THE EFFECT OF MIRRORING ON THE SOCIAL ENGAGEMENT OF YOUNG CHILDREN WITH AUTISM SPECTRUM DISORDER

By

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To my family, friends, teachers, and mentors
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Reduced social engagement in young children with autism spectrum disorder (ASD) can be particularly challenging to treat. If not treated, social deficits could ultimately hinder a child’s development, ability to establish meaningful relationships, and engagement in learning opportunities. Interventions that target social engagement deficits are key in reducing negative outcomes associated with these deficits, and may ultimately improve the quality of life for individuals with ASD. Mirroring is a component of dance-movement therapy (DMT) that is somewhat comparable to imitation. While previous anecdotal and case study reports suggest the effectiveness of the use of mirroring and DMT to positively engage children with ASD, little to no objective data on outcomes of such interventions are available. There is empirical support for imitation interventions in improving play, movement, vocalization, and engagement in children with ASD. The purpose of this study was to measure the effectiveness of a mirroring intervention on the social engagement skills of young, minimally verbal children with ASD. The results suggest that participants’ positive social engagement behaviors increased while inappropriate behaviors decreased. Future research should examine the use of this intervention by training parents, clinicians, and other professionals to
utilize mirroring techniques to engage children with ASD. Future research should also extend the outcomes of the current study to a larger sample.
CHAPTER 1
LITERATURE REVIEW

Introduction

Autism is a lifelong, neurodevelopmental spectrum disorder that was first described by Kanner (1943). Since then, much progress has been made in terms of what is known about autism spectrum disorders (ASD; Volkmar, Reichow, & McPartland, 2014). ASD is marked by impairments in social communication and social interactions, and the presence of restricted, repetitive patterns of behaviors, interests, or activities (American Psychiatric Association, 2013). Due to growing prevalence, autism has garnered national attention and has gained increased focus in interventional research. According to the latest report by the Center for Disease Control and Prevention (CDC), the overall prevalence of ASD in 2010 was 1 in 68 (CDC, 2014). This represents a steady increase over the last years, as the CDC’s previous reports indicated prevalence rates of 1 in 150 in 2002, with a rise to 1 in 110 in 2006 (CDC, 2014).

Recent research has focused on understanding the etiology of autism, yet exact causes of autism remain unknown. Scholars suspect the observed condition results from an interplay between genetics and environment in the cause of autism, but neither the exact etiology nor pathway of expression is fully understood (Lai, Lombardo, & Baron-Cohen, 2014). ASD occurs in males 2-3 times more than females; while it is unknown why autism is more predominant in males, this pattern suggests a likely female-specific protective effect etiologically (Lai, Lombardo, & Baron-Cohen, 2014).

Autism has high rates of comorbidity with other conditions, with over 70% of individuals with autism having other medical, developmental, or psychiatric conditions
(Lai, Lombardo, & Baron-Cohen, 2014). Of particular importance for this study, autism has also been associated with motor impairments including clumsiness, motor incoordination, postural instability, and poor performance on standardized tests of motor functioning (Bauman, 1992; Ghaziuddin & Butler, 1998; Jones & Prior, 1985; Kohen-Raz, Volkmar, & Cohen, 1992; Molloy, Dietrich, & Bhattacharya, 2003; 1997; Rogers, Bennetto, McEvoy, & Pennington, 1996; Vilensky, Damasio, & Maurer, 1981). Recent reports indicate that children with ASD may have perceptuo-motor impairments, specifically difficulty modulating sensory inputs (Baranek, 1999; Srinivasan & Bhat, 2013; Tomchek & Dunn, 2007). Significant problems with dual-and multi-limb coordination have also been reported as well as postural control (Srinivasan & Bhat, 2013) and gait (Srinivasan & Bhat, 2013; Vilensky et al., 1981). Other reported difficulties include imitation and praxis (Mostofsky et al., 2006; Srinivasan & Bhat, 2013). Several authors suggest that problems with perceptuo-motor performance may contribute to difficulties with social communication in autism because movement difficulties may lead to missed opportunities to engage socially with peers and caregivers. Specifically, these impairments lead to motor clumsiness and contribute to awkward social interactions that may deter typically developing peers from engaging with children with ASD. (Bhat, Landa, & Galloway, 2011; Srinivasan & Bhat, 2013). Therefore, Srinivasan and Bhat (2013) have described ASDs as “multisystem disorders with both primary social communication impairments and secondary perceptuo-motor and behavioral comorbidities” (p. 1).

Autism is a spectrum disorder, with well-established variability in expression and outcomes, with some individuals exhibiting very poor long term outcomes while others
may exhibit adequate long term functioning in academic, social, or occupational functioning (Toth, Munson, Meltzoff, & Dawson, 2006). Early intervention has been identified as crucial in order to ensure the best possible trajectory for individuals with autism (Corsello, 2005). Many intervention approaches are well-supported in the literature as effective early intervention strategies, including Applied Behavior Analysis (ABA) (Lovaas, 1987), Treatment and Education of Autistic and Communication Related Handicapped Children (TEACHH; Mesibov, Shea, & Schopler, 2004); however, the majority of early intervention approaches primarily target social communication and developmental skills. While other early interventions for autism such as Sensory Integration Therapy (Baranek, 2002) and Floortime (Greenspan & Wieder, 1999) target perceptuo-motor development among other skills, there is limited evidence to support their use (Srinivasan & Bhat, 2013). Therefore, there is a need to develop interventions that address not only core social communication impairments in ASD but also perceptuo-motor and behavioral comorbidities (Srinivasan & Bhat, 2013). As ASD has been described as a “multisystem disorder” with deficits in primary social communication as well as secondary perceptuo-motor and behavioral comorbidities, and given that these impaired perceptuo-motor performances can limit movement exploration, interventions that address all of these difficulties should be developed and studied. The developmental interventions (previously described) which do address both core communication deficits and perceptuo-motor difficulties have limited reports of their use.

Recently, neuroscience researchers have identified a class of visuomotor neurons in the brain, referred to as mirror neurons, that are activated in similar ways
when individuals perform actions and when they watch other people perform those same actions (Rizzolatti & Craighero, 2004). Research on the mirror neuron system (MNS) suggests that the brain areas involved in perception and production of movement overlap, and that these areas also play a role in understanding movement intention (Rizzolatti & Craighero, 2004). A recent study of MNS in individuals with ASD suggest that there is a local decrease of gray matter in the MNS, which is a basis of empathic behavior (Hadjikhani, Joseph, Snyder, and Tager-Flusberg, 2006). Findings also suggest that the social and emotional deficits of individuals with ASD may be due to abnormal thinning of the MNS. Therefore, it is possible that a movement-based intervention with an imitation or mirroring component may serve to activate this system in individuals with ASD. Researchers have suggested studying neurofunctional changes in children with autism receiving imitation skills training in order to specify cerebral bases of empathic behavior as well as the degree of plasticity in this specific system (Hadjikhani et al., 2006).

In a review of the literature on motor and sensory interventions for ASD, Bhat, Landa, and Galloway (2011) concluded that, while sufficient evidence suggests that individuals with ASDs experience motor impairments, no major studies have empirically quantified the effects of motor- or movement-based interventions on motor and social communication outcomes of children with ASD. This is consistent with the findings of a literature review on studies addressing sensory and motor impairments in children with ASD conducted by Dawson and Watling (2000). This review also concluded that very few studies have been well-validated as effective on these impairments, and that systematic, carefully controlled research should be conducted in this area. Studies
investigating the effects of motor- or movement-based interventions on motor and social outcomes of children with ASD will be further discussed in the literature review section.

**Movement-based interventions for social impairments.** Dance-Movement Therapy (DMT) is an intervention that addresses motor and social impairments. While a number of anecdotal reports and descriptive studies outline the usefulness of DMT for children with ASD (Archambeau & Szymanski, 1977; Cole, 1982; Gunning & Holmes, 1973; Dott, 1995; Siegel, 1973, Torrance, 2003), only two studies to date have demonstrated the effects of DMT on children with ASD (Hartshorn et al., 2001; Koch, Mehl, Sobanski, Sieber, & Fuchs, 2014). Notable flaws of these group studies included researchers who were not blinded to conditions, no randomized assignment into groups, or poorly-described intervention sessions. Further, some studies did not use observational methods to measure outcome or treatment effects, rather they used self-report data as outcome measures. Other methodological problems limit the utility of existing studies of movement-based interventions for children with ASD. For example, studies that have been reported also lack a clear description or documentation of treatment protocols and fidelity, which make it difficult to determine which aspects of DMT or movement were used.

Despite the methodological problems inherent in this line of research, one specific aspect of DMT shows promise as an intervention for children with ASD (Tortora, 2005). This concept is called “mirroring,” and is used in DMT and refers to fully-engaged imitation. Within the fields of psychology, speech-language therapy, occupational therapy, and education, the word “imitation” is often used to discuss mimicking or copying of behaviors by the child. While imitation and mirroring are closely related,
mirroring is slightly different in that it attempts to imitate children in an empathic manner, capturing attunement and aimed at improving social engagement (Koch et al., 2014; McGarry & Russo, 2011). Children with ASD have difficulty imitating others, which is a skill related to social-communication abilities (Rogers & Pennington, 1991) and has been described by Piaget (1962) as a precursor to symbolic functioning and language.

The next section will discuss general interventions for social engagement in ASD, and review studies on mirroring and imitation in ASD, and discuss a theoretical framework for mirroring and imitation interventions. This review concludes with a discussion of the major findings of the review, identified gaps in the existing literature, and suggestions for future research. The goal of this review is to consider the need for outcomes research on mirroring for social engagement in children with ASD.

**Social Impairments in Autism Spectrum Disorder**

Social difficulties are considered the most powerful diagnostic indicators of autism and are considered a central feature of the disorder (Reichow & Volkmar, 2010). Social difficulties are what differentiate children with ASD from those with other developmental disorders (Klin et al., 2007; Reichow & Volkmar, 2010). These difficulties affect a range of skills, such as recognition and understanding of emotional information, expression of social attention, joint attention, pretend play, perspective taking, reciprocal affective behavior, verbal and nonverbal communication, decreased response to own name, and decreased imitation (Lai, Lombardo & Baron-Cohen, 2014; Mundy, 2003). Social impairment in autism includes interactive deficits, such as difficulty for sharing attention on objects or activities (Lewy & Dawson, 1992; Mundy & Crowson, 1997). Children with autism have impaired empathic responses and lack the perception of emotions in others (Charman, 1997). Impaired pretend play skills include significantly
less pretend play than typically developing children, fewer functional and symbolic acts
than typically developing children, and impaired spontaneous play (Charman, 1997;
Mundy, Sigman, Ungerer, & Sherman, 1986). Joint attention skills are also impaired in
autism, such as lack of gestures to share interest in objects or activities (Charman,
1997; Mundy et al. 1986) as well as basic-level imitation skills. Impairments in social
interactions, joint attention, and imitation in children with autism will be discussed.

Impairments in Social Interactions

Of the many features of social difficulties in ASD, qualitative impairments in
social interactions are perhaps the most documented. These impairments are often the
focus of intervention. Key features of impaired social interactions include impaired eye
gaze, lack of social reciprocity, poor or absent joint attention, and limited or absent peer
relationships (Volkmar & Pauls, 2003). Deficits in social interactions negatively impact
social relations, often thought to be the result of an inability to read social and emotional
cues or understand the points of view that other people experience (Baron-Cohen,
1989; Goldstein & DeVries, 2013). Due to impairments in social interactions, children
with ASD have deficits in nonverbal behaviors, lack positive peer relations, and often
lack shared enjoyment and pleasure in activities with others, as well as social and
emotional reciprocity (American Psychiatric Association, 2013; Goldstein & DeVries,
2013).

Within the context of social impairments, children with autism often have difficulty
with initiations, responses, and overall interactions. Regardless of cognitive and
language abilities or age, children with ASD have great difficulty initiating with others in
order to socially engage (Stone & Caro-Martinez, 1990; Thiemann & Goldstein, 2004).
Initiations are considered a key skill in order to improve play skills within a naturalistic
environment, and interventions targeting initiations in children with autism may foster independence within social interactions as a whole (Fredeen & Koegel, 2006; Harper, Symon, & Frea, 2008). Moreover, targeting appropriate initiations in social situations to children with ASD has been shown to decrease disruptive behaviors (Oke & Schreibman, 1990). Responding and participating in interactions or back-and-forth social exchanges are an additional area of difficulty within social competence for children with ASD (Wert & Neiswerth, 2003).

**Impairments in Social Communication**

Formal gestural or symbolic language skills used to communicate are impaired in children with autism, and nearly half of children with autism do not use formal gestural systems in order to compensate for impaired verbal communication (Rutter, 1978; Charlop-Christy & Kelso, 2003). One explanation for the deficits in social communication and interaction in ASD is that children with ASD lack a “theory of mind,” that is, the ability to infer mental states or understand agency in others, or perspective-take (Baron-Cohen, 2000).

**Impairments in Joint Attention**

One precursor to “theory of mind” is joint attention which has also been identified as a precursor for communication and language development. Joint attention has been documented as one of the earliest aspects of social communication skills, emerging as early as the 3rd to 9th month of postnatal life (Mundy et al., 2007; Mundy, Gwaltney, & Henderson, 2010).

Joint attention has been the focus of research in the past three decades, and is defined as “the degree to which a child or adult coordinates their attention with the attention of a social partner, such as engaging in a common line of visual regard, in
order to share a common perceptual experience of objects or events” (Bruner, 1975; Mundy, Gwaltney, & Henderson, 2010; Mundy & Newell, 2007). Joint attention is considered an interactive process because it involves processing of information on several levels. Joint attention requires the processing of self-referenced information, information about another person’s attention, and information about a commonly referenced object or event. Moreover, joint attention as a whole involves integrating the information in all of these areas (self, others, objects, and events) (Mundy, Sullivan, & Mastergeorge, 2009; Mundy, Gwaltney, & Henderson, 2010). Other core joint attention behaviors include protodeclarative pointing and gaze shifts, social orienting, and attention to the distress of others (Dawson et al., 2002; Dawson et al., 2004).

Joint attention skills are predictive of language ability as well as future gains in expressive language skills (Bono, Daley, & Sigman, 2004; Charman, 2003; Dawson et al., 2004; Mundy, Sigman, & Kasari, 1990; Toth, Munson, Meltzoff & Dawson, 2006). Sigman et al. (1999) found protodeclarative joint attention skills (sharing attention for purely a social purpose) were associated with early language for children with autism, that protodeclarative joint attention skills were associated with early language ability and predictive of short-term and long-term gains in expressive language ability. Initiations of protodeclarative joint attention was also correlated with future peer interactions. Protoimperative joint attention skills (such as requesting) correlated with early language ability and short-term gains in expressive language, but not long-term (Sigman et al., 1999). Another study found that joint attention abilities are foundational precursors for other skills besides language development, such as pretend play and theory of mind (Kasari, Freeman, & Paparella, 2006).
Impairments in Imitation

Impairments in imitation in ASD also have a well-documented history (Williams, Whiten, & Singh, 2004). Many comprehensive literature reviews have examined the relationship between imitation and autism, beginning with Rogers and Pennington’s (1991) review of seven studies that found evidence for a deficit in ASD that affects imitation of both simple body movements and actions with symbolic meaning. Another review conducted by Smith and Bryson (1994) concluded that children with ASD show different patterns of imitative deficits that varied with level of functioning, and that specifically tasks requiring bilateral integration may be more affected.

Imitation is one of the earliest skills in development that is closely tied to social-communication and plays a central role in the development of cognitive and social skills in young children (Bates, Bates, & Benigni, 1979; Ingersoll, 2010; Meltzoff & Moore, 1977). There is evidence of specificity of imitation deficits in ASD, and these deficits profoundly affect the development and other skills of children with ASD (Charman, 1997; Ingersoll, 2008; Meltzoff & Gopnik, 1994; Rogers, Hepburn, Stackhouse, & Wehner, 2003; Rogers & Pennington, 1991). Imitation serves a social function and important role within social communication skills (Ingersoll, 2008). Imitation skills occur very early on in development, even in infancy (Ingersoll, 2008; Meltzoff & Moore, 1977). Ingersoll (2008) describes imitation skills as serving two separate functions: learning functions to acquire new skills and knowledge, and social functions for engaging in social and emotional exchanges with others. Within the social use of imitation, typically developing infants acquire social communication skills, which are those deficient in children with autism (Ingersoll, 2008).
One particular type of imitation, reciprocal or mutual imitation, is an exchange through which caregivers or other adults and typical infants both engage in imitation of one another’s vocalizations and facial expressions (Ingersoll, 2008). This is the primary method through which infants communicate social interest in their partner (Ingersoll, 2008; Nadel, Guerini, Peze, & River, 1999; Uzgiris, 1981). In typically developing children, this early reciprocal imitation leads to development of shared affective experiences (Ingersoll, 2008; Malatesta & Izard, 1984) and enables conversational turn-taking necessary for spoken communication (Ingersoll, 2008; Trevarthen, Kokkinaki, & Fiamenghi, 1999). In the first year, infant/caregiver play becomes object-focused and infant imitation is often around actions with toys (Ingersoll, 2008; Uzgiris, 1990). In the second year, imitation begins to involve affective gestures and foundational for interactional patterns throughout early childhood (Ingersoll, 2008; Kuczynski, Zahn-Waxler, & Redke-Yarrow, 1987). In addition to parent-child dyads, reciprocal imitation is central in early peer interactions (Ingersoll, 2008). Actions with object imitations between toddlers often results in social interactions such as counterimitation (Eckerman & Stein, 1990; Grusec & Abramovitch, 1982; Ingersoll, 2008). Social uses of imitation also a precursor to other more complex social behaviors such as language, play, and joint attention (Ingersoll, 2008).

Within this field of study, researchers suggest that imitation and language abilities are associated (Ingersoll, 2008). For instance, several studies have established that children with autism experience specific deficits in vocal and gestural imitation when compared to typically developing children (Sigman & Ungerer, 1984). Dawson and Adams (1984) concluded that children with ASD who were categorized as high
imitators verbalized significantly more frequently than children with ASD who were considered low imitators. Not only is there documented support for the association between imitation and language abilities, but there is also support for a relationship between imitation and play skills in autism (Ingersoll, 2008). Many studies have suggested that young children with autism are impaired in imitation of functional and arbitrary actions with play materials (Charman, 1997; DeMyer, 1972; Stone & Caro-Martinez, 1990). Additionally, imitation deficits can hinder play and interactions with peers, as these are primarily centered around reciprocal imitation with toys (Eckerman & Didow, 1996; Eckerman & Stein, 1990). Imitation skills are also closely correlated with joint attention skills in autism (Ingersoll, 2008). An early study by Curcio (1978) concluded that gesture imitation performance is predictive of sophisticated communicative gestures. Vocal imitation is also highly correlated with joint attention that children with autism use during spontaneous communication (Abrahamsen & Mitchell, 1990). Object imitation and coordinated joint attention are also correlated in young children with autism (Carpenter, Pennington, & Rogers, 2002).

Ingersoll and Schreibman (2006) found that teaching object imitation skills to young children with autism increased coordinated joint attention. Whalen, Schriebman, and Ingersoll (2006) found that training joint attention initiations in children with autism resulted in more frequent object imitation. Therefore, there is evidence that imitation and joint attention behaviors are associated, and increasing one of these skills concurrently increases the other. Overall, there is substantial evidence that imitation is an important, foundational skill that is associated with many social behaviors such as language, play, peer interactions, and joint attention.
Neurobiological Factors

One theory that may explain the deficits in imitation and social engagement in autism is related to the mirror neuron system (MNS). Rizzolatti and Craighero (2004) explain that in order to survive socially, humans must have some level of action understanding, which in turn results in social organization. Humans learn by imitation, which is a basis of human culture, and learning imitation is supported by neurophysiological mechanisms - the mirror-neuron mechanism - that is key to action understanding and imitation (Rizzolatti & Craighero, 2004).

Given the difficulty with emotional engagement with others in autism and some lack of empathic reaction to others, the MNS has been identified as a possible neural substrate of empathy, and has been studied specifically in the brains of individuals with autism (Hadjikhani, Joseph, Snyder, & Tager-Flusberg, 2005). First identified by Rizzolatti, Gallese, and colleagues (1996) as area F5 in the premotor cortex of monkeys, a specific set of neurons fired when the monkey was moving its own hand or mouth, but also when it observed another individual performing the same action. Since its discovery, many studies have supported the presence of an MNS in humans using multiple methods, such as transcranial magnetic stimulation, electroencephalography, magnetoencephalography, and functional magnetic resonance imaging (Decety et al., 1997; Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995; Fadiga, Craighero, & Olivier, 2005; Grafton, Arbib, Fadiga, & Rizzolatti, 1996; Hadjikhani et al., 2006; Hari et al., 1998; Leslie, Johnson-Frey, & Grafton, 2004; Nishitani & Hari, 2000; Rizzolatti, Fadiga, Matelli, et al., 1996;).

The MNS is composed of several different networks of areas which are activated during the observation and imitation of an action (Hadjikhani et al., 2006). The MNS
operates by generating internal representations of actions in relation to oneself and others, and in the capacity to understand the actions and experiences of others (Hadjikhani et al., 2006). Studies using functional brain imaging studies have found a deficit in the functioning of the MNS in autism (Nishitani, Avikainen, & Hari, 2004; Oberman et al., 2005) which may help explain social impairment within autism (Williams, Whiten, & Suddendorf, 2001). This disruption in the functioning of the MNS in autism may be at least partially responsible for the deficit of matching self to others in ASD (Perkins, Stokes, McGillivray & Bittar, 2010; Williams et al., 2001). Some studies have suggested that the execution/observation matching system implicated in the MNS develops conjointly with other networks for complex functions such as imitation, empathy, theory of mind, and language-functions that are all deficit in autism (Perkins et al., 2010; Oberman, Pineda, & Ramachadran, 2007).

In one study examining differences in the MNS in children with autism and typically-developing children, findings suggested that both groups performed an imitation task by adopting very different neural strategies. Children with ASD showed differences in the network comprising the frontal component of the MNS-the insula and the amygdala. (Sigman et al., 2006). The amygdala is an area that contributes to emotion understanding. Another study found evidence of cortical thinning of areas in the MNS to be correlated with ASD symptom severity. These areas were involved in emotion recognition and social cognition, which may suggest that deficits of autism may reflect abnormal thinning of the MNS and broader cortical networks involved in social cognition overall (Hadjikhani et al., 2006).
Treatment Approaches in ASD

A variety of approaches are implemented with children with ASD due to the range of abilities and symptoms related to autism, including other types of treatment approaches (dietary, medication-based, alternative). A review of treatment models of autism by Odom, Boyd, Hall, and Hume (2010) found that the majority of evidence-based treatment models are based on an applied behavior analysis (ABA) framework, followed by developmental and relationship-based approaches. This section will specifically discuss behavioral and communication intervention approaches, relationship-based approaches, and an embodiment approach to treating the social impairments and imitation skills of ASD.

Behavioral and Communication Approaches

The majority of evidence-based practices for treating social impairments in ASD are rooted in behavioral principles, and specifically ABA (Odom et al., 2010). A wide variety of interventions within this type of approach exists, and can generally be divided into comprehensive-treatment models (CMT) or specific interventions (Goldstein & DeVries, 2013). Specific interventions are targeted strategies such as reinforcement, discrete trial training, strategies such as social stories and prompting, peer-mediated interventions; CMTs are models that impact a broader range of deficits related to ASD and are often viewed as “packaged” treatment models (Goldstein & DeVries, 2013). Treatments for autism based on behavioral principles have demonstrated effectiveness in treating behaviors in autism since as early as the 1960s, when Lovaas and colleagues implemented a range of studies utilizing behavioral principles that demonstrated effective change in children with autism in language, social behaviors, play behaviors, and academics, as well as a reduction in severe problem behaviors.
(Lovaas, Berberich, Perloff, & Schaeffer, 1966; Lovaas, Freitag, Newson, & Whalen, 1967; Schreibman, 2000). The children treated in these studies often sought prior treatments which were ineffective. Other methods based on behavioral approaches have also been effective with children with autism, such as the pivotal response training (PRT; Koegel, Koegel, Harrower, & Carter, 1999; Schreibman, 2000).

Overall, behavioral and social interventions comprise the vast majority of treatment approaches for symptoms related to autism (Goldstein & DeVries, 2013). The current range of research strongly supports the use of strategies based on ABA for social and communication skills in autism (Goldstein & DeVries, 2013; National Research Council, 2001). These approaches often focus on preventive antecedent approaches embedded within a Positive Behavior Support (PBS) framework (Goldstein & DeVries, 2013). These approaches focus on modifying environmental situations and contexts that are likely to increase chances of problem behaviors. Interventions within a PBS approach have also been shown to be effective in reducing problem behaviors of children with autism (Goldstein & DeVries, 2013; Koegel, Koegel, & Dunlap, 1996). Functional behavior assessment or analysis has also played a key role in behavioral approaches and interventions for children with autism (Gresham, Sugai, & Horner, 2001; Goldstein & DeVries, 2013).

As previously stated, intervention strategies such as discrete trial training, reinforcement, and prompting are rooted in behavioral principles; many interventions for autism may utilize a range of strategies on a broader scope or combine strategies to make up a "branded" model of intervention (Goldstein & DeVries, 2013). Some of these models include TEACCH (Panerai, Ferrante, & Zingale, 2002), pivotal response training
(PRT; Koegel & Koegel, 2006), and early intensive behavior intervention (EIBI), in addition to many more. Many peer-mediated interventions are also rooted in a behavioral approach, as well as strategies such as Social Stories (Gray & Garand, 1993) and video modeling strategies.

The previously discussed behavioral strategies and interventions often target communication skills in ASD. Goldstein (2002) reviewed communication interventions for children with autism and found 12 studies that utilized discrete trial training methods to target social communicative behaviors. One manualized intervention program for teaching minimally verbal children with ASD to communicate is the Picture Exchange Communication System (PECS; Frost & Bondy, 1994). PECS does not require early communication skills such as imitation or joint attention skills, and through a series of behavioral strategies and teaching, children are taught to initiate requests by giving and exchanging picture symbols to a communication partner. This intervention utilizes behavioral strategies such as prompting and reinforcing.

Skinner’s (1957) originally proposed verbal behavior (VB) approach targeted functional language and teaching functions using controlling variables specific to those functions. This model has been manualized and published as well as “Applied Verbal Behavior” for children with ASD (Sundberg & Partington, 1998). This model as well as the Lovaas model facilitate frequent daily training opportunities. The Lovaas (1977) approach conducts highly structured training trials using discrete trial training, whereas the VB approach is used in conjunction with Natural Environment Training (NET), but both approaches rely heavily on behavioral principles (Carr & Firth, 2005).
Relationship-Based Approaches

Other intervention approaches targeting social impairments in ASD have been classified within the relationship-based framework (Odom et al., 2010). These interventions are described as taking a constructivist approach combined with research from developmental scientific fields to establish and enhance interactions between adults/parents and children with ASD in order to effect change in development and social relationships (Odom et al., 2010). Interventions using relationship-based approaches often target very young, nonverbal children.

One example of a treatment model that utilizes a relationship-based approach is The Denver Model (Rogers et al., 2006). This is a comprehensive, behavioral early intervention approach that integrates a relationship-focused developmental model with ABA principles to develop parental involvement and enhance interpersonal exchanges, increase shared engagement with joint activities, and teach language and communication. DIR/Floortime (Greenspan & Wieder, 1999) is also considered a comprehensive treatment model based on a relationship-based approach (Odom et al., 2010). This method also emphasizes interactions and increasing communication by training adults to meet children at their developmental levels and build on their strengths to enhance communication, social engagement, emotional ideas and thinking, among others. Another comprehensive treatment model that combines many practices and methods from other intervention strategies is called the Social Communication Emotional Regulation Transactional Support (SCERTS) Model (Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006) and utilizes behavioral principles and focuses on development of relationships.
Clearly, a wide range of treatment approaches exists, and some treatments may be difficult to categorize given the combined nature of their treatment elements. Some of the previously discussed intervention models may fit into more than one category of approach style, given their integrated nature. However, it is clear overall that behavioral principles are a well-documented basis for many evidence-based practices in treating social impairments of ASD.

**Embodiment Approaches**

Koch et al. (2014) describe an embodied approach to treating children with autism. Embodiment approaches emphasize that interventions for ASD should “focus on the interaction on the non-verbal level to strengthen intersubjective reciprocity, address timing issues, and build basic social skills from scratch” (Koch et al., 2014). This is based on a combination of theories from Gallagher (2004) and Mundy et al., (2010). Gallagher (2004) describes the interaction theory of autism, which states that primary, early intersubjective understanding develops earlier than theory of mind, and that young children acquire basic knowledge of others’ internal states and intentions through observation of others’ movements, gestures, and facial expressions. In other words, the mind is expressed directly through one’s embodied actions. Mundy et al. (2010) posit that social impairments in ASD are a result of limited simultaneous processing of self-and-other referenced sensory information. A key skill in simultaneous processing of self-and-other referenced sensory information is attending to others while maintaining awareness of one’s own interoceptive bodily state (Koch et al., 2014; Mundy et al., 2010). The development of this key ability is a precursor to empathy, which is foundational for genuine social competence and prosocial skills (Koch et al., 2014). Deficiency in this skill leads to a lack of self-awareness and social understanding
Therefore, embodiment approaches integrate these two views, focusing on enhancement of interactions on the non-verbal level in order to target these interpersonal and social skills. Interventions using mirroring in movement are an example of an embodiment approach integrating these theories.

Koch and colleagues (2014) outline the importance of taking a body-oriented treatment approach to autism, warranted by recent embodiment approaches in cognitive science (Gallagher, 2004; Gallese, 2006; Mundy et al., 2010). Embodiment approaches attempt to use deficits in nonverbal interactions and resources within motor movements in individuals with ASD (Koch et al., 2014). The body is often closely connected with feelings (Koch et al., 2014; Riskind, 1984; Stern, 1985), and the relation between emotion and cognition (Schachter & Singer, 1962) and how closely the body and cognition are related (Casasanto & Boroditsky, 2008; Koch et al., 2014; Lakoff & Johnson, 1999;), warrant a need for directly addressing cognition and emotion with a body-based, bottom-up embodiment approach (Koch et al., 2014). Embodied therapy approaches affect the body individually as well as interpersonally (Koch & Fischman, 2011; Koch et al., 2014). Dance movement therapy (DMT) is one treatment that utilizes an embodied treatment approach.

**Mirroring Interventions for Autism**

**Overview of dance/movement therapy**

The current study will examine the effects of a mirroring intervention. Mirroring is one component of the broader practice of dance/movement therapy (DMT). While the current study does not evaluate a DMT intervention (which must be implemented by a certified Dance Therapist), it is important to generally overview DMT given its role in the foundation of mirroring. Founded in 1966 by Marian Chace, the foundation of the
American Dance Therapy Association (ADTA) has seen increased interest in DMT as a whole. According to the definition put forth by the ADTA, DMT is “the psychotherapeutic use of movement to further the emotional, cognitive, physical, and social integration of the individual” (ADTA, 2013). DMT focuses on a therapeutic relationship, and is effective for individuals with a range of abilities from a range of backgrounds (ADTA, 2013). Overall, meta-analyses have found DMT to be effective with a range of populations (children and adults with anxiety, children and adults with autism, psychiatric patients, individuals with breast cancer, cystic fibrosis, depression, dementia, eating disorders, elderly, fibromyalgia, at-risk youth, elderly patients, and people with Parkinson’s disease; results indicated effective change in anxiety, self-concept, body awareness, interpersonal competence, depression (Koch, Kunz, Lykou, & Cruz, 2014; Ritter & Low, 1996). Both meta-analyses noted methodological shortcomings in studies of DMT and few outcomes studies. The vast majority of research on DMT has focused on qualitative descriptions and case studies (Hervey, 2009; Koch et al., 2014). Many DMT studies lack detailed descriptions of the interventions in a replicable way (Koch et al., 2014). Few well-designed, highly controlled quantitative studies have been conducted on the effectiveness of DMT. Some studies have examined the effect of DMT or other movement-based therapeutic approaches on autism. Within this therapeutic approach with children with autism, Erfer (1995) describes the emphasis on developing a relationship between human beings as the primary goal, regardless of physical skill or ability in focus.

The goals of DMT focus on expression, communication, and adaptive behaviors through movement and facilitation of reflecting, nonverbal expressions, body
awareness, awareness of others, shared engagement and focus with others (ADTA, 2013). These goals align well with the needs of children with autism, given the previously discussed deficits, especially social impairments. Additionally, movement-based therapies can target nonverbal communication skills, such as joint attention, eye contact, imitation skills, and gestures.

**Dance/movement therapy-based interventions for social engagement in autism**

Generally, social engagement in autism has been defined within the literature around directing words or gestures toward others (reference). Specifically, definitions of appropriate social engagement that are generally agreed upon include the following definitions: “saying one or more understandable words while positioned within a meter of a social partner and with body oriented toward social partner and/or directing a gesture or movement toward a peer, making a cooperative response within 5 seconds of a prior social behavior, or responding with verbal, gestural, or movement response within 5 seconds of social partner’s initiation toward the target child” (Delano & Snell, 2006; Niemeyer & McEvoy, 1989; Thieman & Goldstein, 2001). Beginning with Adler’s (1970) reported success in mirroring in movement with children with autism, studies have focused on implementing movement-based interventions in children with autism. For example, Best and Jones (1974) implemented movement education and gross motor activity/imitation sessions paired with swimming sessions for four young nonverbal children with autism. The authors of this descriptive case study found that body awareness and initiations of interactions increased. However, these results were reported in an anecdotal summary rather than outcome measures. Siegel (1973) qualitatively reported that a movement-based therapeutic intervention for “autistic and schizophrenic” children increased positive affect and smiling. Cole (1982) implemented
movement-based therapy sessions with objects in the environment with a nonverbal child with ASD, and reported overall improved therapeutic relationship as sensed by the therapist, increased positive interactions with objects in the environment, and a perceived increase in the seeking of human contact. These findings were also replicated through qualitative studies. Torrance (2003) conducted weekly group movement-based therapy sessions with adolescent males with autism. The author reported the difficulties related to attempting to build a therapeutic contract within this context rather than reporting outcome measures of the sessions.

While DMT techniques been well-described as an effective intervention for individuals with ASD, most of this is documented through anecdotal case studies and descriptive reports rather than quantifying the results. To date, two studies have been conducted that do report outcome data of a DMT intervention for children with ASD in a controlled study (Hartshorn et al., 2001, Koch et al., 2014). Hartshorn and colleagues (2001) conducted 30-minute movement sessions twice per week with 38 children diagnosed with ASD. Participants were separated into groups of 3-8 children and observed at the beginning and end of a two-month period of biweekly sessions. A control group of 38 participants also participated in two movement therapy classes at the beginning and end of a two-month period without participating in biweekly sessions. This study coded the following behaviors of the participants: stereotypical behavior, wandering, responding to touch in a negative manner, on-task active behavior, on-task passive behavior, making eye contact, social-relatedness directed toward the teacher and resisting the teacher. The movement sessions consisted of activities involving interactions between a therapist and a group of children moving together to a
tambourine and stopping when the tambourine stopped, then following the therapist through an obstacle course. The authors conducted a group by repeated measures MANOVA on the first and last sessions. Results indicated that movement therapy sessions increased attentive behaviors and decreased stress behaviors. On-task active behavior did not change, but on-task passive behavior increased. While this is an example that did attempt to quantify results of a DMT intervention on behaviors of children with autism, there are some shortcomings. First, the actual movement sessions were not described in a detailed and replicable manner. Many different techniques of DMT may have been utilized in this study, and it is impossible to determine which specific technique was effective in increasing positive behaviors. Secondly, a group design may not be the most appropriate for measuring change in children with autism in a DMT intervention. As autism is a spectrum disorder, abilities and needs vary widely; DMT is also very individualized and dependent on individual interactions between therapist and participant. Therefore, a group design may not account for individual differences or change. Hartshorn et al (2001) did not directly measure mirroring. One other study that did seek to quantify the effects of mirroring (Koch et al., 2014) will be discussed in the next section.

**Mirroring in movement for ASD.** Mirroring in movement is one technique of DMT. While there have been many reports of mirroring effectively increasing social engagement of children with ASD (Adler, 1970; Tortora, 2005), these studies also give anecdotal reports rather than quantifying results or measuring outcomes. The mirroring approach uses empathic reflection of the participants’ expressive motor behavior by the therapist (and vice versa) to build a mutual relationship (Fraenkel, 1983; Koch et al.,
Rather than focusing merely on the form of movement, mirroring emphasizes the reflection of the quality of movement as well as kinesthetic empathy (Koch et al., 2014). Mirroring shares some aspects with imitation, but mirroring goes beyond simple imitation by developing interaction skills through attunement—an additional interactional component based on body resonance (Kestenberg, 1995; Koch et al., 2014; Husserl, 1952). Mirroring is a two-sided process of constant bodily adjustment in tension levels and patterns and shape flow (Kestenberg, 1995) as well as synchrony (Ramseyer & Tschacher, 2011). Synchrony has been defined as “general movement coordination” (Ramseyer & Tschacher, 2011), and attunement has been defined as “moving together in synchrony, by using the same or complementary movement qualities or shapes” (Koch et al., 2014). While imitation or mimicry may be effective, mirroring may be more effective in enhancing empathic skills in participants because therapists not only analyzes and mirrors exact movements of the participant, but also selects movements that reflect the quality of a patient’s mood, emotions, or affect and engages in mimicry of these as well or responds with different movements reflective of a more global emotion, affect, or mood. (McGarry & Russo, 2011). Research suggests that in instances when emotional postures are exaggerated, the embodiment of that posture increases recognition and experience of the emotion associated with it (Atkinson, Dittrich, Gemmel, & Young, 2004; McGarry & Russo, 2011).

Tortora (2005; 2010) has described a specific treatment program for implementing mirroring in movement called Ways of Seeing. In this process, the therapist follows this four-part procedure: matching (feeling the quality of nonverbal
cues through attunement and mirroring), dialogue (creating dialogue through the use of these movements, (explore and expand (exploring, expanding, and developing those movements), and nonverbal to verbal (moving communication from nonverbal to verbal exchange). In this program, different aspects of mirroring and attunement are defined and utilized.

While a few studies have examined mirroring interventions for children with ASD, the majority were descriptive case studies (Erfer, 19995; Ruttenberg, Fiese, & Gates, 1988; Siegel, 1973), and very few have attempted to measure outcome data on the specific effects of mirroring. To date, one study has used quantitative methods to measure effects of mirroring on the behaviors of children with ASD. Koch and colleagues (2014) conducted a feasibility study which tested a DMT intervention based on mirroring in movement with 31 young adults with ASD. Participants were divided into a treatment group and a no-intervention control group. A one-factorial between-group design was employed; findings indicated improved well-being, body awareness, self-other distinction, and social skills in the treatment group. Authors concluded that DMT based on mirroring could be a feasible therapeutic approach for ASD. Many limitations are found in this study. Firstly, all outcome measures were based solely on self-report scales. Based on deficits associated with ASD, participants may have had decreased self-awareness (Frith, 2003; Koch et al., 2014). There is a need to more objectively measure behaviors related to social skills, body awareness, and self-other distinction, given that some participants may lack the self-awareness or insight to self-report on these variables. Secondly, many of the measures used were not yet standardized or validated. Moreover, the study employed many different techniques of DMT, not just
mirroring. Therefore, it is not possible to attribute any changes solely to mirroring. Finally, the study used a group design with a small sample size, which increases the probability of committing a type-II error, where the null hypothesis is falsely rejected (Koch et al., 2014).

**Imitation interventions for autism.** While imitation and mirroring are not the same, “imitation” is a term often used in the psychology field to discuss mimicking or copying of movements or behaviors by the child. While mirroring does go beyond simple imitation (as described above), there have been many studies which have shown that adults imitating children’s actions effectively increases attention, interaction, and object play in typical development (Field, 1977; Lubin & Field, 1981). As this concept is similar, these studies may provide support and guidance for validating the use of mirroring with children with ASD. Researchers have also shown that imitation interventions work with children with autism (Dawson & Adams, 1984). Generally in the literature, imitation is defined in terms of object imitation, gestural imitation, and verbal imitation. Specifically, spontaneous imitation is defined as:

imitating an action with an object within 10 seconds of the model in the absence of a verbal direction or physical prompt; may not be exact, but must look distinctly like model; may use a different, but similar object; must occur before another action is modeled by the partner or another action is performed (p. 252 Ingersoll, Walton, Carlsen, & Hamlin, 2013).

Dawson and Galpert (1990) expanded on this by demonstrating that mothers who imitate their children’s play behaviors demonstrated in increased child’s gaze toward their mother's faces (attention) and increases in creative play. Reciprocal imitation training (RIT) is a naturalistic behavioral intervention that teaches young children with autism imitation skills within a social context (Ingersoll, 2008). There are studies that suggest that imitation training can improve social deficits that are specific to autism in
young children, such as joint attention and social-emotional functioning (Ingersoll, 2012; Ingersoll & Schreibman, 2006; Ingersoll, Walton, Carlsen, & Hamlin, 2013).

Literature on imitation within the field of psychology supports that such interventions have positive effects on social behaviors of children with ASD. These studies use empirical outcomes research and scientific methods. Further, studies in this area have shown that parents can be trained to implement imitation interventions (Field, Field, Sanders, & Nadel, 2001; Ingersoll & Gergans, 2007). Using similar well-validated approaches, studies can be conducted to determine the effect of mirroring interventions empirically.

Summary

Given the rising prevalence of ASD and the negative long-term impact of associated social impairments of ASD if not treated, it is important to identify interventions that may positively affect skills related to social engagement in autism. If not treated, social deficits could ultimately hinder children’s social interactions, ability to establish meaningful relationships, and ultimately lead to negative life outcomes (Bellini, Akullian, & Hopf, 2007). Individuals with ASD are significantly delayed in their abilities to initiate and maintain effective social interactions, which could often lead to social withdrawal (Bellini, Akullian & Hopf, 2007). Lack of meaningful friendships often leads to rejection and social isolation, which may contribute to anxiety and depression in individuals with ASD (Bellini, Akullian, & Hopf, 2007). Interventions which target social skills and social interaction are key in reducing negative outcomes associated with these deficits, and may ultimately improve the quality of life for individuals with ASD (Bellini, Akullian, & Hopf, 2007). While social skills interventions are currently a focus of ASD research, many investigations are aimed at higher functioning individuals (Bellini,
Peters, Benner, & Hopf, 2007). There is a need for research on intervention that may improve social functioning in children with ASD who are lower functioning or nonverbal.

A number of anecdotal and case study reports support the effectiveness of DMT and/or mirroring with ASD. However, few of these objectively measure outcomes of such interventions; therefore, there is a need for additional empirical support (Koch et al., 2014; McGarry & Russo, 2011). Only one study has measured outcomes of mirroring for ASD, but this study relied only on self-report data rather than objective measurements of behavior. Further, this study employed a group design, which may not be the best measure of change given the range of abilities and needs of individuals with ASD and the individualized nature of mirroring interventions. Additionally, this study incorporated many different techniques of DMT, rather than solely determining the effects of mirroring. Another gap in the literature on mirroring or DMT-based techniques is the lack of description of interventions in a replicable way.

Mirroring techniques are somewhat comparable to imitation interventions, which are not the same in that mirroring goes a step further than simple mimicking of movements. However, there is vast empirical support for imitation interventions, which have been replicated numerous times in outcomes research. There is a need to validate mirroring techniques through similar methods to help establish empirical support. Further, literature on imitation indicates that parents can be trained to use imitation techniques and facilitate effective change with their children with ASD. There is a need to first establish some empirical support for mirroring techniques using objective outcomes measures while mirroring sessions are facilitated by a clinician trained in
mirroring techniques. Once this occurs, perhaps future studies could expand by training parents or other adults to utilize mirroring techniques to engage their children with ASD.

**Limitations in the Literature and Current Study Aims**

Overall, there is a noted gap in the literature on interventions for children with autism who are minimally verbal; as the majority of research tends to target “high functioning” children with ASD (Kasari & Patterson, 2012). It is well-documented that that traditional approaches to autism treatment, such as ABA therapy or EIBIs are very time-intensive, rigorous, and intensive, but produce desired results. Some, in fact, require implementation as intensive as and frequent as 15-40 hours per week (National Research Council, 2001). Somewhat related, interventions that require such highly structured and intense implementation have been found to have limited generalizability outside of clinical settings (Baer, Wolf, & Risley, 1968; Ingersoll & Schriebman, 2006). Many approaches use direct training or teaching approaches, and often include some type of reinforcement techniques for positive social engagement behaviors. The artificial nature of reinforcers has been noted by researchers, and some of these behaviors which have been trained and reinforced were found to extinguish quickly without contingent pairing of a reinforce, suggesting that such target behaviors were not innately reinforcing throughout the treatment (Koegel, O'Dell, & Koegel, 1987).

Specifically in regards to research on mirroring interventions for social engagement in autism spectrum disorder, the vast majority of literature describe effects only descriptively or anecdotally. Of the two known studies that seek to quantify the results of this intervention, there is not one study that specifically and solely examines the effect of mirroring alone. Rather, studies describe “movement therapy” sessions either in poor detail or as part of a package with other components (Hartshorn et al.,
2001; Koch et al., 2014). Other noted flaws include a general lack of high-quality, well-controlled studies to evaluate the effect of mirroring in autism, a lack of social validity and treatment integrity data (Koch et al., 2014; Hervey, 2009).

The current study aims to close some of the gaps found in the literature on mirroring in autism. Future studies should aim to measure social validity, treatment integrity, and conduct well-controlled studies with direct, observable, and measurable behaviors as primary outcome measures. Specific studies on mirroring alone would help evaluate if solely mirroring is an effective intervention for social engagement in autism. Additionally, future studies should clearly and explicitly describe the treatment protocol.

The present study sought to measure the effectiveness of a mirroring intervention on the social engagement skills of young, minimally verbal children with autism. Previously noted gaps in the literature were addressed in the present study. Specifically, the current study sought to address the following questions:

1. What is the effect of a mirroring intervention on the social engagement of young children with autism?

2. To what extent did caregivers report change in social engagement behaviors and problem behaviors in the home setting?
CHAPTER 2
METHODS

The purpose of this study was to Measure the effect of a mirroring intervention on the social engagement skills of young children with autism spectrum disorder. This chapter begins with a description of the criteria for selecting the participants, the recruitment and informed consent process procedures, the setting in which the study was conducted, and the interventionist and materials needed to carry out the study are described. Next, the dependent measures, coding definitions, experimental procedures, study design, and data analysis methods are described. Finally, strategies to ensure interobserver agreement, treatment integrity, and social validity are summarized.

Participants

The participants for the study included four children with ASD who were between the ages of 3 and 5 years old. They were recruited through the Psychology Clinic within the UF Departments of Pediatrics, Psychiatry, and Clinical and Health Psychology. The participants were identified within the Psychology Clinic by clinicians who assessed them. If a participant potentially met inclusion criteria (see below), the study was described to the parents of the potential participants to gauge interest in participating. If parents expressed interests, the primary researcher contacted them to schedule pre-assessment measures.

Prior to the beginning of the study, IRB approval was obtained for the study. Additionally, parents signed a release form consenting the release of information from the UF Psychology Clinic assessment results to be used for the purpose of this study. All target children had a diagnosis of ASD obtained through the UF Psychology Clinic by a licensed pediatric neuropsychologist. The participants were three males (two of which
were twin brothers), and one female. All participants had minimal verbal skills and required either a Module 1 or Module 2 of the ADOS. All participants were between the ages of 3 years, 0 months and 4 years, 2 months (See Table 2-1).

Inclusion Criteria

Selection criteria for participants included: (a) age between 3 and 6 years old, (b) ability to walk independently (c) autism diagnosis according to Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000), and (d) nonverbal or limited verbal skills. The fourth criterion (nonverbal or limited verbal skills) was confirmed through the administration of the ADOS Module 1 (for children who do not consistently use phrase speech) or Module 2 (for children who may use phrase speech but are not verbally fluent). The scores and descriptions of participants’ performance on the ADOS, structured developmental history, and detailed parent interview information was obtained from participants’ records of formal neuropsychological evaluations conducted in the UF Psychology Clinic (for which parents authorized release for the researcher to utilize for this study to describe participants in detail).

Recruitment

Children who were assessed in the UF Psychology Clinic who met inclusion criteria (previously described) were informed about the study. Families who expressed interest in participation were contacted and scheduled for a meeting with the PI to complete the informed consent process.

Informed Consent

The researcher met with the primary caregiver of each participant in order to complete the informed consent process. During this process, the researcher reviewed the limits of confidentiality, the purposes of the study, the risks and benefits of
participation, the methods and procedures of the study, and other treatment options. The researcher reviewed the family’s expectations and understanding of ASD and provided necessary resources and recommendations for treatment options available when families demonstrated a need for such resources. The researcher reviewed the requirements for participation and the approximate length of the study. Caregivers were informed that they may not initially begin treatment, and that baseline phase may last up to as many as 6 weeks. Caregivers were informed that they had the right to withdraw at any time. The researcher spent time answering any other questions caregivers had about the study and caregivers were then asked to provide their signature on the informed consent if they were interested in participating in the study. Caregivers also provided a signature indicating consent for their children to be videotaped as part of the study. Next, the researcher reviewed an authorization for release of information to the researcher. It was explained to the caregiver that a signature on this form would allow the researcher to review reports of neuropsychological assessments conducted within the UF Psychology Clinic, and that relevant measures and background information could be used from these reports for the purpose of the study.

**Assessment Measures and Diagnostic Confirmation**

**Clinical interview**

A semi-structured clinical interview was conducted with each child’s primary caregiver to obtain information relating to the child’s development, medical, academic, family, and treatment history. Specific questions addressed the child’s developmental milestones and the caregiver’s present concerns. For all participants, this was conducted at their initial neuropsychological assessment with the UF Psychology Clinic. For a copy of the clinical interview, see Appendix A.
**Autism Diagnostic Observation Schedule (ADOS)**

The results from the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) for each participant were obtained in order to describe each participant as well as serve for diagnostic confirmation. For each participant, the scores on this measure were obtained from the results of their neuropsychological assessments in the UF Psychology Clinic. The ADOS is a semi-structured observational assessment administered directly to the child. It consists of four different modules, each adapted for a different level of language ability. Administration typically requires from 30 to 45 minutes. This instrument has sensitivity in the upper 90% range and specificity in the upper 80% to lower 90% range (Naglieri & Chambers, 2009). Internal consistency for all domains and modules ranged from .47 to .94 (Lord et al., 2000). Agreement between raters for diagnostic classification when assessing individuals with autistic disorder, PDD-NOS, and non-ASD ranged from 81% to 93% for the four modules. Test-retest reliability over an average period of 9 months was reported between .59-.82 (Lord et al., 2000).

**Participant Descriptions**

**Rob**

Rob, a Caucasian male, was 3 years and 10 months old at the start of the study. He participated in a public special education preschool classroom serving children with varying disabilities. According to parent interview and behavioral observations, Rob only rarely initiated to others in the forms of comments or questions, and did not respond to comments or questions made by the examiner. Overall, he demonstrated poorly modulated eye contact and engaged in social overtures that had unusual quality and non-reciprocal (often included only his own interests). He did not respond to his name
when it was called multiple times by the examiner. His communication and rare initiations were all used for the purpose of requesting preferred items. He did not integrate his gaze or eye contact with these requests. He also engaged in many repetitive behaviors and restricted interests in only specific objects throughout the assessment, and his mother reported that he often “scans” objects by placing them very close to the sides of his eyes and dragging the item in front of his eyes; she also reported that he lines up his cars or trucks when playing with them at home, and that he has certain sensory sensitivities, such as being bothered by flushing toilets or certain sounds on television. He reportedly also engaged in toe-walking.

Rob was formally diagnosed with autism in October of 2014 by a licensed pediatric neuropsychologist. Rob’s language and communication skills required the administration of a Module 2 ADOS (for phrase speech, but not verbally fluent children). Rob occasionally engaged in echolalic speech, repetitive phrases, and he engaged in very limited reciprocal conversation. His vocalizations were limited in number of pragmatic contexts. He engaged in a very limited number of communicative gestures (such as proximal pointing) and conventional gestures (clapping) and descriptive gestures (pretending to brush his teeth). Overall, his score on the ADOS was 13, which exceeded the cutoff score for autism spectrum disorder, indicating the likelihood of ASD.

Previous interventions and therapies which Rob received included home-based early intervention services for motor delays and problems with feeding and walking. Through this program, he had received physical therapy twice weekly and with a physical therapist, and occupational therapy from an occupational therapist three times
weekly as an infant/toddler. Additionally, he had previously received therapy from an infant/toddler developmental specialist (ITDS) once weekly. Rob also received weekly physical therapy and twice-weekly occupational therapy from a hospital-based center. At the start of the study, Rob received occupational therapy once weekly. Additionally, before Rob enrolled in the current study, he had participated in a research study through which he received child-directed therapy. Prior to intervention, Rob’s caregiver completed the SSIS, indicating a standard score of 107 (67th percentile) in the social skills domain, and a standard score of 99 on problem behaviors (50th percentile).

Carli

Carli, a Hispanic female, was 4 years and 2 months old at the start of the study. She participated in public special education preschool classroom for children with varying disabilities. According to parent interview and behavioral observations, Carli made one-word requests but did not speak in short sentences. According to parent interview, Carli was delayed in developing motor and language skills. In terms of motor development, she first sat up alone around 9 months, stood alone around 13 months, and walked alone at 14 months. She did not show interest in sounds until 18 months, understood her first words at 12 months, spoke her first word at 26 months, and did not communicate in 2-3 word sentences at the start of the study (instead, she used one-word requests). She reportedly would often play in proximity of other peers at school but did not directly interact and preferred to play on her own. Carli demonstrated poorly modulated and/or atypical eye contact, did not share interests with others, and did not engage in sustained interactions with others.

Carli also engaged in behaviors indicative of restricted interests and repetitive motor behaviors. According to parent interview, Carli engages in repetitive high-pitched
noises when excited and has a preference for things to be “just so.” For example, Carli would often line up items and engage in somewhat aggressive and challenging behaviors if items are moved unexpectedly, such as crying and yelling if the items were removed. She also repetitively straightened a rug at home when the corners were turned up. Her parents also noted that she experienced some sensory issues, such as appearing to have a high pain tolerance and lacks sensitivity to extreme temperatures; she also had sensitivity to loud sounds.

Carli was formally diagnosed with autism in October of 2014 by a licensed pediatric neuropsychologist. Her overall level of language indicated that a Module 1 of the ADOS-2 was most appropriate for administration, which is used for children who do not consistently use phrase speech. During administration, Carli used single-words and word approximations. She directed only occasional vocalizations to the examiner but these were inconsistent. She demonstrated odd intonation and inappropriate pitch when she vocalized. She did not engage in many gestures (e.g. she did not point, but she did clap her hands once). Carli’s eye contact vacillated from moments of focused and appropriate eye contact to poorly modulated eye contact while initiating, terminating, or regulating social interactions. She did direct a range of appropriate facial expressions toward the examiner. She did not respond to her name when called by the examiner, but eventually responded to her father saying “look!” during the assessment. She used communicative gestures in order to request items. She had some instances of giving and showing items to others during the administration. Overall, her social overtures often lacked integration and social quality, and were often not sustained. She often left joint play in order to play on her own. She also engaged in odd sensory-seeking
behaviors during the ADOS-2 administration, as well as repetitive interests in particular objects (e.g. bubbles). Overall, her score on the ADOS-2 was 15, which passed the cutoff for autism spectrum disorder.

According to parent report, Carli received therapeutic services through a state-sponsored program for early intervention when she was 1 and a half years old until she was 3 years old. These services targeted improved her speech and language skills. Her parents noted that she did not receive any other services and was not receiving services during the time that she participated in the study. Prior to intervention, Carli’s parents completed the SSIS. Results indicated a standard score of 66 on social skills (2\textsuperscript{nd} percentile), and 121 in problem behaviors (87\textsuperscript{th} percentile).

**Grant**

Grant, a Caucasian male, was 3 years, 0 months old at the beginning of the study. Grant participated in a full-day public special education preschool program. His specific class was a self-contained classroom for exceptional students. Grant is the twin brother of another participant (description below). Grant had a history of language and cognitive delays. According to parent interview, he also experienced delayed development of motor milestones. According to both parent interview and behavioral observations, Grant only spoke about two words, which he reportedly used rarely. He often engaged in minimal word approximations and vocalizations, such as “ahhh” and “oooh” and whined in order to request. His mother reported that he rarely engages in gestural communication, but that he had waved a couple of times within his life, and also gave “high fives” on command. He was described by his parents as generally “aloof” and was observed to be difficult to engage during a formal evaluation. His
parents reported that he had some sensory issues, and needed all doors to be closed at all times.

Grant’s overall level of language determined that the administration of a Module 1 of the ADOS was most appropriate. During the administration of the ADOS, it was noted that Grant occasionally approximated some recognizable phrases, but mostly used single words (e.g. “one” “two”). He occasionally directed vocalizations toward the examiner but this was done inconsistently depending on the context. He exhibited odd intonation during vocalizations and often echoed words and phrases. He also often used stereotyped utterances during the administration. While he did use some conventional gestures, this was done in a limited range of contexts and he did not point to objects. Grant’s eye contact was poorly modulated while he initiated and regulated social interactions. He did direct some facial expressions to the examiner during the administration of the ADOS, and displayed some definite shared enjoyment of activities. Overall, it was noted that the equality of Grant’s social overtures was unusual and often restricted to his personal demands. Additionally, Grant demonstrated unusual sensory interests in the assessment materials, spinning only the wheels of a truck repetitively and “peering” at different parts of an object. He also demonstrated hand and finger mannerisms briefly. He engaged in repetitive and restricted play with one object for an unusual amount of time to an unusual degree, repeating the same phrase. Overall, his score on the ADOS was 12, which exceeded the cutoff for autism spectrum disorder.

Services received by Grant previously included speech-language therapy once per week through a state-sponsored early intervention program. He also received speech therapy twice per week at school throughout the study. He previously received
in-home services with an Infant-toddler Developmental Specialist once weekly. Additionally, his mother participated in an 8-week therapeutic program prior to the beginning of the study designed to support social communication development. Prior to intervention, Grant’s mother completed the SSIS. Results indicated a standard score of 72 on social skills (5th percentile), and a standard score of 114 on problem behaviors (82nd percentile).

**Gavin**

Gavin, a Caucasian male, was also 3 years, 0 months old at the beginning of the study and is the twin brother of Grant. He participated in a public special education preschool program throughout the study (this was the same self-contained classroom in a full-day program as his brother, Grant’s). According to parent interview and behavioral observations, Gavin occasionally vocalized and spoke about 10 different words, and requested by whining and vocalizing “eh, eh.” He spontaneously waved in order to greet; no other gestures were noted by his parents. Socially, it was reported that Gavin engaged in some parallel play with his twin brother. His parents reported that he also prefers to have all doors closed and repetitively plays with his belly button. He was observed to lick and mouth blocks during the assessment and walked over toys.

Given Gavin’s overall level of language, the administration of Module 1 of the ADOS was most appropriate. During administration, it was noted that Gavin used some recognizable single words such as “truck” and “car” and approximated some words. He occasionally directed vocalizations to the examiner, but only for the purpose of requesting. He demonstrated odd intonation when he vocalized. A majority of his speech consisted of immediate echolalia. He often used stereotyped utterances or odd words or phrases. While he did exhibit some gestures, they were limited in range and
context; he did not point to objects. He also demonstrated poorly modulated eye contact to initiate and regulate social interaction during the administration of the ADOS. He directed an appropriate range of facial expressions toward the examiner, such as a smile, a scowl, a startled face. He did not pair vocalizations with eye contact but used these behaviors independently of each other in order to communicate social intention. He showed definite and appropriate pleasure with the examiner on several occasions. He responded to the examiner when she called his name after the fourth attempt. He occasionally gave objects to the examiner in order to request for help, but he did not show any objects to anyone in the room. Overall, the quality of his social overtures was slightly unusual, and his communicative attempts were primarily restricted to his personal demands. Additionally, Gavin demonstrated repetitive behaviors and interest in behaviors that were to an unusual degree (e.g. spinning in a chair). Overall, Gavin’s score on the ADOS was 11, which exceeded the cutoff score for autism spectrum disorder.

Services Gavin previously received included speech-language services once weekly through a state-sponsored early intervention program. He also received once-weekly in-home services with an Infant-toddler Developmental Specialist. Throughout the study, he also received twice-weekly speech therapy in school. His and Grant’s mother, as previously mentioned, had also participated in an 8-week therapeutic program designed to support social communication development prior to the beginning of the study. Prior to intervention, Gavin’s mother completed the SSIS. Results indicated a standard score of 72 for social skills (5th percentile), and a standard score of 112 for problem behaviors (78th percentile).
Setting, Change Agents, and Materials

This section describes the setting in which each phase of the study was conducted, the change agents who conducted the experimental procedures, and the materials used to conduct the study.

Setting

All phases of the study were conducted in a hospital-based clinic. The phases included: (a) pre-intervention/assessment, (b) baseline, (c) intervention, and (d) post-intervention/assessment. For all phases, data were collected within the same medium-sized room (10’3” by 18.5”), which was made smaller by closing a divider in the room. This room was a part of the hospital-based clinic. At the beginning of the study, the children were unfamiliar with this room and had never entered this room. The room did not contain any furniture except for a podium stand which held the speakers, and one empty table. There was one television screen mounted on one of the walls which always remained off; nothing else was hanging on the walls of the room.

Interventionist

The interventionist, who delivered the experimental procedures during baseline and intervention phases, was a licensed pediatric neuropsychologist with several years of experience working with children with ASD. She is a supervisor of a hospital-based clinic specializing in neuropsychological evaluations for children with autism, and has provided many parent trainings for parents of children with autism. The researcher conducted the pre-intervention/assessment on participants, collected and analyzed data. The researcher is an advanced-level doctoral student with many years of experience working with children with ASD. An undergraduate assistant in her 4th year of her Bachelor’s degree also assisted by videotaping many of sessions in both baseline
and intervention phases, and coding some of the videos according to the behavioral observation coding system for interobserver agreement. This undergraduate assistant has had experience as a clinical assistant in a clinic specializing in autism, and during the study she was accepted into a Master’s program for Speech Pathology.

**Materials**

During the baseline and intervention phases, a Sony Digital HD Video Camera Recorder (20.4 Mega Pixels-AVCHD Progressive) was used to video tape all sessions. These videos were later uploaded to a computer for coding using the Noldus Observer XT software program. Also during each baseline and intervention session, the following materials were present and set up the same way each session in the same order: 2 pairs of long-stick ribbons, 2 sets of multi-colored ring ribbons, 2 sets of 2 bean bags, and 2 sets of 2 scarves. Each was set up so that one of each pair was in a line on the left, and the other of each pair was lined up on the right. For example, the setup of these materials went as follows, from left to right: 2 pairs of long-stick ribbons, 2 multi-colored ring ribbons, 2 mean bags, 2 scarves, and then the same thing in the same order on the right. The small room was cleared of all furniture except for one small table against a wall. Additionally in the opposite corner of the room was a small stand that stood about 4 feet high. Upon the stand was an iHome used for playing an iPhone 4 to provide music for each session. The music was only instrumental, and the same playlist was used for each session.

**Dependent Measures**

This section outlines the primary dependent measures. Definitions of the primary dependent measures that were collected on the participants’ social engagement and inappropriate behaviors during the study’s phases are provided. The specific definitions
used to operationally define each behavior are described (see Appendix B for coding manual) and have been adapted from previous researchers (Ingersoll et al., 2013; McGarry & Russo, 2011).

Pre-Intervention Measure and Post-Intervention Measure

Social Skills Improvement Scale (SSIS)

The Social Skills Improvement Scale (SSIS; Gresham & Elliot, 2008) is a measure that assesses functioning in three domains: Social Skills, Problem Behavior, and Academic Competence. Specifically, the SSIS aims to assess the presence of problem behaviors and how these problem behaviors affect academic performance and social skills. The measure consists of 83 items and takes about 20 minutes to administer. The SSIS is available for three different age groups: preschool children (ages 3 to 5), elementary and middle school children (ages 8 to 12), and secondary children (ages 13 to 18). Teacher and parent report versions are available for all age groups, and a self-report format is available for elementary and secondary students. SSIS composite scores are normed on a nationally representative sample with a mean of 100 and a standard deviation of 15 (standard scores).

The SSIS assesses not only symptom severity but also the impact of symptoms on functioning and overall impairment. The Problem Behavior domain includes symptoms of internalizing, externalizing, bullying, and hyperactivity/inattention, and autism spectrum behaviors. The Social Skills composite includes behaviors related to communication, assertiveness, responsibility, empathy, cooperation, engagement, and self-control. Normed on a nationally representative sample of 4,700 children between the ages of 3 to 18, the SSIS shows evidence of strong psychometric properties. Test-retest reliability was .82, .84, and .81 for Total Social Skills scores for teachers, parents,
and students, respectively, and .92, .86, and .77 for the Total Problem Behavior scores for teachers, parents, and students, respectively (Gresham, Elliott, Cook, Vance, & Kettler, 2010). Additionally, the SSIS Social Skills has been found to have convergent validity with the Behavior Assessment System for Children (BASC) Externalizing Problems (-.67), Internalizing Problems (-.11), and Adaptive (.80) scales (Gresham & Elliott, 2008).

Prior to the beginning of baseline, the preschool version of the SSIS was administered to the primary caregiver of each participant. Standard scores and percentiles for the domains of Social Skills and Problem Behaviors were obtained. These standard scores were used to describe the participants pre-intervention (see above for each participant's scores). This measure was also re-administered to primary caregivers of participants after each participant completed the last intervention session. Pre- baseline and post-intervention raw scores and percentiles for the domains of Social Skills and Problem Behaviors will later be reported and discussed for each participant.

**Repeated measures**

During the baseline and intervention phases, data were video taped in vivo and then coded on the following dependent measures: (a) frequency of initiations, (b) duration of gaze, (c) duration of positive affect. The definitions for these measures follow (see Appendix B for a detailed, full coding manual with examples and non-examples of all behaviors measured).

**Initiations.** Initiations were defined as acts in which the child directed a verbal or nonverbal (gestural) behavior toward the adult to elicit adult attention, gain access to objects, request to join an activity or movement, attempt to initiate play, provide
assistance or request assistance, make a comment, ask a question, or elicit attention from the adult to show/give objects, or initiate physical contact; all behaviors must be done in a positive or neutral tone (not paired with negative affect or aggression, etc). For further details and examples/nonexamples, please see Appendix B.

**Gaze.** Gaze was defined as instances in which the child directed eye contact or visual gaze toward the adult for at least 2 seconds. Visual gaze occurred any time it was directed at the adult’s body and/or face/eyes. Gaze was coded as a duration, meaning that once a child engaged in gaze for at least 2 seconds according to the definition, the researcher coded the total seconds that the child remained gazing at the adult until the gaze was directed elsewhere. The coding software calculated the proportion of gaze by adding the total seconds the child was coded to be gazing out of the total possible seconds of the entire session. For more examples/non-examples and details of gaze, see the detailed coding manual in Appendix B.

**Positive affect.** Positive affect was defined as displays of positive emotions through gestural or vocal means, such as clapping, laughing, and smiling. Each time these displays of positive affect were observed by the child, positive affect was coded as duration. When children began engaging in examples of positive affect, the researcher immediately began coding this behavior until it was no longer occurring. The coding software then calculated the total seconds that positive affect was coded, and converted this number to a percentage of the overall total possible seconds of the session. These instances were those in which the children were expressing positive engagement or enjoyment. For more examples/non-examples and further details, please see the coding manual in Appendix B.
Experimental Procedures and Study Design

The experimental procedures section outlines the steps that were followed to recruit participants, obtain informed consent, and then to conduct each phase of the study, and the study design section describes the single-case design used to evaluate the effects of the treatment. Four phases were conducted (a) pre-intervention, (b) baseline, (c) intervention, and (d) post-intervention.

Pre-Intervention/Assessment Phase

After caregivers completed the informed consent process and signed the authorization for release of information, the researcher obtained relevant measures from participants’ assessment reports in order to describe participants (see previous participant description) based on the information obtained in clinical interviews. The researcher also obtained results from the ADOS from participant records. After the completion of this process, the researcher administered the SSIS-preschool form to each caregiver. For a summary of assessment measures, please see Table 2-2.

Baseline and Intervention Phases

Baseline

During the baseline phase, participants were brought into the therapy room by the undergraduate assistant who videotaped all sessions (with the exception of 2 sessions which were videotaped by the researcher). For the first ten minutes before each session began, the participant spent time in the therapy room with the undergraduate assistant and the props. As described in the Materials section, the room was set up the same way each time, with one set of the following materials on the left side on a floor against a wall, with another set just to the right of it: 2 pairs of long-stick ribbons, 2 sets of multi-colored ring ribbons, 2 sets of 2 bean bags, and 2 sets of 2
scarves. The purpose of this was so that there was one set of props for the therapist, and one set of props for the participant. No music played during the first ten minutes. This time was solely meant to help participants get acclimated to the room and the undergraduate assistant. These first ten minutes of acclimation were not video-recorded.

After ten minutes of room acclimation had passed, the therapist entered the room with the iPhone used to play music. The undergraduate began video recording, and the music playlist was initiated. During each baseline session, the therapist did not engage in any mirroring of the participants (see definition in the next session). Each baseline session lasted ten minutes. During this time, the therapist occasionally initiated to the participant, and engaged in different physical movements about every minute. After the session ended, the video-recording of the session was uploaded into the coding software and children’s social engagement behaviors were coded.

**Intervention**

During the intervention phase, sessions began exactly as they did in baseline. The participants were brought into the same therapy room by the undergraduate assistant. For the first ten minutes before each session began, the participants were given the same period of time to acclimate to the room. Exactly as in baseline, the props were set up. During the first ten minutes of acclimation, just as in baseline, music was not playing this portion was not being video recorded.

Once the first ten minutes of acclimation passed, the therapist entered the room to implement the intervention. Just as in baseline, these sessions each lasted ten minutes. The therapist entered the room, began playing the music playlist, and the undergraduate began video recording. Unlike in baseline, the therapist implemented a
mirroring intervention. As soon as the session began, the therapist began to mirror the participants. As part of the mirroring procedure, the therapist imitated the shape, form, movement qualities, and tones of children’s actions within 5 seconds of being modeled by the child; or the therapist matched particular qualities of the children’s movement while not completely mirroring the entire shape, form, attitude, or rhythmic aspects of the children’s movements; or a characteristic of the action of the child was displayed by the therapist but with a different body part, spatial attention, or intensity. The therapist mirrored the children’s behaviors for the entire 10-minute session. If participants engaged with the props, the therapist utilized the second set of props to mirror the actions with those objects. Just as in baseline, the therapist occasionally (at least three times per session) initiated to the children, and engaged in different physical movements separate from those being modeled by the children. After the session ended, the video-recordings of the session was uploaded into the coding software and children’s social engagement behaviors were coded.

**Post-Intervention**

Following each participant’s last intervention session, the caregiver was again administered the parent form of the preschool version of the SSIS. Composite scores for each domain were calculated.

**Experimental Design**

A multiple baseline design across participants with replication was used to evaluate the effectiveness of the mirroring intervention on social engagement behaviors of children with autism. The first two participants (Rob and Carli) began the study first and received baseline and intervention. After they had been participating for a few weeks, the replication was conducted on the last two participants (Grant and Gavin).
Data Analysis

The data analysis section outlines the procedures used to analyze and evaluate the coded data. The interobserver agreement section will describe the steps taken to ensure the reliability of the data collected.

Data collection, coding, and analysis. Sessions across all phases were videotaped using a Sony Digital HD Video Camera Recorder and later uploaded to a desktop computer and imported into the Noldus Observer XT software program to be coded. Each session was conducted for ten minutes.

During each session, the primary researcher coded the frequency of initiations, the duration of gaze, and the duration of positive affect. The duration of gaze and positive affect were converted to a percentage of their occurrence out of the total ten-minute session by the Noldus Observer XT software program.

Each of the dependent measures were graphed and analyzed visually following procedures outlined by Kennedy (2005) in order to determine the effect of the treatment on the dependent variables. All phases were conducted until visual inspected of the graphed data revealed at least three consecutive and stable data points. The researcher used the Microsoft Excel software program to graph the data. Line graphs were drawn for dependent variables for each participant.

Kennedy (2005) recommended the examination of three aspects of line graphs, used for the primary dependent measures in the current study, in order to determine the effect of the intervention. These included: (a) level of the dependent variable, (b) trend of the data, and (c) variability. He further recommends to additional aspects of analysis in order to determine the effect of the treatment on dependent variables across conditions. Those include: (a) immediacy of effect, and (b) overlap of data between
phases. All of these procedures were followed in order to analyze the data as well as to determine phase changes. Specifically, the level of the dependent variable was calculated by determining the mean of each dependent variable in each phase (baseline and intervention). The trend of the data was determined by calculating the slope and plotting the best-fitting line to the data in Excel. The variability was determined by calculating the range of the data. The immediacy of effect was calculated for each dependent variable by calculating the mean of the last three baseline data points and the mean of the first three intervention data points in order to observe any immediate change in level that occurred between the end-of-baseline and beginning-of-intervention. Finally, the overlap of data between phases was determined by calculating the percentage of non-overlapping data (PND) statistic. This was calculated by identifying the highest baseline data point, counting the number of intervention points that exceed the highest baseline data point, then calculating the proportion of non-overlapping to the total number of intervention data points.

**Interobserver Agreement**

Interobserver agreement (IOA) is the extent to which two or more observers agree that a behavior occurred, and more specifically, when and how long a behavior occurred (Kazdin, 1982). It provides a measure of the reliability of the observers and should be assessed in order to minimize observer biases, control for inconsistency of observers as one source of variation in data collection, and to determine if the target behaviors are well defined (Kazdin, 1982).

Kazdin (1982) recommends that IOA be collected during at least 25% of all observations across the different phases of the study. The current study adhered to this
recommendation and IOA was calculated on at least 30% of sessions during the baseline phase and the intervention phase of the study.

For frequency measures (initiations), total agreement was calculated. In order to calculate IOA for frequency measures, the number of responses recorded by the primary observer was totaled. The number of responses recorded by the secondary observer was also totaled. Finally, the smaller total was divided by the larger total and multiplied by 100 to give the IOA total agreement for each frequency measure.

For duration (gaze, positive affect), the total agreement approach was used (Kennedy, 2005). To calculate the IOA for these measures, the duration recorded by the primary observer was totaled. Similarly, the duration recorded by the secondary observer was totaled. Finally, the smaller total was divided by the larger total and multiplied by 100, giving the IOA total agreement for duration. The primary researcher was the primary data collector during each phase of the study and a trained undergraduate student assisted with IOA.

The previously described procedures were used for baseline and intervention sessions for each dependent measure. IOA for baseline and intervention sessions will be reported for each participant on the dependent measures for each participant below.

**Initiations**

Agreement on all four participants’ initiations was an average of 86.93% with a range of 62% to 100%. Reliability was calculated for approximately 30% of all baseline and intervention sessions for each child on initiations.
Gaze

Agreement on all four participants’ gaze was an average of 83% with a range of 62% to 100%. Reliability was calculated for approximately 30% of all baseline and intervention sessions for each child on initiations.

Positive Affect

Agreement on all participants’ positive affect was 93.40% with a range of 80% to 100%. Reliability was calculated for approximately 30% of all baseline and intervention sessions for each child on initiations.

Treatment Integrity and Social Validity

Despite the importance of treatment integrity and social validity, seldom is either collected in single subject studies targeting young children with ASD (Odom et al., 2003). This section will describe how treatment integrity and social validity were collected for the current study.

Treatment Integrity

Data on treatment integrity were gather by viewing videotapes from baseline sessions and intervention sessions. Data was gathered during baseline to ensure that intervention was not being implemented. This was done by coding baseline videos using a partial-interval recording system with 10-second intervals. Treatment integrity data was collected on 30% of baseline sessions for each participant. Baseline videos were watched and coded according to the definition of “mirroring by therapist” (see previous description as well as more-detailed description in coding manual in Appendix B). During baseline, the criteria were set that mirroring should occur less than 5% of overall intervals across baseline sessions. In addition to calculating overall treatment
integrity in baseline, the overall percentage of mirroring that occurred during the baseline phase for each participant was calculated.

Treatment integrity data was collected on intervention sessions to ensure that the intervention was being implemented. Once treatment was implemented, the criteria was set that mirroring by the therapist should occur in at least 75% of the overall intervals across the intervention session using the 10-second partial interval recording system. Treatment integrity data was collected on 30% of intervention sessions for each participant. If mirroring occurred in at least 75% of intervals within the intervention phase, it was determined that the intervention was being implemented with fidelity. In addition to calculating the percentage that mirroring occurred within the intervention phase overall, this percentage of mirroring that occurred during this phase was also calculated for each separate participant.

Social Validity

Social validity data was collected by experts within the field of autism. Two advanced-level doctoral students specializing in autism spectrum disorder were asked to view clips of videos of participants in baseline and intervention (raters were blind to which phase the participant was in within each video clip). These experts had multiple years of specialized coursework within ASD as well as clinical experience in the treatment for ASD and some experience in the diagnosis of ASD. The experts were asked to view 5-minute video clips of randomly selected footage of participants in each phase. They then completed Likert scales to indicate the degree of appropriate social engagement behaviors displayed by the participants in the video clips (see Appendix C for the Social Validity Questionnaire).
Table 2-1. Participant characteristics

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Sex</th>
<th>Race</th>
<th>ADOS module</th>
<th>ADOS score</th>
<th>Dx</th>
<th>SSIS social skills SS</th>
<th>SSIS problem behaviors SS</th>
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</thead>
<tbody>
<tr>
<td>Rob</td>
<td>3-10</td>
<td>M</td>
<td>Caucasian</td>
<td>2 (Phrase Speech)</td>
<td>13</td>
<td>Autism</td>
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<td>99</td>
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<td>Carli</td>
<td>4-2</td>
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<td>Hispanic</td>
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<td>Autism</td>
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<td>121</td>
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<tr>
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<td>1 (Pre-Verbal/Single Words)</td>
<td>12</td>
<td>Autism</td>
<td>72</td>
<td>114</td>
</tr>
<tr>
<td>Gavin</td>
<td>3-0</td>
<td>M</td>
<td>Caucasian</td>
<td>1 (Pre-Verbal/Single Words)</td>
<td>11</td>
<td>Autism</td>
<td>72</td>
<td>112</td>
</tr>
</tbody>
</table>

Note: Age in years-months. M= male, F=female. SS= standard score. Dx= diagnosis.

Table 2-2. Assessments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Informant</th>
<th>Dx confirmation</th>
<th>Weekly (during Tx)</th>
<th>Pre-Tx (or baseline)</th>
<th>Post-Tx</th>
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<tr>
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<tr>
<td>Motor Imitation Scale</td>
<td>Observer</td>
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<td>✓</td>
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</tr>
<tr>
<td>Direct Behavioral Observation of Child Initiations and Gaze</td>
<td>Observer</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Direct Behavioral Observation of Child Positive Affect</td>
<td>Observer</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Note: Tx=treatment.
CHAPTER 3
RESULTS

The purpose of this study was to examine the effects of a mirroring intervention on the social engagement behaviors of young children with autism spectrum disorders. Specifically, the effectiveness of the mirroring intervention is assessed using a multiple-baseline design across two participants, with a replication. The study was conducted across 4 phases: (a) pre-intervention/assessment phase, (b) baseline, (c) intervention, and (d) post-intervention/assessment. This chapter reports the results of the intervention on the primary dependent variables across all 4 phases. Additionally, the results of interobserver agreement, treatment integrity, and social validity data are reported in this chapter.

Pre-Intervention/Assessment Phase

As described in Chapter 2, the pre-intervention phase of the study consisted of the administration of the Social Skills Improvement System (SSIS) for the primary caregiver of each child in order to measure the participants’ problem behaviors and social engagement behaviors from a parent’s perspective both before and after the intervention. Table 3-1 includes the raw scores and age-based percentile scores for each participant for each domain. The maximum raw score for the social skills domain was 138, and the maximum raw score for the problem behaviors domain is 99.

Intervention Results

Following the pre-intervention phase of the study, baseline and intervention phases were implemented for each participant (see Figure3-1). Data were collected across each phase of the study on target children’s selected target behaviors for social engagement. In the baseline phase, the primary dependent variables were measured.
for each participant. In this phase, the interventionist did not mirror or imitate the behaviors of the participants, but the social engagement behaviors were measured by the researcher. There is a consensus that a minimum of three data points are necessary in order to establish stability of a dependent measure (Horner et al., 2005; Kazdin, 1982). Therefore, the a priori criteria for one participant moving from the baseline phase to the intervention phase were the visual inspection of at least 3 consecutive stable data points. Once the participant moved into the intervention phase, the same dependent measures were coded during these sessions, while the interventionist mirrored the participants throughout the entire session. These data were collected via video camcorder live during each session, and the dependent measures were later coded by the researcher using the Noldus XT software.

In order to assess the effects within single case designs, six features are recommended to examine within- and between- phase data patterns: (1) level, (2) trend, (3) variability, (4) immediacy of effect, (5) overlap, and (6) consistency of data patterns across similar phases (Hersen & Barlow, 1976; Kazdin, 1982; Kennedy, 2005). These were used in this study for the primary dependent measures, to determine the influence of the intervention. Level refers to the mean score for the data within a phase; this was calculated by determining the mean of each dependent variable within each phase. Trend refers to the slope of the best-fitting straight line for the data, which was determined by calculating by plotting the trendlines for each dependent variable within each phase. Variability refers to the range or standard deviation of data about the best-fitting straight line; this was determined by calculating the range of each dependent variable within each phase. Immediacy of effect, which refers to the change in level
between the last three data points in baseline and the first three data points in intervention (Kazdin, 1982; Kennedy, 2005; Kratochwill et al., 2010). The immediacy of effect determines how quickly after intervention is implemented that a change is seen in the dependent variable. The more rapid the effect, the more convincing the inference that change in the outcome measure was due to the manipulation of the independent variable (Kratochwill et al., 2010). Immediacy of effect was calculated by determining the change in level between the last three data points in baseline and the first three data points in intervention. Another core feature used for assessing results of single-case design studies is the calculation of overlap; overlap refers to the proportion of data from one phase that overlaps with data from the previous phase (Kazdin, 1982; Kennedy, 2005; Kratochwill et al., 2010). The larger the proportion of nonoverlapping data points, the more compelling the demonstration of an effect of the independent variable on the dependent variable (Kratochwill et al., 2010). Finally, consistency of data in similar phases involves visually inspecting the data from all phases within the same condition for the extent to which there is consistency in the data patterns from phases within the same conditions. Taken altogether, the primary dependent variables were assessed for all six features.

The primary dependent measures for each participant were decided by examining the most significant, stable behaviors during baseline and determining which behaviors were most appropriate for intervention targets. For all four participants, it was determined that initiations and gaze would be appropriate primary dependent variables, as these behaviors were low for all participants during baseline. Additionally, it was determined that positive affect would also be primary dependent variables for Grant and
Gavin, as this behavior was low during baseline; it was not determined that positive
affect would be a primary dependent measure for Rob and Carli, as these behaviors for
these participants was relatively stable during baseline and was therefore not
appropriate to be a primary intervention target. The results for each child for selected
target behaviors across each phase follow.

**Initiations**

The current study was conducted using a multiple-baseline design across two
participants with replication. The first two participants to begin baseline and then
intervention were Rob and Carli. The study was replicated on two more participants,
Grant and Gavin.

**Rob’s baseline**

Baseline data were collected on Rob’s frequency of initiations. During baseline,
the interventionist was present in the room and initiated toward Rob, but did not
implement the mirroring intervention or imitate Rob in any way. Rob initiated an average
of 0 times per session (he never initiated once during his three baseline sessions).
Since the baseline data for Rob’s initiations were stable at 0% during baseline, and the
criteria was set for the first participant to move from baseline to intervention after 3
consecutive stable data points, the first intervention session was then implemented with
Rob.

**Rob’s intervention**

Rob’s initiations increased to a mean of 38 initiations (12-78) per session across
the intervention phase (see Table 3-2). Rob’s initiations during intervention reveal a
positive trend. When the immediacy of effect is calculated, an immediate large increase
in level of initiations between baseline and treatment is observed, with a mean level of
the final three baseline data points of 0, and a mean of 26 initiations across the first three intervention sessions. The percentage of non-overlapping data (PND) for Rob’s initiations during the intervention phase was 100%, meaning that none of Rob’s data points during the intervention phase for initiations overlapped with his data points for initiations during the baseline phase (all of his data points for initiations were above baseline levels; see Table 3-3).

**Carli’s baseline**

After the intervention was implemented with Rob, the researcher continued to collect baseline data on Carli. During baseline, Carli’s frequency of initiations had a mean of 2.25 (0-5) initiations per session in the baseline phase.

**Carli’s intervention**

Intervention was implemented with Carli once Rob demonstrated stable and increased level of initiations above baseline levels for at least 3 consecutive sessions. During intervention, Carli’s initiations increased from baseline a level of 2.25 to a mean of 28 initiations per session (see Table 3-2). Carli’s frequency of initiations during intervention demonstrated a positive trend. The immediacy of effect for Carli’s initiations was calculated, and an immediate change in level was evident from end of baseline ($M=4$) to beginning of intervention ($M=26$). (The PND for Carli’s initiations during intervention phase was 100%, meaning that none of the data points for initiations in intervention phase overlapped with those of the baseline phase (see Table 3-3). For an overview of baseline and intervention data points for Rob and Carli, see Figure 3-1.

**Grant’s baseline**

While Rob and Carli continued, the study was replicated with the next two participants, Grant and Gavin, and baseline and intervention data were collected with
Grant and Gavin exactly as it was with Rob and Carli. During the baseline phase, Grant’s initiations were stable with a mean of 1 (0-3) initiation per session. For an overview of Grant’s baseline and intervention data points, see Figure 3-2.

**Grant’s intervention**

Grant’s initiations were at near-zero levels in baseline and remained stable for 3 sessions in a row before intervention was implemented. During the intervention phase, Grant’s initiations increased from baseline levels to a mean of 25.73 (see Table 3-2). Grant’s initiations in intervention were somewhat variable, with a range of 1-51 initiations across sessions within this phase. However, his data still demonstrate a positive trendline when plotted. Grant’s initiations did not demonstrate an immediate effect of treatment, with the mean initiations in the end of baseline sessions at 1, and mean initiations during beginning of intervention of 2. Additionally, the PND of Grant’s initiations were 73%, meaning that the majority of Grant’s data points for initiations during the intervention phase did not overlap with data points for initiations during the baseline phase, or that the majority of Grant’s initiations during intervention were above baseline levels for his initiations (see Table 3-3).

**Gavin’s baseline**

While intervention was being implemented with Grant, baseline data were collected on Gavin’s initiations. Gavin’s initiations in the baseline levels were stable at near-zero levels, with a mean of 0.55 initiations. For a summary of Gavin’s baseline and intervention data points, see Figure 3-2.

**Gavin’s intervention**

After Grant’s initiations during intervention were stable and increasing above baseline levels for at least 3 consecutive sessions, intervention was implemented for
Gavin. Gavin’s initiations increased from baseline levels to a mean of 34.84 initiations in the intervention phase. When a trendline is plotted, a positive and increasing trend is demonstrated for Gavin’s initiations. Gavin’s initiations within the intervention phase were somewhat variable but overall steadily increasing, with a range from 13 to 56 initiations. Gavin demonstrated immediate increase in level of initiations when calculated for the last three baseline data points and the first three intervention data points. During the last three baseline data points, Gavin’s mean of initiations was 1, with an increase during the first three baseline sessions to a mean of 24 initiations. Additionally, Gavin’s PND for initiations were 100%, meaning that none of the data points for his initiations during the intervention phase overlapped with those of the baseline phase (all intervention points were above baseline levels).

Gaze

Rob

During baseline, data were collected on the duration of gaze for Rob. The average percentage of gaze during baseline was steady at 0% for all sessions during baseline. Once intervention was implemented with Rob, his percentage of gaze increased from baseline levels to a mean of 12.14% per session, with a range of 4%-29%. Rob demonstrated some immediate change in level of gaze from baseline to intervention, with mean duration of gaze in the last three baseline sessions of 0% to a mean of 9% in the first three intervention sessions. The PND for Rob’s gaze was 100%, meaning that none of the data points for his gaze overlapped with those during baseline.
Carli

During baseline, Carli’s duration of gaze had a mean of 5.63% with a range of 2.4-19%. These levels increased during the intervention phase, with mean of 25.27% (18%-32%). Carli demonstrated immediate change in level of gaze from baseline to intervention, with mean duration of gaze in the last three baseline sessions of 4% to a mean of 24% in the first three intervention sessions. The PND for Carli’s gaze was 80%, meaning that the majority of data points for Carli’s percentage of gaze during intervention did not overlap with the levels of gaze during baseline.

Grant

During baseline, Grant’s duration of gaze was stable at near-zero levels with a mean of 0.72% (0.30%-1.14%). Grant’s percentage of gaze increased during intervention, with a mean of 17.45% (3.3%-40%). Grant demonstrated some immediate change in level of gaze from baseline to intervention, with mean duration of gaze in the last three baseline sessions of 0.72% to a mean of 7.69% in the first three intervention sessions. The PND of Grant’s gaze was 100%, meaning that none of the data points for Grant’s gaze in intervention overlapped with those during baseline, or that all data points for gaze during intervention were higher than any baseline levels.

Gavin

During baseline, Gavin’s duration of gaze was stable at near-zero levels with a mean of 1.64% (range= 0.0-5.28%). Gavin demonstrated definite immediate change in level of gaze from baseline to intervention, with mean duration of gaze in the last three baseline sessions of 1.24% to a mean of 22% in the first three intervention sessions. Gavin’s percentage of gaze increased during intervention, with a mean of 23.43% (17%-
32%). The PND of Gavin’s gaze was 100%, meaning that all of his data points for gaze in the intervention phase were above baseline levels and did not overlap at all.

**Positive Affect**

**Grant**

For the last two participants, positive affect was measured. In baseline, Grant’s positive affect was stable at near-zero levels with a mean of 0.05%, with a range of 0.0-0.14%. Grant's positive affect increased significantly during intervention, with a mean of 15.21% (0.0%-33.0%). Grant demonstrated some immediate change in level of positive affect from baseline to intervention, with mean positive affect in the last three baseline sessions of 0.05% to a mean of 7.69% in the first three intervention sessions. The PND for Grant’s positive affect was 91%, indicating that the vast majority of his positive affect data points during intervention did not overlap with those during baseline.

**Gavin**

Gavin’s mean positive affect during baseline was at near-zero levels with a mean of 1.7% (0.0%-5.67%). During intervention, Gavin’s positive affect rose from baseline levels with a mean of 30.43% (18%-38%). Gavin demonstrated definite immediate change in level of positive affect from baseline to intervention, with mean positive affect in the last three baseline sessions of 0.82% to a mean of 27% in the first three intervention sessions. The PND for Gavin’s positive affect was 100%, meaning that none of Gavin’s data points for positive affect during intervention phase overlapped with any of his data points for positive affect during the baseline phase; all data points for positive affect during intervention were above baseline levels.
Post-Intervention Results

Post-Intervention SSIS

As described in Chapter 2, the post-intervention phase consisted of the administration of the SSIS again to the primary caregiver of each child. The purpose of this was to measure the participants’ problem behaviors and social engagement behaviors from a parent’s perspective both before and after the intervention and to compare post-intervention SSIS scores to pre-intervention SSIS scores. The total scores for both the pre-intervention administration of the SSIS and the post-intervention administration for all four participants are found in Table 3-1.

Rob

The results of the post-intervention SSIS Parent Rating Scale for Rob were a raw score of 100 (70th percentile) in the social skills domain and a raw score of 17 (41st percentile) in the problem behaviors domain. This is a slight increase in raw score on social skills from the pre-intervention score, and a slight decrease of raw score in problem behaviors from pre-intervention. Higher scores in the social skills domain represent more positive social skills, and higher scores in the problem behaviors domain represent more severe problem behaviors; therefore, a lower score in problem behaviors represent less severe behaviors.

Carli

The results of the post-intervention SSIS Parent Rating Scale for Carli were a raw score of 101 (62nd percentile) in the social skills domain and a raw score of 22 (60th percentile) in the problem behaviors domain. When compared to pre-intervention scores, Carli’s parents reported a significant increase in the social skills domain, as well as a slight decrease in problem behaviors.
Grant

The results of the post-intervention SSIS Parent Rating Scale for Grant were a raw score of 30 (1\textsuperscript{st} percentile) in the social skills domain and a raw score of 17 (41\textsuperscript{st} percentile) in the problem behaviors domain. When compared to the pre-intervention results, Grant’s mother reported a decrease in raw score of Grant’s social skills, and his problem behaviors score remained the same.

Gavin

The results of the post-intervention SSIS Parent Rating Scale for Gavin were a raw score of 41 (4\textsuperscript{th} percentile) in the social skills domain and a raw score of 29 (72\textsuperscript{nd} percentile) in the problem behaviors domain. When comparing these raw scores to the administration of the SSIS at pre-intervention, Gavin’s social skills decreased slightly, and his problem behaviors also decreased slightly.

Treatment Integrity Results

Treatment integrity is reported for the baseline and treatment sessions as an overall percentage of intervals in which mirroring by the therapist occurred, using partial interval recording with 10-second intervals.

Baseline

As described in Chapter 2, sessions in baseline were coded for treatment fidelity for 30\% of each participant’s baseline sessions. To ensure that the mirroring treatment was not being implemented during baseline, videos were coded according to the coding scheme and definition of “mirroring by therapist.” The goal for baseline session was for the therapist to engage in mirroring a minimal percentage of overall intervals (less than 50\%). Across all four participants, mirroring only occurred in 3.09\% of intervals during baseline, which met criteria for no intervention implementation.
Individually for each participant, mirroring occurred during baseline the following percentage of intervals per session: Rob (0.00%), Carli (7.32%), Grant (3.33%), Gavin (1.64%). For a summary of treatment integrity results for baseline and intervention, see Table 3-4.

**Intervention**

Also described in Chapter 2, sessions in baseline were coded for treatment fidelity for 30% of each participant’s intervention sessions. In order to ensure that mirroring treatment was implemented during intervention, videos were coded according to the coding scheme and definition of “mirroring by therapist.” The goal for intervention sessions was for the therapist to engage in mirroring a minimum of 75% of the intervals of each intervention session. Across all four participants, the therapist implemented mirroring in 95.36% of intervals during intervention, (which exceeded the minimum goal of 75% of intervals per intervention session).

Individually for each participant, mirroring occurred during intervention the following percentage of intervals per session: Rob (96.67%), Carli (92.00%), Grant (95.28%), Gavin (97.5%).

**Social Validity**

Two graduate students pursuing advanced doctoral degrees who specialize in autism spectrum disorder completed expert social validity ratings for the participants. The scale consisted of Likert values, which ranged from 1, typically indicating the process and outcomes were not at all present to 5, typically indicating the process and outcomes as very evident. The experts each rated video clips for different participants by viewing clips from baseline and intervention (raters were blind to the phase of each
video). The mean and standard deviation for expert responses to each question were calculated.

The mean response to question one concerning the frequency of child attempts to socially engage with the therapist across raters for all participants in baseline was 1.25 ($SD= 0.50$). When raters viewed video clips of the participants during the end of intervention, the mean response was a rating of 4.25 ($SD=0.96$). The mean response to question two, which concerned the overall quality of the interactions between the child and therapist was 1 ($SD=0.00$). Across raters for participants when video clips of baseline sessions were viewed. For videos viewed of the end of intervention sessions, the raters' mean response to this question was 4.5 ($SD=0.58$). The final question, which concerned the extent to which the child enjoyed interaction with the therapist garnered a mean rating of 1.5 ($SD=0.58$) for video clips of baseline sessions, and a mean rating of 5 ($SD=0.00$) for video clips of sessions in the end-of-intervention. For a summary of social validity ratings in baseline and intervention, see Figure 3-3.
### Table 3-1. SSIS scores at pre- and post-intervention

<table>
<thead>
<tr>
<th>Participant</th>
<th>Social Skills raw score (percentile)</th>
<th>Pre-Intervention Problem Behavior raw score (percentile)</th>
<th>Post-Intervention Problem Behavior raw score (percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rob</td>
<td>98 (67)</td>
<td>20 (50)</td>
<td>100 (70)</td>
</tr>
<tr>
<td>Carli</td>
<td>48 (2)</td>
<td>25 (87)</td>
<td>101 (62)</td>
</tr>
<tr>
<td>Grant</td>
<td>46 (5)</td>
<td>34 (82)</td>
<td>30 (1)</td>
</tr>
<tr>
<td>Gavin</td>
<td>45 (5)</td>
<td>32 (78)</td>
<td>41 (4)</td>
</tr>
</tbody>
</table>

Note: Maximum possible raw score on Social Skills domain is 138; maximum possible raw score on problem behaviors domain is 99. Higher scores in the social skills domain represent more appropriate social skills, while higher scores in the problem behavior domain represent more severe problem behaviors.

### Table 3-2. Change in level of dependent variables.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline level</th>
<th>Intervention level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rob</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>0.00</td>
<td>38.00</td>
</tr>
<tr>
<td>Gaze</td>
<td>0.00%</td>
<td>12.14%</td>
</tr>
<tr>
<td>Carli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>2.25</td>
<td>28.00</td>
</tr>
<tr>
<td>Gaze</td>
<td>5.63%</td>
<td>25.27%</td>
</tr>
<tr>
<td>Grant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>1.00</td>
<td>25.73</td>
</tr>
<tr>
<td>Gaze</td>
<td>0.72%</td>
<td>17.45%</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>0.05%</td>
<td>15.21%</td>
</tr>
<tr>
<td>Gavin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>0.55</td>
<td>34.84</td>
</tr>
<tr>
<td>Gaze</td>
<td>1.64%</td>
<td>23.43%</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>1.7%</td>
<td>30.43%</td>
</tr>
</tbody>
</table>
Table 3-3. Percent of Non-Overlapping Data (PND) Statistic for evaluation of dependent variables.

<table>
<thead>
<tr>
<th>Participant</th>
<th>PND statistic (%)</th>
<th>PND category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rob</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>100.00</td>
<td>Highly Effective</td>
</tr>
<tr>
<td>Gaze</td>
<td>100.00</td>
<td>Highly Effective</td>
</tr>
<tr>
<td>Carli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>100.00</td>
<td>Highly Effective</td>
</tr>
<tr>
<td>Gaze</td>
<td>80.00</td>
<td>Fairly Effective</td>
</tr>
<tr>
<td>Grant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>73.00</td>
<td>Fairly Effective</td>
</tr>
<tr>
<td>Gaze</td>
<td>100.00</td>
<td>Highly Effective</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>91.00</td>
<td>Highly Effective</td>
</tr>
<tr>
<td>Gavin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>100.00</td>
<td>Highly Effective</td>
</tr>
<tr>
<td>Gaze</td>
<td>100.00</td>
<td>Highly Effective</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>100.00</td>
<td>Highly Effective</td>
</tr>
</tbody>
</table>

Note: The higher the PND statistic, the more effect the treatment (PND < 50% = unreliable treatment; PND 50-70% questionable effectiveness; 70%-90% fairly effective; > 90% highly effective).

Table 3-4. Treatment integrity data

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rob</td>
<td>M=0.00%</td>
<td>M=96.67%</td>
</tr>
<tr>
<td>Carli</td>
<td>M=7.32%</td>
<td>M=92.00%</td>
</tr>
<tr>
<td>Grant</td>
<td>M=3.33%</td>
<td>M=95.28%</td>
</tr>
<tr>
<td>Gavin</td>
<td>M=1.64%</td>
<td>M=97.5%</td>
</tr>
</tbody>
</table>

Note: M= mean. Reported percentages are how many intervals in which mirroring (treatment) was implemented. Baseline levels should be lower (less than 50% of session was the goal), and intervention session percentages should be higher, (goal was to be above 75%).
Figure 3-1. Results for Rob and Carli across baseline and intervention phases.
Figure 3-2. Results for Grant and Gavin across baseline and intervention phases
Figure 3-3. Social validity results
CHAPTER 4
DISCUSSION

The purpose of this study was to examine the effects of a mirroring intervention on the social engagement behaviors of young children with autism spectrum disorder. Specifically, the study measures the effects of a mirroring intervention using a multiple-baseline design across two participants with a replication.

Autism is marked by several characteristics, particularly impairments in social communication and social interactions (APA, 2013). This spectrum disorder is increasing in prevalence and has gained increased focus in interventional research. One treatment approach falls within the overarching category of dance/movement therapy (DMT), but several studies in this field are descriptive or anecdotal in nature, and do not specifically describe the studies or their components in a replicable way (Archambeau & Szymanski, 1977; Cole, 1982; Gunning & Holmes, 1973; Dott, 1995; Siegel, 1973, Torrance, 2003). Two studies were found in which the researchers attempted to quantify the outcomes of DMT-based therapies for children with ASD; however, these studies did not describe the movement session or the intervention in detail, and further, these studies did not specifically measure mirroring independent of other interventions. Therefore, the current study sought to answer the following question: what is the effect of a mirroring intervention on the social engagement skills of young children with autism?

The purpose of this chapter is to expound upon the results of the current study. First, the chapter begins with both an overview and interpretation of the findings is provided. In addition, this chapter addresses the contribution of those findings to current literature. Next, the chapter discusses the implications for future research and
practice. Finally, the chapter concludes with a discussion of the limitations of the current study.

Overview of Findings

Four children diagnosed with autism spectrum disorder (ASD) between the ages of 3 and 5 years old participated in this study investigating the effect of a mirroring intervention on the social engagement skills of children diagnosed with ASD with minimal verbal skills. Overall, results indicate that participation in a mirroring intervention improves the social engagement skills of initiating, gazing toward others, and engaging in positive affect (such as laughter, smiling, etc). All children demonstrated an increase in level from baseline to treatment phases in targeted skills. On a separate measure of social skills and problem behaviors, caregivers reported mixed effects on social skills; 3 of the 4 participants’ parents reported that problem behaviors decreased from pre-intervention to post-intervention, and a 4th participant’s caregiver noted that problem behaviors remained the same from pre-intervention to post-intervention.

Child Social Engagement Skills

As previously noted, impairments in skills related to social engagement and joint attention are key impairments present in autism. Often, such early joint attention skills and are predictive of language ability and improvement on such skills in early years may also be predictive of gains in expressive language skills (Bono, Daley, & Sigman, 2004; Mundy, Sigman, & Kasari, 1990; Toth, Munson, Meltzoff & Dawson, 2006). Many approaches to the treatment of ASD, specifically for treatment of communication and social engagement, are very time-intensive (Rogers & Vismara, 2008). A key finding of the current study is that a mirroring intervention by a therapist that occurred only once
weekly for 10 minutes resulted in significant improvements in children’s behaviors related to social engagement (initiations and gaze, specifically). Further, the current study did not provide a direct training approach. This finding is significant because while it is well-supported in the literature that imitation interventions can improve children’s social engagement skills in autism, most studies take a direct training approach. For example, previous studies have measured the effect of Reciprocal Imitation Training that directly teaches young children imitation skills within a social context (Ingersoll, 2008; Ingersoll, 2012). Further, it is common in imitation studies for the child to be trained to imitate the therapist, and some type of reinforcer is often provided when children imitate appropriately (Ingersoll & Schriebman, 2006). In the current study the therapist simply mirrored the participants’ actions, expressions, tone, and play during intervention. The findings suggest that children’s social engagement skills were positively impacted by this non-intensive, infrequent intervention. That is, improvements in children’s social engagement skills resulted from an adult (therapist) simply imitating the children, without requiring the children to imitate the therapist, tangible reinforcement, or direct instruction. Participants responded relatively immediately to the treatment, showing quick gains in frequency of initiations and duration of gaze toward the therapist.

The positive results of the current study are important in that previous research has found that behaviors such as social initiations, positive affect, empathic responses, imitation, and language all relate to joint attention skills (Whalen, Schreibman, & Ingersoll, 2006). Additionally, improvement in these basic social engagement skills lead to improved joint attention over time, which has been linked to the development of
language and better attending to language cues in the environment (Bruner, 1975; Whalen, Schreibman, & Ingersoll, 2006). Therefore, interventions which can increase these basic social engagement skills such as positive affect, initiations, and gaze may also lead to increases in joint attention skills, and later language skills. Overall, all four participants showed a significant increase in level from baseline to intervention in all dependent measures (initiations, gaze), and the last two participants also demonstrated significant increases in level on a third dependent measure: positive affect. For three of the four participants, immediacy of effect of intervention was demonstrated, meaning that participants demonstrated positive change in social engagement immediately after intervention was implemented (for further explanation for Grant’s immediacy of effect, see next section). Overall, the vast majority of data points for all four participants did not overlap with those during baseline sessions. As explained by What Works Clearinghouse’s (WWC) Standards for Single-Case Design Studies (Kratochwill et al., 2010), demonstrating little overlap of outcome variables between baseline and intervention phases helps demonstrate that the intervention is responsible for the claimed effect. Additionally, the data across all four participants for initiations and gaze are fairly stable, demonstrating little variability as determined by range of data points. One exception to this may be some variability within Grant’s data (explained in the next section). Overall, these results indicate that current intervention was effective in increasing social engagement behaviors in autism without a rigorous, time-intensive intervention. Many traditional approaches to autism treatment, such as ABA therapy or early intensive behavioral interventions (EIBIs) require stringent, time-intensive, and sometimes expensive treatment. For example, some comprehensive interventions for
children with ASD may require intensive implementation, around 15-40 hours per week (National Research Council, 2001; Reichow, 2012). The current study required implementation for a total of ten minutes per week with the therapist and results were shown; this may offer an additional approach to improving social engagement skills with less intensive and time consuming implementation. On a related note, interventions that require such highly structured and intensive implementation have been regarded as limited in terms of maintenance and generalizability of targeted behaviors (Baer et al., 1968; Ingersoll & Schreibman, 2006).

Not only did the current study not provide direct teaching trials or behavioral-based approaches, it also did not implement any reinforcement techniques for positive social engagement behaviors. Previous researchers have noted that, given the artificial nature of reinforcers, some behaviors that children with autism were trained and reinforced to engage in were later found to extinguish quickly without contingent pairing, suggesting that such behaviors were not innately reinforcing throughout the treatment (Koegel, O'Dell, & Koegel, 1987).

Social Validity

The present study measured social validity of the intervention according to experts; this is unique when compared to other studies investigating mirroring and/or DMT-based interventions for autism. Of the studies that have examined mirroring and/or DMT-based interventions for social engagement skills in autism, none measured social validity (Hartshorn et al., 2001; Koch et al., 2014). Furthermore, many studies in the area of autism and social engagement measure social skills in terms of quantity, but often fail to address the quality of social interactions. It is important to address the overall quality of interactions given the fact that children may be taught to socially
interact with others frequently, but the quality of the initiation or interaction may be so poor that it is often ignored or avoided (Kasari & Patterson, 2012.) Therefore, an important gap in the literature addressed by this study is the a) measurement of expert social validity and b) the consideration of overall quality of social engagement skills of the participants. Overall, expert social validity data indicated that the overall frequency of attempts of the participants to socially engage with the therapist was much less frequent in sessions during baseline than sessions during intervention. Additionally, experts indicated the overall quality of interactions to be poorer during baseline than in intervention. Finally, expert raters indicated that children appeared to enjoy interactions with the therapist much more during intervention sessions than in baseline sessions. Taken together, this indicates that the intervention appears to have social validity with noticeable change in participants’ overall social engagement and interactions from baseline to intervention phases.

**Explanation of Findings**

Although the study’s findings are relatively straightforward, few of the findings warrant further explanation. These include: (a) Grant’s data, and (b) caregiver report data.

**Grant’s data**

Generally, participants demonstrated stable data points for social engagement variables and demonstrated immediate positive change upon implementation of intervention. One slight exception may be Grant’s data, which warrants further explanation. It should be noted that taken all together, Grant’s data do indicate overall significant change in level from baseline to intervention for all dependent variables (initiations, gaze, and positive affect). Additionally, the vast majority of his data points in
intervention did not overlap with those for baseline. Results indicate that Grant’s social engagement overall did increase as a result of the intervention, but at times his data points were somewhat variable. Additionally, Grant’s immediacy of effect of the intervention on dependent variables was much lower than for other participants. This indicates that, while he did demonstrate gradual positive change over time, he did not demonstrate this immediately upon implementation of the intervention.

Several explanations for this variability and lack of immediate effect can be hypothesized. One such explanation may have been a possible distant setting event for Grant before certain sessions. On occasions where Grant engaged in inappropriate behaviors (aggression, negative affect, attempts to escape the room) during intervention, Grant’s mother had noted that on those particular days he appeared to be very sleep deprived. For some sessions, she noted that he had been woken up from his nap to participate in the sessions. She also noted that often adjusted to new routines (such as coming to a new weekly session) very slowly and was often very tired during the time the sessions began, as he had just started attending a full-day pre-K program just before the study began.

Qualitatively, it was noted by the researcher that the topography of Grant’s inappropriate behaviors was very different from that of Gavin’s, despite the fact that they are twins. Anecdotally, on most occasions, when the twins arrived for their sessions, Grant would engage in externalizing behaviors such as aggression, negative affect (crying), and would often attempt to escape the room. Grant’s mother explained that he may be less willing to come with the researcher to the session if he was the second twin to participate in a session, given that he would often begin playing with toys while he
waited, and he tends to react very negatively to transitioning away from preferred
activities/toys. Grant and Gavin’s mother noted that Gavin often transitioned much
easier. Additionally, it was noted by researchers that the topography of Gavin’s problem
behaviors were much different than Grant’s in that Gavin did not engage in aggression
or overly negative affect. Therefore, the twins’ mother often suggested that Grant
participate in a session first. This may have contributed to his engagement in
challenging behaviors during the first few sessions of each phase given that he had to
leave a room where he had seen his twin brother begin to play with toys. However,
given that he would likely engage in more serious challenging behaviors if he was asked
to transition from waiting with toys in the waiting area in order to participate in a session,
it was deemed that this order was often more appropriate.

Caregiver Report of Social Skills and Problem Behaviors

Caregiver report of social skills and problem behaviors administered pre-
intervention and post-intervention indicated mixed results. For two of the participants,
Rob and Carli, parents noted either stable or improved social skills and problem
behaviors. For the other two participants, the twin brothers, the caregiver noted that
social skills/problem behaviors did not improve from pre- to post- intervention. While not
clinically significant, she reported a slight decrease in raw scores in these areas. In
reviewing previous studies targeting social skills in autism, there have been studies that
result in improved dependent outcomes, but no observed change on parent reported
social behaviors (Gevers et al., 2011; Castorina & Negri, 2011). These results may
indicate that the skills measured in the present study did not generalize from the clinical
setting to a more naturalistic study, or from the therapist to a parent. However,
generalizing such skills to a parent would not yet be expected, as parents were not
included in a parent training component, nor were instructions of how to mirror children shared with caregivers. This was done in order to measure the implementation of mirroring in strictly clinical setting; perhaps a next step involving parent training or mirroring within a more naturalistic environment may be appropriate (see section on implications for future research). Finally, another possible explanation for these findings on parental report of social skills is that the particular instrument used (SSIS) may not be sensitive to change in such a limited time frame.

**Theoretical or Conceptual Implications of Findings**

The findings of the current study have theoretical implications for the mirroring research within the DMT field literature, as well as for autism research and literature within the field of psychology. In regard to the mirroring other DMT-based literature, the current study demonstrates the utility of a mirroring-only intervention in increasing young children with autism’s social engagement. Previous DMT-based literature lacked studies that focused solely on mirroring (e.g. studies investigated effects of “dance therapy” which mirroring may have been one component of) or studies did not appropriately and accurately describe the intervention that was implemented. There have been many reports in the past of mirroring and movement-based therapies increasing social outcomes for children with outcomes, but such studies were largely descriptive in nature, and did not quantify or directly measure outcome variables or effects (Adler, 1970; Cole, 1982; Siegel, 1973; Torrance, 2003). In contrast, the current study measured the results of a specific, well-described intervention implementing only mirroring in a quantifiable, repeated, systematic way.

Two studies to date attempted to quantify the results of a DMT-based intervention for autism. Hartshorn et al (2001) did quantify the results of an intervention
based on DMT using a group design (group by repeated measures MANOVA), but this study did not define or explain the actual sessions in a detailed or replicable manner. Further, as autism is a heterogeneous, spectrum disorder with varying abilities and needs, a more individualized design may be more appropriate to account for individual change and clinical utility. A second study by Koch and colleagues (2014) conducted a group design study to measure the effects of a DMT-based intervention on mirroring with adults with ASD. One limitation with this study was that the only outcome measure was a self-report scale, completed by participants with ASD who have known decreased self-awareness. This scale was not validated or standardized. Additionally, the study employed many techniques of DMT, not solely mirroring. Therefore, it was not possible to attribute changes demonstrated in this study solely to mirroring. The current study addressed the gaps left by these two studies within the field by providing the results of a mirroring-only, well-described intervention on children with ASD using objective outcome measures.

**Implications for Future Research**

The primary researcher found positive effects of the intervention on the social engagement behaviors of young children with ASD. Thus, the results along with the limitation of the current study provide implications for future research. First, the study’s findings should be replicated with a larger group of individuals with ASD, and perhaps with higher levels of language or verbal skills. These studies may provide additional information for individuals who make up the autism spectrum with different ages, skills, and ability levels. This may also assist researchers in identifying any subgroups of ASD that may be more or less responsive to this type of intervention. For example, children
with ASD who engage in severe problem behaviors may respond better than children who are simply socially passive.

Second, the utility of this intervention in combination with other agents of change should be explored. For example, researchers should train parents to mirror their children with ASD effectively, and analyses should explore how children respond to a parent-implemented mirroring intervention. Given that results of the current study indicate positive change in social engagement behaviors within a clinical setting, it may be that parents who implement a similar approach within a home setting could see similar results. From there, the research could be replicated with other agents of change (siblings, teachers, peers, etc). The current study did not explore a parent component specifically because it is important to be properly trained in mirroring and requires a specific skill set. However, with extensive training components, future studies could provide such skills to parents in order to measure such effects.

Thirdly, additional outcomes of the intervention could be examined. For example, other skills related to social engagement could be measured (such as responding), or imitation skills could be specifically measured, or problem behaviors, etc. Additionally, future studies should focus on objectively and directly measuring how skills of the intervention generalize to other people, other settings, and other skills. Equally important, future research should also measure how well such skills are maintained after the intervention has commenced.

In summary, future researchers should focus on four areas. First, the findings should be replicated with a larger group of children with ASD with more diverse characteristics. Second, the intervention should be examined with various change
agents (e.g. parents, teachers, siblings, peers). Third, the effects on additional outcomes should be examined. Fourth, future studies should objectively measure generalization and maintenance of skills while implementing the intervention.

**Implications for Clinical Practice**

In addition to future research implications, the current study has implications for practice. Researchers have previously demonstrated that imitation skills in children with ASD are a precursor for language skills and other social engagement skills (Charman, 1997; Ingersoll, 2008; Rogers et al., 2003). Additionally, researchers have demonstrated the effectiveness of parents imitating children (Ingersoll & Schriebman, 2006). However, researchers of the mirroring literature have not demonstrated effectiveness by natural change agents in natural environments, such as within a home or school setting. This study provides some evidence that using mirroring techniques may be effective in increasing social engagement in children with ASD. This study provides evidence that clinicians, medical teams, or teachers, or other professionals may utilize mirroring techniques within their own practices in order to increase the likelihood that children with ASD will socially engage with them. For example, some clinicians may find some young, minimally verbal children with ASD particularly challenging to engage in order to assess. This study provides evidence that it may be useful for such clinicians to take time to mirror the behaviors, movements, emotions, expressions, and tones of children with ASD in order to engage them socially to be able to proceed with tasks. Professionals may find this technique useful in a number of settings when attempting to engage children with ASD in order to teach, interact, or request.
Limitations

There are several limitations of the current study that should be addressed. The study was conducted using a multiple baseline design, which is often described as having multiple advantages as well as disadvantages. First, the small sample size may limit the external validity of this study (Kazdin, 1982). All four participants had a diagnosis of autism; thus, it is unknown whether the study’s findings could be replicated with children who have other diagnoses similar to autism (e.g. PDD-NOS, Asperger’s syndrome) or if the findings could extend to a larger sample of children with autism. Further, the study included only young children with minimal verbal skills; one cannot be certain that the findings would extend to older children with more advanced verbal skills. Furthermore, all of the participants and their families lived in north central Florida, creating a geographic limitation and potential limitation to generalizing results to non-represented populations. Additionally, the four participants were comprised mostly of individuals of Caucasian descent (3 of the 4 participants), and one of Hispanic background. Therefore, the findings of this study may not necessarily generalize to children of other various racial backgrounds.

Another important set of limitations to address involves the study conditions. This study was completed with one therapist completing baseline and intervention sessions, and the primary researcher coding all outcome measures for each phase. While IOA was collected with a second observer to decrease bias or observer drift, neither observers were blind to which phase the participants were in (due to the nature of the intervention). Thus, researcher/observer bias cannot be completely controlled for. Given the lack of people to participate as researchers, no naïve observers of outcome measures were utilized in the study.
Another limitation of note is related to the generalizability the current study. First, the study did not evaluate the extent to which social engagement skills were generalized within a similar setting to another therapist. While measures were taken pre- baseline and post-intervention on parents’ perception of social skills and problem behavior within the home, the study did not include a measure of social engagement skills as measured within the current study (through direct behavioral observation) in other settings (such as home or school). Overall, it is well-documented within the literature of autism research that generalizability of targeted behaviors within a clinical setting to other naturalistic settings is limited (Campbell, Herzinger, & James, 2008; Ingersoll, 2008; Ingersoll, 2010). Therefore, it is somewhat expected that skills targeted in the current study may not naturally generalize to other social partners or settings; this is a point to be considered for future research directions for mirroring studies in more naturalistic settings. Additionally, the duration of the current study from baseline to intervention (ranging from 10-16 weeks) may not have been sufficient enough to detect meaningful change in social functioning on the SSIS.

A final limitation relates to time constraints. Many treatments for children with ASD are very time intensive and last from a few months to several years that are more likely to positively impact social functioning (Rogers & Vismara, 2008). The current study only lasted a range of 10-16 weeks throughout both baseline and intervention for participants. Due to parent and participant time constraints (e.g. busy schedules with other therapies, school, parent work schedules and job requirements), participants only received the intervention once weekly for a very short time (actual mirroring only occurred for 10 minutes per session). It may true that with more frequent sessions per
week, participants may have shown even more positive changes in social engagement behaviors. Additionally, maintenance data was not collected after treatment phases ended given families’ and researchers’ time constraints (e.g. school years ending, vacations began, schedules of families changed). Therefore, this study cannot report on how well the participants’ results could have maintained post-intervention phase.

**Summary**

Previous anecdotal reports have described the effectiveness of mirroring techniques with children with ASD, specifically on social engagement behaviors. However, no researchers have quantified such results in a systematic, objective manner. The studies that have sought to quantify results have done so with poorly-described, general “DMT-based” interventions rather than specifically with mirroring techniques. The current study extended the literature in this area and addressed the limitations of past studies. Similar to past reports, the current study’s results demonstrate that social engagement behaviors of children with ASD increase when a therapist mirrors utilizes mirroring techniques. It also extended the mirroring literature by focusing solely on young children with autism with limited verbal skills. Additionally, adherence to treatment was measured objectively.

In addition to extending the DMT literature, the current study also extended the imitation literature. Similar to previous autism research, this study demonstrated the effectiveness of mirroring/imitating children in order to increase social engagement. In contrast, the current study solely examined the effectiveness of a mirroring technique with no direct verbal commands or requests of the children with ASD. Especially of note, the current study does not require time-intensive implementation that may hinder generalizability and maintenance; each session consisted of 10 minutes of intervention.
implementation without any direct instructions or teaching trials for the children participating.

The current study contributes to research and practice because it adds to the DMT/mirroring and imitation in autism literature by demonstrating that an intervention solely implementing mirroring techniques results in positive change in quantifiable, objectively-measured social engagement behaviors when implemented with fidelity. Additionally, there is a notable gap in the literature on autism interventions with minimally-verbal children, as the majority of the research tends to target “high-functioning” children with ASD (Kasari & Patterson, 2012). This contributes to clinical practice because the study demonstrates the utility of mirroring young, minimally verbal children with autism, which may be useful in order to socially engage children in a wide range of clinical and professional settings. In conclusion, the implementation of a mirroring technique by a therapist within a clinical setting led to an increase in social engagement behaviors.
APPENDIX A
CLINICAL INTERVIEW FORM

Name:
Sex:
Handedness:
Age:
Grade:
Parent(s) name(s):
Number one concern:
Prenatal/Perinatal
GA ________  Weight  Length
Pregnancy Complications? Prenatal care?
Substance use (alcohol, cigarettes)
Delivery:
Hospital stay:
Infancy
Breastfed?  How long?
Illnesses:
Hearing Screen:
Eating:
Temperament:
Milestones:
Sit __________  Crawl ________  Walk ________  Talk ________
Toileting ________
Early Steps/Child Find/Early Intervention Program?
Preschool
Daycare or preschool classes?
  Behavior
  Concerns

Early Childhood to Current
Illnesses:
Vision test:
Medical concerns (ask RE: HI, LOC, “concussion”):
Medications:
School:
  School name (public or private)
  Grades
  IEP?
  Teacher concerns
Sleeping:
Eating:
Therapies:
  OT
  PT
  Speech
Emotional/Psych:
Friends
Extracurricular activities
General mood
Strengths

Play Behavior:

Family History:

Who is in the household:

Parent Education and occupation

Siblings (name/age)

Medical problems

Learning problems

Psych problems

ASD Sxs:

Communication:

Point
Gesture
Echolalia
Canned phrases

RRBs:

Repetitive motor
Rituals/Compulsions

“just so”

Transitions

Other:

Clumsy
Toe walking

Sensory issues (sounds, textures, temperatures, lights, etc.)

Eating

Regression?:

APPENDIX B
CODING MANUAL

Level 1: Child Behaviors
• Child Social Engagement Behaviors
  o Vocal initiations
  o Nonvocal initiations
  o Vocal responses
  o Nonvocal responses
  o Gaze
  o Positive Affect
• Child Imitative Behaviors
  o Motor imitation
  o Vocal imitation
• Child Inappropriate Behaviors
  o Negative affect
  o Escape
  o Stereotypy/Self injury

Level 2: Adult Behaviors
• Adult social behaviors
  o Vocal initiations
  o Nonvocal initiations
  o Vocal responses
  o Nonvocal responses
• Adult mirroring
  o Mirroring/Attunement
• Opportunities to Imitate
  o Motor behavior initiation
  o Vocal behavior initiation
  o Object behavior initiation

Social Code Definitions
Level 1: Target Child Behaviors
Child Social Engagement Behaviors
• **Vocal initiations:** Vocal initiations are defined as acts in which the child directs a verbal behavior toward the adult to elicit adult attention, gain access to objects, request to join an activity or movement, attempt to initiate play with adult (e.g. with an object) provide assistance, or request assistance, makes a comment, asks a question, or elicits attention from adult to show/give objects/places/things; initiates physical contact (e.g. a hug). Must be done in neutral or positive tone. Coded as frequency.
  o **Examples:**
    ▪ Child says “hi”
    ▪ Child says “toy” to request object
• Child says “help” to request assistance
• Child asks “Play?”
• Child says “please”
• Child says “block”
• Child laughs toward adult

  o **Non-Examples:**
    • Child looks at examiner, but does not vocalize
    • Child watches therapist play/move/dance but does not join/vocalize (code as passive engagement)
    • Child gestures to give a high-five (code as nonverbal initiation)
    • Child cries (not in neutral or positive tone- code under negative affect)

• **Nonverbal initiations:** acts in which the child directs a gestural behavior toward the adult to elicit adult attention, gain access to objects/activities, request to join an activity or movement, provide assistance, or request assistance or elicits attention from adult to show objects/places/things. Paired with neutral or positive affect (e.g. not frowning or throwing/ not aggressive) Coded as frequency. NOTE: if child pairs verbal initiation with nonverbal movement/gesture, code under verbal initiations.

  o **Examples:**
    • Child waves “hi” to therapist
    • Child hands object to therapist
    • Child points to object to request it
    • Child points to the therapist
    • Child holds out hand with palm open to request object
    • Child initiates high –five with therapist by holding up hand

  o **Non-examples:**
    • Child picks up object, plays with it on own, without orienting toward therapist
    • Child watches therapist play/move/dance, doesn’t join/gesture (code as passive engagement)
    • Child says “please” (code as vocal initiation)
    • Child throws object toward therapist while frowning (Code as inappropriate behavior)

• **Vocal responses:** acts in which the child engages in a verbal behavior to acknowledge an adult initiation **within 5 seconds** of that initiation. Tone must be neutral or positive, not paired with negative affect. Includes laughter in response to adult initiation. Excludes imitative responses (e.g. child repeats what therapist says- that would be coded as vocal imitation instead). Coded as frequency.

  o **Examples:**
    • Therapist holds out object and child walks toward therapist and says “thanks”
▪ Therapist says “what do you say?” Child responds “please”
▪ Therapist asks “what do you want to do?” Child responds “play.”
▪ Therapist asks “what do you want to play?” Child responds “blocks.”
▪ Therapist says “I’m having fun!” and child laughs in response

  o Non-examples:
    ▪ Therapist says “hello!” and child does not respond
    ▪ Therapist says “you do it!” and child says “you do it!” (code as vocal imitation)
    ▪ Therapist says “hello!” and child screams “no!” (coded as inappropriate behavior)
    ▪ Child cries (coded as inappropriate behavior)

• Nonverbal responses: acts in which the child engages in a gestural/motor behavior to acknowledge an adult initiation within 5 seconds of that initiation. Must be done with neutral/positive affect (e.g. not while frowning). Coded as frequency.
  o Examples:
    ▪ Therapist asks child “what do you want to play?” and child points to object
    ▪ Therapist says “hello!” and the child waves back
    ▪ Therapist asks “can you hand me that block?” and child hands therapist the object
    ▪ Therapist asks “where should I go?” and child points to an area
  o Non-examples:
    ▪ Therapist says “hello!” and child does not respond
    ▪ Therapist says “you do it!” and child repeats “you do it!” (code as vocal imitation)
    ▪ Therapist says “hello!” and child frowns and shakes head ‘no’ (code as negative affect)
    ▪ Child throws object after therapist asks “how are you?” (code as inappropriate behavior)

• Positive Affect: child displays positive emotions through gestural or vocal means, such as clapping, laughing, smiling. These are instances in which the children are expressing positive affect or enjoyment. Coded as duration.
  o Can be vocal includes vocalizations that express positive affect or enjoyment such as laughter, squealing while smiling
    ▪ Note: if squealing while smiling, is around play/enjoyment, not squealing to narrate play (e.g. “squeeeeeeal eeeeh eeeeh! While bouncing bean bag alone in corner).
  o Can be nonvocal: includes gestural/ non-verbal behaviors displaying positive affect such as smiling, clapping
- **Gaze** is coded when eye contact or visual gaze is directed toward the adult for at least 2 seconds. Gaze will be coded when the child gazes at the adult’s body and/or face and/or eyes. See examples of each below:
  (Coded as duration)
  - **Gaze at body**: the child directs visual gaze at the child’s body (without looking at the adult’s face or eyes) for at least 2 seconds
  - **Gaze at face**: the child directs eye contact/visual gaze toward the adult’s face and/or eyes for at least 2 seconds
    - *Examples:*
      - Child watches adult engage in movement (body gaze)
      - Child stops moving and glances at therapist’s face/eyes (face/eye gaze)
    - *Non-examples:*
      - Child looks past the therapist at the wall while movement occurs (passive engagement)
      - Child stares at floor
      - Child does not direct gaze at therapist at all, although is engaged in movement
  - **Non-examples:**
    - Child watches therapist’s ribbon waving while waving own ribbon also
    - Child looks beyond the therapist at the wall, does not move or engage with objects
    - Child stacks blocks, and initiates to therapist by pointing

**Child Imitative Behaviors**
- **Motor/object imitation**: the child imitates all or part of therapist’s action with an object and/or gestures and/or movements within 10 seconds of being modeled by the therapist. (Note: the child may imitate the motor movement with a different object, the same object, or no object.) Code as frequency.
  - **Examples:**
    - (Therapist spins in a circle), Child starts to spin within 10 seconds of the therapist
    - (therapist waves ribbon up and down 4 times), Child waves ribbon up and down at least once
    - (Therapist claps hands 5 times), Child claps hands at least once
    - (Therapist stomps feet 4 times), Child stomps feet at least once
  - **Non-examples:**
    - (therapist spins around in circle), Child watches therapist for 10 seconds and about 40 seconds later spins once
- (Therapist rolls ball on ground), Child picks up ball and throws toward wall

**Vocal imitation:** when the child imitates all or part of adult’s speech *within 10 seconds* of the adult’s model with neutral or positive tone/affect. Code as frequency.
  - **Examples:**
    - (Therapist says “happy!”), Child repeats all or at least one syllable of “happy” or approximates the word within 10 seconds
    - (Therapist says “my name is Susan”) Child repeats “Susan” once within 10 seconds
  - **Non-examples:**
    - (Therapist spins in circle and says “weeeee!”), Child spins in circle (and doesn’t vocalize “weeee!”)
    - (Therapist says “spinning!”) Child yells “NO SPINNING” with frown (code as negative affect)

**Child Inappropriate Behaviors**

*Note: If a child is engaged in any inappropriate behaviors, do not code other behaviors (e.g. gaze, initiations, positive affect)*

- **Negative affect:** nonaccidental verbal or gestural behavior with the potential to cause harm to people or objects. Includes throwing objects toward others, destroying others’ objects/structures, yelling, hitting, or other negative statements/behaviors. Also includes non-physical forms of aggression such as facial expressions and body posturing (e.g. frowning, crossing arms, lying on floor face-down) Code as duration.
  - **Examples:**
    - Child lies on floor and cries
    - Child lies on floor face down, back to therapist
    - Child kicks legs up and down while lying on floor
    - Child throws objects at therapist
    - Child screams “NO!” and frowns
    - Child screams “LEAVE!” with arms crossed
    - Child says “no play” with arms crossed, frowning
    - Child stands against wall, not facing therapist, arms crossed
  - **Non examples:**
    - Child says “no thank you” in neutral tone with no negative body posturing
    - Child says “Not playing” while smiling
    - Child rolls on floor laughing/smiling

- **Escape:** Child attempts to escape or leave room/area by running toward the door, standing by door, or attempting to touch door knob *for at least 2 seconds.* MUST be paired with neutral or negative affect, which can be
gestural or verbal, such as frowning, crying, yelling, or saying “no.” Code as duration.
  - **Examples:**
    - Child runs to door screaming “leave!”
    - Child stands by door for 3 seconds
    - Child pounds on door
  - **Non examples:**
    - Child runs around perimeter of room
    - Child runs and looks at door, doesn’t approach
    - Child touches doorknob while looking at adult and smiling and/or laughing and making eye contact

- **Stereotypy/Self-Injury:** Target child engages in repetitive, stereotyped movements or self-injurious behaviors *for at least 3-seconds*, while not engaged in imitation, initiations, or responses. Coded as duration.
  - **Examples:**
    - Child is hand flapping while walking
    - Child is banging head with hand
    - Child is scratching arm repetitively
    - Child is banging head against wall
  - **Non examples:**
    - Child is hand flapping while smiling at therapist (gaze)
    - Child approaches therapist, imitates movement while repetitively vocalizing “eeee! Eeee! Eee!” (vocal initiation, gaze)

**LEVEL 2: ADULT BEHAVIORS**

**Adult Social Behaviors**
- **Vocal initiations:** as acts in which the therapist directs a verbal behavior toward the child to elicit attention, gain access to objects, request to join an activity, provide assistance, or request assistance. Includes laughter. Must be done in neutral or positive tone. Coded as Frequency.
  - **Examples:**
    - Therapist: “hello!”
    - Therapist: “This is fun!”
    - Therapist: “can I have the ribbon?”
    - Therapist laughs while child spins
  - **Nonexamples:**
    - Therapist waves hello (nonverbal initiation)
    - Therapist points toward an object (nonverbal initiation)

- **Nonverbal initiations:** as acts in which the therapist directs a gestural behavior toward the child to elicit attention, gain access to objects/activities, request to join an activity, provide assistance, or request assistance. Paired with neutral or positive affect (e.g. not frowning or throwing/ not aggressive). Coded as frequency.
Examples:
- Therapist waves hello
- Therapist points at object
- Therapist puts up hand for a “high five”

Non examples:
- Therapist says “hi!” (vocal initiation)

Vocal responses: as acts in which the therapist engages in a verbal behavior to acknowledge a child initiation within 5 seconds of that initiation. Tone must be neutral or positive, not paired with negative affect. Includes laughter in response to child initiation. Coded as frequency.

Examples:
- Child waves hello, therapist: “Hello!”
- Child points to an object, therapist says “blocks?”
- Child says “fun!” Therapist says “I know, fun!”

Nonexamples:
- Child waves hello, therapist waves back (nonverbal response)
- Child asks “here?” the therapist nods “yes” (Non verbal response)

Nonverbal response/motor response: acts in which the adult engages in a gestural behavior to acknowledge a child initiation within 5 seconds of that initiation. Must be done with neutral/positive affect (e.g. not while frowning). Coded as frequency.

Examples:
- Child points to an object, therapist claps in response
- Child waves hello, Therapist waves back in response
- Child says “play?” therapist points to an object in response
- Child asks “can I dance?” therapist nods head ‘yes’

Non examples:
- Child says “hello!”, therapist does not respond
- Child waves “hello,” therapist says “hello” back (verbal response)

Adult Imitation Initiation Behavior

Opportunities to Imitate

Motor/object Opportunity to Imitate (OTI): adult engages in a motor behavior (e.g. a gesture) with OR without an object that the child has an opportunity to imitate. (Note: NOT dependent on whether child takes opportunity to imitate.) (NOTE: not mutually exclusive from nonverbal initiations). Coded as frequency.

Examples:
- Therapist picks up block, stacks.
- Therapist rolls ball on floor
- Therapist jumps up and down
- Therapist claps hands
- Therapist spins in circle
- Therapist waves ribbon
- Hands child object (code nonverbal initiation and Motor/object OTI)

**Nonexamples:**
- Therapist says “hello” (code as vocal initiation and vocal behavior initiation)

**Vocal Behavior/ Opportunity to Imitate (OTI):** adult engages in a vocalization which the child has an opportunity to imitate. (Note: NOT dependent on whether child takes opportunity to imitate). (NOTE: not mutually exclusive from vocal initiations- can code both). Coded as frequency.

**Examples:**
- Therapist says “ball.” When playing with ball
- Therapist says “Having fun!” (coded as vocal initiation and vocal OTI)

**Non examples:**
- Therapist claps hands (nonverbal response and motor OTI)
- Therapist points (nonverbal response and motor OTI)

**Tx Integrity Coding Manual**

Did the adult mirror at least 75% of the intervals? This code is based on partial interval recording. To code this, watch video for 10 seconds, then code whether or not adult mirroring occurred in that interval. Definition of code:

**Adult Mirroring Behaviors**

- **Adult mirroring/attunement:** therapist embodies shape, form, movement qualities, and feeling tone of child’s actions within 5 seconds of being modeled by the child; OR therapist matches particular quality of child’s movement, while not completely mirroring entire shape, form, attitude, rhythmic aspects; OR a characteristic of the action is displayed, but may occur with a different body part, spatial attention, or intensity. Coded as duration.

Then, calculate how many intervals out of total intervals mirroring occurred. If less than 75%, check “no,” if over 75% of intervals, check “yes.” *specify what percentage of intervals
APPENDIX C
SOCIAL VALIDITY QUESTIONNAIRE

Video:
Rater:

Questions: After viewing the 5-minute clip, please highlight your answer to the following. The Likert scale is as follows: 1 (not at all) to 5 (very much).

1. How often did the child attempt to engage socially with the therapist?
   Not at all       Very much
   1               2               3               4               5

2. What was the overall quality of the interactions between the child and the therapist?
   Not at all       Very much
   1               2               3               4               5

3. Do you think the child enjoyed interacting with the therapist?
   Not at all       Very much
   1               2               3               4               5
LIST OF REFERENCES


BIOGRAPHICAL SKETCH

Kaycee Reese was born and raised in Ocala, Florida. She attended the University of Central Florida where she earned a Bachelor of Arts degree in psychology and Bachelor of Science degree in political science in 2011. Kaycee was then accepted to the doctoral program in school psychology at the University of Florida which she began in 2011. She earned her Master of Education in school psychology in 2014. She earned her Doctor of Philosophy degree in school psychology in summer 2017 after completing an APA-accredited doctoral internship at the Johns Hopkins School of Medicine/Kennedy Krieger Institute in Baltimore, Maryland. In fall 2017, Kaycee will begin a 2-year postdoctoral fellowship in pediatric neuropsychology at Massachusetts General Hospital/Harvard Medical School in Boston, Massachusetts.