- When you feel bad for someone else. You are sorry for their situation.

Examples

Sorry your family member is sick

Sorry you broke your leg

Sorry your dog is sick

Sorry your cat is sick

Guilty Sorry- When you are sorry because you are caught. This means you know what you did was wrong.

Examples:

Sorry I cheated off your test

Sorry I stole your money

Sorry I lied to you

Sorry I ate your cookie

Sincere Sorry- When you accidentally hurt someone or break something and you feel bad.

Examples:

Sorry I stepped on your foot

Sorry I broke your Gameboy

Sorry the ball hit you, I did not mean to throw it at you

Quick Polite Sorry- When you bump into someone and say sorry and then move on.

Examples:

Oops, I'm sorry

Oh, excuse me, sorry about that

Pardon me, sorry

Oops, sorry

Strict Sorry- Saying sorry for something when there is no other option.

Examples:

I am sorry you do not like driving in the car, but we have to go to the store

I am sorry, but we have to

I am sorry, I know you don't feel well, but we need to go to the post office

Rude Sorry- When you use a rude tone of voice and you do not mean it.

Examples:

SORRY (spoken while you make a mean face)

SORRY (spoken while sticking your tongue out)

SORRY (spoken with a rude tone of voice)

Appendix B

The Six Types of Sorry

Guilty Sorry: The guilty sorry is used when a person is only saying sorry because they were caught doing something they were not supposed to do. Example: You took a five-dollar bill from your mom's wallet and she noticed. When you say sorry it is not really an apology; it is more a feeling of guilt for getting caught.

Rude Sorry: The rude sorry is when you apologize to someone but you do so in a tone of voice that is not kind. You might also make a rude face or stick your tongue out. When you do this, you are actually re-insulting the person you are supposed to be saying sorry to. Example: You get into an argument with a friend at school. When the teacher tells you that you need to apologize to your friend, you say sorry, but you make a mean face and stick out your tongue.

Sincere Sorry: The sincere sorry is when you are saying sorry and you truly mean it. You are apologizing for something that you really feel bad about. Example:
You accidently break your friend's favorite toy. You feel very bad about it, and when you say sorry, you really mean it. You are being truly sincere.

Strict Sorry: The strict sorry is one that you might hear from a parent. This might happen when a parent needs you to do something you do not want to do.
Example: When your parent tells you that you need to go to the store with them, but you don't want to go to the store. Your parents might say, "I am sorry you don't want to go to the store, but we have to."

Polite Sorry: The polite sorry is also a quick sorry. It is a brief moment when you recognize that something has happened and then you continue on your way.

Example: You are walking down the street and you bump into someone. You pause and say sorry, and then you keep moving.

Empathetic Sorry: The empathetic sorry happens when you feel bad for someone or a situation they are in. Although you feel bad, there is nothing you can do to change the situation. Example: Your friend's grandparent is sick and they are sad. You feel sad for your friend but there is nothing you can do to change the situation.

Appendix C

Before Playing the Game Questions

Before they play the game.

Please answer these questions on a scale of 1 - 5 (1 being *Never*, 5 being *Always*).

1. How often do you hear your child say the word sorry?

   1 2 3 4 5

2. How often do you hear yourself say the word sorry?

   1 2 3 4 5

3. How often do you use the word sorry for something other than an apology?

   1 2 3 4 5

4. How often do you tell your child to say sorry?

   1 2 3 4 5

5. How often does your child know what they say sorry for?

   1 2 3 4 5

6. How often do you know what you are telling your child to say sorry for?

   1 2 3 4 5

7. How often does your child get in trouble for being rude when saying sorry?

   1 2 3 4 5

8. How often does your child know they are getting in trouble for being rude when they say sorry?

   1 2 3 4 5

9. How often do you see your child struggling to understand the small verbal nuances of a social situation?

   1 2 3 4 5

10. How often does your child get in trouble for not understanding the small verbal nuances of a social situation?

    1 2 3 4 5

Appendix D

Progress Tracker

1. What time of day did your child play the game?

Morning Afternoon Evening

2. Did your child finish all levels of the game?

Yes No

3. How many stars were complete on each level?

Level 1- 1 2 3

Level 2- 1 2 3

Level 3- 1 2 3

Level 4- 1 2 3

Level 5- 1 2 3

4. Did your child keep playing to try for a higher score?

Yes No

5. What was their final score?

Appendix E

After Playing the Game

Since beginning to play the game:

1. How often do you hear your child say sorry?
   1 2 3 4 5

2. How often does your child know what they are saying sorry for?
   1 2 3 4 5

3. How often do you need to tell your child to say sorry?
   1 2 3 4 5

4. Does your child have a greater awareness of the use of sorry in social situations?
   1 2 3 4 5

5. Does your child use the names of the six sorry variants that were used in the game?
   1 2 3 4 5

6. Did your child enjoy playing the game?

   1 2 3 4 5