FACILITATING *INITIATING JOINT ATTENTION* IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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A dissertation submitted to the Discipline of Speech Pathology and Audiology, School of Human and Community Development, Faculty of Humanities, University of the Witwatersrand, Johannesburg, in complete fulfilment of the requirements for the degree M.A. Speech Pathology by dissertation

Johannesburg, 2009

DECLARATION

I declare that this dissertation is my own unaided work. It is submitted for the degree of Masters in Speech Pathology by dissertation at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination in any other university.

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29th day of October, 2009.

ABSTRACT

Background: Joint attention (JA) is selectively and pervasively impaired in children with autism spectrum disorders (ASD) and has been found to link to later outcomes in language, theory of mind, play and social development. This study investigated the effectiveness of a social interactive intervention to improve initiating JA skills in children with ASD. The intervention was based on the mirror neuron hypothesis, in that techniques used encouraged the children to take on their communication partners' perspective through a process of embodied simulation. **Method:** Three participants diagnosed with ASD, under the age of 5, were recruited as well as 3 typically developing children for the setting of training criteria. A multiple-baseline design across participants was implemented. **Results:** All three participants displayed improvements in their ability to initiate JA. Skills generalized to other settings and communication partners. Improvements were observed by both trained and naïve observers. **Conclusions:** A social interactive model, based on the mirror neuron hypothesis, utilizing specific techniques which follow the child's lead may be used to effectively improve initiating joint attention (IJA) in some children with ASD.

Keywords: Joint attention; autism; mirror neurons; embodied simulation; intervention; social interactive approach; undemanding talk; linguistic mapping; contingent imitation; object interest

ACKNOWLEDGEMENTS

Dr Nola Chambers, for all your valuable input, guidance and patience, without which none of this would have been possible.

Organization for Autism Research, for financial assistance in completing this project.

The Key School and parents of the participants, for allowing me to engage with your children for the purpose of this study and for your valuable continuous input in monitoring the children's progress.

The staff at The Centre for Language and Hearing impaired Children, for all your academic input and emotional support.

My family and friends for all your emotional support, patience and words of encouragement.

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LIST OF ABBREVIATIONS

ASD	Autism Spectrum Disorder
JA	Joint Attention
IJA	Initiating Joint Attention
RJA	Responding to Joint Attention
TD	Typically Developing
DSM	Diagnostic and Statistical Manual of Mental Disorders
APA	American Psychological Association
CSBS	Communication and Symbolic Behaviour Scales
IQ	Intellectual Quotient
INP	Initial Neuropathological Process
SND	Secondary Neurological Disturbances
DTT	Discrete Trial Training
PRT	Pivotal Response Training
SP-D	Social Pragmatic Developmental
TMS	Transcortical Magnetic Stimulation
MEP	Motor Evoked Potentials
PET	Positron Emission Tomography
fMRI	Functional Magnetic Resonance Imaging
TPJ	Temporo-parietal Junction
ST	Simulation Theory
OFC	Orbito-frontal Cortex
STG	Superior Temporal Gyrus
P1	Participant 1

P2	Participant 2
P3	Participant 3
IOA	Interobserver Agreement
SLP	Speech-Language Pathologist

CHAPTER ONE

INTRODUCTION TO JOINT ATTENTION

Typically developing children often share their interests with others. By sharing their experiences about objects or events they are engaging in joint attention (JA) with others. There are many definitions of JA; one is that JA is a mutual mental focus between participants for the sole purpose of shared experience (Paparella & Kasari, 2004). This shared attention is vital for language acquisition, and has been concurrently and predictively linked to language ability in both typically developing (TD) children and children presenting with autism spectrum disorders (ASD) (Jones & Carr, 2004). In addition, due to the fact that social motivation is thought to underlie JA, the emergence of JA is proposed to indicate the emergence of social understanding (Jones & Carr, 2004), and has been linked to levels of social interaction competence (Travis, Sigman & Ruskin, 2001). JA is also proposed to be a necessary precursor in the development of theory of mind (Wilde Astington & Barriault, 2001).

Children with ASD present with deficits in all the above-mentioned areas, namely language acquisition, social interaction and theory of mind, as well as a marked deficit in the development of JA. Recently, JA has been described as the link in these areas of deficit (Whalen & Schreibman, 2003). Furthermore, children with better JA skills have been found to derive more benefit from intervention (Bono, Daley & Sigman, 2004). Interventions are typically embedded in interactions between the child and interventionist. These interactions usually relate to an object, symbol or individual and attempt to facilitate the child's

interaction with the external point of interest through JA (Bono et al. 2004). Therefore, JA may be described as a prerequisite for more successful intervention outcomes and language learning. In order to provide a context and rationale for this study, the following review describes the development of JA in TD children and children with ASD. It also emphasises the significance of JA skills for later outcomes, as well as previous intervention efforts for improving JA skills in children with ASD.

Development of joint attention in typically developing children

JA involves two or more participants actively sharing attention related to an object or event and monitoring one another's attention. This may take one of two forms, namely responding to joint attention (RJA), that is the child adopts another's point of focus by following their gaze, point or comment, or initiating joint attention (IJA), that is the child directs another's attention to share their point of focus through the use of gesture, gaze shifts or commenting (Jones & Carr, 2004). IJA can be defined as a type of communicative act, which means it is an intentional behaviour, with the aim of drawing another's attention to an external event of object, which takes the form of a gesture, vocalization or verbalization, directed towards another person and which serves a communicative function (Wetherby & Prizant, 2002).

Initially acts of JA take place between infants and caregivers and later occur between peers. JA emerges from 6 months of age when interactions between the infant and caregiver start to make reference to external objects and events. Towards the age of 6 months an infant will begin to *respond* to the adult's

attention directive, that is he/she will begin to follow their caregivers gaze or point. As the infant approaches 9 months, once he has followed the adults' gaze or point he will begin to "check back" with his caregiver, shifting his gaze between the object of interest and caregiver. This *gaze alternation* is to ensure that the child and caregiver share the same focus point (Morales, Mundy, Delgado, Yale, Messinger, Neal & Schwartz, 2000; Morales, Mundy & Rojas, 1998). At this point the infant also typically begins to *initiate* joint attention, initially by alternating their gaze between the adult and the object of interest. Soon after, infants begin to share attention more actively through the use of gestures, including showing or pointing, before incorporating vocalization with the nonverbal behaviours in order to draw a communicative partner's attention to an object or event of interest. By 24 months, children have developed proficient JA skills; namely referential looking, attention following and declarative gestures, which allow them to engage in interactions about their surroundings with others (Carpenter, Pennington & Rogers, 2002).

Communicative acts for JA may be conveyed using a variety of means, or forms. These include; (a) *Gaze shifts:* Shifting eye gaze between a communication partner and a point of interest and back (i.e. partner-object-partner or object-partner-object); (b) *Gestures: Conventional gestures* (gestures with common meaning, including giving, showing, reaching or pointing) may be *distal* (gestures in which the child's hand does not actually come into contact with their communication partner or object of interest) or *contact*; (c) *Verbal communication:* The use of vocalizations (the production of voice in the absence

of discernable words) or verbalizations (the use of words and sentences) (Wetherby & Prizant, 2002).

Tomasello (1988) proposed that the development of JA and language is a *transactional* process, in that the child initially engages in nonlinguistic JA routines with an adult which facilitates the early acquisition of referential labels. This language is then used by the child as another device for more complex acts of IJA.

Bakeman and Adamson (1984) proposed six categories or levels of engagement, the highest of these being *coordinated JA*. These levels are as follows; (a) *Unengaged*: The child does not appear concerned with any person or object in the environment. (b) *Onlooking:* This is the beginning of dyadic interactions, the child watches another person actively but does not engage with that person. (c) *Persons:* The child is engaged, but only with another person. This would involve face-to-face or person play. For example, when a child laughs his caregiver may go closer to him and touch or imitate him, he may then reach for the caregiver. This is a vital prerequisite for the development of coordinated JA, as from birth infants preserve a state of silent attentiveness within a social context and even though the child does not introduce specific communicative acts into these moments, he or she is receptive to the social interaction. (d) *Objects:* The child is preoccupied with only an object and attends to the object at hand solely. (e) *Passive/supported joint engagement:* This is the onset of triadic interactions. The child and caregiver actively attend to the same object, however, the child is unaware of the caregiver's involvement. Caregivers often attempt to facilitate passive joint engagement by manipulating toys, for example shaking a rattle in

front of the infant. During this time the child's communication partner carries most of the burden of ensuring the shared focus is maintained. This is another prerequisite for the development of coordinated JA, that there be a shared point of focus. (f) *Coordinated joint engagement:* The child purposefully attends to another person as well as the object at hand. For example a child takes a toy which their mother has been engaging them with then coordinates their gaze back and forth between their mother and the toy. The emergence and consolidation of coordinated JA is a pivotal point within a child's communication development.

Bates, Camaioni and Volterra (1975) described JA as the use of an external stimulus to attract the attention of one's communication partner, therefore, JA serves a social function. JA thus requires an awareness of one's surroundings and motivations to share points of interest with others (Mundy, 1995). This social function differentiates JA from other communicative acts, particularly behaviour regulation. Even though both IJA and behaviour regulation may involve similar means, or forms of behaviour, such as gaze alternation and the use of conventional gestures to coordinate attention between one's self, an external stimuli and one's communication partner, the differentiating feature is the function of the act.

JA serves an indicative, or social function, whilst behaviour regulation serves an imperative function, namely, to gain access to an object or for assistance. The reinforcement for a request would be non-social, whilst the reinforcer (or resultant end product) for JA would be social interaction with one's communication partner. It is this social function that is the defining criterion for eye gazes, gestures and vocalizations to be classified as acts of JA (Jones & Carr, 2004).

Whilst both JA and social interaction serve a social function, it is the point of focus which distinguishes these two acts. An act for JA would serve to draw one's communication partner's attention to an external object or event, however, the function of social interaction would be to direct another's attention to ones' self (Wetherby & Prizant, 2002). An example of an act for social interaction would be when a child calls their parent to look at them at the top of the jungle gym.

Development of joint attention in children with ASD

Autism is a neurodevelopmental condition characterised by the early onset of pervasive deficits in social and communicative development (Mundy & Burnette, 2005). Manifestations of this disorder vary greatly depending on the developmental level and chronological age of individuals (American Psychiatric Association (APA), 2000). According to the Diagnostic and Statistical Manual of Mental Disorders (4th ed.) (DSM-IV, APA, 2000) there are three domains in which children must demonstrate symptoms in order to be diagnosed with ASD. These domains are listed in Table 1. Impairment in JA is listed as a core diagnostic impairment under the social domain and manifested by a "lack of spontaneously seeking to share enjoyment, interests, or achievements with other people (e.g. by a lack of showing, bringing, or pointing out objects of interest)". Thus, the development of JA skills in children with ASD has been documented as being selectively and pervasively impaired (Carpenter et al., 2002; Loveland & Landry, 1986), and is considered to be one of the first signs of ASD, often evident within the first year of life (Wetherby, Goldstein, Clearly, Allen & Kublin, 2003).

Table 1. Diagnostic criteria for ASD

A. A total of six (or more) of the items, with at least two of the items from (1), and one each from (2) and (3):
   (1) qualitative impairments in social interactions, as manifested by at least two of the following:
      a. marked impairments in the use of multiple nonverbal behaviours such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction
      b. failure to develop peer relationships appropriate to developmental level
      c. lack of spontaneously seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, brining, or pointing out objects of interest)
      d. lack of social or emotional reciprocity
   (2) qualitative impairments in communication as manifested by at least one of the following:
      a. delay in, or total lack of, the development of spoken language (not accompanied by any attempt to compensate through alternative modes of communication such as gesture or mime)
      b. in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
      c. stereotyped and repetitive use of language or idiosyncratic language
      d. lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level
   (3) restricted repetitive and stereotyped patterns of behaviour, interests, and activities, as manifested by at least one of the following:
      a. encompassing preoccupation with one or more interest that is abnormal in either intensity or focus
      b. apparently inflexible adherence to specific, non-functional routines or rituals
      c. stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole body movements)
      d. persistent preoccupation with parts of objects
B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.
C. The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (4th ed.) Text revision. (DSM-IV-TR).* APA: Washington, DC, p. 75

Deficits in JA are evidenced by difficulties in (a) orientating and attending to one's social partner; (b) alternating gaze between one's communication partner and objects or events; (c) sharing affect or emotional states with others; (d) tracking gaze shifts and/or points from others; and (e) the ability to draw another's attention to your point of focus (i.e., an object or event of interest) simply to share it with that person (Woods & Wetherby, 2003).

When compared to developmentally matched peers presenting with intellectual disability or specific language impairment, JA deficits have been found to discriminate 80-90% of preschool children with ASD, under 6 years of age, from other children with Down Syndrome, aged between 20 and 68 months (Lewy & Dawson, 1992). In comparison to other developmentally delayed populations, children with ASD initiate JA less often (Wetherby, Prizant & Hutchinson, 1998) and present with more difficulty in following gaze shifts and declarative gestures (Leekam & Ramsden, 2006). It must be noted, however, that children with ASD produce as many imperative, or requesting, gestures as other children, therefore the function of gesture used is vital to consider in terms of diagnosis (Leekam & Ramsden, 2006). Even though young children with ASD present with deficits in both responding to and IJA, their ability to RJA appears to improve as they develop, while difficulties in IJA appear to be more persistent (Mundy & Burnette, 2005).

Wetherby, Watt, Morgan and Shumway (2007) evaluated the social communication profiles of TD children, children with ASD and developmentally delayed children between the ages of 18 and 24 months using the Communication and Symbolic Behaviour Scales Developmental Profile (CSBS DP; Wetherby & Prizant, 2002) and found that whilst the TD children and children with developmental delay would communicate for JA, this was significantly less in the case of the children with ASD.

Sigman and Capps (1997) described three criteria which must be met in order to describe a deficit as being a core deficit; these being (a) specificity (i.e., the deficit should only occur characteristically in that specific disorder and no

other); (b) universality (i.e., the deficit should occur in 100% of the population presenting with that disorder); and (c) primacy (i.e., the deficit should be evident early on in the development of the disorder). From the above research it is evident that in children with ASD, all three of these criteria appear to be met in terms of JA, therefore, deficits in JA may be described as a core deficit in ASD.

Individual differences in joint attention

Typical infants demonstrate much individual variability in their ability to respond to and initiate JA (Mundy & Gomes, 1998). It is thought that these individual differences may be due to both intrinsic and extrinsic factors. Intrinsic, or endogeneous, factors may include the individual child's level of sociability, positive affect, temperament, emotional reactivity (Mundy & Burnette, 2005) and maturation of social-cognitive processing systems (Vaughan et al., 2003).

Predominant extrinsic, or exogeneous, factors include the infant's early social environment, specifically, parental sensitivity and ability to scaffold JA (Vaughan et al., 2003). Recent findings have suggested that individual differences in the emergence of JA, evident at approximately 9 months, were affected primarily by endogeneous factors, particularly emotional reactivity (Vaughan et al., 2003). However, as infants develop, exogeneous factors appear to become more dominant in relation to individual differences. Siller and Sigman (2002) found that in particular, the amount and quality of caregiver interactions appears to have a significant impact on the rate of development of JA after 9 months of age. They also found a correlation between the level of caregiver synchronization to their children's interest, at approximately 50 months of age, and their children's

JA skills and later language outcomes over a period of 1, 10 and 16 years. This study included 25 children with ASD, 18 children with developmental delay and 18 TD children.

The results of the Siller and Sigman (2002) study suggest that modifying the environment through early intervention may be critical in ensuring optimal development of JA skills in children who present with deficits in JA. This also suggests that an important shift occurs between the impact of neurological differences and the impact of the environment on the development of JA at a developmental age of 9 months (Vaughan et al., 2003).

Effects of individual differences in JA on later outcomes

Individual differences in the development of JA skills have been found to be a reliable predictor of later outcomes in a number of areas in TD children, children with ASD and children with developmental delays. Firstly, early skills in JA have been linked to later language outcomes. The ability to appropriately respond to other's JA bids is thought to reduce referential mapping errors during language acquisition (Mundy & Burnette, 2005).

As previously mentioned the development of JA and language is proposed to be a *transactional* process, where the child initially engages in nonverbal acts of JA with an adult, thus facilitating the initial development of early referential labels. These labels are then used as more complex devices for IJA (Tomasello, 1988). Therefore, JA routines foster a child's foremost development of referential labels (Tomasello, 1988). Similarly, when a child initiates JA, their caregiver is able to use such opportunities to introduce new semantic labels (Mundy &

Burnette, 2005). As a result, both responding to and IJA have been found to correlate with both concurrent and later outcomes in language development in TD children. More specifically, the ability to respond to JA as early as 6 months of age has been found to relate to later semantic skills (Markus, Mundy, Morales, Delgado & Yale, 2000; Morales et al. 1998) as well as later outcomes in receptive (Markus et al. 2000; Morales et al., 2000; Mundy & Gomes, 1998) and expressive language (Mundy & Gomes, 1998). In TD children, individual differences in their ability to initiate JA at a mean age of 14 months correlated significantly with expressive language abilities at three years of age (Watt, Wetherby & Shumway, 2006). JA also plays an important role in the development of conversational skills, as early JA routines facilitate the development of important skills for conversation including turn taking, topic introduction and maintenance, and cohesion (Tomasello, 1988).

JA skills have also been found to relate to the development of theory of mind. Charman, Baron-Cohen, Swettenham, Baird, Cox and Drew (2000) found that gaze alternation ability at 20 months was longitudinally associated with theory of mind ability at 44 months within a sample of TD infants. In addition, due to the fact that JA is a socially motivated act, it is believed to be the first indication of social understanding, and a prerequisite for the development of more complex social skills (Jones & Carr, 2004). A child's ability to initiate JA has been found to correlate with later social competence skills, namely their level of social engagement with peers within a natural context, and prosocial behaviour within a laboratory setting (Travis et al., 2001).

Similar themes have been recorded in at-risk populations. JA skills in premature and low birth weight infants have been found to correlate with later language development as well as verbal and nonverbal IQ at age 2, 3 and 5 years (Smith & Ulvund, 2003; 1998; Ulvund & Smith, 1996). Studies specifically investigating the implications of deficits in JA within the ASD population have also found correlations with later language outcomes (Bono et al., 2004; Mundy, Sigman & Kasari, 1990; Sigman & McGovern, 2005). Notably, Mundy et al. (1990) found that no other variables considered, namely nonverbal ability, mental age, or IQ displayed comparably significant correlations with language development compared to JA in 15 children with ASD, with a mean chronological age of 45 months. Thurm, Lord, Lee and Newschaffer (2007) found that JA and imitation skills in a group of children with ASD at the age of 2 years were the strongest predictors of language outcomes at 5 years of age. JA skills were most impaired in those children who had not developed language by age 5.

Greater ability to respond to JA in children with ASD has also been linked to better language gains in intervention, due to the fact that intervention is often based within relationships and interactions between the therapist and child and often related to external stimuli (Bono et al., 2004).

Deficits in JA in children with ASD have also been associated with poorer play (Sigman & Ruskin, 1999). If a child only engages with a limited number of toys in a few different manners the caregiver has fewer opportunities to initiate JA and provide labels for the child, again impacting on later language outcomes and JA development. This again highlights the transactional nature of the development of these interrelated skills (Yoder & McDuffie, 2006).

Deficits have also been linked to later emotional responsiveness (Sigman & Ruskin, 1999), most likely due to the fact that JA is the earliest form of perspective taking and therefore a prerequisite for skills such as empathy (Jones & Carr, 2004).

Disturbance in the development of JA in children with ASD has been thought to be related to physiological differences within the frontal lobe, which plays a significant role in the organization of behaviour as well as psychological processes related to attention, and higher-order problem solving involved in social-emotional interactions (Mundy & Crowson, 1997). Due to the manner in which the brain develops, Mundy and Crowson (1997) postulated that there may be a critical period in which to provide scaffolding in order to improve these organizational skills. Neurological development is an interactive process shaped by the external environment, particularly within the first few years of life. Mundy and Burnette (2005) proposed a "coactive model" of development (see Figure 1), which suggests that an interaction exists between early behaviour disturbances and later neurodevelopmental outcomes in children with ASD.

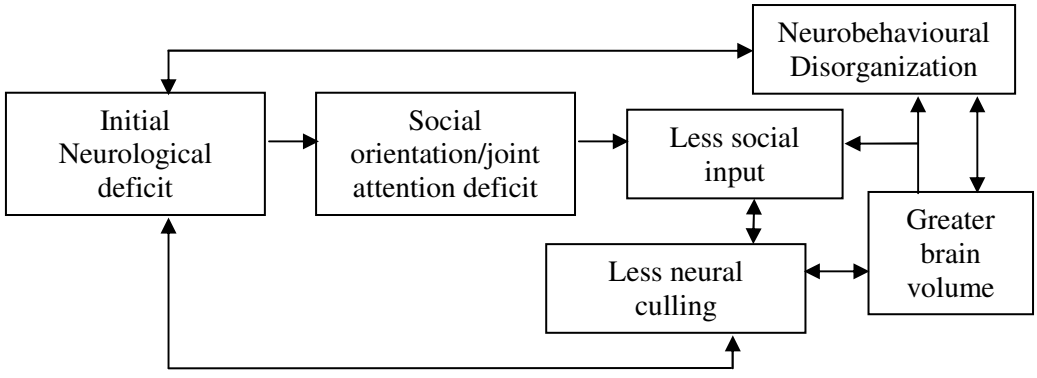

Figure 1. A coactive model of organism-environment interaction in the neurobehavioural development of autism in the first 6 years of life. Mundy, P. & Burnette, C. (2005). Joint Attention and Neurodevelopmental Models of Autism. In F.R. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.) *Handbook of Autism and Pervasive Developmental Disorders (Volume one).* (p. 659). Wiley: New Jersey

Within this model, neurological differences, the initial neuropathological process (INP), affects the child's ability to attend to and process social information. Within the early years of life, secondary neurological disturbances (SND) begin to develop as a result of interaction between the INP and environment, that is, the INP results in decreased responsiveness from the child which leads to a decreased flow of social information to the child, that is parents tend to respond less to the child and provide less social input. Without early intervention to change this cycle, the SND have an increasingly negative impact on the child's development. This model highlights the potential importance of early intervention in order to amplify social input and reduce the development of the SND (Mundy & Burnette, 2005; Mundy & Crowson, 1997).

The coactive model is supported by research findings emphasizing the significance of mother-child interaction on the development of JA (Vaughan et al., 2003; Markus et al., 2000). Siller and Sigman (2002) found that parents of children with ASD provided less synchronized verbalizations towards their child with developmental delays. Specifically, their utterances were often unrelated to their child's point of focus. Due to the impact of JA skills on early development, as well as the need for intervention within the critical period in order to reduce the impact of SND, early intervention for JA deficits in children with ASD is imperative (Mundy & Crowson, 1997).

CHAPTER TWO

PREVIOUS INTERVENTIONS TO FACILITATE THE DEVELOPMENT OF JA

In general, intervention efforts for children with ASD, including those specifically targeting JA, have fallen along a continuum from traditional behavioural to social-pragmatic approaches. In this chapter these approaches will be discussed and their defining characteristics, strengths and weaknesses highlighted.

Traditional behavioural interventions targeting JA have been based on discrete trial training (DTT). DTT is defined as a strategy to teach new skills in which a single method to increase the likelihood of a behaviour occurring is utilized so the desired response may be reinforced (Prizant & Wetherby, 1998). A trial refers to a "single teaching unit", which starts with the introduction of a stimulus or instructions by the interventionist, followed by the child's response and then a consequence or reinforcement for that response. The stimulus or instruction is only presented once and the child's response is described as correct, incorrect or absent. The subsequent consequence is reliant on the child's response. Correct responses are rewarded with positive reinforcement, whilst incorrect responses are followed by commenting from the interventionist (e.g. "no" or "wrong"), after which the child is physically prompted to perform the desired behaviour (Prizant & Wetherby, 1998).

In this approach the environment is extremely structured and is controlled by the interventionist. The child is usually placed facing the interventionist, who is positioned to be on the same level as the child. The desired behaviour is divided into discrete sub-skills which are targeted repeatedly and sequentially. Behaviours to be targeted are chosen by the therapist based on what the child is unable to do spontaneously at the onset of intervention. The development of the targeted skills is facilitated by the use of prompts, prompt fading and contingent indirect tangible reinforcement (e.g. access to food or a toy). Each behaviour is targeted individually within a set of 10 trials. More than one behaviour may be targeted across the sets of trials within a session. Once the child is able to obtain an 80% success rate, over 3 sets of trails, several of the acquired behaviours are randomly targeted within a set of trials (Ingersoll & Schreibman, 2006). In the DTT approach the role of the interventionist is to initiate intervention interactions and maintain control. There is little use of contextual support, and intervention is mostly directed through the use of verbal cues (Prizant & Wetherby, 1998).

Although DTT approaches have reported success in improving IQ and communication domains, major limitations within this approach are evident when it comes to teaching the social motivations underlying language development. One limitation is that acts for communication other than the target behaviours in question are often not reinforced, and at times even discouraged. Also treatment tasks are often disjointed and unnaturalistic and have no logical order which the child may relate to everyday events (Prizant & Wetherby, 1998).

Due to the fact that the interventionist is in control of the session the child may often not feel the need to initiate communication. This is particularly

problematic when one is targeting a skill such as IJA. In addition, children may become dependent on the prompts or cues. Interventions based on DTT have therefore often resulted in poor spontaneity and generalization of skills. Intervention where the child is an active participant and is able to experience skills as opposed to simply observing behaviour is imperative (Prizant & Wetherby, 1998).

With particular relevance to the current study, behavioural studies that have specifically targeted JA have tended not to address the social function of JA, namely to share an event or object with one's communication partner. Because studies employing the DTT approach have usually provided tangible reinforcement for desired behaviours, even behaviours such as commenting or IJA, it could be argued that the function of these behaviours has been altered to one of behaviour regulation as opposed to JA. This is due to the fact that over time, the children will engage in the desired behaviour, such as pointing or commenting, in order to gain access to the reinforcement and not in fact to share the object or event with their communication partner (Jones & Carr, 2004). They may therefore engage in the target behaviours with little understanding as to their conventional meaning. As a result, they are highly unlikely to be used spontaneously in appropriate everyday communicative situations.

An intervention by Buffington, Krantz, McClannahan and Poulson (1998) illustrates an example of this phenomenon. Their treatment followed a traditional behavioural teaching paradigm in an attempt to teach participants to initiate an act of JA, specifically, to draw another's attention to an object of interest on the wall. Adults provided a discriminative stimulus which had both verbal (e.g., "Let's talk

about something on the _____") and nonverbal (e.g., a pinwheel) components. The desired responses were well defined (e.g., saying "look!" while looking at and pointing at the pinwheel). If responses were incorrect, incomplete or absent the adult provided physical prompts for the required gesture and modelled the required verbal response. However, their reinforcement for complete, correct responses, which included tokens, was unrelated to the intent of the desired communication message, which was to share attention. By providing tangible reinforcement for desired behaviours, the social function of the desired JA behaviours was most likely changed to one of behaviour regulation, as the children may have produced the desired response for the purpose of gaining access to the reinforcement rather than for shared attention.

Despite these difficulties, DTT approaches have made a number of valuable contributions to the education of children with ASD, including emphasis on the need for intensive intervention and the development of strategies for data collection and task analysis in order to divide tasks into identifiable components, with defined teaching criteria. Also, this approach has demonstrated the value of highly structured, repeatable episodes, with emphasis on early attention skills (Prizant & Wetherby, 1998).

Due to poor results in generalization and spontaneity of target behaviours, particularly JA, following DTT, more naturalistic behavioural approaches have been developed. These have yielded greater success than pure traditional approaches, particularly for pivotal deficits in children with ASD. Among the better known strategies are incidental language teaching, the natural language paradigm and enhanced milieu approaches. Milieu approaches include pivotal

response training (PRT), which utilizes behaviour modification techniques, such as prompting and tangible reinforcement. PRT differs from DTT in that both the interventionist and child share control within a given session, and the interventionist is encouraged to follow the child's lead. Other differences include the fact that the child's motivation is utilized through the use of tasks which the child enjoys and the provision of choices. Attempts which are not necessarily successful are reinforced and sporadic maintenance tasks introduced (i.e., tasks which the child has previously mastered). In addition, interventionists attempt to use reinforcers which are directly related to the task, facilitating the link between the target behaviour and the reinforcer. For example, if a child has pointed to a toy, he may gain access to that toy. During these interactions the interventionist is more of a communication partner for the child, who serves a supportive role within interactions (Prizant & Wetherby, 1998).

Within these more natural approaches, any goal directed attempt at communication by the child, whether verbal, vocal or gestural, is reinforced. Thus the child does not only have to perform a predetermined behaviour in order to receive reinforcement. The ultimate goal is spontaneous communication and interaction. Within these approaches the interventionist would structure the environment in such a way as to motivate the child to interact. Strategies include the use of pause at crucial moments in familiar routines thereby interrupting the natural flow of events (Prizant & Wetherby, 1998).

Whalen and Schreibman (2003) reported successfully using PRT to target RJA and IJA, specifically responses to showing, following of a gaze or point in response to JA as well as coordinated gaze shifting and protodeclarative pointing

in order to IJA in five, 4-year-old children with ASD. All the participants successfully completed the training for RJA (i.e. responding to showing and following a point or gaze), thereafter one of the participants left the project and only four of the participants underwent the training for IJA. Improvements in all four participants who underwent the training for IJA (i.e. coordinated gaze shift and protodeclarative pointing) skills were reported. The researchers also reported generalisation to other settings and communication partners, particularly of skills for RJA. Although maintenance of skills for RJA was reported at the three month follow up, a significant decrease in terms of the skills for IJA was recorded for all four participants at follow up (Whalen & Schreibman, 2003).

While this study suggests positive potential for PRT in improving JA skills in children with ASD, it must be noted that in this study, access to the desired toys was removed from the children if they did not initiate or RJA as required. Again, it is possible this negative reinforcement may have changed the nature of the target behaviours to acts of behaviour regulation. That is, the children may have used the target behaviour to retain access of the toys and not to draw interest to the toys for shared attention.

Moving to the other end of the intervention continuum, social-pragmatic developmental (SP-D) approaches emphasise naturalistic, interactive techniques to facilitate the development of target behaviours, such as contingent imitation, naturally occurring reinforcement, time delay and environmental arrangement (McGee, Morrier, & Daly, 1999). These approaches emphasise initiation and spontaneity from the onset and follow the child's attentional focus and motivation as much as possible. SP-D approaches build on the child's current abilities, even

if they use unconventional means for communication (Prizant & Wetherby, 1998). These approaches are child-directed and the child's surroundings are manipulated in such a way that they provide opportunities for communication. The child initiates the interaction or teaching opportunity and the interventionist follows the child by being responsive to the child's desires and imitating or extending the child's behaviours. This occurs within social routines and ongoing interactions and requires the interventionist to follow the child's lead and provide specific prompts (Prizant & Wetherby, 1998).

The rationale for this interactive-facilitative approach includes the fact that (1) opportunities for communication development occur naturally throughout the day, and scheduled intervention does not take advantage of all of these opportunities; (2) previous research has shown that caregivers' style of interaction affects language and communication development; and, (3) the transactional nature of communication suggests that appropriate modification of caregivers' interaction style assists in the child developing a sense of competence in communication. This results in an increase in active participation in communication and increased motivation to interact (Prizant & Wetherby, 1998).

The role of the child's communication partner is to extend the child's initiations and respond in a manner which shows the child that their behaviours are meaningful and accepted. The goal is for the child to build up an independently constructed repertoire of communicative routines, means and functions. The purpose of the child's interaction should be under his or her control in order to ensure the communicative function is maintained (Prizant & Wetherby, 1998).

In contrast to behavioural approaches, SP-D draws on research based on normal communication development. In addition, in SP-D approaches there is more emphasis on the child's overall functioning as a communicative partner. Thirdly, within PRT there is greater online intensive data collection of the frequency of isolated behaviour (e.g. vocalizations) as a measure of success, whilst SP-D places greater emphasis on multimodal communication and targets multiple goals within a given activity (e.g. communication, social-affective signalling and play goals), thereby requiring multimodal analysis of functional communicative acts involving vocal, verbal and nonverbal components (Prizant & Wetherby, 1998). Due to the transactional nature of communication development, studies may be strengthened through multimodal analysis which adhere to specifically defined criterion, such as those included in behavioural approaches.

SP-D approaches are based on an understanding of the interdependency of the different aspects of development, such as the relationship between the development of communication and socioemotional development, and between language and play development. Therefore, in addition to observing the child's acquisition of their new communication skills (e.g., their use of words and gestures), progress is also considered in relation to progress through developmental stages, which informs goal setting. Lastly, SP-D approaches place greater emphasis on the child's communication abilities within a meaningful context, with a clear beginning, a logical sequence of events, and ending in order to facilitate the child's comprehension of the structure of events within everyday contexts (Prizant & Wetherby, 1998).

There are a number of techniques that are typically associated with SP-D approaches. Some of these have been shown to enhance JA skills in children with ASD. Contingent imitation is often used where the interventionist imitates the child's behaviour immediately after it has occurred. Dawson and Galpert (1990) found that a group of children with ASD, between 2 and 6 years of age, exhibited significant increases in the average duration of eye gaze towards their mother's faces, when their mothers imitated their children's actions during play. These behaviours correlated to the third level of JA development, *persons,* where the child is engaged, but only with another person, and involves face-to-face or person play (Bakeman & Adamson, 1984). Tiegerman and Primavera (1984) also targeted eye gaze in 6 preschool children, aged between 4 and 6 years of age, using contingent imitation. In their study, the clinician imitated the child's actions on a set of duplicated objects. Imitating the child's play behaviour resulted in an increase in the frequency and duration of eye gaze behaviour. Harris, Handleman and Fong (1987) recorded improvements in positive affect and attention in 3 nonverbal children aged between 7 and 9 years, when the experimenter imitated the child's self-stimulatory behaviour closely.

Other techniques that have been found to be effective in enhancing JA include natural reinforcement and environmental arrangement. Pierce and Schreibman (1995) reported improvements in the JA skills of two 10-year-old children with ASD when natural reinforcement, such as allowing choices and providing preferred materials as well as natural social consequences, was paired with following the child's lead in a peer-mediated intervention study. The TD peers were taught by modelling, role play and direct instruction to implement these

strategies. This resulted in prolonged social interaction and increased engagement in JA behaviours.

Yoder and Warren (1999) reported increases in commenting when systematic violations within joint action routines were introduced. The study included 58 participants aged between 17 to 32 months. However, it must be noted that the children who participated in this study presented with a wide range of diagnoses, including ASD, Down syndrome and failure to thrive.

Examples of other techniques which follow the principle of following the child's lead include supported joint engagement, where the interventionist follows into and scaffolds the child's ability to maintain his/her focus of attention by acting on their object of interest; synchronous undemanding talk, where the adult talks about the child's point of focus; and, linguistic mapping, where the adult encodes the communicative message the child has directed unconsciously through eye gaze, gestures (e.g. reaching) or vocalizations (Yoder & McDuffie, 2006).

The efficacy of these last three techniques in enhancing JA skills specifically, has not been investigated. Yoder and McDuffie (2006) state that in interactions such as these the child and caregiver would have the same point of focus, and despite the fact that the child has not overtly initiated or responded to JA, the caregiver still manipulates the child's experience. Therefore these techniques may be useful in allowing the child to experience IJA, without having to explicitly or consciously communicate.

SP-D studies have typically included packages of techniques and have not investigated the effectiveness of following the child's lead in isolation. Also, many previous studies have not included children under the age of 5, however,

numerous studies have highlighted the importance of early intervention in order to target early developing skills such as JA. Early intervention (i.e. under the age of 5 years, and even more so under the age of 3 years) has been found to be linked to better outcomes (Wood & Wetherby, 2003). Lastly, many studies have not specifically targeted the highest level of JA, being coordinated JA, and have achieved person attention only.

In summary, research investigating techniques specifically designed to follow the child's lead and allowing them to experience IJA, such as those mentioned above is needed. Focus on early intervention, specifically with children under five years of age, is vitally important to minimize later implications of deficits in JA. Also, studies specific to children with ASD are needed and must have clearly defined criteria for target behaviours whilst still allowing for multimodal analysis of interrelated skills.

CHAPTER THREE

PHYSIOLOGY OF JA DEFICITS: MIRROR NEURON HYPOTHESIS

Recently, impairments in mirror neurons have been suggested to play a role in poor JA. Mirror neurons are a class of visuomotor neurons, first identified by Rizzolatti (1996) in the premotor cortex of macaque monkeys (Rizzolatti, Fadiga, Gallese & Fogassi, 1996). They are located specifically in area F5 of monkeys, which occupies the most rostral parts of the ventral premotor cortex and extend rostrally into the posterior border of the inferior limb of the arcuate sulcus (Gallese & Goldman, 1998). Mirror neurons were initially thought to be mainly responsible for the perception and interpretation of motor actions (Williams, 2008). Research related to mirror neuron functioning in monkeys and humans is described in this chapter and related specifically to the JA deficits observed in individuals with ASD in order to provide a theoretical basis for the intervention strategies employed in this study.

Mirror neuron studies in monkeys

Rizzolatti et al. (1996) found that mirror neurons were activated when monkeys imitated a goal-directed behaviour, suggesting an important role of these neurons in imitation. They also found that mirror neurons were activated when monkeys merely observed behaviours. In other words, they observed activation of the same neural mechanisms as if the monkeys had carried out the action (Oberman, Hubbard, McCleery, Altschuler, Ramachandran & Pineda, 2005). This suggests that these neurons fulfilled a type of cortical observation-execution

matching system. This system thus appeared to allow for the external execution (imitation) of an action *or* the internal recreation (observation) of the action. This internal recreation of actions through observation is thought to allow the monkeys to comprehend another's actions (Oberman et al. 2005).

Later, Fogassi, Ferrari, Gesierich, Rozzi, Chersi & Rizzolatti (2005) discovered a group of mirror neurons in the inferior parietal cortex of monkeys that fired differently based on the purpose of an action, for example, whether an object was picked up to eat or simply to place elsewhere. They concluded that the mirror neurons in the inferior parietal region may serve intention representation by matching contextual cues, such as the direction of movement or the nature of an object (e.g. a nut vs ball), to the action itself. This would suggest a role for mirror neurons not only in internally representing simple actions, but also in understanding of the intention another's movements, which is imperative for social interaction (Oberman et al. 2005).

Further studies have found that mirror neurons are activated in the monkey's brain even if the final crucial part of an action was hidden, that is they did not actually see the hand-object interaction (Kohler, Keysers, Umilta, Fogassi, Galesse & Rizzolatti, 2002). This further suggests that mirror neurons may play a role in understanding intentions, even if these are not fully observed. Also, these neurons fired when a characteristic sound of an action was simply heard (e.g., the cracking of a nut shell), suggesting the existence of "audio-visual mirror neurons". Monkeys may use these abilities to facilitate their social interactions, as it has recently been found that the observation and sound of noisy eating encourages eating behaviour in pigtailed monkeys (Gallese, 2006).

Recently the most lateral part of F5 was examined in monkeys, where a group of mirror neurons related to mouth function is located (Ferrari, Gallese, Rizzolatti & Fogassi, 2003). Usually these neurons fire when a monkey grasps an object with its mouth, licks or bites an object, or observes any of these actions. However, a small percentage of these neurons were also found to be activated when communicative facial expressions (e.g., smiles) were observed by the monkey, suggesting involvement in social facial communication (Gallese, 2006). Taken together, these results suggest an important role for mirror neurons in social functioning in monkeys, which has lead to burgeoning research with human participants.

Mirror neuron studies in humans

There is now accumulating evidence to suggest that the mirror neuron observation-execution matching system also exists in humans. Fadiga, Fogassi, Pavesi and Rizzolatti (1995) found through the use of transcortical magnetic stimulation (TMS) and motor evoked potentials (MEPs) that excitation of the hand muscles was markedly increased upon observation of grasping actions. It was also found that only the muscles the observer would have used to carry out the observed action were stimulated. This study provided evidence of a mirror system in humans similar to that of monkeys. Therefore, whenever we observe an action, the same muscles which we would use if we performed the action are concurrently stimulated (Gellese & Goldman, 2008).

Even though individual neurons may not be studied in human participants as they can be in monkeys, similar patterns have been found within humans. For

example the use of TMS, positron emission tomography (PET), and functional magnetic resonance imaging (*f*MRI) has revealed activation of a group of neurons during actual movement, observed movement and imagined movement (Rizzolatti, Fadiga &, Fogassi, 1996). These neurons were located within the prefrontal cortex, which has been associated with JA deficits, as well as the parietal cortex and superior temporal sulcus, which provide visual input to the mirror neurons via the temporo-parietal junction (TPJ). The involvement of multiple sites suggests that there may be an action observation-execution matching network (Oberman et al., 2005). This network is coarsely arranged in a somatotopic manner, with identifiable cortical areas in the premotor and parietal cortices activated by the observation or execution of mouth, foot or hand movements (Gallese, 2006).

More recently, the role of mirror neurons in higher order functions, such as action interpretation, theory of mind and language has been explored. Action interpretation is the ability to determine the goal of actions still to come. Action intentions were studied using *f*MRI in humans (Iacoboni, Molnar-Szakacs, Gallese, Buccino, Mazziotta & Rizzolatti, 2005). In this study, participants observed three kinds of stimuli; grasping hand actions with no context (i.e., with no objects), a scene containing objects only (i.e., context only) and grasping hand actions in context (i.e., involving objects), which suggested the intention of the action. Observations of the actions embedded in context resulted in a significant increase in signal flow to the mirror neurons, suggesting these neurons are in fact involved in determining action intention. Another finding of this study was that mirror neurons were activated regardless of whether the observer of an action was

asked to determine the intention of an action or not, implying that this interpretation occurs naturally (Iacoboni et al., 2005).

Fogassi et al. (2005) also observed a group of mirror neurons which discharged during the observation of actions that were related to subsequent acts that were not yet observed. These mirror neurons only fired when a sequence of actions was observed and coded the same motor act differently depending on the overall goal of the action. For example, when participants observed another simply picking up a cup these neurons would not fire, however, when the person being observed picked up a cup in order to drink from it, these neurons would then fire. It was suggested that these mirror neurons were therefore involved in interpreting actions in relation to the sequence they were embedded in, and therefore allowed participants to predict the agent's next action and therefore their overall intention (Fogassi et al., 2005).

Involvement of mirror neurons in understanding others' intentions lead to further theorising regarding the role of mirror neurons in theory of mind or "mind reading". It has been suggested that once able to comprehend other's movements in terms of one's own, and the intentions of others actions, one may then begin to understand the observed individual's state of mind. Mind reading refers to the process of identifying mental states of another, such as their perceptions, beliefs, expectations and desires, and is a skill which all typical humans develop (Gallese & Goldman, 1998). Comprehension of the manner in which other's minds work and realizing that they are similar and different to us is crucial to social interaction. This understanding develops over three stages; (a) action representation: Newborns imitate simple acts such as tongue protrusion, mouth

opening, lip protrusion and simple finger movements as early as 2-3 weeks old, thereby developing a connection between perception and production of acts; (b) first-person experience: The infant's everyday experiences characterise links between bodily states and mental experiences (e.g., striving for a goal is often related to effortful body movements). These experiences teach the child about internal states and associated behaviours; and (c) understanding others as intentional agents: This involves attribution. When the child sees another person acting similarly to how they have in the past they ascribe the internal state that is most often associated with that behaviour (Meltzoff, 2006).

It is proposed by simulation theory (ST) that this attribution of perceptions, beliefs, expectations or desires to others, involves the use of one's own mental capacities to calculate and predict the mental processes of others. For example, when told a story about imaginary characters and asked questions about the character's feelings, we would put ourselves in the imaginary character's "shoes" in order to answer the questions. Similarly, when playing a game of chess, one would attempt to predict our opponent's next move by simulating their thought process and creating *pretend* desires, preferences and beliefs you take your opponent to have. Your pretend preferences, beliefs and desires are taken into account in your decision making mechanisms, which creates a pretend decision (see Figure 2). You may then base your next move on that pretend decision (Gallese & Goldman, 1998).

ST implies that mind reading, or theory of mind tasks, involve attempts to imitate the mental state of another, suggesting a matching occurs between the agent and simulator. Simulation may be used to retrodict (determine what has

already happened) and to predict mental states. In the case of retrodiction, one would determine what goal another had to carry out a completed action. In this manner one would make a "backward" inference.

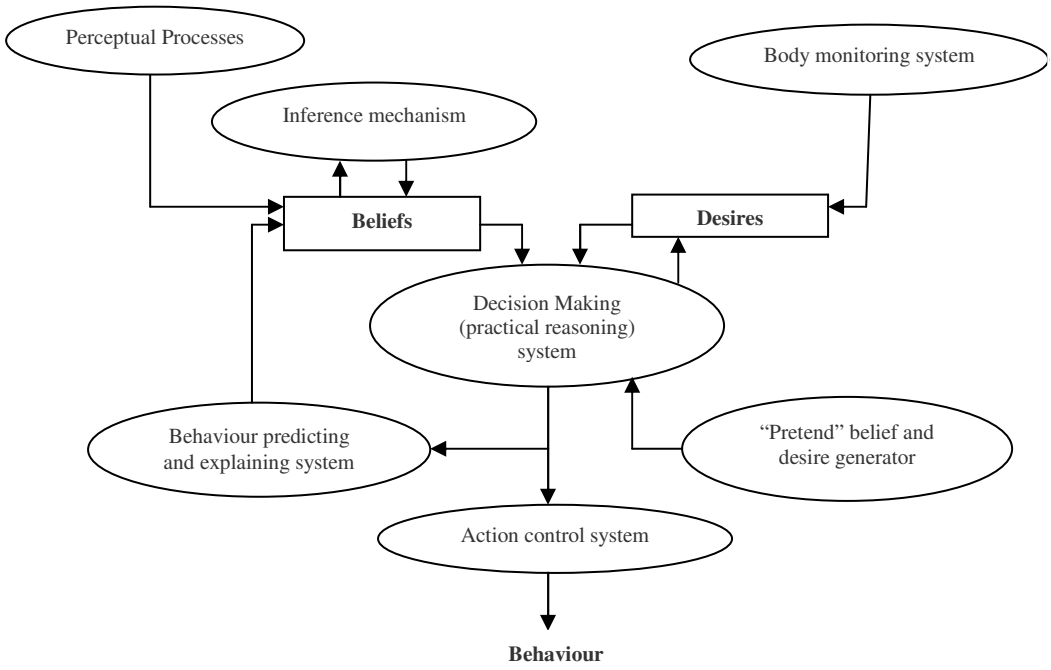

Figure 2. The basic elements of the simulation routine (Gallese, V. & Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. *Trends in cognitive science, 2(12),* 497

This retrodiction implies the involvement of mirror neurons, as previously mentioned studies have proven their involvement in action comprehension. The mirror neurons will internally generate the plan for an observed action and the expected outcome, therefore putting the observer in the actors' "shoes" so to speak (Gallese & Goldman, 1998). This may lead to the perspective taking skills required for JA and other social communicative acts. One may use retrodiction to respond appropriately to acts for JA initiated by another, and also to place

yourself in another's shoes to determine whether in fact they have had the same experience as you, and if not, the desire to share your experiences with them (Oberman et al., 2005).

Gallese (2006) proposed that social cognition is more than overtly considering another's thoughts through abstract imagery (social metacognition). He proposed that social cognition contains an experimental component, whereby one attempts to obtain a *sense* another's behaviour, feelings and experiences. This is referred to as *embodied simulation*. This component of social cognition mediates between one's prior knowledge of experiences of self versus others. Action retrodiction or prediction and the assigning of intention are all related to mirror neuron functioning in a process of *embodied simulation*.

Mirror neurons may therefore play a crucial part in JA due to similarities between imitation and the attribution of mental states required for JA, in that both require translating the perspective of another to oneself. Specifically, identifying the focus of another's attention, or the motivation to draw another's attention to one's own attention focus, would require one to take another's perspective. This mirroring of one another's attentional focus, therefore implies activation of the mirror neurons (Williams, Whiten, Suddendorf & Perrett, 2001).

Monitoring the direction of gaze shifts is important for JA as it may reveal intentions and help to predict future actions. Bristow, Rees and Frith (2007) examined whether behavioural and neural responses to gaze shifts were affected by the context of the shift. Two faces were shown to 10 TD subjects, with a mean age of 17, one looking directly at the subject socially and one looking away unsociably. The face then shifted gaze, either towards an obvious target, in an act

of JA, or towards another location. Both behavioural and neural responses were affected by the social context and the intended goal of the gaze shift. Reaction times were significantly quicker to the social gaze shifts in comparison to the unsocial shifts. Using *f*MRI, they found significantly more activation in the medial prefrontal cortex in response to social gaze shifts, suggesting activation of this area during JA.

Williams, Waiter, Perra, Perrett and Whiten (2005) conducted an experiment related to JA in typically functioning individuals. The participants were shown a video clip of a moving spot. There was a person in the video, who in some instances watched the spot and in others looked elsewhere. In both instances there was associated activation in the parietal lobe, but only when watching with someone else was an experience of JA created, which was characterised by greater activation in the left frontal pole of the right ventromedial frontal cortex.

Having established the potential role of mirror neurons in the typical development of JA, researchers have begun to consider whether specific dysfunctions in mirror neurons can be observed in individuals with JA deficits, specifically, individuals with ASD.

Mirror neuron functioning in individuals with ASD

Emerging evidence now suggests that there may indeed be a dysfunction of mirror neurons in children with ASD. Oberman et al. (2005) found evidence of mirror neuron dysfunction in 11 children with ASD, aged 13 years. Reduced mu-wave suppression was demonstrated when the children observed actions, but not

when they followed action instructions. Later this study was replicated by Bernier, Dawson, Webb and Murais (2007) who found this reduced wave suppression correlated with the degree of impairment in imitation skills in 17 adults with ASD.

Dapretto et al. (2005) found decreased activity of the mirror neurons in 9 children with ASD, aged between 10 and 14 years, in comparison to TD peers, during tasks involving observing and imitating facial expression. In addition, they found activation within this area was inversely related to performance on the social subscale of the ADOS, suggesting that poor mirror neuron functioning may have had a direct relationship with the social symptoms observed in children with ASD, including JA.

Baron-Cohen et al. (2006) showed reduced activity in the network that comprises the social brain, that is the orbito-frontal cortex (OFC), superior temporal gyrus (STG) and amygdala, during a test in which participants had to judge what another person was thinking or feeling from the expressions of their eyes. The study compared 6 participants with ASD, with a mean age of 26, to 12 TD participants matched in age. Using fMRI they found decreased activation in these areas as well as some areas of the prefrontal cortex, in the participants with ASD.

More recently, Pfeifer, Iacoboni, Mazziotta and Dapretto (2008) demonstrated a close relationship between activity in Broca's area and observation or imitation of emotional expression in tasks involving the imitation of facial expression in 17 adult males with ASD. Taken together, studies of mirror neurons in individuals with ASD suggest consistent physiological differences in mirror neuron functioning.

Gallese (2006) suggests that these physiological differences in the mirror neuron systems of children with ASD result in deficits in the process of *embodied simulation*, resulting in an inability to obtain a sense of the behaviours, feelings and experiences of others. If the mirror neurons of children with ASD do not naturally fire when observing other's actions in an attempt to make sense of the actions and therefore to understand the intention of those actions, then the process of *embodied simulation* (i.e., the value of the multitude of social observational learning experiences) that is typically experienced in the first two years of life will be severely restricted. Many aspects of social development will be affected, but in particular, responding to and initiating JA with others will be impaired. Responding to other's bids for JA will be difficult as children will have difficulty comprehending the overall intention behind these acts, which is to draw their attention to something. Also, children with ASD will have difficulty comprehending that their communication partner's experiences are different to their own and therefore that their communication partners may have not noticed events or objects they have. They will therefore not be compelled or motivated to initiate JA with others.

While the mirror neuron hypothesis provides intriguing potential explanations for the observed JA deficits in children with ASD, it has yet to be applied specifically as a theoretical basis to intervention efforts. It is still unclear how the mirror neuron hypothesis may be translated into therapeutic techniques to enhance the process of *embodied simulation* and thus improve JA skills. It is the intention in this study to use the mirror neuron hypothesis in formulating the therapeutic approach and techniques to improve JA skills in preschool children

with ASD. This study is therefore a first step in relating the theory of mirror neuron deficits to intervention techniques to improve JA.

Intervention for JA deficits based on the Mirror Neuron Hypothesis

Based on the previous discussion, children with ASD are not likely to learn a skill simply by observation and/or imitation due to impaired mirror neuron functioning, which impairs their process of *embodied simulation*. Simply observing another person IJA may not assist them in taking on that person's perspective and relating to their point of focus. They are therefore not likely to develop IJA as a by product of intervention targeting RJA. Instead, children with ASD may need to have the experience of IJA, perhaps even inadvertently at first, in order to acquire the skill of IJA. In this study, therefore, IJA was the focus of intervention as opposed to RJA, with the aim of teaching this skill through repeated experiences of *embodied simulation*.

As previously discussed, children often base their interpretations of others' actions on their own previous experiences. This implies that children with ASD need to have repeated experiences of IJA before they can appreciate the intention of IJA in others. Thus, if one were to place a child with ASD in the role of IJA, by repeatedly responding *as if* they had initiated JA, one could potentially build up the experiences needed for them to draw on for understanding other's bids for JA. Once they are able to take on another's perspective in acts of JA and experience success within the role of IJA, even unconsciously, they may be more motivated to share their experiences spontaneously.

There are a group of therapeutic techniques which appear to lend themselves to facilitating this process of *embodied simulation*, with particular relevance for facilitating experiencing IJA. These have already been discussed in chapter 2, and are consistent with the social-pragmatic approach to intervention. All four techniques are based on the principle of following the child's lead and include the following: (a) supported joint engagement, where the interventionist follows into and scaffolds the child's ability to maintain his/her focus of attention by acting on their object of interest; (b) synchronous undemanding talk, where the adult talks about the child's point of focus; (c) linguistic mapping, where the adult encodes the communicative message the child has directed unconsciously through eye gaze, gestures (e.g. reaching) or vocalizations (Yoder & McDuffie, 2006); and (d) contingent imitation, or the immediate imitation of the child's vocalizations/verbalizations and/or behaviours (Dawson & Galpert, 1990). Although these are not new techniques in and of themselves, they have not been used exclusively as a package to target IJA from the perspective of the mirror neuron dysfunction hypothesis.

In each of these techniques, it is proposed that one is able to give the child the experience of drawing another's attention to an object or event of interest, even without intentionally doing so, while receiving the social reinforcement appropriate to such an act. The intensive repetition of this experience may assist the child in learning what it feels like to draw another's attention to an object and receive this social reinforcement. This may in turn help the child to interpret other's bids for JA more accurately, based on their own accumulated experiences. In addition, these experiences may emphasise the child's experience as being

separate from that of their partner. That is, when the child's communication partner verbalizes their thoughts for them, in a manner which emphasised them as separate from others (e.g. "*you* saw a bunny"), the child may come to realise that they are in fact distinct from others and that they experience events differently to others. All of this is designed to facilitate the process of *embodied simulation*, or the ability to acquire a sense of their communicative partner's thoughts as separate from their own. Once a child has grasped this concept they may begin to share their experiences with others in spontaneous bids of IJA.

This particular group of techniques also allows the child to experience the appropriate social reward (shared attention on an object) associated with acts for JA, rather than introducing an artificial or tangible reward that might change the function of the act to one of behaviour regulation. The child does not need to explicitly acknowledge or direct communicative acts towards their communicative partner initially, but the partner's behaviour still moulds the child's experience of the object/event. Therefore the child's reinforcement is their communicative partner's social response as opposed to a tangible reinforcement.

The package of intervention strategies implemented in this study was designed to provide intensive opportunities for the child to experience *embodied simulation* in developmentally appropriate play activities, including shared book reading, which provides many opportunities specifically for following the child's focus of attention, and later spontaneous bids for IJA. In addition, in order to simulate conditions in which TD children will often initiate JA with others, specific JA trials were incorporated into the intervention. These trials were designed to provide novel or interesting events to which the child could respond

and either draw the interventionist's attention to the event/object or, if the child merely looked at the object, the interventionist could respond to that gaze shift *as if* the child had intentionally drawn their attention to the object. The aim of these trials was thus to provide more opportunities for the child to experience the act of IJA, even unwittingly at first.

In this study, intervention targeted the highest level of JA, or coordinated joint engagement, where the child purposefully and spontaneously attends to another person as well as the object at hand with the goal of drawing their partner's attention to the object/event of interest as the primary dependent variable. However, during the intervention, all other communicative signals and "lower order" JA behaviours were responded to by the interventionist. For example, a gaze shift towards a novel event would be responded to by the interventionist as if the child had drawn their attention to it intentionally, so the child is exposed to the social rewards for coordinated IJA (e.g. commenting by the interventionist on their point of focus, such as "You saw the truck go") without explicit awareness that their own focus of attention is shared with the adult. This experience may encourage them to seek the interventions' response again, leading them to independently initiate JA.

In summary, based on the arguments presented in the previous chapters, this study proposed to examine the effectiveness of an intervention targeting IJA in children with ASD. The intervention incorporated the following four features: (1) included a set of techniques that is theoretically consistent with the mirror neuron hypothesis, that is, techniques which will facilitate the process of *embodied simulation* in acts for IJA, though initially unconsciously; (2) include

techniques that maintain the social function of JA; (3) employ measures with strictly defined criteria for communicative acts for IJA; and (4) target children under the age of five years.

CHAPTER FOUR

METHOD

Aims

1. To describe the effects of an early intervention, based on the mirror neuron hypothesis, aimed at improving the ability to initiate JA skills in children with ASD. This included considering individual variability in the participants response to the intervention.
2. To describe the efficacy of the use of specific trials to provide opportunities for IJA.
3. To describe maintenance and generalization of the target skill.
4. To describe the impact of the intervention on other communicative acts.

Participants

Recruitment and selection criteria. Three participants diagnosed with ASD and identified as presenting with deficits in IJA were recruited from a preschool in Johannesburg, which caters specifically for children with ASD. Non-probability, purposive sampling was used, as all children were recruited from a single pre-school group (Schiavetti & Metz, 2002). This is due to the fact that within the South African context it is difficult to find participants under the age of five who have received a formal diagnosis of ASD. Healthcare practitioners in South Africa are often reluctant to diagnose ASD at a young age in order to exclude any other possible conditions. Also, within the South African context children do not

receive preferential access to services once a diagnosis has been made, and therefore diagnosis often has less urgency for professionals.

Inclusion criteria were as follows each participant was required to have: (1) A diagnosis of ASD from a neurodevelopmental paediatrician or child psychologist based on the DSM IV criteria as previously outlined; (2) Deficits in IJA, as the aim of this study was to improve these deficits through the specified therapeutic techniques. Deficits in IJA were defined as an inability to intentionally communicate to direct another's attention to an object or event through gaze shifts, gestures or verbal communication.

The only exclusion criterion was that participants were not to present with any organic abnormalities, such as a hearing loss or seizures which could have affected the child's ability to respond to the intervention consistently. A summary of the characteristics of the participants including their chronological age at the commencement of the study, gender, age of diagnosis, time of formal schooling, whether they used verbalizations to communicate, home language and ability to respond to JA, is presented in Table 2. A detailed narrative describing each participant follows. In order to characterize each participant, a detailed record review was carried out and their communication abilities, at the start of the study, were assessed using the CSBS DP (Wetherby & Prizant, 2002).

Table 2. Characteristics of ASD participants

Participant	Age	Gender	Age of Diagnosis	Months in formal schooling	Verbal	Home Language	RJA
P1	4, 6 years	Male	2 years	21 months	Yes	English	Yes
P2	4, 3 years	Male	4 years	5 months	No	English	Yes
P3	4, 8 years	Female	4 years	1 month	Yes	Tswana/ English	No

The CSBS DP is standardized assessment designed to evaluate communication and symbolic abilities in children with a functional communicative age between 6 months and 2 years. It may be used with preschoolers of up to age 5 or 6, provided they are functioning at a developmental level below 2 years of age. The CSBS DP may be used as a screening tool to identify children at risk for developmental delay. It may also be used to evaluate whether a child is delayed in terms of their social communication, expressive speech/language and/or symbolic development. Lastly, this tool may be used to document changes in social communication, expressive speech/language and symbolic functioning (Wetherby & Prizant, 2002).

The CSBS DP was developed and trialled on children ranging between 12 and 24 months of age. A total of 337 behaviour samples were included in the standardization, 165 of these beings females and 172 being males. Children in the standardisation sample were collected from eight sites in the United States of America and two sites in Canada, with the majority of the children being from Florida. Therefore the sample cannot be described as being nationally or internationally representative, however, was considered appropriate as the test probes were largely nonverbal and assessed many preverbal skills which are considered to be mostly universal. The majority of the children recruited for the sample were white (n = 200), and significantly fewer African Americans (n = 30), Asians (n = 10) and other (n = 3) racial groups were included, due to the areas in which children were recruited.

Important language predictors which are considered in 7 cluster scores of the CSBS DP are: (1) Emotion and eye gaze; (2) Rate and function of

communication; (3) Use of gestures (4) Use of sounds; (5) Use of words; (6) Understanding words; and, (7) Use of objects. These skills are grouped into three *composite* scores, these being;

a) *Social composite:* The expression of emotion through shared positive affect, the use of three point gaze shifts, the ability to follow a point for JA, and the use of communicative acts for JA, behaviour regulation and social interaction. This area also encompasses the use of gestures.
b) *Speech composite:* The use of consonants, words and word combinations within intentional communicative acts.
c) *Symbolic composite:* Understanding of words and use of objects.

These profiles of functioning are specific core deficits in children with ASD.

The development of the CSBS DP was driven by the need to link the current developmental literature with a standardised assessment tool. The CSBS DP provides quantitative and qualitative information regarding the child's communicative, social-affective and symbolic abilities. Statistical measures found the assessment to be valid and reliable. A unique feature of this tool is the fact that it provides a variety of communication temptations designed to provide opportunities for spontaneous initiations for communication, including acts for IJA, which is the primary variable of interest in this study. The CSBS DP is a sensitive measure to specific social deficits observed in children with ASD (Wetherby & Prizant, 2002).

Participant 1. Participant 1 (P1) was 4 years and 6 months old at the onset of the intervention. He was diagnosed with ASD in June 2005 at the age of 2 by a neurodevelopmental paediatrician, and began attending the recruitment school in

August 2005. Since his admission, he received speech, occupational and play therapy, however, only one of these therapies was provided each term and the service provided was rotated so that each child received one term of intervention in each area throughout the academic year. In his case history, no complications in terms of pregnancy or birth were reported. All P1's motor milestones were age appropriate. He began using single words by one year, however, was still not combining words at the onset of the intervention. P1 presented with no significant medical conditions and had no family history of speech, language, hearing or learning disabilities. His home language was English.

No formal speech, language or cognitive assessments had been carried out on P1. The researcher therefore administered the CSBS DP, and analysed his performance qualitatively due to the participant's age. The raw sores are presented in Table 3.

Table 3. Raw cluster, composite and total CSBS DP scores for each participant prior to intervention

Composite	**Cluster**	**P1**	**P2**	**P3**	**Potential Score**
Social	Emotion and eye gaze	12	6	2	18
	Communication	9	5	3	24
	Gestures	9	6	4	22
	Total	**30**	**17**	**9**	**64**
Speech	Sounds	20	0	10	26
	Words	20	0	5	28
	Total	**40**	**0**	**15**	**54**
Symbolic	Understanding	6	3	0	33
	Object use	8	16	1	29
	Total	**14**	**19**	**1**	**62**
Total		**84**	**36**	**25**	**180**

On the social composite of the CSBS DP prior to this study P1 made no use of gaze shifts in order to direct the researcher's attention. He did display shared positive affect during all of the activities, for example he would often smile or laugh with eye gaze during the activities. He was able to consistently follow the researcher's point indicating that he had mastered the skill of responding to other's bids for JA.

P1 communicated at least once during all activities except for the book task. He usually communicated between 1-2 times during each task, however, when the balloon was presented, more than 3 communicative acts were observed. He communicated only for behaviour regulation. No acts for JA were observed. He was observed to use a point, show, give, reach and distal point gesture for behaviour regulation.

Within the speech composite P1 was observed to produce syllables with consonants in every task. He was observed to use a range of consonants, however, did not produce a /m/, /y/ or /ʃ/. He was observed to use 5 words during the assessment, namely "walk", "hey", "again", "open" and "no". All these words served the purpose of behaviour regulation.

During the symbolic composite P1 was only able to identify two of the objects presented. His range of actions on the objects presented was limited and those actions observed were subsequent to modelling by the researcher. No actions towards others, such as the researcher or doll, were observed, and no sequences of actions were observed.

Within the classroom P1 presented with some spontaneous language, however, this was limited to single words for behaviour regulation. He presented

with a lot of difficult behaviour such as tantrums and would often cry in order to communicate his needs or protests.

Participant 2. Participant 2 (P2) was 4 years and 3 months old at the onset of the intervention. He was diagnosed with ASD in January 2007 at the age of 4 by a neurodevelopmental paediatrician, and began attending the recruitment school in February 2007. Since his admission he had also received speech, occupational and play therapy on a rotational termly basis. In his case history, no complications in pregnancy or birth were reported. All P2's motor milestones were age appropriate. He was not producing any words at the onset of the intervention. P2 presented with no significant medical conditions and had no family history of speech, language, hearing or learning disabilities. P2's home language was English.

The results of the CSBS DP assessment prior to the study are presented in Table 3. P2 made no use of gaze shifts in order to direct the researcher's attention during the assessment, and displayed no shared positive affect. He did, however, consistently follow the researcher's point, suggesting that like P1, he was capable of responding to other's bids for joint attention. Communicative acts were observed during the balloon, bubble and snack jar tasks. All these served the function of behaviour regulation and gestures, as opposed to vocalizations, were used for all communicative acts. P2 was observed to use give, reach and head shake gestures. The give and reach served the function of behaviour regulation, however, the head shake did not meet the criteria for a true communicative act.

P2 produced no speech sounds/words during the assessment and was not observed to produce any speech sounds within the classroom at the onset of

intervention. He also was unable to identify any of the objects presented or body parts. A number of actions on the objects presented were observed during the assessment, such as drinking with the bottle/cup, feeding with utensils, stirring and pouring. P2 did not require any modelling or prompting in order to carry out these actions. This suggests the development of functional use of objects. Actions towards others were also observed, for example P2 kissed the doll, gave the doll the bottle and fed the doll with the utensils indicating the emergence of pretend play. Sequences of actions were not observed.

In the classroom P2 presented with no spontaneous language. He displayed evidence of object interest and functional pretend play. Within the class, few communicative acts were observed and those observed served the function of behaviour regulation and took the form of gestures. P2's school attendance was very erratic, and he would often not attend school for weeks at a time due to transportation difficulties.

Participant 3. Participant 3 (P3) was 4 years and 8 months old at the beginning of the intervention. She was diagnosed with ASD in 2007 at the age of 4 by a paediatrician, and began attending the recruitment school in June 2007. Since her admission she had also received speech, occupational and play therapy, on a rotational basis each term. In terms of her case history, no complications in pregnancy or birth were reported. All P3's motor milestones were age appropriate. She never babbled, however, began using single words by one year, and was still not combining words at the onset of the intervention. P3 presented with no significant medical conditions and had no family history of speech, language,

hearing or learning disabilities. She lived with her grandmother and her home languages were English and Tswana.

No formal speech, language or cognitive assessments had been carried out on P3. She did, however, undergo an MRI scan which detected no structural abnormalities, the CSBS DP raw sores are presented in Table 3.

P3 made no use of gaze shifts in order to direct the researcher's attention during the assessment, and only displayed shared positive affect once, which was when the wind-up toy was presented. She did not follow the researcher's point, thus suggesting that she had not mastered the skill of responding to other's bids for joint attention.

Only 3 communicative acts were observed throughout the assessment. These were all acts for behaviour regulation. Two of these were observed when the wind-up toy was presented and once during the play task. P3 was observed to use give and push gestures. These both served the function of behaviour regulation as P3 wished for the researcher to put the toys away.

P3 was observed to produce syllables with consonants during two of the tasks. Few consonants were evident in her speech. She was observed to use 4 words during the assessment, namely "bye", "ouch", "dula" (which is "sleep" in Tswana) and her name. None of these words met the criteria for communicative acts as they did not serve a clear function, with the exception of "bye" which was a behaviour regulation act as the participant wished to leave the room.

Within the symbolic composite P3 was unable to identify any of the objects presented or body parts. No functional or play actions on the objects presented were observed, even once some actions were modelled. No actions

towards others, such as the researcher or doll, were observed, and no sequences of actions were observed. In other words, almost no spontaneous object interest or object play was observed prior to intervention. Therefore this had to be targeted during the intervention. This is discussed further in the experimental design and results section.

Within the classroom P3 presented with little spontaneous language, and often produced nonsense words. She made use of a lot of learnt words or phrases out of context. She perseverated a great deal, both verbally and physically, for example would often repeat "bye" when she had enough of an activity and would often repeat words during activities such as "ow" or "shush". A great deal of her verbalizations did not meet the criteria for true communicative acts, and those which did were limited to acts for behaviour regulation. At the onset of the project she appeared highly anxious and took a number of sessions to become comfortable with the interventionist. She presented with a lot of avoidance behaviours and would often request to leave the therapy room during the intervention.

Typically Developing Participants. In addition to the participants with ASD, three TD children were recruited from a mainstream preschool in Johannesburg, and were matched to the children with ASD in terms of race and gender. These are important variables within the South African context as socioeconomic status and access to resources has been largely related to gender and race in the past and have therefore had great implications on child development. The TD children were recruited for the purpose of setting realistic training criteria for the intervention study. This was in order to ensure that the

children were not over- or under- trained in the target behaviours. In addition, observations of the TD participants within similar contexts allowed the researcher to identify typical social behaviours for the purpose of IJA in South African preschool-aged children. The TD children did not participate in the intervention phase of this investigation and did not act as controls for the children with ASD. Precedent for including TD children for this purpose was demonstrated by Whalen and Schriebman (2003) who assessed 6 typical children during the baseline phase of their single-subject design intervention study in JA in order to set training criteria for the children with ASD to ensure that the participants were not under- or over-trained.

All the TD participants were 2 years of age as the ability to initiate JA is fully developed by this age (Carpenter, Pennington & Rogers, 2002). These children had to have no history of a delay in receptive or expressive language or pragmatic development. In addition, children with any organic abnormalities (e.g., hearing loss, seizures) were excluded from the sample. Characteristics of the TD participants are provided in Table 4.

Table 4. Characteristics of TD participants

TD participant	Matched Participant	Chronological age	Race	Gender	1st Language English Speaker
TD1	P1	2 years, 6 months	White	Male	Yes
TD2	P2	2 years, 3 months	Black	Male	No
TD3	P3	2 years, 8 months	Black	Female	No

Experimental Design and Conditions

A pilot study on one participant was conducted to fine-tune intervention and coding procedures. Results are presented in chapter five. Following this a single subject, multiple baseline design across participants was implemented. Large group studies may not always be valid when clinicians attempt to apply data to specific clients. In addition it is not always possible to construct large homogeneous groups of participants with similar difficulties. Single subject research design, involves the investigation of a single participant, or a small group, in which intervention and dependent variables are controlled. This data is often easily translated into clinically significant findings through systematic recording and analysis of outcomes (Zhan & Ottenbacher, 2000) and was thus adopted for this study. The advantages of this design are the ability to control for developmental maturation as well as other extraneous variables such as the treatment setting. This also allows the experimenter to measure several targets within several participants, in various settings simultaneously, thereby increasing external validity (Horner et al. 2005). Unlike group designs, in single subject designs treatment is not withheld from any of the participants, and outcomes are not obscured by statistical analysis as the researcher is able to identify treatment trends for each child (Richards et al. 1999). Single subject research methods also allow the researcher to focus on individuals within a heterogeneous population, for which parametric analysis would not be possible (Richard et al., 1999). This design was therefore particularly appropriate for this study where the three participants presented with unique pre-intervention communication profiles. This design does, however, have limitations in terms of generalizability, due to the

small number of participants involved. Also, inconsistency of visual analysis of graphs may be a factor due to the subjective nature of the analysis (Zhan & Ottenbacher, 2001). The multiple-baseline design consisted of three phases:

Phase I (Baseline). During the baseline sessions, a trained research assistant interacted with the participants; however no facilitation techniques were introduced. Other than the children seeing the interventionist during classroom observations, this was the children's first direct interaction with her. Within the sessions, interactions involved a book routine, an insert puzzle routine and an activity involving pulling toy animals out of a bag. The interventionist simply presented the stimuli and waited for the children to initiate communication, only then would she respond to their communication bids by acknowledging their requests or attention directives verbally.

In order to provide specific opportunities for each participant to initiate JA specific JA trials were also presented, these provided specific trials which have not been used in previous studies. These trials were designed to provide novel events within the session to elicit the child's attention. This provided an easily discernable point of focus for the interventionist to comment on using undemanding talk or linguistic mapping. It also provided multiple opportunities for the participants to spontaneously initiate JA. Trials consisted of the activation of remote-controlled stimuli, specifically large, plastic bugs (a bee or a ladybird) or a large remote-controlled plastic truck, all of which moved and produced an auditory stimulus. The stimuli were placed next to or slightly behind the interventionist out of her line of sight and were activated remotely by the interventionist twice during each routine at the interventionist's discretion. The

stimuli were activated when the child was engaged with the interventionist, however, the environment had to be quiet enough for the child to hear the stimuli before they were activated. Based on the findings of the pilot study (see Chapter 5), only 6 trials were presented in each session, two per activity. During the trials, the interventionist did not respond to the stimulus in any way unless directed by the child. Both the TD children and the children diagnosed with ASD participated in the baseline phase of the study.

Phase II (Intervention). The intervention phase focused on following the child's lead in order to provide opportunities for the child to unconsciously experience *embodied simulation.* This was operationalized through the following techniques:

(a) *Supported joint engagement:* This is defined as an interaction in which the interventionist follows into and scaffolds the child's ability to maintain his/her focus of attention. For example, the interventionist may move or shake the child's object of interest in order to hold the child's attention to the object once the child is already focused on it. The child and adult are then focused on the same object, however, the child is not required to acknowledge or direct communicative behaviours to the adult. The adult encourages the child to maintain focus on the object for a long enough period for the adult to talk about the object (Yoder & McDuffie, 2006).

(b) *Synchronous undemanding talk:* The adult talks about the child's point of focus. The interventionist may label and describe their point of focus and this may be paired with a point (e.g. "It's a giraffe! He's got a long neck!"). The

adult may also describe the child's actions (e.g. "You put the fairy in!") (Yoder & McDuffie, 2006).

(c) *Linguistic mapping:* The adult linguistically encodes the communicative message the child has directed unconsciously through eye gaze, gestures (e.g. reaching) or vocalizations. For example looking to another child, the adult will respond, "You can see Billy!" (Yoder & McDuffie, 2006).

(d) *Contingent Imitation:* The adult imitates the child's vocalizations or movements immediately after they occur (Hwang & Hughes, 2000).

Intervention sessions implemented the same three routines as used in the baseline (i.e., a book routine, an insert puzzle routine and a routine involving pulling toy animals out of a bag) as well as the presentation of the two JA trials (activation of remote-controlled toy) in each routine. In accordance with the multiple baseline design, intervention was introduced in a time-lagged fashion for each child, that is, one of the children began the intervention phase after three baseline sessions, one after four baseline sessions and one after five baseline sessions. This allowed the researcher to determine whether any changes in JA skills were functionally related to the introduction of intervention. If changes in IJA occur only once intervention has begun, changes are presumed to be a result of intervention.

At the onset of the intervention, one of the participants (P3) was found to present with no object interest, therefore object play was targeted concurrently to the planned intervention, as children with poor object interest provide so few opportunities for an adult to use undemanding talk and/or linguistic mapping

(Yoder & McDuffie, 2006). In this instance, the interventionist targeted the following skills:

(a) *Sustained, productive object engagement:* This refers to the child's ability to purposefully move objects in a manner which allows the adult to clearly identify what object interests the child (Yoder & McDuffie, 2006).

(b) *Play with a variety of objects:* This was to increase the variety of the content of the synchronous undemanding talk the adult may engage in (Yoder & McDuffie, 2006).

(c) *Diversity of object play:* When a child plays with a variety of objects in a variety of ways this allows the adult to utilize a variety of responses (Yoder & McDuffie, 2006).

These skills were targeted through the use of the following techniques:

(a) The interventionist physically guided the child's hand, for example she physically took the child's hand and guided her to make the horse walk (Bundy, Lane & Murray, 2002).

(b) Once the child consistently allowed the interventionist to guide her hand movements, the interventionist then withdrew physical cues and modelled appropriate play. The child was then required to imitate the interventionist's modelled behaviour. In instances when the child did not imitate the interventionist's modelled behaviour, hand over hand guiding was again used (Bundy, Lane & Murray, 2002).

(c) When the child consistently imitated the interventionist's modelled behaviour the interventionist then used only visual and verbal prompts, for example she

pointed to an animal and said "Cow wants to go for a walk" (Bundy, Lane & Murray, 2002).

(d) Lastly, once the child consistently responded to visual and verbal prompts, the interventionist faded full instructions and gave a partial cue (e.g. "Doggie is so thirsty") (Bundy, Lane & Murray, 2002).

Once the child began to display object interest independently, within the sixteenth session, all the above strategies were withdrawn.

Phase III (Maintenance and Generalization). Once the training criteria were met, that is the participants were able to initiate JA 10 times within a session, facilitation techniques were withdrawn during a maintenance session in order to determine whether the participant could independently initiate JA. In addition the children were observed in the classroom and their use of JA in the classroom was evaluated by the teachers through interviews in order to evaluate whether these skills had generalized to a different setting and people.

Intervention setting and intensity

All sessions took place in an environment familiar to the participants, namely their school. Rooms used in the school varied according to availability, often leading to some elements of unfamiliarity in the sessions. At times, environments were very visually distracting to the children, such as a playroom which housed a variety of toys. Sessions lasted approximately 10-15 minutes and took place 2 times per week. However, breaks did occur in intervention during the school holidays and on days when the children were ill. All sessions were video

recorded for later coding of JA behaviours, reliability coding, social validity and treatment fidelity measures.

The TD participants were assessed at their preschool which they were all familiar with. The children were assessed within the school's therapy room, however, none of the children had been in the room before, therefore adding an element of unfamiliarity to the assessment. The room contained a desk, two small chairs and toys.

Measures

Due to the nature of the behaviours being investigated, all sessions were video recorded for coding. The primary dependent variable for the study was the number of acts for JA displayed by the participants during each session. Only communicative behaviours which met the criteria for communicative acts were coded on the coding sheet (see appendix A). Therefore the behaviour needed to be a gesture, vocalization, or verbalization directed towards another person in order to serve a communicative function, specifically JA (Wetherby & Prizant, 2002). Examples of these behaviours may be viewed in appendix B. Acts were recorded in terms of their means, (i.e., the specific behaviours used to express communicative intent such as eye gaze, gestures, and/or vocalization) and function (i.e., the purpose of act; e.g. IJA, behaviour regulation or social interaction). It was important to describe the function of the communication act in order to ensure acts of JA were differentiated from behaviour regulation acts (Wetherby & Prizant, 2002). In addition, this allowed any improvements in other communicative functions to be recorded and examined. Coding definitions were

based on the coding conventions detailed by Wetherby and Prizant (2002) and are presented in Tables 5 and 6.

Table 5. Definitions for Communication Means based on the CSBS DP

(a)	**Gaze shift:** This is defined as alternating eye gaze between a person and an object and back. Eye gaze must be directed at the adult's face. This three-point gaze shift may be a person-object-person gaze shift (i.e., the child looks at the interventionist first, then shifts gaze to an object, then immediately shifts gaze back to the interventionist), or an object-person-object gaze shift (i.e., the child looks at an object, then shifts gaze to the interventionist, and then shifts gaze back to the object immediately).
(b)	**Conventional Gestures:** This is a repertoire of gestures with shared conventional meaning. When the child gives, shows, reaches and points to an object for the purpose of sharing that object with the adult. Reaching includes open-hand reaching using one hand with the palm up or down, reaching with both arms, and pointing, which may be distal or contact.
(c)	**Vocalizations:** This occurs when the child responds verbally to direct the interventionist's attention to an object or event (e.g. "look", "bug", "there", "wow"), or request information, an explanation or clarification regarding an object or event, using a wh- or tag questions.

Table 6. Definitions for Communication Functions based on CSBS DP

(a)	**(JA):** This is defined as the use of communication to direct another's attention to an object or event. The child requires the adult to look at or notice something. *Comment on an object/event:* acts used to direct another's attention to an object or event *Request information:* acts used to seek information, an explanation or clarification regarding an object or event, includes wh- and tag questions.
(b)	**Behaviour Regulation (BR):** This is defined as the use of communication in order to regulate the behaviour of another person or obtain a specific result. *Requests:* acts used to gain access to an objects or to direct another to carry out an action. *Protests:* acts used to refuse an object that is not desired or to direct another to stop an action which is not desired.
(c)	**Social Interaction (SI):** This is defined as the use of communication in order to direct or maintain another's attention one oneself. The child requires the adult to look at him/her. *Request social routine:* acts used to direct another to begin or continue a game-like social interaction. *Call:* acts used to gain attention. *Show off:* acts used to attract another's attention.
(d)	**Unclear (UC):** This is defined as acts used for a communicative purpose, however there is insufficient information to determine the function of the act.

Adapted from Wetherby, A.M. & Prizant, B.M. (2002). *Communication and Symbolic Behaviour Scales-Normed edition.* Baltimore: Paul H. Brooks Publishing Co.

Data was coded primarily by the researcher who coded 100% of the data. All relevant data for each session was recorded on a coding sheet. Perseverative behaviours were only coded once. Perseverative behaviours are described as repeated previous responses (Fisher & Happe, 2005), for example P3 would often repeat the same word throughout the session inappropriately with no true communicative intent. For each session, the activity routine and the remote control toys (trial) used was noted.

Check marks were used to indicate the presence of pre-specified communicative behaviours. The time code when the trials were presented and the time code of the behaviours were also recorded. The function of the behaviour was recorded by entering a check mark under the appropriate communicative function. Finally, the total acts for joint attention for each session were plotted on a graph for visual analysis (see Data Analysis section).

Inter Observer Agreement

Measures of inter observer agreement (IOA) are an important indicator of the degree to which two or more raters agree on a behaviour being coded. Measuring IOA therefore helps to protect against observer bias and drift (Reichow, Volkmar & Cicchetti, 2008) and provide a measure of the reliability of the findings. Prior to the study, the investigator trained two qualified speech-language pathologists on coding the relevant skills. Training was achieved though initial verbal instruction with the aid of the definitions given in Tables 5 and 6. The researcher and independent raters then jointly coded three sessions from the data obtained during the pilot study in order to ensure the independent raters were

familiar with the coding criteria. The researcher and independent raters then independently coded two more of the pilot participant's sessions and achieved 80% agreement. The trained raters then coded 25% of the data, using randomly selected sessions in order to calculate IOA. None of the data used for training was included in the interrater reliability calculations.

IOA was calculated by means of percentage agreement, as well as Cohen's *kappa* (Reichow et al. 2008) which corrects for chance. Values between .6 and .75 were accepted as good, and values over .75 are described as excellent (Von Eye & Young Mun, 2005). IOA was 88% for JA, 83% for behaviour regulation and 63% for social interaction. Overall agreement was 84%. An overall kappa of .79 was obtained, suggesting excellent agreement. Percentage agreements were also calculated for each participant separately and these values are presented in Table 7.

Table 7. Overall and individual interobserver percentage agreement

	P1	P2	P3	Total
Joint Attention	95%	93%	63%	88%
Behaviour Regulation	84%	100%	79%	83%
Social Interaction	50%	94%	67%	63%
Total	88%	94%	76%	84%

Data Analysis

Each participant's data was plotted on a graph. Consistent with single subject experimental methods, visual inspection was used to evaluate the effectiveness of the treatment. Visual inspection involved analysis of the level, trend and variability in performance during the various phases of the study. Level refers to mean performance during each phase, trend refers to the slope of increase or decrease of performance in each phase, and variability refers to the degree of

fluctuation within each phase. The immediacy of the effect of intervention onset and termination, overlap between phases, the magnitude of changes, and the consistency of data across phases were also considered (Horner et al., 2005).

There are numerous advantages to using visual inspection of the data to determine treatment effects. Visual inspection allows the researcher to observe changes which may not be statistically significant, but may have clinical significance. Visual analysis is also more likely to identify independent variables which produce strong social significance, for example the effect of disruptions in intervention due to school holidays or change in interventionists. It also allows the researcher to consider sources of variability as opposed to simple overall effect size (Richards et al., 1999). However, the possible limitations of visual analysis must also be noted. For example, visual analysis may be less reliable than statistical analysis due to analyst's subjectivity.

Treatment effectiveness was also quantified through the calculation and analysis of effect sizes. Effect sizes are defined as a metric which estimates the size of the treatment effect, that is, it represents the strength of the relationship between the variables. The larger the effect sizes, the greater the degree to which the phenomenon being studied is manifested in the sample data (Meline & Wang, 2004). In this case, the effect was calculated as the size of the difference between the mean number of acts for IJA during the baseline and maintenance phase, to a standard deviation measure using the *d* index to calculate the effect size as a change in the level of the behaviour being examined (Busk & Serlin, 1992). A medium effect size, which in the case of the *d* index is .50 (Cohen, 1992), is considered clinically relevant.

Social Validity

Social validity refers to evaluations of the social relevance of an intervention by assessing the social importance of the treatment's goals, procedures, and outcomes. Another aspect of treatment evaluated by social validity measures are the appropriateness and meaningfulness of the treatment to both the clinical and social environments. This is achieved by professionals evaluating the intervention based on its appropriateness (Horner et al. 2005).

In order to determine social validity, segments from each participant's baseline and maintenance sessions were shown to a group of 6 qualified speech-language pathologists (SLPs) who were all specialised in early childhood language intervention. The SLPs rated the child's use of acts to IJA by completing a 3-point frequency rating scale (1-never; 3-often). Items were adapted from the CSBS DP Infant-Toddler Checklist (Wetherby & Prizant, 2002) and related to the children's use of gaze, gesture and vocalization to direct another's attention and general attempts to initiate JA. Refer to Appendix C for the social validity rating scales.

Also prior to the study, the participant's educators received training on different communicative acts and identification of JA, behaviour regulation and social interaction. Throughout the study, educator provided feedback to the researcher on communicative acts observed in the classroom.

Treatment Fidelity

Social interactive interventions such as this require consistent and accurate implementation of the prescribed techniques by an interactive communication partner in order to facilitate the child's interaction attempts (Hwang & Hughes, 2000). Treatment fidelity is a measure of the extent to which these techniques (i.e. the independent variable) were implemented as proposed. This allows the researcher to consider any patterns between the implementation of the techniques and the changes in the participant's behaviour (Horner et al. 2005).

Initially the intervention was to be provided by the researcher, however, there were concerns regarding bias. Therefore, the intervention was ultimately provided by a research assistant, the change in interventionist was verbally communicated to the participant's caregivers and educators. Prior to the onset of the study an honours' Speech Pathology student was trained to implement the intervention techniques. This was achieved through the provision of verbal and written instruction. The student then observed all the recorded phases of the pilot intervention with the researcher who discussed the sessions with the student. The student then provided the intervention for all three of the participants, under the supervision of the researcher, in order to ensure the process was as unbiased as possible. Due to logistical problems arising from the student therapist's academic timetable she was unable to complete the intervention. The researcher therefore provided the intervention for P2 and P3 final sessions (P1 had acquired and maintained the target skills by this time and therefore intervention was terminated). Again the change of interventionist was verbally communicated to the participant's caregivers and educators.

In order to determine treatment fidelity, intervention sessions were viewed by a group 6 of qualified SLPs who were specialized in early intervention. The SLPs were required to rate the frequency with which the interventionist used the prescribed intervention techniques using a 3-point frequency rating scale (1-never; 3-often).

Ratings were made regarding how frequently the interventionist responded appropriately to the child by labelling the child's point of focus, whether the interventionist's responses were contingent, and whether the interventionist used naturalistic reinforcement (i.e. social reinforcement). The treatment fidelity rating scale may be viewed in Appendix D.

All SLPs who viewed the intervention sessions felt that the interventionist "often" responded appropriately to the children by labelling their point of focus. In addition, all of the SLPs felt that the interventionist's responses were contingent and that she utilized natural reinforcement. This suggests that she was able to appropriately follow the child's lead in such a way that would allow the child to experience the desired *embodied simulation* and thus realize that the interventionist experienced objects and events as separate from themselves.

Ethical considerations

The research received ethical clearance from the Human Research Ethics Committee (Medical) prior to the start of the study, with clearance certificate number M070541 (see Appendix E). In making this application and in the research project, the following ethical principles were considered and implemented:

Access/ participant recruitment. In order to avoid any conflicts of interest, no participants were recruited from the researcher's private practice. In addition, all participants continued receiving regular speech therapy with their current speech-language pathologists during the study. When potential recruitment sites were approached, the researcher was not given any family contact details until families had indicated their interest. That is, families were contacted by their child's school and provided verbal and written consent before they were contacted by the researcher.

Information. All potential participant families were provided with a participant information sheet that described the nature of the project and the intervention; assurance of confidentiality; the right to withdraw at any time; the need for video recording and the fact that the video recordings would be viewed by other speech-language pathologists for coding purposes (Appendix F). It was also discussed in the information sheet that video recordings would be kept in a locked cupboard at the university for five years subsequent to the study. The information sheet presented the fact that the intervention techniques were experimental and therefore success was not guaranteed, however, in the event that the intervention was unsuccessful, counselling would be made available. Lastly, potential participant families were reassured that their children would continue to receive their regular speech therapy and that the intervention would be in addition to that.

Confidentiality. All data captured was labelled only with a key and the participants' identifying information was kept separate throughout the

intervention. Participants were referred to by number in the coding and the writing up of the research report. No names were used at any time.

Termination of intervention. Intervention continued until the participant's JA skills reached the criterion set by the TD children. Due to the fact that P1 and P2 reached this criterion, no subsequent intervention specifically targeting this skill was required. However, P3 failed to reach this criterion during the study and hence her school therapist was trained on how to implement the techniques within her individual speech therapy sessions once the study ended.

Contact with significant others. The child's caregivers were provided with a written report of their child's progress at the end of the intervention, and also received verbal feedback throughout the project. With the caregiver's permission, the child's school and private speech-language pathologist were also provided with written feedback regarding the child's progress. This was to allow the parents, therapist and teachers to reinforce the target behaviour at home and school.

Risks to participants. No foreseeable risks to the participants were anticipated as a review of 16 empirical studies using similar techniques revealed no negative effects on participants (Hwang & Hughes, 2000).

CHAPTER FIVE

PILOT STUDY

A pilot study was carried out in order to fine-tune the treatment protocol and coding procedures prior to the main study. The pilot study data was also used to train the interventionist and data coders. The intervention battery was administered to one child with ASD. The pilot participant was a 3-year-old white female diagnosed with ASD with no co-occurring diagnosis, such as hearing loss or epilepsy. She was diagnosed with ASD at the age of 2 by a neurodevelopmental paediatrician. At the time of the pilot study she was attending a private special educational preschool which specialised in treating children with ASD. She was also undergoing a home-based applied behavioural analysis program with a private facilitator. In addition to two speech therapy sessions she received per week at her school from the school therapist, she also received therapy twice per week outside school times from a private therapist. She was on no medication at the time of intervention but was following a gluten and casein free diet.

During observations prior to the baseline session she was noted to only communicate for behaviour regulation purposes. This was mainly in the form of one word utterances, however, some spontaneous two word combinations were noted. She made use of only a few gestures. These included a reach, pull, push and give. None of her communicative acts were coordinated with eye gaze. She was observed to engage in some symbolic play, for example she would feed or bath a doll.

The aim of the pilot study was to determine whether the proposed intervention battery was feasible to implement and whether the techniques led to observable increases in ability to initiate JA. The pilot participant was seen at the private practice she attended and the intervention was administered by her regular therapist. She was therefore familiar with both the environment and interventionist. She presented with a stable baseline, as she initiated no acts of JA over two consecutive sessions.

Once the intervention techniques were implemented, she rapidly began to initiate JA, and thereafter a swift increase in the number of acts of IJA was observed. An improvement in this skill both at home and in her schooling environment was also reported. Results of the pilot study are presented in Figure 3.

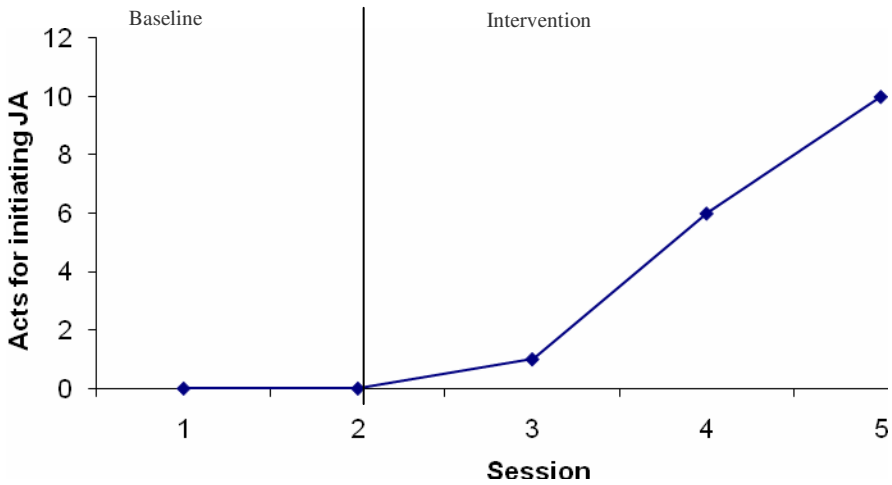

Figure 3. Acts of IJA per session for pilot participant

Careful observation of the intervention sessions revealed that the interventionist had included more directive therapeutic techniques than only

following the child's lead. These included modelling, where the interventionist demonstrated the use of words, phrases, or gestures to initiate JA regarding objects and activities the child was interested in (Ihrig & Wolchik, 1988). In other words, the interventionist was observed to actively attempt to direct the child's attention rather than following the child's lead and responding appropriately. The use of joint action routines was also observed, that is repetitive play routines were established with the child, and once these were well established, variations were introduced in order to provide opportunities for communication (Rosenthal Rollins, Wambacq, Dowell, Mathews & Britton Reese, 1998). Lastly, the use of pause was observed, which is the use of short pauses in conjunction with environmental cues in order to encourage communication (Wolery, Anthony & Caldwell, 2002). Although the intervention overall was felt to be successful, additional therapeutic techniques deviated from the theoretical assumptions underlying the techniques chosen for this study. Specifically, they were clinician-directed and overtly controlled interactions which encouraged the child to follow the therapist's lead. This was problematic as it decreased the number of opportunities for the child to naturalistically initiate and thereby decreased the number of instances the child was able to experience the act of IJA, even inadvertently. In addition, these techniques were not compatible with the underlying theoretical basis for the intervention techniques chosen (i.e., a dysfunction in mirror neurons). Therefore, opportunities to facilitate the perspective taking required to encourage the development of this JA skill were few. As a result of these findings, the study interventionist was carefully trained

and monitored to ensure that these techniques were not inadvertently used in the study intervention battery.

In addition, it was noted that an accommodation effect occurred when the JA trials (i.e., the activation of the remote-controlled stimuli) were activated too frequently during sessions. In other words, the participant stopped responding to the trials when they were activated too frequently. As a result it was decided that the trials would be presented only twice during each routine.

Following the pilot study it was felt that a more formal baseline measure of overall communication was required, as opposed to simple record review and observations, to appropriately compare baseline and follow up communication behaviours in a formal test situation. It was therefore decided that participants should be evaluated using the CSBS DP (Wetherby & Prizant, 2002) both before and after the intervention.

CHAPTER SIX

RESULTS

Performance of TD participants

A single baseline session was conducted with the TD participants in order to determine the training criterion of number of acts for JA for the participants with ASD. Results of the baseline session are presented in Table 8. The TD children initiated JA, on average, 20 times per session, with a range of 14-24. None of the three activities presented appeared to be more successful than another in eliciting acts of IJA across all three children. In general, the frequency of bids to initiate JA appeared to be influenced by the individual child's interests and preferences. In addition, it was noted that the TD participants did not initiate JA in response to all six trials introduced in the sessions, however all of the participants did respond to the trial by shifting their gaze towards the toy every time it was activated. They therefore provided easily identifiable points of focus, which would be particularly useful when implementing techniques which rely on following the child's lead. The trials appeared to therefore offer potential recurrent opportunities to implement the intervention strategies in this study.

Based on the TD participant performances, an intervention criterion of 10 acts for IJA in a given session, which is half the average of the TD children, was established for the participants with ASD, in order to move from the intervention to maintenance phase. This however was not applicable if the criterion was reached in the first session in order to ensure that JA skills were truly acquired. This value was chosen as the aim of the study was not to achieve levels of IJA

commensurate with mature users of JA, but rather to ensure mastery of the skills at a clinically significant level. Communicating for JA 10 times in a session was felt to be a realistic value for this goal.

Table 8. Acts for IJA in TD participants

	TD1	TD2	TD3	Mean	*SD*
Animal routine	4	9	5	6	2.65
Book routine	3	10	2	5	4.36
Puzzle routine	5	2	11	6	4.58
Trials	2	3	4	3	1.00
Total	14	24	22	20	5.29

Performance of participants with ASD

The frequencies of acts for IJA observed during each session across the three phases of the study are presented in Figure 4 for all three participants. Values indicate the total number of acts for IJA observed during the three routines and in response to the specific JA trials combined.

Visual inspection of the data indicates that all three participants presented with stable baseline measures prior to intervention as there were no improvements in IJA for any of the participants during the staggered baseline sessions. However, it must be noted that the baseline phase only spanned 3-5 sessions. A longer baseline phase may have strengthened the design of the study. Overall the data in Figure 4 suggests that all three participants displayed improvements in their ability to initiate JA during the intervention phase, however, the responses of the three participants to the intervention differed substantially.

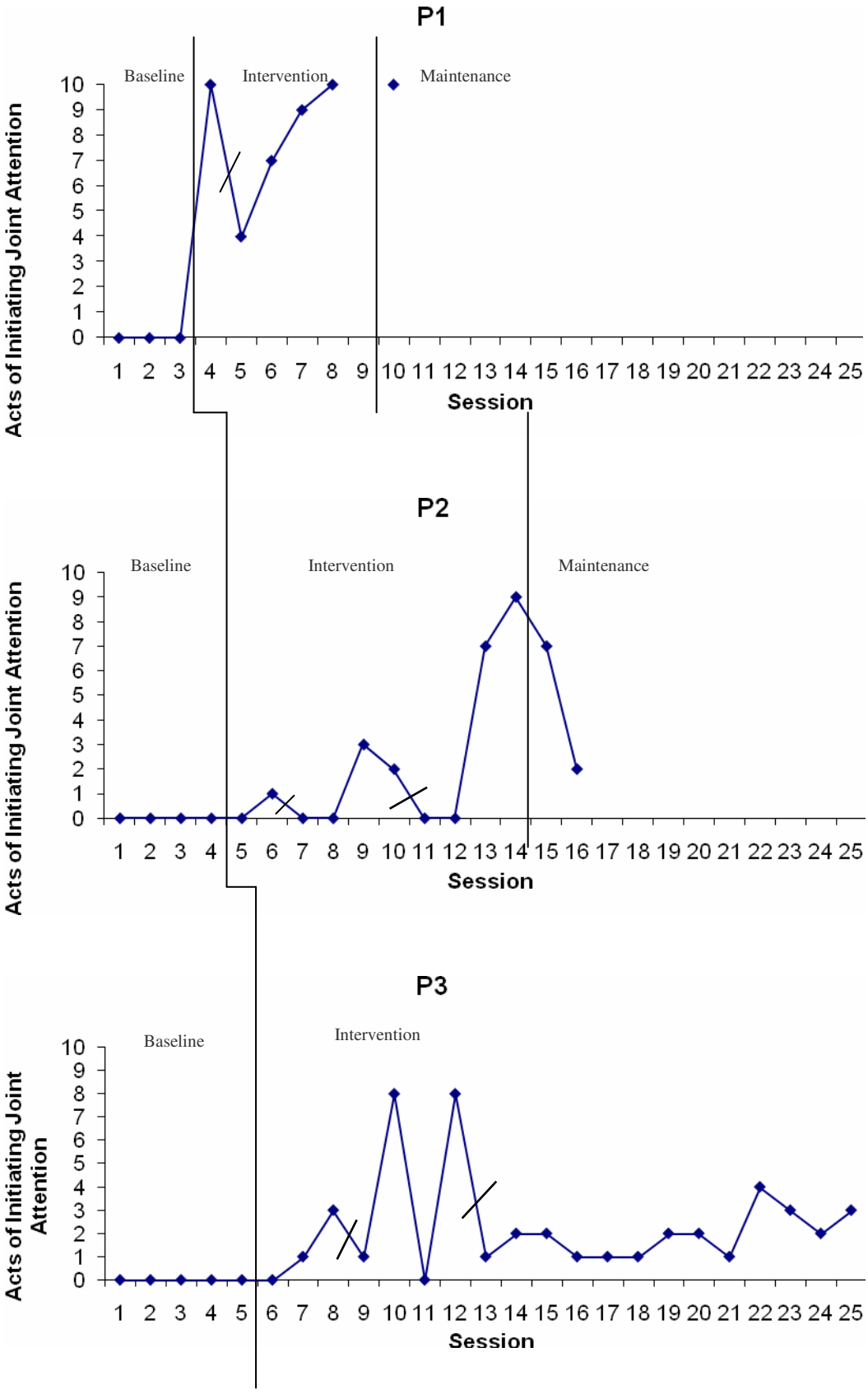

Figure 4. Frequency of acts for IJA for each participant

P1 demonstrated the clearest treatment effect, with immediate changes observed in the first treatment session, in which he actually reached the treatment criterion of 10 spontaneous acts for initiating coordinated JA. However, it was decided that he would continue with therapy to ensure that JA skills had truly been acquired. He only required 6 sessions to meet the criterion to transition to the maintenance phase. During his maintenance phase, P1 maintained the training criterion of 10 acts for IJA. The trend of P1's data indicates a steep slope of increase, suggesting a rapid acquisition of the target skills with P1 presenting with the steepest slop of increase in the target behaviour in comparison to P2 and P3.

In terms of variability or fluctuation, only one decline in the target skill was observed, which was followed directly by improvements in his skills. This occurred during the intervention phase (session 5) directly after a break in intervention, due to school holidays which lasted a week (breaks in intervention are indicated by lines intercepting the graphs).

With regard to magnitude of change, P1 initiated JA up to 12 times more in the intervention phase than was observed in the baseline phase. This suggests a large and clinically significant magnitude of improvement. The magnitude of P1's improvement was the greatest of the three participants. An effect size of 1.6 was calculated for P1 suggesting a large effect (Cohen, 1992).

P2 demonstrated a treatment effect from his second intervention session and was also able to reach the maintenance phase, but only after 10 sessions of intervention, in session 14. Although P2 continued to initiate JA in the maintenance sessions, a decrease in the target behaviours was noted. Consideration of the visual data indicated that the slope of P2's improvement was

less steep than that of P1 indicating a more gradual acquisition of the target skill. On P2's graph, three points of fluctuation are evident, two in the intervention phase and one in the maintenance phase. This resulted in at least 5 overlapping data points between the baseline and intervention phases. P2's school attendance was very erratic due to transport difficulties. Both points of decline in his acquisition of the target behaviours were preceded by long breaks in intervention of greater than four weeks at a time, which may have affected his performance. The last decline in performance occurred subsequent to the intervention techniques being withdrawn. P2's magnitude of improvement was not as great as P1, however, he was able to initiate JA up to 10 times more than was observed during the baseline phase. This proved to be clinically significant according to the social validity data. An effect size of 0.79 was calculated for P3, again suggesting a large effect size (Cohen, 1992).

In contrast, P3 did not meet the training criterion of 10 acts for IJA in a given session. Although the immediacy of P3's acquisition was the same as that of P2, with her IJA in the second intervention session, the slope of her improvements was much more gradual. Inspection of her graph suggests much more variability in her performance, with six decreases in her performance being evident, even though her school attendance was much more consistent than that of P2. Although two of the largest declines in her performance were preceded by breaks in intervention, no other significant precipitating factors could be identified for the other declines. P3 displayed the smallest magnitude of improvement, only IJA up to a maximum of eight times more than was observed in the baseline session.

She displayed a marked increase in her number of JA initiations in the fifth intervention session, and even though she did not meet the training criterion set, an effect size of 1.08 was calculated, suggesting a large effect size (Cohen, 1992). This suggests that her improvements in IJA were still clinically significant.

Due to the fact that P3 did not display object interest during the baseline sessions, this had to be targeted in the intervention sessions in conjunction with IJA, as per the techniques discussed in the methodology. This was targeted over the first 16 intervention sessions up to session 21, where after she spontaneously displayed object interest. There were no clear changes once the techniques for enhancing object interest were terminated.

In summary, all three participants showed large and clinically significant treatment effects. P1 demonstrated the most immediate, consistent, and substantial effect. P2 demonstrated a fairly rapid, but more gradual acquisition of acts for JA, while P3 appeared to demonstrate some early gains in treatment, but was inconsistent in her performance after session 12 (the 7th treatment session) and was unable to reach the training criterion to move on to the maintenance phase.

Acts of IJA across routines

In order to determine whether one routine or another, as well as the children's responses to the trials presented during the routines, was more successful in eliciting acts for IJA across the participants mean acts for IJA across the routines and trials were examined. Results are presented in Table 9. As with the TD participants, no clear trends were noted in terms of the participants' use of

acts for IJA across the three activities used (i.e., book, puzzle and animals), or the JA trials.

Table 9. Mean (*SD*) number of acts for IJA during various routines

	P1	P2	P3	Mean	*SD*
Animal routine	3.90	1.29	0.94	2.04	1.62
Book routine	3.40	1.43	0.65	1.83	1.42
Puzzle routine	2.20	1.57	0.47	1.41	0.88
Trials	1.10	0.14	0.19	0.48	0.54
Total	2.65	1.11	0.56	1.44	1.08

During the intervention, the participants initiated JA during all three routines and, like the TD participants, variations appeared to be related to the child's interests. For example, P2 displayed many acts of IJA when a transport insert puzzle was used whilst P1 displayed the most acts of IJA when a fantasy insert puzzle was used.

The aim of the trials as novel stimuli was to provide extra opportunities for the interventionist to clearly identify the participant's point of focus and follow their lead. This would result in more opportunities for the intervention strategies to be implemented and therefore provide more opportunities for the participants to experience *embodied simulation*. The potential for this was clearly suggested by the fairly high rate of gaze shifts to the trials for each participant observed during the baseline sessions as depicted in Figure 5. The trials seem to have provided consistent opportunities for the interventionist to respond with the techniques throughout the study. P1 and P2 responded relatively consistently to the trials, with each only having absent responses in one session. P3's responses were less consistent. Interestingly, her responses to the trials decreased once she developed

object interest, suggesting that she was better able to focus on the play tasks or perhaps less able to shift her attention from the play tasks to the trials when they were activated.

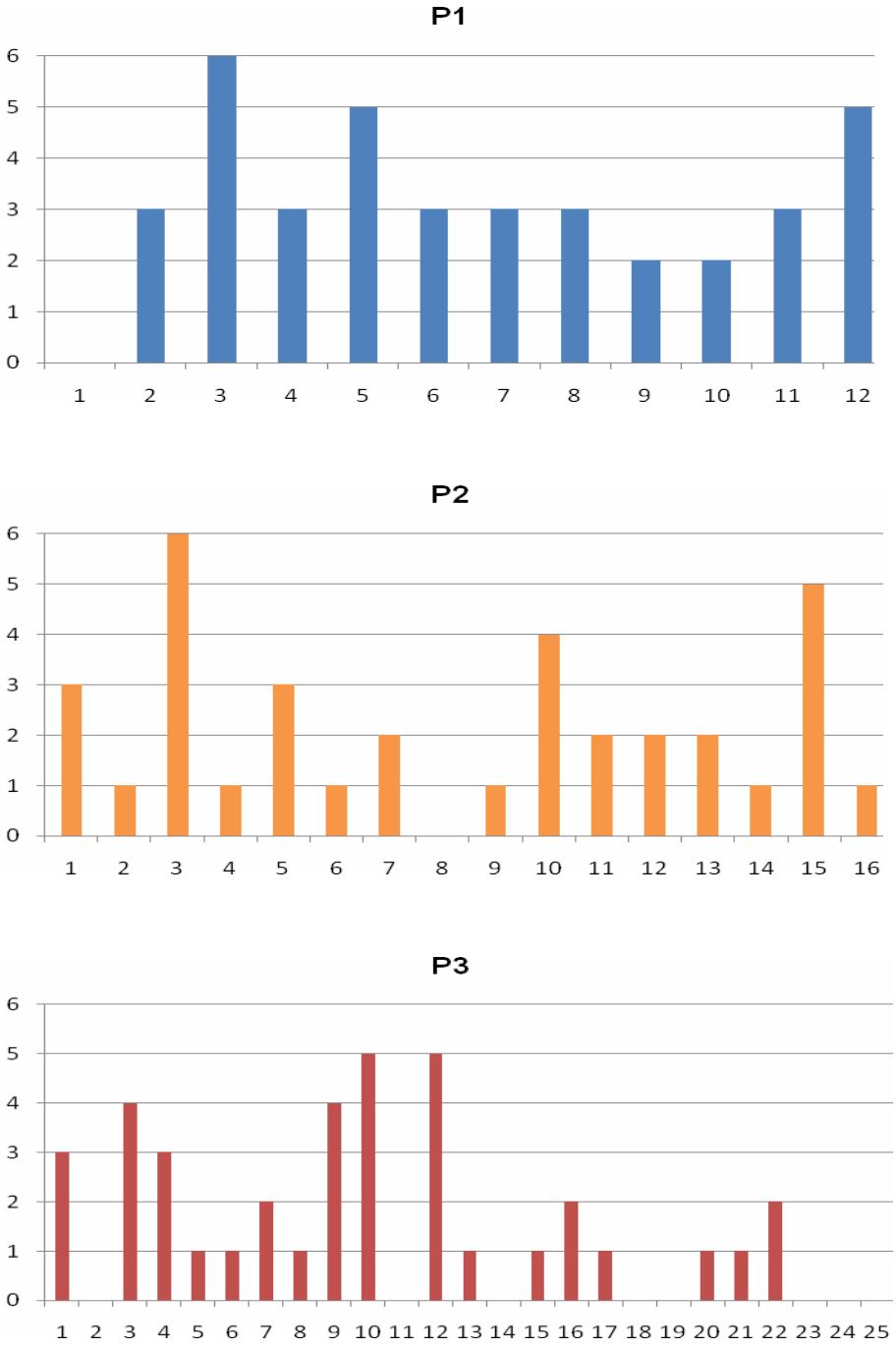

Figure 5. Number of gaze shifts to trials

Even though the participants seldom initiated true acts for JA in response to the trials, they did provide additional opportunities for the implementation of the intervention techniques. This was important particularly with a child like P3 who initially had no object interest, which made it difficult for the interventionist to follow her point of focus and implement the intervention strategies. If the trials had not been introduced, the interventionist would have had to wait until the sixteenth session when the participant begun to spontaneously display object interest to reliably identify her point of focus and implement the intervention strategies.

Maintenance and Generalization of JA behaviours

To assess generalization of the target behaviours P1 and P2's ability to spontaneously initiate JA in the absence of the facilitation techniques was recorded during the maintenance phase. In addition to this quantitative measure, the researcher also observed all the participants in the classroom and discussed their skills with their educators in order to obtain qualitative information regarding their use of the target skills following intervention. Post treatment all three participants displayed more acts of IJA than was observed during their baseline sessions, even though P3 did not meet the training criterion in the given time for the study, with P1 showing the most significant gains. Although IJA behaviours were maintained over the maintenance period for P1, a decline in these behaviours was observed for P2 once the intervention techniques were withdrawn.

Qualitatively, the ability to initiate JA in the classroom was observed both by the researcher as well as reported by educators, who had received training on

identifying IJA skills, for all three participants. For example, on one occasion when the interventionist was observing in the classroom, P1 coordinated a show with eye gaze when drawing the interventionist's attention to a toy in the class. In the class, P2 was also observed to coordinate a point with a vocalization when drawing his teacher's attention to a picture of an animal. Also, P3 was observed to coordinate a give with eye gaze when drawing a toy to her teacher's attention.

In addition, the teacher reported noticing that the children used vocalizations and pointing to draw her attention to external objects and events more often. As the interventionist was visiting the school on a weekly basis, it was possible to monitor the participants' maintenance of skills through classroom observations and teacher interviews for as long as eight months post intervention for P1 and four and three months post intervention for P2 and P3 respectively.

Impact of intervention on other communicative acts

In order to determine whether the intervention had any impact on the frequency of communicative acts for other functions, specifically, behaviour regulation and social interaction, the frequency of these acts was calculated and presented graphically in Figure 6.

Visual inspection of the data in Figure 6 suggests that all three participants displayed improvement in their use of acts for social interaction, which is an act to draw attention to one's self. Whilst P2 and P3 also displayed improvements in their use of communicative acts for behaviour regulation, the number of these acts used by P1 remained fairly similar to that of his performance during his baseline.

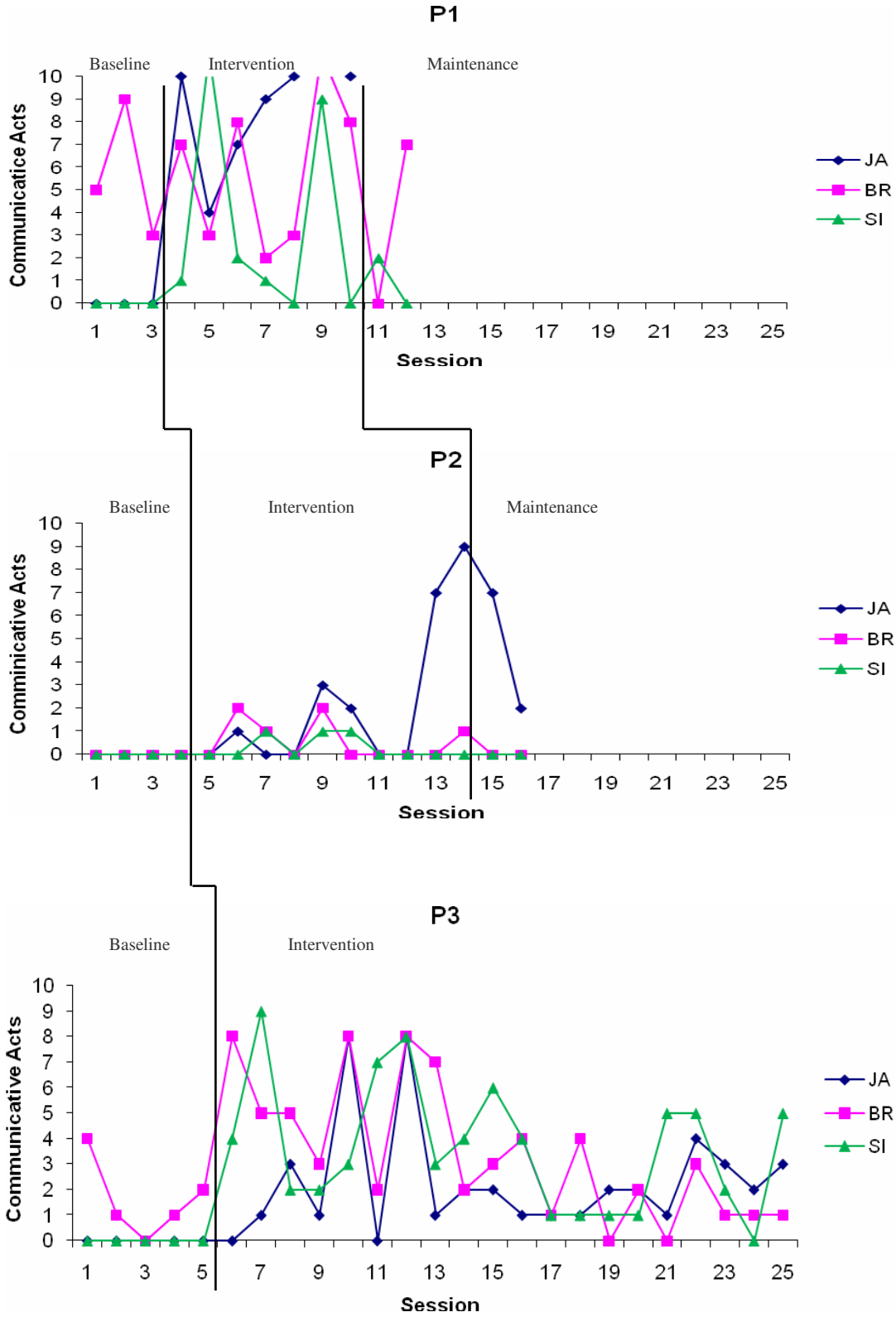

Figure 6. Frequency of communicative acts for each participant

Further inspection of the data in Figure 6 suggests that improvements in acts for all three functions were fairly similar in terms of their slope and variability, suggesting that acquisition of communicative acts for these three functions was related. However, for both P1 and P2, improvements in acts for JA appeared to outstrip improvements in acts for behaviour regulation and social interaction, suggesting that the procedures used in this study may have particular relevance for enhancing JA skills.

Post-treatment Performance on the CSBS DP

In order to determine whether the intervention effects could be detected on a formal assessment tool, all participants were reassessed on the CSBS DP following the maintenance sessions or at the end of the study period for P3. The results are presented in Figure 7 contrasting the pre- and post-intervention scores. All of the participants appeared to show improvements in almost all skills assessed by the CSBS DP. Interestingly, the most gains (particularly for P2 and P3) were made within the social subscales, again suggesting the specificity of the intervention techniques. However, changes due to maturation cannot be ruled out as raw scores were used. These could not be converted to standardised scores due to the participants' chronological age.

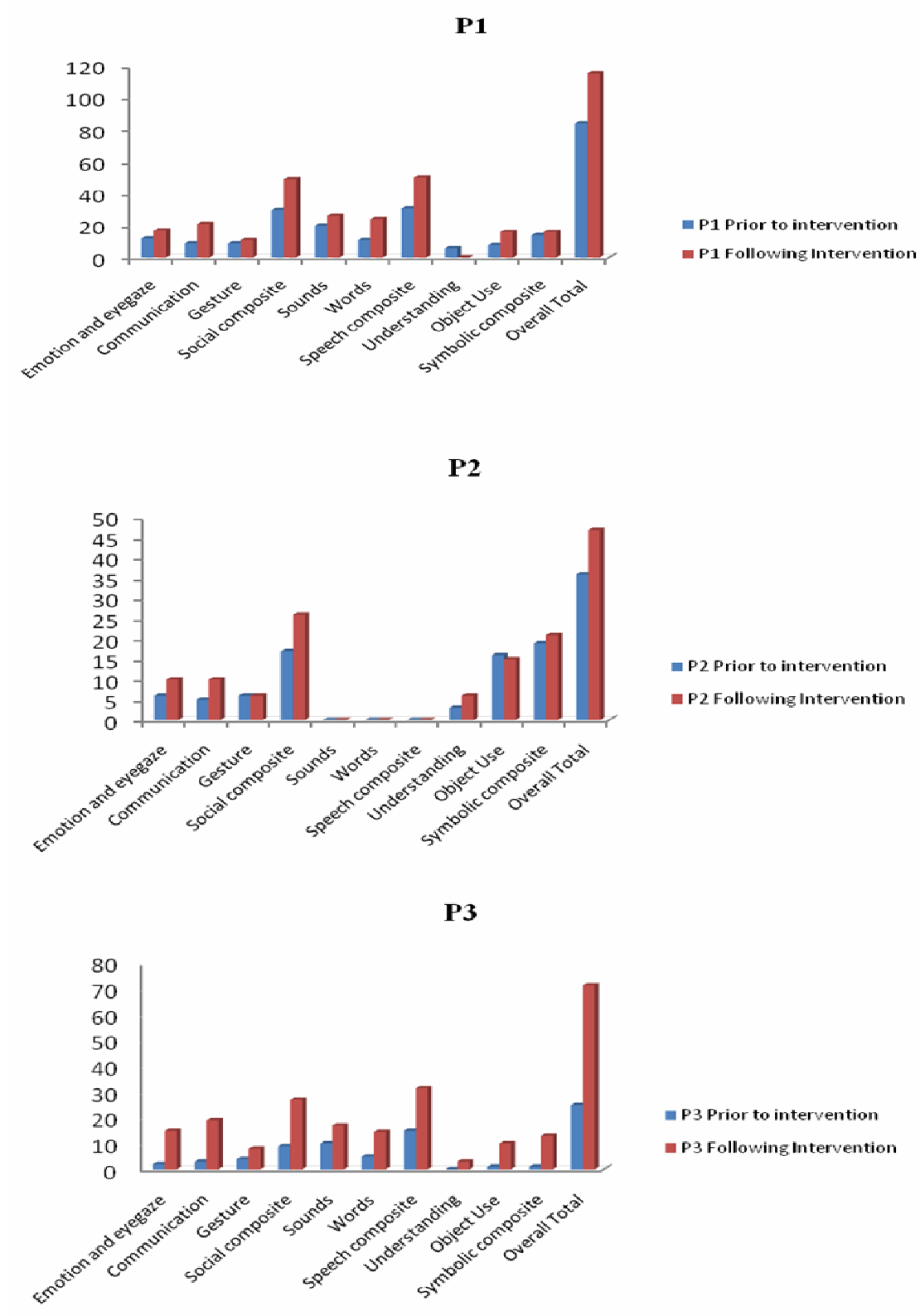

Figure 7 Raw cluster, composite and total CSBS DP scores for each participant prior to and post intervention

The time between the baseline assessment and post intervention assessment was 14 months for all of the participants. A detailed description of changes in performance for each participant follows.

Participant 1. Following intervention P1 made use of gaze shifts in order to direct the researcher's attention in all the activities except the book routine. This is a significant improvement as during the baseline no gaze shifts were observed. Following intervention he showed an increase in the frequency of shared positive affect, with this being observed in all the routines. P1 communicated at least once during all activities and in most activities communicated on more than three occasions. In contrast to the baseline measures where he communicated only for behaviour regulation, following intervention he communicated for all three communicative functions (i.e., behaviour regulation, social interaction and JA), and often communicated for all three functions in a single activity. Following intervention, P1 was noted to use the full inventory of consonants, and substantially more word combinations to serve a variety of communicative functions, including IJA.

P1's range of actions on the play objects presented was greatly improved from the baseline measure, where his object use was limited and those actions observed were subsequent to modelling by the researcher. Following intervention he spontaneously produced a range of actions on the objects, such as drinking with the cup, feeding with the spoon, stirring, scooping, pouring and rocking the doll. In addition, action schemes towards others were observed, such as feeding the doll with the bottle, spoon and cup. Sequences of action schemes were also

observed, these included stirring with the spoon then feeding the interventionist and pouring into the cup then handing to the interventionist.

Participant 2. Following intervention P2 was able to make use of gaze shifts and shared positive affect during two of the activities; these behaviours were not observed during the baseline measure. Following intervention communicative acts were observed during the balloon, bubble, snack jar and play tasks. In contrast to the baseline measure where communicative acts all served the function of behaviour regulation, post intervention P2 interacted for behaviour regulation, social interaction and JA. Following intervention, more use of gesture was observed and these were coordinated with eye gaze, making these acts meet the criterion for coordinated JA.

Following intervention P2's phonemic repertoire had increased, however, he was still not making use of words. During the play task, sequences of actions, such as pouring and then drinking from the cup and scooping then eating with utensils, were observed which were not observed in the baseline measure.

Participant 3. Following intervention P3 was observed to display shared positive affect during all of the activities and gaze shifts were observed during the balloon, snack jar and book tasks. Contributing to the large improvement in her Emotion and Eye Gaze cluster score was her ability post treatment to follow the researcher's point consistently, suggesting the development of her ability to respond to other's bids for JA. This was felt to be a pertinent factor which is discussed further in the discussion.

Communication acts were observed throughout the post-intervention assessment, whereas during the baseline only three acts were recorded. As

opposed to the baseline, where all acts observed served behaviour regulation functions, communicative acts following intervention served the function of JA, social interaction as well as behaviour regulation. This is a significant improvement from the baseline. P3 was observed to use give, show, push and reach gestures following intervention, all serving various functions of behaviour regulation, social interaction as well as JA.

An increased phonemic repertoire was noted as well as an increased number of words. During the comprehension probes, P3 was able to identify one of the objects presented, a bottle, which she was unable to indentify before intervention.

No actions on the play objects presented were observed during the baseline measure, even once some actions were modelled. However, following intervention P3 was observed to put objects inside other objects, feed with the utensils, stir, scoop, pour and rock the doll. In addition, an action scheme on another was observed in that she fed the doll with the bottle, as well as an action sequence wherein she stirred then scooped and fed the doll with the utensil. Object interest was specifically targeted in the intervention, mainly in the animal routines where play with the toys was facilitated. These results suggest that P3 did indeed acquire object interest as she was able to generalize these skills to the novel toys used in the CSBS DP.

Social Validity

In order to obtain a measure of the social validity of the changes observed in intervention, segments of the baseline session for all three participants and

post-intervention sessions for P1 and P2 were observed by 6 SLPs who rated the segments on the use of a variety of joint engagement behaviours. They were also shown the last intervention session for P3, as she did not reach the criterion set to transition to the maintenance phase. All of the participants were rated as never using gesture, eye gaze or vocalizations to initiate JA by all six of the SLPs during their baseline sessions. All 3 participants were perceived to have shown improvements in their use of eye gaze, gesture and vocalization to initiate JA in their maintenance / last intervention session by all of the SLPs. Specific results of the social validity measure may be viewed in Table 10.

Table 10. SLP ratings of JA before and after treatment (N=6)

Items	P1		P2		P3	
	Before	After	Before	After	Before	After
1. The child appropriately uses eye gaze to direct the adult's attention	N = 6 S = 0 O = 0	N = 0 S = 2 O = 4	N = 6 S = 0 O = 0	N = 0 S = 6 O = 0	N = 6 S = 0 O = 0	N = 0 S = 6 O = 0
2. The child appropriately uses commenting to direct the adult's attention	N = 6 S = 0 O = 0	N = 0 S = 6 O = 0	N = 6 S = 0 O = 0	N = 0 S = 6 O = 0	N = 6 S = 0 O = 0	N = 0 S = 6 O = 0
3. The child appropriately uses gesture, such as pointing, showing, giving or reaching, to direct the adult's attention	N = 6 S = 0 O = 0	N = 0 S = 5 O = 1	N = 6 S = 0 O = 0	N = 0 S = 6 O = 0	N = 6 S = 0 O = 0	N = 0 S = 6 O = 0

(Never = N; Sometimes = S; Often = O)

Although there was no section for additional comments on the social validity measure, the SLPs gave some verbal feedback to the researcher after watching the sessions. The SLPs commented that, in addition to the increased

frequency of P1's use of eye gaze, they felt that the quality of his eye gaze during the maintenance sessions was significantly improved. They commented that the improvement in P2's use of pointing was most notably improved, and that the overall quality of P3's social interactions was the most obvious improvement.

During weekly interviews with the participant's educators the teacher reported noticing that the children used vocalizations and pointing to draw their attention to external objects and events more often. These results support the findings that overall improvements in the participant's ability to initiate JA were evident following intervention.

CHAPTER SEVEN

DISCUSSION

This study aimed to investigate the effectiveness of a group of social interactive techniques, based on the mirror neuron hypothesis, to facilitate the development of IJA in three children with ASD. The purpose of the techniques was to facilitate the children's understanding that others are separate from themselves through a process of *embodied simulation*, or the ability to gain a sense of another's thoughts, a necessary skill for IJA.

Taken together, the results suggest clinically significant gains in the ability to initiate JA in all three participants as a result of the intervention, despite unique patterns of responses for each participant. Factors which were felt to contribute to the variability in effectiveness of the intervention were: (1) breaks in intervention, which visibly affected the participant's performance, (2) the inclusion of the trials within the sessions, which provided opportunities for the interventionist to reliably follow the children's lead and implement intervention techniques, (3) development of RJA, and (4) presence of object interest. These factors are each discussed in more detail below.

Improvements in other areas of communication development, such as acts for behaviour regulation and social interaction, were evident but not as substantial, suggesting the intervention was fairly specific to the development of skills for IJA. Based on Mundy and Burnette's (2005) "coactive model", the emergence of JA skills may result in the child becoming more responsive to their environment, which in turn would result in greater social input and thereby further

language development. This suggests that the improvement in this skill may later lead to the further acquisition of other communication skills. The theoretical implications of these findings are also elaborated further in this discussion.

Individual variability in response to intervention

All three participants displayed clinically significant improvements in their ability to initiate JA with large effect sizes, although only two of the participants reached the training criterion. All three of the participants were observed to IJA in the classroom as well as at home subsequent to the intervention. Even though P3 did not reach the training criterion her improvements were clinically significant. Therefore the training criterion may have been set too high.

Improvements in JA skills were also evident through visual analysis of the data, and was supported by social validity measures. The participants' skills were observed to be maintained for up to eight months post intervention for P1 and up to four months post intervention for P2. Even though P3 did not meet the training criterion of 10 acts for IJA, she was observed to initiate JA up to 8 times in two of the intervention sessions. Her teacher also reported observing her initiate JA within the classroom, and this was also observed by the researcher.

The findings of this study suggest that the use of social interactive techniques which follow the child's lead may provide opportunities for children with ASD to experience *embodied simulation*, or allow them to take on another's point of view and realize that their communicative partner has experiences separate from their own. It appears that repeatedly responding to the children's point of focus as if they had initiated JA, may have helped them learn how it feels

to initiate JA. They may thereafter be motivated to share their experiences with their communication partner, resulting in spontaneous bids for IJA. This is imperative as children with ASD do not acquire skills through passively observing other's engaging in behaviours and need to actively experience engaging in behaviours themselves in order to acquire skills (Prizant & Wetherby, 1998).

It is important to emphasise that these acts did in fact serve as acts for IJA. There are a number of factors to consider when discerning between the acts for behaviour regulation and acts for JA. Firstly, social interactive approaches such as the one used in this study demand that naturalistic reinforcement be utilized. As a result, the children gained no tangible reinforcement for acts of IJA. Therefore, their only motivation for IJA could have been to share their interest with their communication partner in order to continue receiving responses to their JA bids.

Criteria for establishing the function of the communicative acts were based on definitions of communicative acts outlined by Wetherby and Prizant (2002) in the CBSB DP. Lastly, spontaneous acts of IJA were observed to generalize to different people (i.e., caregivers and educators) and in different environments (i.e., classroom and home), suggesting that these skills had truly been acquired by the participants.

All three participants initiated JA during all three activities (i.e., book, puzzle and animals). The frequency of acts appeared to be related to the participants' interests rather than the actual activity. For example, P2 enjoyed an animal book which had a colourful picture of a different animal on each page and initiated JA frequently when that book was used, whilst P3 would initiate JA more often when a flap book was used.

The activities appeared to provide equal opportunities for the children to initiate JA, and were felt to be useful activities when using intervention techniques, as it was often easy to accurately determine the child's point of interest during these tasks. It is, however, crucially important that the interventionist, whether it be a speech-language pathologist or caregiver, consider the child's interest when planning intervention and make sure that the equipment chosen matches their interests for optimal results.

The social significance of the changes in targeted behaviours was demonstrated through the assessment of social validity. The results showed that not only were the changes noticeable to the researcher and reliability coder, but also to external observers, which were six qualified SLPs. All of the observers rated the children as "never" using gestures, vocalizations of eye gaze to initiate JA during observations of the baseline sessions. During analysis of the maintenance sessions the SLPs felt that P1 initiated JA "often" and that P2 and P3 initiated JA "sometimes".

Even though P2 and P3 only initiated JA "sometimes" the SLPs felt that the quality of these behaviours had improved notably. P3 did not meet the training criterion set for the target behaviour, however, naïve observers, namely her grandmother and educators, as well as qualified SLPs, had noted that she was using more eye gaze, vocalizations, points and shows in order to draw her communicative partner's attention to her point of focus at the end of the study. Again, due to the fact that generalization of P3's skills were evident to these observers, as well as the large effect size of her improvements, it is possible that the training criterion may have been set too high. Based on her findings it is likely

that her abilities would be better comparable to a younger child's, who's JA are still emerging rather than a 2 year old child (such as the matched TD participant involved), who's JA skills would have been fully developed. This is an important consideration for future research and is discussed further below.

The rate of acquisition of skills for IJA was observed to be influenced by the consistency of intervention. Although P2 only required 4 more sessions than P1 to reach the training criterion, this took five months longer. This was primarily due to transport difficulties resulting in very poor school attendance by P2. This is a particularly relevant issue within the South African context, as transport difficulties often prohibit children from attending intervention sessions at schools, hospitals and clinics.

The findings here suggest that the intervention, as interpreted in this study, would be most effective with a minimal intensity of 1-2 sessions per week. Within our current context this is often not possible for numerous reasons. Firstly, the government does not subsidise specialized schooling, such as the school the participants attended, or any private intervention, and although intervention is provided at government hospitals and clinics, these facilities are often great distances away from families' homes and are under resourced. As a result, children are often only seen approximately once a month for intervention. Parents are often forced to work longer hours in order to pay for private intervention, in a context where most families already require both parents to work to simply pay for everyday necessities.

This results in both logistical difficulties, in getting children to intervention, as well as financial difficulties. It therefore could be more beneficial

to train caregivers to implement the intervention. Further research could focus on the implementation of these techniques by caregivers. This would also be valuable considering the implications of language barriers in intervention in the South African context.

It must also be noted that due to the fact that the children were seen at school they did not receive intervention during the school holidays. These holiday breaks, indicated on Figure 4, mostly adversely affected P3. A regression in P3's object interest was noted after each holiday, which could have adversely affected her performance. This is another factor which may be overcome through training caregivers to implement intervention.

As mentioned in the methodology, a research assistant was trained to administer the intervention. However due to difficulties in her academic timetable, she was unable to continue with the study after the second school holidays. This resulted in a change in interventionist. As seen in Figure 4 this only appeared to have adversely affected P3, who as mentioned in her case history, was an extremely anxious child. She found change difficult and took time to develop a relationship with the new interventionist.

The aim of the trials was to provide a novel stimulus to allow additional opportunities for the therapist to easily identify the child's attentional focus and implement the intervention techniques, and therefore provide more opportunities for the participants to experience *embodied simulation*. The potential for this was seen by the numerous gaze shifts to the trials for each participant observed in the results. As mentioned, P1 and P2 responded fairly consistently to the trials, whilst P3's responses were less consistent. Her responses to the trials decreased once she

developed object interest, suggesting that she was better able to focus on the play tasks or perhaps less able to shift her attention from the play tasks to the trials when they were activated. Numerous authors have found that children with ASD have impairments in attention, specifically in selective attention, orientating and shifting attention (Dawson, Meltzoff, Osterling, Rinaldi & Brown, 1998).

Another factor felt to have influenced the rate of acquisition of the target skills was the introduction of the remote control trials which provided recurrent, novel events to capture the participant's attention. The positioning of the trials made any attention shift directed towards them clearly visible. These allowed the interventionist to reliably identify the children's point of focus and implement the intervention strategies repeatedly in every session, thereby increasing opportunities for the child to experience *embodied simulation*. This was particularly useful with P3 who had not developed object interest until the sixteenth session and therefore did not provide many opportunities for the interventionist to follow her lead.

Responsiveness to the intervention may also have been influenced by the development of object interest. Whilst P1 and P2 both displayed good object interest prior to intervention and progressed fairly quickly through the intervention, P3 initially displayed no object interest. As a result, it was necessary to target object interest concurrently to the intervention techniques. P3 only began to display spontaneous object interest in the absence of scaffolding from the interventionist during the 16th intervention session (i.e., session 21).

This finding supports the hypothesis by Yoder and McDuffie (2006) who proposed the importance of object interest to the development of communication

skills in children with ASD. They stated that a child needs to be interested in an object to want to share the experience of seeing or playing with that object with their communication partner. Also, following the child's lead relies on the interventionist talking about the child's point of focus (synchronous undemanding talk) and linguistically encoding the communicative message the child has directed unconsciously through eye gaze, gestures (e.g., reaching) or vocalizations (linguistic mapping). Children with poor object interest provide few opportunities to implement these techniques and make it difficult for the interventionist to accurately determine the child's point of focus (Yoder & McDuffie, 2006). For example, if a child only engages with a few objects the adult's undemanding talk will then only provide a few labels for the child. Similarly, if the child only engages with objects in a limited number of ways the adult's undemanding talk may then only introduce a few action labels for the child (Yoder & McDuffie, 2006). This will lead to fewer opportunities for the child to experience IJA through the process of *embodied simulation*. Fewer unwitting experiences of IJA would lead to fewer opportunities to learn what it feels like initiate JA and therefore delays in intentionally IJA. The value of the remote control trials was that they provided opportunities to reliably identify the child's point of focus to a novel event and implement the techniques and thus allowed for more opportunities for the child to unconsciously experience IJA.

Rate of acquisition of IJA may also have been affected by the ability to RJA. At baseline, P1 and P2 responded consistently to the interventionist's bids for JA, whilst P3 did not. This may be particularly relevant as developmentally the ability to RJA typically develops before a child initiates JA (Morales et al.,

2000; Morales, Mundy & Rojas, 1998). Once a child is able to RJA they would have better perspective taking skills on which to build, which in turn may assist in the development of IJA.

Social pragmatic theories of development suggest that once a child understands that their communications partner's point of interest is different from their own, they may act intentionally to establish a mutual point of focus. However, in previous studies where RJA was targeted prior to IJA (Whalen & Schreibman, 2003), the acquisition of IJA was not guaranteed. Based on the mirror neuron hypothesis which formed the basis of this study, it is possible that some children need to experience IJA in order to acquire this skill. The value of the techniques based on the mirror neuron hypothesis is that they are designed to give the participants the experience, without necessarily relying on the presence of response to JA as a prerequisite. That is, they are not required to actively acknowledge or initiate communicative acts, nor coordinate attention with the object/event and their partner. Rather it is their communication partner's responses, through following the child's lead, that help to manipulate the way they experience objects and events (Yoder & McDuffie, 2006), in this case, sharing JA.

Specificity of intervention

Results of the study revealed improvements specific to social communicative skills, particularly IJA. Improvements in frequency of acts for social interaction in all three participants were also observed. P2 and P3 also displayed improvements in their ability to communicate for behaviour regulation following intervention. However, neither of these improvements was as

noteworthy as the improvements in JA. This suggests that the intervention specifically targeted JA. This lends further support to the theory that by specifically following a child's lead, in a manner which distinguishes them as separate from others, they are able to consider another's perspective, or experience *embodied simulation.* This appears to encourage JA skills particularly, as opposed to behavioural regulation and social interaction, which require less perspective taking. Also the children received social, rather than tangible, reinforcement which would encourage social communication such as acts for JA and social interaction rather than acts for behaviour regulation.

Wetherby et al. (2007) found that persistent deficits in IJA were unique predictors of later language outcomes in children with ASD. This suggests that early interventions which result in improved JA skills by the age of 5 would result in better outcomes in other areas of communication development. Mundy and Burnette's (2005) "coactive model" of development suggests an interaction exists between early behavioural disturbances and later neurodevelopmental outcomes in children with ASD. Therefore the early provision of scaffolding in order to improve pivotal skills may minimize cumulative effects on language development over time. This is due to the fact that neurological development is an interactive process shaped by the external environment, particularly within the first few years of life (Mundy & Burnette, 2005; Mundy & Crowson, 1997; Vaughan et al., 2003; Markus et al. 2000; Siller & Sigman, 2002; Warren, Yoder, Gazdag, Kim & Jones, 1993).

Transactional theories stress the relevance of reciprocal interactions with significant communication partners. JA skills specifically are important as they

influence the manner in which the child's partners communicates with them. Acts of IJA by a child elicit specific responses, such as verbal labels, from the child's communication partners (Yoder & McDuffie, 2006) which in turn result in rich language learning opportunities.

IJA skills may therefore have a cumulative effect on the number and quality of a child's interactions with others. When children share their interests they are often seen as more pleasurable to engage with, than children who simply interact for behaviour regulation. Therefore, without IJA skills children are exposed to less incidental linguistic input. Even so, it is impossible for interventionists to introduce children to all the semantic labels they may need. Therefore it is imperative for them to be equipped with the behaviours which would facilitate incidental linguistic input (Yoder & McDuffie, 2006). This again implies the importance of caregiver training. Many of the significant others of a child with ASD have experienced unsuccessful interactions with the child, leading to decreased social input. As highlighted in the transactional theories, environmental responsiveness is imperative to minimize secondary neurological deficits, or the cascading effects of initial deficits in JA. In a longitudinal correlational study of the language skills of 25 preschoolers with ASD carried out by Siller and Sigman (2002), a relationship between parent responsivity and later language outcomes in mid and late teenage years was revealed. This suggests that parent training would be imperative in order to maintain JA skills, as well as ensure acquired communicative skills for JA are appropriately harnessed in order to facilitate further language development.

Limitations

There were a number of important limitations in this study that may have affected the results and which also necessitate caution in the interpretation of the findings. Firstly, intervention was not always administered consistently due to school holidays, transport difficulties, and the children missing sessions due to illness. Hence, this is primarily a study of effectiveness, where an intervention is applied in real-world settings, rather than efficacy, where intervention is administered in ideal, laboratory settings (Prizant & Wetherby, 1998).

In addition, due to time constraints, the baseline phase of this study was rather short and therefore improvements related to developmental maturation cannot be absolutely ruled out. Time constraints also only allowed for a single maintenance session to be carried out with each participant. More maintenance sessions would have improved the strength of the study in confirming maintenance of skills. The change of therapist also affected the progression of the study. As seen in the results, this change affected the participants' performance initially with them requiring a few sessions to become familiar with the new interventionist. The limited sample size used in this single subject design study has negative implications for the generalizability of results. Also, the visual analysis of the data is a subjective process which could affect reliability of results.

Future Research Implications

Future research investigating the use of the intervention techniques may include the effectiveness of parent-implemented intervention as well as use of the techniques with a larger sample size. Even though improvements in other areas

were less evident than those of JA, it must be considered that no longitudinal data was collected, and more noteworthy improvements in other skills may become evident at a later stage due to improved JA. Therefore it would be particularly important to examine the long term effects of targeting IJA on related outcomes such as language development, theory of mind, play and social development within a longitudinal study.

Conclusions and Implications

The use of social pragmatic intervention techniques based on the mirror neuron hypothesis allows children with ASD to experience what it feels like to draw another's attention to an object of interest, even though unwittingly at first. With repeated experience, it appears that the children learn to experience themselves as separate from others and thereby take on another's perspective (*embodied simulation*). The child may then realize that other's experiences are different from their own and want to share their experiences with others in order to continue receiving the social reinforcement associated with JA, which they receive when an adult follows their lead and responds to their unconscious attention directives.

This may in turn lead to a cascading effect on other areas of communication development as it equips the child with the tools required for them to initiate interactions for reasons other than behavioural regulation, making them more enjoyable for caregivers to interact with, thereby leading to increased linguistic input which may facilitate further social and language development.

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Appendix A

CODING SHEET FOR COMMUNICATION AND SYMBOLIC BEHAVIOURS

CODING SHEET FOR COMMUNICATION AND SYMBOLIC SCALES

Child:					**Date:**				**Coder:**					
Trial:									**Setting:**					
Activity	**Trial**	**Response**	**Act**	**Communicative means**							**Function**			
					Gesture					**Vocalization**				
	Time code		Time code	**Gaze**	**Give**	**Show**	**Reach**	**Point**	**Other**	*Transcribe utterance*	**JA**	**BR**	**SI**	**UC**

Appendix B

Definitions of Communicative Acts

Definitions for Communication Acts

Communication Acts:

In order for a behaviour to be classed as a communicative act it must meet at least one possible description for all three of the following questions:

(a) Was the act a gesture, vocalization or verbalization?
- giving an object
- intentionally touching a part of their communicative partner's body
- moving their partner's hand or face
- moving an object towards or away from their partner
- head shaking or nodding
- hitting, biting or pinching self or their partner
- throwing, dropping or hitting an object
- throwing off with or without object
- making indicative gestures
- pointing with finger or fingers
- tapping with hand or fingers
- raising arm
- open-hand reaching within minimal body movement
- showing an object
- making a depictive gesture
- waving
- clapping
- non-vocalization (e.g. cry, scream, squeal, smack, raspberry)
- verbalization

(b) Was the act directed towards another person?
- giving object to partner
- touching partner
- moving object or palm-up reaching toward or away from partner in reference to the child's midline
- using any other gesture and looking at their partner
- using any other gesture and a vocalization/verbalization
- using a vocalization/verbalization and looking at the adult

(c) Was the act used as a communicative signal to serve a communicative function? (Is the child anticipating a response from their communicative partner?)
- regulating their partners behaviour (Behaviour regulation)
    - to give an object requested
    - to carry out action
    - to stop doing something
- attracting their attention to themselves (Social Interaction)
    - to engage in a social routine
    - to comfort the child
    - to notice the child
    - to ask permission for the child to do something
- direct their communication partner's attention to an object or event
    - to look at or comment about an object/event
    - to provide information requested about an object/event

Adapted from Wetherby, A.M. & Prizant, B.M. (2002). *Communication and Symbolic Behaviour Scales-Normed edition.* Baltimore: Paul H. Brooks Publishing Co.

Appendix C

SOCIAL VALIDITY MEASURE

SOCIAL VALIDITY MEASURE

Instructions: After watching the video clip, please rate the following three items by ticking the choice that you feel best describes the child's behaviour. If you are unsure, please choose the closest response based on your observations.

Items	Rating
1. The child appropriately uses eye gaze to direct the adult's attention	□ Never □ Sometimes □ Often
2. The child appropriately uses commenting to direct the adult's attention	□ Never □ Sometimes □ Often
3. The child appropriately uses gesture, such as pointing, showing, giving or reaching, to direct the adult's attention	□ Never □ Sometimes □ Often

Appendix D

TREATMENT FIDELITY RATING SCALE

TREATMENT FIDELITY MEASURE

Instructions: After watching the video clip, please rate the following three items by ticking the choice that you feel best describes the interventionist's implementation of the intervention strategies. If you are unsure, please choose the closest response based on your observations.

Items	Rating
1. The therapist responded appropriately to the child by labelling the child's point of focus	□ Never □ Sometimes □ Often
2. The therapist's responses were contingent	□ Never □ Sometimes □ Often
3. The therapist utilized natural reinforcement	□ Never □ Sometimes □ Often

Appendix E

Clearance Certificate from Human Research Ethics Committee

(Medical) at the University of the Witwatersrand

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dos Santos

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M070541**
PROJECT	Facilitating initiating joint attention in chil with Austism spectrum disorder
INVESTIGATORS	Miss K Dos Santos
DEPARTMENT	Speech Pathology
DATE CONSIDERED	07.05.25
DECISION OF THE COMMITTEE*	APPROVED UNCONDITIONALLY

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed u application.

DATE 07.06.26 **CHAIRPERSON** .....
(Professors PE Cleaton-Jones, A Dhai, M C Feldman, A Woodiwiss)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr N Watt

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th F Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the above research and I/we guarantee to ensure compliance with these conditions. Should any departure t contemplated from the research procedure as approved I/we undertake to resubmit the protocol Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix F

CONSENT FORMS

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, WITS, 2050

Tel: (011) 717 4500

Fax: (011) 717 4559

INFORMATION DOCUMENT

FACILITATION INITIATING JOINT ATTENTION IN CHILDREN WITH AUTISM SPECTRUM DISORDER

Dear parents,

My name is a Kerry Dos Santos, I am a qualified speech-language therapist, completing my masters degree at the University of the Witwatersrand. I am doing research on teaching children with autism spectrum disorder (ASD) to direct people's attention. Research is just the process to learn the answer to a question. In this study I want to learn whether my technique to teach children with ASD this skill is effective.

Joint attention is the use of words, gestures or sounds to direct another's attention to an object or event. When a child initiates joint attention he/she wants the person they are with to look at or notice something. Joint attention has been found to be important for language development. Children with ASD have difficulty with this skill.

I am asking your permission to include your child in this research study. This would involve 15 minute speech therapy sessions with myself twice a week. Therapy sessions will take place at a location which is convenient for you, such as your home. The project will involve three phases, an assessment, therapy and maintenance phase. In the assessment phase your child's joint attention skills will

be evaluated. At this point it must be noted that should your child be able to initiate joint attention they will not require intervention in this area and therefore will no longer be a candidate for the study.

During the therapy phase the therapist will begin to follow your child's lead by monitoring what he/she is interested in and then labelling that object. This is because that is what parents usually do when their children direct their attention. Therefore, I am responding as if the child has directed my attention without them actually having to do it, thereby giving them the experience of initiating joint attention. I anticipate that creating this experience for a child with ASD will encourage them to independently initiate joint attention.

Once your child is able to consistently draw the therapist's attention to objects presented, the maintenance phase will begin. Within this phase your will be observed in the classroom and individually in order to see whether he/she is able to initiate joint attention with other people independently.

Three children with ASD will be included in the study. Due to the fact that this is an experimental technique, I am not sure how long the project will take. However, I anticipate that the speech therapy sessions will be completed by November 2007.

It must be noted that this is an experimental technique and therefore has not been proven to work as yet. However, research using similar techniques has shown improvements in these skills. No foreseeable risks related to participation in this study are anticipated for your child. Possible benefits of taking part in the study are possible improvements in your child's joint attention skills, which is important for language development. Should the therapy be found to be unsuccessful voluntary counselling will be available to you at no cost.

Please note that these sessions would occur in addition to your current speech therapy sessions, and in no way serve as an alternative or replacement for your child's current speech therapy. All therapy sessions will be free of charge. Once therapy has been terminated should a regression in your child's JA skills take place training will be provided for their speech therapist on techniques to target this skill.

You will be given pertinent information on the study while involved in the project and after the results are available. Participation is completely voluntary and participants are free to withdraw from the project at any time.

With your permission, the researcher would like to video record all sessions to allow her to later analyse them. These video recordings will be viewed by other qualified speech therapists in order to ensure that they are analysed fairly. All efforts will be made to keep your child's information confidential. However, absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law. Organizations that may inspect and/or copy research records for quality assurance and data analysis include groups such as the Research Ethics Committee. However, your child's name will not be written on the videotapes or used in the research report or any publications of the findings. The videos will be stored at the University of the Witwatersrand, in a locked cabinet, for a period of 5 years after which time they will be destroyed.

You will be given verbal feedback regarding your child's progress throughout the project and will receive a written report at the end of the study. With your permission a written report may also be provided to your child's speech therapist and school.

Should you have any questions or require any further information please do not hesitate to contact me at 082 664 2742 or (011) 484 3408.

Kind Regards,

Kerry Dos Santos
Student Researcher

Dr Nola Watt
Supervisor

Joint Attention Facilitation Project

Letter of Consent: Intervention

I agree to take part in Kerry Dos Santos's study of joint attention intervention. I agree to allow my child, _____ (child's name), to receive weekly therapy targeting his/her joint attention skills. I have read the information sheet and understand that my child's information will be kept confidential and that I may change my mind about taking part in this study at any time.

Name: _____

Designation: Patent / legal guardian / primary caregiver

Signature: _____

Date: _____

Joint Attention Facilitation Project

Letter of Consent: Videotaping of intervention

I agree to allow my child, _____ (child's name), to receive weekly joint attention intervention. I agree to allow the intervention sessions to be videotaped and understand that this videotape will be used to analyse my child's performance and monitor his/her progress. I understand that this videotape will be stored in a locked cupboard at the University of the Witwatersrand. I understand that this video will not be stored, transmitted or in anyway be made available on the internet. I agree to allow this videotape to be used in the research project only under the direct supervision of Kerry Dos Santos at the University of the Witwatersrand and that my child's information will be kept strictly confidential at all times.

Name: _____

Designation: Patent / legal guardian / primary caregiver

Signature: _____

Date: _____

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, WITS, 2050

Tel: (011) 717 4500

Fax: (011) 717 4559

INFORMATION DOCUMENT

FACILITATION INITIATING JOINT ATTENTION IN CHILDREN WITH AUTISM SPECTRUM DISORDER

To Whom It May Concern:

Re: Joint attention research project

My name is a Kerry Dos Santos, I am a qualified speech-language therapist, in the process of obtaining my masters degree from the University of the Witwatersrand in Speech Pathology. As part of my masters degree I am required to complete a research project for which I would like to invite any possible candidates from your centre to participate. My research project will focus on enhancing joint attention skills in children with autism spectrum disorder, specifically initiating joint attention, which has been found to be an important skill for the development of language and social interaction skills in typically developing children and children with autism spectrum disorder.

This intervention program would involve weekly or biweekly 15 minute speech therapy sessions with a qualified speech therapist. Sessions will take place at a location which is convenient for the family. This may be at their home or at your centre, with your permission. The project will comprise of three phases, a baseline, intervention and maintenance phase. In the baseline phase no therapy

techniques will be introduced, in order to determine if the child is able to initiate joint attention. At this point it must be noted that should a child be able to initiate joint attention they will not require intervention in this area and therefore will no longer be a candidate for the study.

During the intervention phase the therapist will begin to follow the child's lead by observing their attentional focus and then will respond as though they had initiated joint attention. This will allow them to experience initiating joint attention without intentionally directing their conversational partner's attention. The researcher anticipates that creating this experience for a child with autistic spectrum disorder a sufficient number of times will encourage them to independently initiate joint attention.

Once the child is able to consistently draw the therapist's attention to objects presented, the generalization phase of the project will begin. Within this phase the child will be observed in the classroom and individually in order to determine whether they is able to initiate joint attention with other people independently.

With the family's permission, the researcher would like to video record all sessions, in order to allow her to later analyse interactions. These video recording will be viewed by other qualified speech therapists in order to ensure that they are analysed in an unbiased manner as well as for evaluation of the therapy techniques. The child's identity will remain confidential at all times. Their names will not be written on the videotapes or used in the research report or any publications of the findings. The videos will be stored at the University of the Witwatersrand, in a locked cabinet, for a period of 5 years after which time they will be destroyed.

It must be noted that this is an experimental therapeutic technique and therefore it has not been proven to be successful as yet. However, research using similar techniques has shown improvements in eye gaze. No foreseeable risks related to participating in this study are anticipated for participant. Participation is voluntary and participants are free to withdraw from the project at any time.

If you allow me to recruit possible candidates from your school, I will provide you with information sheets for potential families. If you could deliver

these to suitable candidates, they may contact me directly or with your permission I may contact the families which are interested in participating. Please inform them that this intervention would be additional to any other services they are receiving and will not detract from these services in any way.

Should you have any questions or require any further information please do not hesitate to contact me on 082 664 2742 or (011) 484 3408.

Kind Regards,

Kerry Dos Santos — Dr Nola Watt

Student Researcher — **Supervisor**

Joint Attention Facilitation Project

Letter of Consent: Recruitment

I agree to allow Kerry Dos Santos to recruit possible participants for her joint attention research project from _____ (centre's name). I have read the information sheet and understand that the children's information will be kept confidential at all times, that only Kerry Dos Santos will have access the children's information, and that I may change my mind about allowing participants to be recruited from my centre at any time. I agree to distribute information sheets to possible participants and thereafter provide any interested candidates with Kerry Dos Santos' contact information, or with the families consent, forward their contact information to Kerry Dos Santos.

Name: _____

Designation (Principal, etc.): _____

Signature: _____

Date: _____