

**A combined prosodic and linguistic treatment approach for  
language-communication skills in children with autism  
spectrum disorders: A proof of concept study**

**by**

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Presented in fulfilment of the requirements for the degree of MCommunication  
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**MAY 2015**

## ACKNOWLEDGEMENTS

To my research supervisor, Professor Bart Vinck, and my co-supervisor, Mrs. Salomé Geertsema, a heartfelt thank you for your support and trust in me to complete this research project.

To Professor Anita van der Merwe, thank you for your valuable academic contribution on earlier versions of this research project.

To Dr. Elsie Naudé, thank you for your excellent and professional language editing on this dissertation.

To my family, friends and colleagues, thank you for your unconditional love and support.

## ABSTRACT

### **A combined prosodic and linguistic treatment approach for language-communication skills in children with autism spectrum disorders: A proof of concept study**

#### **Background**

The complex nature of Autism Spectrum Disorders (ASD) and the challenges regarding effective treatment methods for this population gave incentive to this research. Despite deficits in auditory processing, listening skills, pragmatic skills and social interaction, children with ASD possess inherent strengths in terms of certain auditory processing abilities. These auditory processing abilities include superior pitch discrimination (Bonnel et al., 2010; Heaton, 2005, 2008; Mottron et al., 2000), the ability to discriminate stressed words better than unstressed words (Paul et al., 2005), and the ability to process information when absolute pitch values and timing of pitch direction changes are modified within a melody (Ouimet et al., 2012). These strengths may be utilized in language therapy. An integrated approach in which language therapy is combined with prosodically varied speech may enhance the effect of language treatment.

Results from research regarding the neurological foundations of processing melodic and rhythmic stimuli suggest that specific elements of prosody, such as variations in intonation and stress, may stimulate areas of the brain often found to be atypical in individuals with ASD (Boddaert, 2004; Samson et al., 2006). Elements of prosody such as intonation and stress variation therefore warrant research into a different treatment approach to stimulate atypical, but more effective processing (Bertone et al., 2005; Gervais, 2004). This study aimed to determine whether the use of prosodically varied speech within a traditional language therapy framework had any effect on the listening skills, pragmatic skills, and social interaction behaviour of three children with ASD.

## Method

A single participant multiple baseline design across participants was implemented. Three participants were selected for this research. The performance of the participants was compared before treatment, after a three week period of treatment, and after a two-week withdrawal period from treatment utilising prosodically varied speech within a traditional language therapy approach. The following aspects of behaviour (investigated by means of specific assessment scales) were analysed for each participant:

- Listening skills (as determined by the *BLM G-5 (2010) Listening Skills Observation Checklist*)
- Pragmatic skills (as determined by the *Pragmatic Skills Checklist - Shipley & McAfee, 2009, form 8-7*)
- Stereotyped, social communication and social interaction behaviour (as determined by the *Gilliam Autism Rating Scale, 2<sup>nd</sup> edition*).

The use of prosodic speech variation within a traditional language treatment framework is a recent intervention approach for children with ASD (Sandiford, Mainess, & Daher, 2013; Wan et al., 2011). This approach has not been tested extensively, and therefore a single-participant design was used to provide “proof of concept” of such an approach (Smith, Dawson, Guthrie, & Lord, 2007).

## Results

The results were analysed quantitatively and qualitatively, and indicated positive behavioural changes in listening skills, pragmatic skills, and social interaction behaviour for all the participants. Change in behaviours was measured after using prosodically varied speech within a traditional language therapy framework. There was a high measure of agreement between the scores of the researcher and the external rater on the assessment scales used to measure behavioural change in the participants. Statistical significance was not calculated for each individual due to the limited data, but visual inspection indicated that all the participants showed positive behavioural changes in performance across all areas after three weeks of treatment, independent of their pre-treatment performance level.

## **Conclusions**

The use of prosodically varied speech within a traditional language therapy framework appears to be a viable form of treatment for children with ASD. However, while general trends were observed, the findings should not be generalised to all individuals with ASD because of the heterogeneity of this population. The research was evaluated and implications for further research, as well as for clinical practice, were presented.

*Key words: Autism Spectrum Disorders, prosodically varied speech, listening skills, pragmatic skills, social interaction behaviour, proof of concept.*

## OPSOMMING

### **‘n Gekombineerde prosodiese en taalbenadering vir die behandeling van kommunikasiegedrag in kinders met outisme spektrum afwykings: ‘n Bewys van konsep studie**

#### **Agtergrond**

Die komplekse aard van Outisme Spektrum Afwykings (OSA) en die uitdagings ten opsigte van effektiewe behandelingsmetodes vir hierdie populasie, was die aansporing vir hierdie navorsingsprojek. Ten spyte van probleme met ouditiewe prosessering, luistervaardighede, pragmatiese vaardighede en sosialeinteraksie, beskik kinders met OSA oor inherente sterk punte, insluitend: bo-gemiddelde toonhoogte diskriminasie (Bonnell et al., 2010; Heaton 2005, 2008; Mottron et al., 2000), die vermoë om beklemtoonde woorde beter as onbeklemtoonde woorde te diskrimineer (Paul et al., 2005) en die vermoë om die verskil in tydsduur van note in ‘n melodie te identifiseer (Ouimet et al., 2012). Hierdie sterk punte kan moontlik tot voordeel van die kind met OSA gebruik word in ‘n tradisionele taalterapienadering. ‘n Gekombineerde benadering waarin taaltherapie met prosodiese variasie gebruik word, kan die effek van die taaltherapie verbeter.

Navorsing oor die neurologiese basis aangaande die prosessering van melodiese en ritmiese stimuli, dui op die vermoë van spesifieke prosodiese elemente (klemvariasie en intonasie) om atipiese areas van die brein van ‘n persoon met OSA te stimuleer (Boddaert, 2004; Samson et al., 2006). Elemente van prosodie soos klemvariasie en intonasie regverdig dus moontlik navorsing wat gerig is op ‘n nuwe behandelingsbenadering om atipiese (dog meer effektiewe) prosessering te stimuleer (Bertone, 2005; Gervais, 2004). Hierdie navorsingsprojek se hoofdoel was om die effek van ‘n prosodiese benadering, binne die raamwerk van ‘n tradisionele taalbenadering, vir die behandeling van luistervaardighede, pragmatiese vaardighede en sosiale-interaksie vir drie kinders met OSA te bepaal.

## Metode

Die navorsing is oor 'n tydperk van agt weke uitgevoer. 'n Enkel-deelnemer navorsingsontwerp is gebruik, met drie jong deelnemers wat reeds met OSA gediagnoseer is. Spesifieke gedragsaspekte is met behulp van assesseringskale vir elke deelnemer ondersoek. Verandering in gedrag in die volgende areas is vergelyk voor behandeling, na drie weke van behandeling, en na twee weke waar geen prosodiese variasie tesame met taal terapie toegepas is nie:

- Luistervaardighede (soos vasgestel met die *BLM G-5 (2010) Listening Skills Observation Checklist*)
- Pragmatiese vaardighede (soos bepaal deur die *Pragmatic Skills Checklist - Shipley & McAfee, 2009, form 8-7*)
- Stereotipiese gedrag, sosiale kommunikasie en sosiale interaksie (soos bepaal deur die *Gilliam Autism Rating Scale, tweede uitgawe*).

Prosodiese variasie binne die konteks van 'n tradisionele taal terapie benadering vir die behandeling van kinders met OSA is 'n betreklik nuwe konsep (Sandiford, Mainess, & Daher, 2013; Wan et al., 2011), en dit het dus 'n enkel-deelnemer ontwerp geverg om "bewys van konsep" te verskaf (Smith, Dawson, Guthrie, & Lord, 2007).

## Resultate

Die resultate is kwalitatief en kwantitatief ontleed en het op merkbare positiewe gedragsveranderinge in luistervaardighede, pragmatiese vaardighede en sosiale interaksie vir al die deelnemers gedui. Daar was 'n noue verband tussen die tellings wat die navorser en die eksterne merker aangeteken het op die assesseringskale wat gebruik is om gedragsveranderinge in die deelnemers te meet. Resultate is nie statisties ontleed nie omdat daar slegs drie deelnemers was, maar 'n visuele oorsig het getoon dat daar positiewe gedragsveranderinge was in al die areas vir elke deelnemer, na drie weke se behandeling.

## **Gevolgtrekking**

Die gebruik van prosodiese variasie tydens tradisionele taal terapie blyk 'n geldige behandeling vir kinders met OSA te wees. Alhoewel algemene tendense waargeneem is, mag die bevindinge nie veralgemeen word na elke persoon met OSA nie, omdat die OSA-bevolking heterogeen is. Die navorsing is geëvalueer en implikasies vir verdere navorsing, sowel as vir die kliniese praktyk, is bespreek.

*Sleutel terme: Outisme Spektrum Afwykings, spraak met prosodiese variasie, luistervaardighede, pragmatiese vaardighede, sosiale interaksie vaardighede, bewys van konsep.*



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## OPERATIONAL DEFINITIONS

The core terms used in this research dissertation are:

- ❖ Autism Spectrum Disorders (ASD)
- ❖ Communication-related behaviours
- ❖ Intonation
- ❖ Linguistic therapy approach
- ❖ Listening skills
- ❖ Neuro-typically developing children (NTDC)
- ❖ Pragmatic skills
- ❖ Proof of concept
- ❖ Prosodic elements of speech
- ❖ Prosodically varied speech
- ❖ Receptive prosody
- ❖ Stress variation
- ❖ Stereotyped social-communicative behaviour

The definitions below apply to the terms as they are used in this research dissertation.

**Autism Spectrum Disorder/Disorders (ASD):** ASD is defined as a neurological developmental disorder with known structural and functional abnormalities in brain regions that are primarily responsible for social, communicative, and executive functions (Grossman, Bemis, Skwerer, & Tager-Flusberg, 2010; Groen et al., 2008; Zager, 2005). The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V, 2013) defines ASD as persistent deficits in social communication and social interaction across multiple contexts. These persistent deficits manifest as



deficits in social-emotional reciprocity and nonverbal communicative behaviours, as well as deficits in developing, maintaining, and understanding relationships (DSM-V, 2013). Judgement of severity is based on social communication impairments and restricted, repetitive patterns of behaviour (Appendix A-2). This research relates to young children with Autism Spectrum Disorder, thus the abbreviation children with ASD is used throughout the dissertation.

**Communication-related behaviours:** Three communication-related behaviours, namely pragmatic skills, listening skills, and stereotyped social-communicative behaviours, are investigated in this research. These behaviours characterise the distinct nature of ASD and are therefore targeted in intervention.

**Intonation:** Intonation refers to the variation of pitch (high or low tones) in connected speech. It is an element of spoken prosody and is used along with concomitant variation in other prosodic features to signal the difference between a statement and a question or between different types of questions (Crystal, 1975:11).

**Linguistic therapy approach:** Traditional language intervention using the linguistic therapy approach has been shown to be particularly effective for promoting functional language skills that generalize to the natural environment (Prizant, Wetherby, & Rydell, 2000). This type of intervention is primarily designed to address topics of interest to the child during therapy, includes linguistic input appropriate to the developmental level of the child, and provides natural reinforcement for the communication of the child (Prizant, Wetherby, & Rydell, 2000).

**Listening skills:** Listening skills are demonstrated as the ability to actively attend to auditory information provided by the speaker, and to display interest in the topic discussed. Listening skills allow the listener to provide the speaker with appropriate feedback, such as pertinent questions, so that the speaker knows the message is being understood. Listening skills are important for effective communication exchange between individuals.

**Neuro-typically developing children (NTD children):** The term NTD children will be used throughout this dissertation to refer to children who are developing age-appropriate communication-related skills in the correct sequence.

**Pragmatic skills:** Pragmatic skills refer to the social language skills used in daily interactions with others. The scope of pragmatic skills includes the content of an utterance, the manner in which the utterance is conveyed, and whether it is appropriate for a given situation. Pragmatic skills are especially significant when communicating personal thoughts, ideas and feelings. Individuals with poor pragmatic skills often misinterpret communicative intent and have difficulty responding appropriately either verbally or non-verbally.

**Proof of concept:** A proof of concept is a realisation or demonstration, the purpose of which is to verify that a concept or theory has the potential of being used successfully; in this case, for clinical application. Proof of concept in this study is therefore a prototype that is designed to determine the feasibility of a treatment plan.

**Prosodic elements of speech:** Spoken prosody is a complex vocal signal composed primarily of the pitch (high and low tones), intensity (loudness), and duration of an utterance (Grossman, Skwerer, Bemis & Tager-Flusberg, 2010).

**Prosodically varied speech (PVS):** The term is used in this study to refer to speech which incorporates exaggerated intonation and stress variation. Prosodically varied speech was used within a traditional language treatment framework to provide intervention for the children with ASD participating in this study. The abbreviation PVS is used throughout the dissertation.

**Receptive prosody:** Receptive prosody refers to the understanding of prosody in a verbal utterance. Prosody plays an important role in a range of communicative functions, serving to enhance or change the meaning of what is said. The majority of investigations into prosody in autism have focused on expressive abilities, and surprisingly little is known about the ability of individuals with autism to interpret prosodic cues in the speech of others (McCann, 2003).

**Stereotyped behaviour:** This term refers to behaviour which is both repetitive and excessive in amount. Stereotyped behaviour of children with ASD may include atypical speech, movement, and play. This type of behaviour may also involve preoccupations with objects, topics, or rituals.

**Stress variation:** Stress, in linguistic terms, refers to the increased loudness and length of a verbal utterance and is an element of spoken prosody. Stress variation is used to highlight important information in a verbal utterance.

# CHAPTER 1

## ORIENTATION AND PROBLEM STATEMENT

### 1.1 CHAPTER ORIENTATION

In this introductory chapter, Autism Spectrum Disorders (ASD) is defined. General early characteristics, as well as specific disorders in communicative development (including listening skills, pragmatic skills, prosodic development and social behaviour) are described. A brief overview of the neurobiology of children with ASD is provided. Aspects of assessment and diagnosis are reviewed, and the need for special education for children with ASD is discussed. The overview of the earliest, as well as current, treatment approaches has a specific focus on habilitative therapies which include traditional language therapy for the three disordered behaviours targeted in this study. A section on previous research investigating the receptive prosodic abilities of children with ASD, as well as previous research regarding the effect of using prosody as a form of intervention, is included. Evidence based phases of research and the rationale for using a proof of concept study is described. Finally, a summary of the problem statement and the rationale for combining a traditional linguistic therapy approach with prosodically varied speech concludes this introductory chapter.

### 1.2 AN INTRODUCTION TO AUTISM SPECTRUM DISORDERS (ASD)

Leo Kanner first described autism as a disorder in 1943. Kanner focused on three defining characteristics of autism that remain the defining characteristics more than seventy years later: social isolation, language impairments, and insistence on sameness (Kanner, 1943; DSM-V, 2013). Since its earliest description by Kanner in 1943, the definition of autism has evolved to that of a complex spectrum disorder, more specifically a neurological developmental disorder with known structural and functional abnormalities in brain regions that are primarily responsible for social, communicative and executive functions (Groen, Zwiers, van der Graag, & Buitelaar, 2008; Grossman, Bemis, Skwerer, & Tager-Flusberg, 2010; Zager, 2005). The

American Psychiatric Association (APA) in its *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) identified autism as one of five disorders under the broad term Pervasive Developmental Disorders (PDD) (Appendix A1). It is important to note that the participants in this study were diagnosed according to the DSM-IV (2000), as the DSM-V (2013) had not been published when this study commenced. The other four disorders under the heading PDD in the DSM-IV (2000) were Asperger Syndrome, Rhetts Syndrome, Childhood Disintegrative Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS). Each of these disorders had specific diagnostic criteria as outlined by the APA in the DSM-IV (2000). Autism Spectrum Disorder (ASD) was characterized by severe and pervasive impairment in several areas of development, including social interaction and communication skills.

The originally described basic triad of impairments underlying ASD included impairment of social interaction, impairment of communication, and restricted repetitive and stereotyped patterns of behaviour (Wing, 1988). The new DSM-V edition which was accepted in May 2013 (Appendix A2) reduces this triad to a dyad: impairment of social interaction and communication (now to be regarded as one combined domain) and restricted repetitive and stereotyped patterns of behaviour. The latest diagnostic criteria expand to include four criteria. Criterion A denotes the 'social communication deficits' domain, consisting of three items, all of which must be met to satisfy this criterion; Criterion B denotes the 'fixated interests and repetitive behaviours' domain, consisting of four items, of which at least two must be met to satisfy this criterion; Criteria C and D concern 'symptoms existing in early childhood' and 'symptoms impairing functioning', respectively (APA, 2013). In order to diagnose ASD, a diagnostician must ensure that all four criteria are met.

### **1.3 GENERAL THEORETICAL PERSPECTIVES ON THE NATURE OF ASD**

This section aims to highlight general early characteristics of children with ASD, as described in the literature. The next section will describe the specific deficits in three core features of communication development investigated in this study. This section will focus on the different cognitive processing styles, communication behaviours and auditory processing difficulties and skills which are associated with children with ASD.

Early descriptions of ASD included three prime characteristic features: a sense of aloneness, a preoccupation with maintaining sameness, and an onset of the condition in the first two years of life (Eisenberg & Kanner, 1956). One of the earliest indicators described is failing to make eye-contact or respond to their names once absorbed and focused on a particular activity. This behaviour may relate to the way in which incoming stimuli are processed. Children with ASD possess an analytical processing style (versus a holistic processing style) (Stacey, 2003). Happé (1999) suggested that ASD, traditionally described in terms of cognitive deficits, should rather be thought of as reflecting a different cognitive style. Individuals with this processing style tend to focus on details and this has an impact on many areas of daily life, ranging from solving problems (learning, school, work) to reciprocal social interaction (Quintin, Bhatara, Poissant, Fombonne, & Levitin, 2013).

Children with ASD communicate primarily to express needs, desires, and preferences, rather than to convey sincere interest in others, or to share experiences, excitement, and feelings. These children display little reciprocity, mutuality or shared purpose in discourse with peers, adults or teachers (Constantino et al., 2003). Each of these behaviours complicates the ability of a child with ASD to engage wholly in the give-and-take pattern of conversational discourse expected during social exchanges and used for supporting the development of friendships. Language difficulties are sometimes thought to lie at the root of these communication deficits. Despite their problems with expressive language, however, some minimally verbal children with ASD have good receptive language (Coonrod & Stone, 2004).

Children with ASD are strongly influenced by sensory information from the environment, including auditory stimuli (Schafer et al., 2013). Processing of auditory information is essential to functioning and learning in the classroom. Children with ASD exhibit abnormal behavioural performance on auditory-based tasks, especially in the presence of background noise (Corbett & Constantine, 2006; Tomchek & Dunn, 2007). An analysis of profiles completed by 400 parents of children with ASD revealed that 58–79% of the respondents indicated distractibility or inability to function in noisy environments, unresponsiveness to discriminative auditory stimuli, and difficulty attending to auditory information (Tomchek & Dunn, 2007). One of the most significant predictors of educational performance in children with ASD is the

challenge of auditory filtering, which is the ability to hear speech stimuli, complete tasks, and function in the presence of background noise (Ashburner, Rodger, & Ziviani, 2008).

Aside from the auditory processing challenges facing the child with ASD, they also display certain skills in this regard. One finding that stands out in auditory research in ASD is that many individuals have enhanced pitch discrimination and pitch-memory abilities (Ouimet, Foster, Tryfon, & Hyde, 2012). The use of stress variation and intonation in a spoken utterance may help to stimulate a form of auditory processing in children with ASD which, though not typical, could aid in extracting meaning from auditory stimuli (Caria, Venuti, & de Falco, 2011; Lillie, 2007). Auditory based training paradigms appear to have a positive effect on speech processing and on speech production in non-verbal children with ASD (Ouimet et al., 2012).

However, despite the existence of strengths regarding auditory processing in individuals with ASD, they generally show diminished processing of social and complex sounds such as speech (Ouimet et al., 2012). Possible reasons for this may be the limited use of these skills, because there is minimal variation of prosodic elements in conversational discourse and traditional therapy approaches, and thus these strengths are not applied to aid the child in a social-communication situation (Heaton, 2005; Ingersoll & Shreibman, 2006).

### **1.3.1 Early identifying features of ASD**

#### **1.3.1.1 Disorders in communicative development**

Concerns about speech and communicative development are the most frequent initial complaints by parents of children who were later diagnosed with ASD (Guinchat et al., 2012). Communication impairment is characterised by a delayed development or lack of communicative gesture and spoken language, difficulties in the ability to initiate or maintain conversation, and unusual language use such as echolalia and idiosyncrasies (Volkmar et al., 2005).

### **1.3.1.2 Disorders in listening skills development**

Listening is the ability to attune to important auditory messages and to discard unnecessary information (Madaule, 2004). The attuning function of listening plays a fundamental role in auditory processing and attention span. The inability to distinguish important speech signals from unnecessary background noise is probably the most disabling aspect of ASD (Madaule & Petrofski, 2004). The child is constantly over-stimulated and overwhelmed by outside stimuli which keep interfering with the ability to perceive important speech signals, and hypersensitivity to sound sometimes ensues. Children with ASD often ignore all incoming auditory signals, which lead to a state of isolation and creates a barrier to communication and learning (Madaule, 2004).

### **1.3.1.3 Disorders in pragmatic development**

ASD has been described as a communication disorder that involves pragmatic impairments, defined as deficits in the use of language in social contexts (Tager-Flusberg, 2005). Social communication behaviour can be observed at birth in the intense mutual eye gaze that connects babies to their parents (Prelock & Nelson, 2012). The development of joint attention early in infancy is of particular importance to social communication, and later pragmatic skills development (Prelock & Nelson, 2012). Joint attention starts as a mutual gaze between the infant and caregiver, and then proceeds to incorporate shared attention to a third object or person. If development proceeds typically, the infant will learn to obtain the attention of the caregiver by using shifting gaze or vocalisation (Prelock & Nelson, 2012). Research suggests that young children with ASD are less likely to engage in joint attention, use fewer gestures, and are less able to coordinate their vocalisations, eye gaze and gestures than typically developing peers (Veness et al., 2011). Pragmatic deficits often remain a linguistic impairment throughout life (Grossman, Bemis, Skwerer, & Tager-Flusberg, 2010).



#### 1.3.1.4 Disorders in prosodic development

Prosody refers to the *pitch* (measured as fundamental frequency), *intensity* (measured as amplitude of the sound wave), and *durational* parameters that accompany the speech signal (Peppe et al., 2007). Though prosodic deficits in ASD are common and socially impairing, little is known about the neural mechanisms that underlie this important communicative function. The prosodic characteristics of the speech of an individual with ASD constitute one of the most significant obstacles to his or her social integration (Pelphrey et al., 2002). Since the first description of ASD (Kanner, 1943), abnormal prosody has been frequently identified as a core feature of individuals with ASD who are verbal (Baltaxe & Simmons, 1985, 1992; Paul et al., 2005; Tager-Flusberg, 1981). Even before they start producing spoken language, patterns of sound production and vocal quality in children with ASD are abnormal. This is followed by later deficits in intonation and vocal quality (Shriberg et al., 2001). Differences noted in observational reports (Gillberg & Coleman, 2000; Tager-Flusberg, 2001) included monotone or machine-like intonation, deficits in the use of pitch and control of volume, deficiencies in vocal quality, and use of abnormal stress patterns.

Despite the apparent expressive prosodic deficits observed in children with ASD, some studies have suggested intact receptive prosodic abilities in children with ASD (Boucher, Lewis, & Collis, 2000; Paul et al., 2005; McCann et al., 2007). More research is needed to determine whether people with ASD have good receptive prosodic ability, but realise it in an atypical way (McCann et al., 2007).

#### 1.3.2 Neurobiology of ASD

Despite severe deficits in language development, there is evidence that auditory processing of specific prosodic elements of speech is often preserved in children with ASD (Brenton et al., 2008; Heaton, 2009; Heaton 2012; Ouimet et al., 2012). Additionally, research suggests abnormal inter-hemispheric asymmetry in individuals with ASD, with relatively lower than normal activation of the left hemisphere (Flagg et al., 2005; Herbert et al., 2005; Lazarev et al., 2010). There is some evidence of the importance of the right hemisphere of the brain in the processing of melody and rhythm (Callan et al., 2006; Hoffman, 2008; Ono et al.,

2011), while the left hemisphere of the brain is commonly associated with language comprehension and use in the majority of individuals (Callan et al. 2006; Knecht et al., 2000). If the right hemisphere in people with ASD is relatively intact, it may be the case that right hemisphere functions such as rhythm and melody can serve as areas of strength and sources of compensatory activity. The corpus callosum, which joins the cerebral hemispheres and allows for transfer of information between hemispheres, is often impaired in children with ASD (Gozzi et al., 2012; Hardan et al., 2009). However, studies conducted on the corpus callosum indicate that it can be strengthened by exposure to melodic stimuli until the age of seven in typically developing individuals ( Schlaug et al., 2009). Taking into account the specific auditory processing strengths of children with ASD (Brenton et al., 2008; Heaton et al., 2008; Heaton 2009; Ouimet et al., 2012) as well as the overall benefits of melodic stimuli to the brain (Schlaug et al., 2009), it is clear that further research into melodic based interventions for treating individuals with ASD is necessary.

#### **1.4 ASSESSMENT AND DIAGNOSIS OF ASD**

The diagnosis of ASD depends on the ability of experienced evaluators to both subjectively and objectively identify qualifying features, through detailed history taking, observation, and the use of assessment tools such as checklists and questionnaires specific to the diagnosis of ASD (Manning-Courtney et al., 2003, Lord & Corsello, 2005).

Despite evidence that some symptoms of ASD are present early in life (Baghdadli, Picot, Pascal, Pry, & Aussilloux, 2003; Goin-Kochel, Mackintosh, & Myers, 2006) a diagnosis of ASD is usually made between three and five years of age (Goin-Kochel et al., 2006; Latif & Williams, 2007; Mandell, Novak, Zubritsky, 2005). Most parents voice concerns during the first two years of life, but then wait another three years before consulting a professional who is able to make the diagnosis (Siklos & Kerns, 2007). This long interval has a dramatic effect on parental stress (Chamak, Bonniau, Oudaya, & Ehrenberg, 2011; Osborne & Reed, 2008), on the therapeutic process, and on the child's prognosis (Mansell & Morris, 2004).

A comprehensive ASD evaluation requires a multidisciplinary team, including a paediatrician, psychologist, neurologist, psychiatrist, speech-language pathologist (SLP), occupational therapist, and social worker (Chawarska, Rubin, & Volkmar, 2004). The team members typically conduct a thorough neurological examination, as well as in-depth cognitive and language testing. Because hearing problems can cause behaviours that appear to be similar to ASD, children with delayed speech development should also have their hearing tested (Volkmar, Chawarska, & Klin, 2005).

Several standardized assessment scales and observation checklists are available to aid in the diagnosis of ASD, and they will be discussed in the next section. These checklists include lists of symptoms specific to the core deficits of listening skills, pragmatic skills and social-interaction behaviour observed in children with ASD. The assessment scales and observation checklists include the Gilliam Autism Rating Scale (GARS-2) (Gilliam, 2006), the Parent Interview for Autism (PIA) (Stone & Hogan, 1993), the Autism Diagnostic Interview-Revised (ADI-R) (Lord, Rutter, & LeCouteur, 1994), as well as diagnostic observation instruments like the Childhood Autism Rating Scale (CARS-2) (Schloper, Bourgondien, Wellman, & Love, 2010), the Screening Tool for Autism in Two-Year Olds (STAT) (Stone, 2000), and the Autism Diagnostic Observation Scale-Generic (ADOS-G) (Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, Pickles & Rutter, 2000).

The use of diagnostic assessment scales and observation checklists specific to the diagnosis of ASD are recommended in the diagnostic process (Manning-Courtney et al., 2003). The DSM-IV, as well as the newly introduced DSM-V (American Psychiatric Association, 2013) and the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10), list the required features. The clinical heterogeneity of ASD requires professionals to identify symptoms that are not necessarily included in the standard definitions of ASD (Guinchat et al., 2012). Recommended additional diagnostic tools include those that rely on parental report. These are the Gilliam Autism Rating Scale (GARS-2) (Gilliam, 2006), the Parent Interview for Autism (PIA) (Stone & Hogan, 1993), the Autism Diagnostic Interview-Revised (ADI-R) (Lord, Rutter, & LeCouteur, 1994), as well as diagnostic observation instruments like The Childhood Autism Rating Scale (CARS-2) (Schloper, Bourgondien, Wellman, & Love, 2010), The Screening Tool for

Autism in Two-Year Olds (STAT) (Stone, 2000), and the Autism Diagnostic Observation Scale-Generic(ADOS-G) (Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, Pickles & Rutter, 2000). Due to their discriminative ability and diagnostic utility the ADI-R and ADOS-G are considered the gold standard for diagnostic tools and are frequently required in research protocols (Lord & Corsello, 2005). Most of these tools require administration by trained and experienced professionals.

As components of a comprehensive assessment, speech, language, communication and cognitive evaluations serve the purpose of providing valuable diagnostic information as well as information that can be used in intervention planning. Comprehensive speech, language and communication evaluations should be performed in the case of all children with possible ASD by a trained and experienced speech-language pathologist, with emphasis placed on the development of listening skills, pragmatic use of language, and social interaction behaviour, in addition to receptive and expressive language skills (Manning-Courtney et al., 2003). Despite a comprehensive, multidisciplinary diagnostic approach, some children will be difficult to categorize diagnostically, particularly very young children or children in whom features are not severe or classic. For these children, it may be valuable to communicate to the family that a diagnosis of ASD evolves over time. This is true for any child diagnosed with ASD (Manning-Courtney et al., 2003).

## **1.5 THE NEED FOR SPECIAL EDUCATION OF CHILDREN WITH ASD**

Children with disabilities form a significant population within public education schools. In the USA, there are reportedly 5.8 million children with disabilities receiving services under the American Individuals with Disabilities Education Improvement Act (IDEIA) in public schools, with over 3.4 million of these students spending 80% or more of the school day in general education classrooms (Data Accountability Centre, 2007). In South-Africa, statistics indicate that there are approximately 467 000 children with disabilities, of which only 4,3% are accessing early learning facilities (Household Survey, 2010). Inclusive Education Law in South Africa stipulates that all students have the right to receive an appropriate education in the least restrictive environment. Students may not be excluded from educational services due to a disability, no matter how severe the disability may be (Education White Paper 6, 2001). Special education theory is located within a predominantly

functionalist paradigm and is concerned with both learners who experience learning breakdown and those who are regarded as disabled (Education White Paper 6, 2001). Children with ASD often experience difficulty adapting to a mainstream school environment, because their behaviour is so obviously different from that of typically developing children (Whitman, 2004).

Individuals with ASD display many challenging behaviours, which decreases their ability to learn via conventional teaching methods. These challenges include visual thinking, more time to process information, decreased ability to generalise learning, decreased attention to tasks, sensory problems, a lack of flexibility and extreme literalness (Williams, 1995). The educational implications of ASD within the Triad of Impairments (Wing, 1988) are far-reaching and encompass many challenges for mainstream school teachers. Challenges in social interaction within the classroom environment include a low tolerance of peer group, dislike of sharing and taking turns, little or no empathy for others and social aloofness (Lamers & Hall, 2003). Simple social actions such as lining up are often a complicated process (Lord, 2000). Communication challenges in the classroom include a lack of motivation to communicate, limited understanding of the attempts of others, minimal enjoyment of shared social situations and limited conversational skills (Lord & Corsello, 2005). Challenges regarding rigidity of thought and behaviour include difficulty with pretend play or dramas, repetitive play patterns and difficulties with judging the cause and effect of their own behaviour (Schafer et al., 2013). Specific clinical characteristics that may influence performance in a classroom setting include distractibility, disorganization, listening difficulties, inattention to tasks, and limited or heightened alertness (Schafer et al., 2013). When children exhibit several of these clinical characteristics, which directly impact their educational performance, they may qualify for special education services for ADHD under the eligibility category of “other health impairment” (OHI; Individuals with Disabilities Education Act, 2004).

Given the increased recognition of ASD in children with average cognitive ability and the emphasis on the inclusion of students with special needs in regular education classrooms (Williams, Johnson & Sukhodolsky, 2005), schools and clinicians are increasingly called upon to enhance the social skills of school-age children with ASD (White, Keonig & Seahill, 2006). These children need to be taught appropriate skills for interacting and communicating with others, as well as modifying their behaviour

to comply with acceptable social norms (Bloch, Weinstein & Seitz, as cited in Zager, 2005).

Children with ASD do not respond positively to conventional teaching methods. Treatment plans specifically targeting areas of challenge for children with ASD should be compiled in such a way that they lead to more voluntary responses by the child with ASD. Expecting children with ASD to learn via the conventional curriculum and teaching methods that are effective for typical children will invariably lead to failure from the beginning (Grandin, 2008).

## **1.6 AN OVERVIEW OF TREATMENT APPROACHES FOR ASD**

Because of the developmental nature of ASD, the delays associated with it accumulate over time (Whitman, 2004). Therefore intervention programmes need to be implemented as early as possible to change the developmental trajectory in order to prevent increasing delays and to facilitate adaptive behaviour. According to the literature, there are many available treatment approaches which target general behaviour, medical management, and speech and language development of children with ASD. These treatments include educational interventions (Applied Behaviour Analysis; Treatment and Education of Autistic and Communication-Handicapped Children), developmental approaches, biologically and medically based treatments, and habilitative therapies such as speech therapy, occupational therapy and physical therapy. Each of these treatment approaches will be discussed below.

### **1.6.1 Applied Behaviour Analysis (ABA) as the earliest treatment approach for children with ASD**

Lovaas (1987) developed a form of behaviour modification as a treatment method for children with ASD to address a variety of behaviours, such as self-help skills, language, social skills and academic skills. Lovaas (1987) emphasized the importance of starting intervention as early as possible, using systematic prompts to assist these children in learning and motivating parents and teachers to deliver the intervention programme in their everyday lives. In his approach, targeted behaviours, including skills (to be increased) and problem behaviours (to be decreased), are objectively defined and are repeatedly measured.

On-going assessment is used to develop and implement an individualized, comprehensive treatment program for children with ASD. ABA focuses on increasing functional behaviour, through the process of determining the maintaining variables that increase socially acceptable behaviour or diminish inappropriate behaviour. Targeted skills are analysed and then broken down into component parts to be systematically taught until mastered. Many instructional techniques have been derived from applied behaviour analysis, including discrete trial instruction, incidental teaching, natural environment training, fluency-based instruction, and direct instruction. ABA is the most empirically validated approach for the education and treatment of ASD (Manning-Courtney et al., 2003). Outcome studies of the ABA methodology have consistently demonstrated significant improvement for children with ASD (Jacobson & Mulick, 2000).

### **1.6.2 Treatment and Education of Autistic and Communication-Handicapped Children (TEACCH)**

TEACCH is a program that seeks to provide structured settings in which children with ASD can develop their skills. TEACCH was developed by Schopler and Reichler (1971) at the University of North Carolina. This approach, like ABA, uses behavioural techniques in working with children with ASD. TEACCH differs from other behavioural approaches, however, in that it places its emphasis on working with the children at whatever developmental, cognitive, educational, and social level they manifest. The approach takes relative strengths that are discernible into account and uses those strengths to enhance progress, as opposed to taking on the goal of attempting to achieve a solution. Measurements of progress compare the progress of each child against his or her own status, as well as comparing the progress of the child with group scores.

Seitler (2011) conducted a study of home-based schooling for children with ASD using the TEACCH method. Results showed that preschool children receiving TEACCH-based parent instruction showed significantly greater improvement than other children with ASD who did not receive the TEACCH intervention in areas such as imitation, fine visual–motor coordination, gross–motor coordination, and nonverbal abstract conceptualization. After four months in the program, the TEACCH

group showed a mean developmental gain of 9.6 months. Despite methodological design limitations to the study, it does lend some support to the success of the TEACCH approach in treatment for children with ASD (Seitler, 2011).

### **1.6.3 Developmental Approaches**

Developmental approaches focus on helping children master the seven developmental skills of attention and focus; engaging and relating; nonverbal gesturing; affect cueing; complex problem solving; symbolic communication; and abstract and logical thinking (Seitler, 2011). One such developmental approach is Greenspan's Developmental, Individual-Difference, Relationship-Based (DIR) Model (Greenspan & Wieder, 2000; Greenspan & Wieder, 2006). Greenspan and Wieder (2006) suggested that an ASD treatment model should include an interactive experience called "floor time" that ranges from 2 to 5 hours per day. In addition, children with ASD should attend speech therapy 3 to 5 times per week and occupational therapy 2 to 5 times per week. School attendance is encouraged for children who can interact and imitate gestures and/or words and engage in preverbal problem solving. Parents are also counselled regarding their floor time interactions with the child. The primary goal of the DIR approach is for the child to form a sense of himself or herself and to progress through the seven developmental milestones. The goal is achieved as the therapeutic team creates a program based on the child's unique needs and provides an integrated and developmentally appropriate use of many of the traditional therapeutic interventions (Greenspan & Wieder, 2006).

### **1.6.4 Biologically and medically based treatments**

A variety of medications that target specific symptoms in children with ASD have been studied (Aman, Lam, & Van Bourgondien, 2005). These medications include selective serotonin reuptake inhibitors to improve interpersonal contact (Kolevson, Mathewson, & Hollander, 2005), atypical antipsychotics, particularly risperidone, to manage challenging behaviour in individuals with ASD (Shea et al., 2004), stimulants and adrenergics to decrease hyperactivity and hyper-arousal, anticonvulsants to treat seizure disorders, and melatonin to treat irregular sleeping patterns (Manning-Courtney et al., 2003).



Nutritional and dietary interventions for children with ASD have been described and receive extensive coverage in the literature (Christison & Ivany, 2006; Millward, Ferriter, Calver, & Connell-Jones, 2008; Mulloy et al., 2010). For many years, vitamin B6 and magnesium have been reported as potentially beneficial for children with ASD (Mousain-Bosc et al., 2005). Examples of biological therapies include immune-regulatory interventions (for example dietary restriction of food allergens or administration of immunoglobulin or antiviral agents), detoxification therapies, gastrointestinal treatments and dietary supplement regimens that act by modulating neurotransmission (Gupta, 2004; Levy & Hyman, 2005).

Special diets, including gluten- and casein-free diets, have been proposed as beneficial for children with ASD, based on a hypothesis of increased gut permeability and absorption of toxic peptides that lead to the development of ASD (Buie, 2005; Christison & Ivany, 2006). Medications and nutritional therapy are mostly used in the context of other therapies and interventions as a supplementary treatment to address features that may be impairing the ability of the child with ASD to progress or function (Manning-Courtney et al., 2003).

### **1.6.5 Habilitative Therapies**

Speech-language and occupational therapy are the most common supplementary therapies for children with ASD (Seitler, 2011). The primary role of the speech-language pathologist (SLP) in treating children with ASD is to develop or improve the core deficits in communication associated with ASD (Goldstein, 2002). These core deficits include listening skills, pragmatic skills, social interaction behaviour, and receptive and expressive language. Pragmatic language use is defined as the use of verbal and nonverbal language for social purposes and includes understanding and interpreting social cues such as gestures, facial expressions, and body language (Prelock & Nelson, 2012). Direct therapy that targets pragmatic skills can result in significant improvements in social behaviour (Scheuermann & Webber, 2002). The main goal is to help develop a functional communication system (Greenspan & Wieder, 2006; Myers & Johnson, 2007).

The SLP usually implements a traditional language treatment approach to enhance disordered communicative behaviours (Goldstein, 2002). Traditional language interventions have been shown to be particularly effective for promoting functional language skills that generalize to the natural environment (Prizant, Wetherby, & Rydell, 2000). These types of traditional intervention are primarily designed to address topics of interest to the child during therapy, include linguistic input appropriate to the level of language development of the child, and provide natural reinforcement for the communication of the child (Prizant, Wetherby, & Rydell, 2000).

Recommended strategies for instruction of children with ASD have included incorporating student preferences for materials and rewards, varying the tone of voice used, and displaying enthusiasm accompanied by positive facial affect during instruction (Lamers & Hall, 2003). A study by Lamers and Hall (2003) investigated the listening preferences of high-functioning children with ASD, including their preferred prosody for classroom instruction. Significant preferences were revealed for three children with ASD, who were then observed during classroom activities as they responded to teacher instructions with various prosodic profiles. Results revealed that the responses of the children to prosody of voice differed, with children less likely to respond if a relatively monotonous prosody was used. Prosodic characteristics of voice can be incorporated as style of delivery of instruction. Using clear, simple instructions, along with an enthusiastic tone, has long been the recommended style of instruction delivery for teachers of children with ASD (Prizant, Wetherby, & Rydell, 2000).

Using prosody as a style of instruction within a traditional play-based language therapy approach capitalizes on the specific auditory processing abilities that have been observed in many children with ASD, and offers activities that they intrinsically enjoy (Heaton, Hudry, Ludlow and Hill, 2008). A positive response to prosodic variation may help children with ASD engage and interact with others, thus allowing them to participate in activities that could facilitate the acquisition of listening, pragmatic, and social-interaction skills (Wan, Bazen, Baars, Libenson, Zipse and Zuk et al., 2011).

### **1.6.6 Summary of recent intervention approaches**

Over the last 10 years, there has been a shift in the types of interventions regarded as most appropriate to support the communication and behavioural needs of children with ASD (Seitler, 2011). According to the U.S. National Autism Centre (2011), behavioural treatments received the strongest support in the National Standards Project review, although non-behavioural approaches were identified as making a critical contribution requiring additional research. Delay and deviance in the area of communicative ability is universal in ASD and is one of the central areas for intervention (National Autism Centre, 2011). Behavioural interventions generally agreed to aid optimal learning include the use of natural linguistic behavioural approaches to teaching, displaying enthusiasm accompanied by positive facial affect during instruction, and a general focus on “learning to learn” challenges (Ingersoll & Shreibman, 2006). There seems to be consensus that intervention approaches need to be integrated and to adapt to the language and communication deficits within a social impairment framework to be effective (Prelock & Nelson, 2012).

## **1.7 PROSODIC ASPECTS OF SPEECH**

Prosody is an element of language and communication that utilizes variations of duration, intensity, and pitch, to change emphasis, stress, rhythm, and intonation (Wagner & Watson, 2010). Prosody in speech is a by-product of language, not a construct upon which it is built (Patel, 2007). Prosody is a complex temporal organisation of acoustic events, perceived mainly through the auditory modality, and possesses inherent qualities that may be used to aid in very specific aspects of language development (Thaut, 2003).

Research suggests that rhythm, tempo, melody, and intonation may provide a sense of structure to facilitate perception and production of expressive language in children with ASD (Patel, 2007). Boucher, Lewis, and Collis (2000) found that children with ASD were equal to their typically-developing peers in the ability to label six basic emotions based on the affective prosody of single-word utterances (e.g., days of the week). Affective prosody refers to a speaker varying the pitch and duration of an utterance to indicate his or her emotional state (Grossman et al., 2010).

Communicative functions in which prosodic elements play an important part include pragmatic functions such as the use of stress to signal an important or contrastive word, usually indicating a specific emotive response, as in the utterance: 'I wanted BLUE socks' where 'blue' is stressed to suggest that this is an important word, probably contrasting with a previously mentioned colour (McCann, 2003). This use is manifested as differentiation between stressed and unstressed words or syllables by variation in speech intensity and duration (McCann, 2003).

### **1.7.1 Perception of prosodic elements of speech**

To date, the majority of investigations into prosody in ASD have focused upon expressive abilities, and surprisingly little is known about the ability of individuals with ASD to interpret prosodic cues in the speech of others (McCann, Gibbon, O'Hare, & Rutherford, 2007; Paul & Augustyn, 2005). In a review article, McCann and Peppe (2003) concluded that the existing research literature showed inconsistent evidence of the processing of spoken prosody in children with ASD.

Despite the core features of deficits in auditory processing, listening skills, pragmatic skills and social interaction, children with ASD possess inherent strengths in terms of superior pitch discrimination (Bonnell et al., 2010; Heaton 2003, 2005; Mottron et al., 2000), their ability to discriminate stressed words better than unstressed words (Paul et al., 2005), and their ability to process changes in absolute pitch values and timing of pitch direction changes within a melody (Ouimet et al., 2012).

### **1.7.2 The use of prosodically varied speech as a treatment method**

Verbal intonation refers to the variation of three elements of spoken prosody: the variation of pitch in the spoken phrase, the duration of the utterance, and the points of stress in the phrase (Sparks & Deck, 1981). Some exaggeration of these three elements of a spoken prosody model occurs when an utterance is intentionally intoned. First, the duration of the utterance is lengthened, and then the constantly varying pitch of speech is reduced and shaped into a rhythmic pattern involving only two pitches (Sparks & Holland, 1976; Sparks & Deck, 1981) (Appendix B). Finally, the rhythm and degree of stress is exaggerated to provide increased emphasis on certain words in the phrase. These three modifications of spoken prosody serve as a

means of emphasizing the prosodic structure of the utterance. The three modifications of spoken prosody has been adapted for this study from the Melodic Intonation Therapy model (Sparks & Deck, 1981) to provide intervention for listening skills, pragmatic skills and social-interaction behaviour within the framework of a traditional language treatment approach for three children with ASD.

## **1.8 PREVIOUS RESEARCH REGARDING THE USE OF PROSODICALLY VARIED SPEECH AS A TREATMENT APPROACH**

Individuals with ASD exhibit superior abilities in associating pitches (single tones) with arbitrary labels and remembering these associations (Heaton, Hermelin, & Pring, 1998). Individuals with ASD have been shown to discriminate pitches (Bonnell et al., 2010) and subtle changes in pitch direction (Heaton, 2005) with greater accuracy than controls. Similarly, they can identify alterations of a single interval in a contour-preserved melody (Mottron, Peretz, & Ménard, 2000) as well as within a melody where absolute pitch values and timing of pitch direction changes are modified (Ouimet et al., 2012).

In a study by Lamers and Hall (2003), significant receptive prosodic preferences were revealed for three children with ASD. The children with ASD were observed during classroom activities as they responded to teacher instructions using various prosodies. Results revealed that the responses of the children to prosodic characteristics of voice differed, with children less likely to respond if a monotonous tone was used. Prosody of voice can be incorporated as style of delivery of instruction. Using clear, simple instructions, along with an enthusiastic tone, has generally been the recommended style of instruction delivery for teachers of children with ASD (Prizant, Wetherby, & Rydell, 2000). There is, however, limited research describing the impact of any specific style of delivery (Lamers & Hall, 2003).

A study by Smith and Robb (2005) showed that children with ASD are able to recall stressed words better than unstressed words. They displayed no statistical difference from typically developing peers in disambiguating verbs from nouns on the basis of stress placement, for example differentiating REcall from reCALL (Paul, Augustyn, Klin, & Volkmar, 2005). Their main deficits appear to be in the production of prosody, and several studies have noted the inappropriate production of

contrastive stress (McCann & Peppé, 2003), inappropriate phrasal stress, or excessive stress in spontaneous speech (Shriberg et al., 2001).

A study by Miller and Toca (1979) investigated a variation of melodic intonation therapy (MIT) in the case of a 3-year-old nonverbal male with ASD (Miller and Toca 1979). The male participant received one year of traditional therapy involving signed and verbal language with little to no improvement at which time adapted melodic intonation therapy was attempted. The adapted melodic intonation therapy made use of signed language as well as an intoned stimulus. After treatment, the subject was noted to use trained, imitative and spontaneous intoned verbal attempts that were observed to generalize to other settings (Miller & Toca, 1979). Despite the success of this case study, the results of a single participant cannot be generalized to the greater population, nor can it be determined without the use of a control group whether the adapted melodic intonation therapy in itself resulted in the increase in language (Sandiford, Mainess, & Daher, 2013). Other factors, such as maturation of the child and the introduction of traditional therapy prior to the adapted melodic intonation therapy, may have played a role in eventual language acquisition (Sandiford et al., 2013).

More recent studies investigated Auditory-Motor Mapping Training (AMMT) as an intervention for children with ASD, by using music and rhythm to facilitate speech (Wan et al., 2010, 2011; Wan and Schlaug 2010). In their 2011 proof of concept study, these researchers used a single-participant design to study six nonverbal children between the ages of 5 and 9. For the purpose of the study, *nonverbal* was defined as “having no intelligible words” (Wan et al., 2011, p2). The clinician introduced a target high frequency word or phrase by singing while simultaneously tapping out a matching rhythm and pitch on a set of tuned drums five times a week over an eight-week period of time. Researchers concluded that participants improved in their ability to articulate words and phrases over time. The ability to articulate words and phrases generalized to words not trained in therapy (Wan et al. 2011). The results of this study are promising and continue to indicate the need for more melodic-based interventions for children with ASD.

## **1.9 LEVELS OF EVIDENCE IN INTERVENTION RESEARCH**

This section provides an overview of Phase I in scientific rehabilitation intervention research and why Phase I studies form a critical part of providing a foundation for clinical practise.

In the field of rehabilitation research, Fey and Finestack (2009) focussed on a system for developing language interventions with children. They contended that "adoption of such a system is essential to the growth of language intervention science and to the development of an evidence base suitable for guiding clinicians in making crucial treatment decisions" (p. 514). The five-phase model for studying the effectiveness of intervention begins with the pre-trial studies. In Phase I research, the intervention and its hypothesized effects are identified. A small number of participants are recruited, and initial approximations of candidacy criteria are established. The treatment protocol and specific outcome measures are defined. While these studies are often observational or correlational, estimates of effect size can be established in Phase I research, and the data can be used to calculate the sample size required to gain sufficient statistical power to test the hypotheses (Fey & Finestack, 2009).

## **1.10 SUMMARY OF RATIONALE AND PROBLEM STATEMENT**

In this chapter, some perspectives on Autism Spectrum Disorder are presented. This serves as a foundation for the orientation of the research. ASD remains an enigmatic, though clinically defined disorder for which there is little clear understanding of the aetiology or the development of the behavioural manifestations (Bauman & Kemper, 2005).

Research in the neurological foundations of the processing of melodic and rhythmic stimuli tend to point toward the ability of specific elements of prosody (stress variation and intonation) to stimulate or activate areas of the brain often found to be anatomically abnormal in individuals with ASD (Boddaert, 2004; Samson et al, 2006). Elements of prosody such as intonation and stress variation therefore warrant research into a different treatment approach to stimulate atypical processing (Bertone, 2005; Gervais, 2004). New prosodic approaches to treatment might in turn

stimulate the development of language and communication (and as such social interaction) cerebral centres. The study aims to determine if the use of prosodically varied speech within a traditional speech-language therapy framework has any effect on the listening skills (as determined by the *BLM G-5 (2010) Listening Skills Observation Checklist*), pragmatic skills (as determined by the *Pragmatic Skills Checklist - Shipley & McAfee, 2009, form 8-7*) and social interaction behaviour (as determined by the *Gilliam Autism Rating Scale, 2<sup>nd</sup> edition*) of three children with ASD.



## CHAPTER 2

### METHOD

#### 2.1 CHAPTER ORIENTATION

The methodology implemented in this study is described in this chapter. The main aim, as well as sub-aims, is presented. A description of the participants, procedures, material and apparatus, and finally data collection and analysis procedures, is provided.

#### 2.2 AIMS AND SUB-AIMS

##### 2.2.1 Main research aim

To determine if a combined prosodic and linguistic treatment approach has an effect on aspects of the communicative behaviour of three children with ASD.

##### 2.2.2 Sub-aims

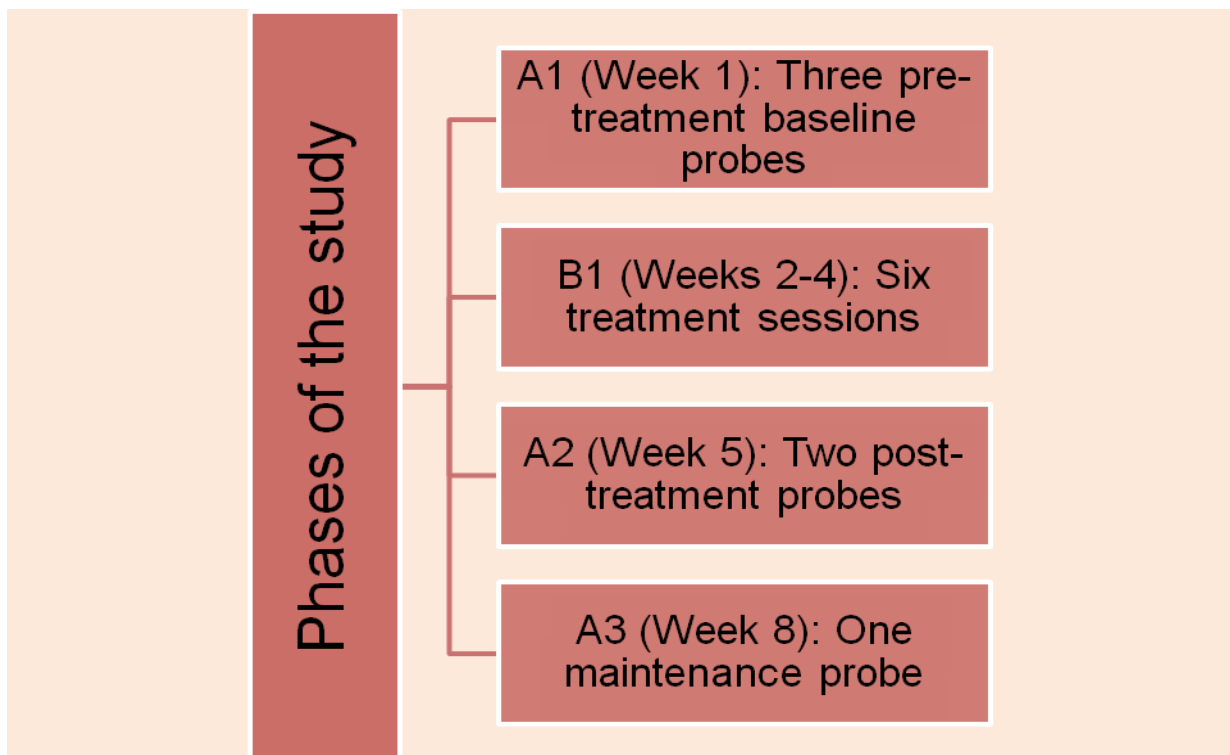
To determine if the use of prosodically varied speech by the clinician during traditional language treatment effected change in the following areas:

- Listening skills (as determined by the *BLM G-5 (2010) Listening Skills Observation Checklist*)
- Pragmatic skills (as determined by the *Pragmatic Skills Checklist - Shipley & McAfee, 2009, form 8-7*)
- Stereotyped, social-communication and social-interaction behaviour (as determined by the *Gilliam Autism Rating Scale, 2<sup>nd</sup> edition*).

## 2.3 RESEARCH DESIGN

A single participant multiple baseline design across participants was used during this study. Single participant designs are constructed to investigate basic questions and to provide careful descriptions of the studied disorder (Leedy & Ormrod, 2005). Measurement of the behaviour of an individual over time is one of the cornerstones of single-participant experimental studies. Only repeated measurements over time can reveal behavioural patterns and changes in those patterns as treatment progresses (Kearns, 1986). The independent variable in this research was traditional language therapy with prosodically varied speech, while the dependent variable was the communication-related behaviour (including listening skills, pragmatic skills, and social-interaction skills). Given that prosodic speech variation within a traditional language treatment framework is a recent intervention that has not been extensively tested, a single-participant design was used to provide “proof of concept” (Smith, Dawson, Guthrie & Lord, 2007).

The research implemented an ABA design and was conducted over an eight week period (Figure 2.1).



## Figure 2.1: Schematic presentation of the research design

### 2.3.1 Participants

#### 2.3.1.1 Selection criteria for participants

Table 2.1 describes the selection criteria for the participants, as well as the justification for each criterion.

**Table 2.1: Selection criteria for participants**

Criterion	Justification
<b>Home language</b> Participants had to speak either English or Afrikaans as first language.	To ensure that participant-clinician interaction was not hampered by poor language proficiency on the side of the clinician, as the researcher was proficient in English and Afrikaans only.
<b>Communication deficits</b> All participants included in this study had to display deficits in listening skills, pragmatic skills (discourse) and social interaction (as determined by assessment with the various instruments).	The aim of the study was to determine if the treatment effected change in behaviour and there had to be scope for improvement. The use of prosodically varied speech within a traditional language treatment framework was aimed at facilitating these communication-related skills.
<b>Diagnosis of Autism Spectrum Disorder</b> All the participants had to be diagnosed as being on the autism spectrum. Diagnosis in all cases was according to the DSM-IV (Appendix A1), as the DSM-V (Appendix A2) had not been published when this study commenced. In addition, however, participants needed to have some degree of functional speech and minimal "hyper hearing".	Children with little or no functional speech, as well as high-functioning children with ASD, were excluded from the research, as the use of prosodically varied speech within a traditional language treatment framework requires some degree of functional speech. "Hyper hearing" would result in over-stimulation and anxiety.
<b>Chronological age</b> The chronological age of the participants had to be between 6:0 and 8:11 years (school-going age).	In order to keep the curriculum content homogenous for all the participants, they were required to be in the same school phase. Children in this age-group are in the foundation phase, where specific concepts are taught.
<b>Therapy</b> Participants were not to receive additional (external) speech therapy during the research period.	In order to ensure internal validity for the results of using prosodically varied speech within a traditional language therapy framework, the possible effect of additional speech therapy had to be eliminated.

### 2.3.1.2 Selection procedures

Three children who met the selection criteria were purposively selected as participants from a school that accommodates children with ASD (Appendix A1).

### 2.3.1.3 Description of participants

The profiles of the three participants are depicted in Table 2.2.

**Table 2.2: Profiles of participants**

Participant	Sex	Chronological age	Age at diagnosis	Home language	Degree of ASD (as determined by the ADOS-G)	Communication mode
Participant 1	Male	6y 7m	3y 2m	Afrikaans	Moderate	Two-word utterances
Participant 2	Male	7y 4m	6y 1m	English	Severe	Single words
Participant 3	Male	8y 4m	5y 6m	English	Moderate	Sentences

## 2.4 ETHICAL CONSIDERATIONS

It is imperative to take ethical implications into consideration when conducting a research study in which human participants take part (Leedy & Ormrod, 2005). In order to achieve best practise in research and in the clinical profession, researchers need to adhere to a set of ethical principles. The following principles were adhered to in this study (Leedy & Ormrod, 2005):

**Informed consent and assent:** An informed consent form that describes the nature of the research study as well as what would be expected of the participants, should they wish to participate, was given to all prospective participants and their parents prior to conducting the research (Appendix C). Informed assent was obtained from each child. The child was asked if he would like to participate and he had to point to either a happy face picture (if he agreed to participate in the session) or a sad face picture (if he did not agree to participate in the session).

**Autonomy:** The autonomy of each participant was taken into consideration in that they had been informed of the nature of the study to be conducted, and that they had been given the choice to participate or not. Furthermore, the parents of participants who agreed to participate were given the right to withdraw their children from the study at any time they wished to, without any negative consequences.

**Fidelity (right to privacy):** Personal information from the participants as well as the quality of their performance in the conducted tests was treated in a strictly confidential manner.

**Honesty to professional colleagues and research participants (veracity):** Participants' parents were informed of both the purpose and procedure of the study and were in no way deceived by the researcher or led to believe false information. Findings were documented in a complete and honest manner, without misrepresenting any information that could mislead other professional colleagues. A request for ethical clearance was submitted and approved by the Research and Ethics Committee of the Faculty of Humanities, University of Pretoria.

## 2.5 PROCEDURES

### 2.5.1 Probe procedures

Each participant was assessed independently. Assessment took place in the same room where treatment was provided. Only the participant and the researcher were present during interaction sessions. A number of activities were planned and appropriate materials were available to facilitate interaction. The materials included a soft toy dog, picture cards, empty coffee tins, building blocks, stencils, plastic fruit, picture books, bubbles and a toy medical kit. Behaviour and reactions of each participant were assessed by means of the three assessment scales described in Table 2.3. The researcher initiated all activities, and each assessment session lasted approximately 30 minutes. The video camera was set up in the corner of the room and switched on as each participant entered the room. All interaction sessions were video-recorded.

Table 2.3 depicts the different assessment tools and the scoring criteria that were used during the pre-treatment, post-treatment and maintenance probes.

**Table 2.3 Assessment tools and scoring criteria**

<b>Assessment material</b>	<b>Aspects that were assessed (Appendix D1-D3)</b>	<b>Scoring criteria</b>
Listening Skills Observation Checklist (BLM G-5, 2010)	<ol style="list-style-type: none"> <li>1. Focuses on the purpose of listening (e.g., to provide information, answer specific questions, give examples)</li> <li>2. Looks at speaker</li> <li>3. Controls personal activity level</li> <li>4. Demonstrates responsive reaction (e.g., nods, smiles)</li> <li>5. Shows appreciation for speaker's ideas (e.g., comments, nods)</li> <li>6. Draws reasonable conclusions from material heard (answers questions appropriately)</li> <li>7. Asks for clarification or examples when appropriate</li> <li>8. Withholds judgment on ideas until presentation is completed (does not interrupt speaker)</li> <li>9. Uses respectful language in any interaction</li> <li>10. Discerns exaggeration or emotional aspects in language (intonation, loudness, stress)</li> <li>11. Can identify main argument or ideas after presentation is complete (answers questions correctly)</li> </ol>	A checklist (BLM G-5, 2010) was used to score 11 listening behaviours for each child. A score of 1 was given if the behaviour was observed during the 30 minute session, while a score of 0 was given if the behaviour was not observed during the session.
Pragmatic Skills Checklist (Shipley & McAfee, 2009, form 8-7)	<ol style="list-style-type: none"> <li>1. Responds to greetings</li> <li>2. Makes requests</li> <li>3. Describes events</li> <li>4. Takes turns</li> <li>5. Follows commands</li> <li>6. Makes eye contact</li> <li>7. Repeats</li> <li>8. Attends to tasks</li> <li>9. Maintains topic</li> <li>10. Role-play</li> <li>11. Sequences actions</li> <li>12. Defines words</li> <li>13. Categorizes objects</li> <li>14. Understands object functions</li> <li>15. Initiates activity or dialogue</li> </ol>	A pragmatic skills checklist (Shipley & McAfee, 2009) was used to score 15 pragmatic behaviours for each child. A score of 1 was given if the behaviour was observed during the 30 minute session, while a score of 0 was given if the behaviour was not observed during the session.
Gilliam Autism Rating Scale (GARS - 2)	<p>Three sub-scales:</p> <ol style="list-style-type: none"> <li>1. Stereotyped behaviours (e.g. flicks fingers rapidly in front of face for a period of 5 seconds or more; spins objects not designed for spinning).</li> <li>2. Communication (e.g. avoids looking at speaker when name is called; repeats words out of context).</li> <li>3. Social Interaction (e.g. avoids eye contact; resists physical affection from another person).</li> </ol>	The GARS-2 was used to score 42 social-communicative behaviours in three sub-categories for each child. A score of 1 was given if the behaviour was observed 0-2 times during the 30 minute session; a score of 2 was given if the behaviour was observed 3-5 times during the session; a score of 3 was given if the behaviour was observed more than 5 times during the session, while a score of 0 was given if the behaviour was not observed during a session. The Autism Index was calculated for each participant, and subsequently converted to a percentile for each participant (see Appendix D for the conversion tables).

## **2.5.2 Treatment procedures**

A large room was used, with minimal noise and distractions. Each participant was treated individually. Only the participant and the researcher were present during interaction sessions. A number of activities were planned and appropriate materials were available to facilitate interaction. The aims of treatment, materials and activities used, treatment procedures and the use of prosodically varied speech within a language treatment framework are described in Table 2.4. The researcher briefly explained each activity to the participant by means of a visual timeline (pictures in sequence of the activities which would be done during that session), so as to put the participant at ease and to let him know what to expect during the session. The video camera was set up in the corner of the room and switched on as each participant entered the room. Each treatment session lasted approximately 30 minutes. All interaction sessions were video-recorded.

## **2.6 MATERIAL AND APPARATUS**

### **2.6.1 Material for assessment**

The following material was used to assess each participant during the three baseline probes, the two post-treatment probes, and the maintenance probe.

Assessment scales:

- Listening Skills Observation Checklist (BLM G-5, 2010)
- Assessment of Pragmatic Skills Checklist (Shipley & McAfee, 2009, form 8-7)
- Gilliam Autism Rating Scale (GARS – 2, 2006)

Appendix D1-D3 describes the different assessment tools which were used for pre-treatment, post-treatment and maintenance probes.



## 2.6.2 Material for treatment

The material and activities that were used during the interaction sessions as well as the aim(s) of each activity are described in Table 2.4. During the treatment sessions, a telescopic goal approach was used (Nelson, 2009). Treatment aims, which are naturally related to different communication areas (listening skills, pragmatic skills and social-interaction skills), were dealt with in each session (Nelson, 2009). The prosodically varied speech procedures are described in Appendix B. Phrases were intoned on just two pitches; melodic contour was determined by the natural prosody of speech.

\***Bold type** indicates the stressed syllables, which were sung on the higher of the two pitches.

**Table 2.4: Material used during treatment sessions**

Treatment aims	Justification	Procedures	Material
To facilitate whole-body listening skills throughout the treatment sessions.	Listening is the ability to attune to important auditory information and to ignore unnecessary information. The attuning function of listening plays a fundamental role in auditory processing and attention span, both essential to the acquisition of receptive language which is deficient in children with ASD (Nwora & Gee, 2009).	(Name of child), this is Nando the dog. He will help us to listen well today. Nando has big ears to listen (show ears), and big eyes to look at me when I'm speaking (show eyes).	Soft-toy dog
To establish routine, to elicit a response to greeting, to facilitate joint attention and to establish eye-contact.	Young children with ASD typically exhibit core deficits in social communication skills, particularly in the areas of joint attention, reciprocity, eye-contact, and skills in functional and symbolic play (Veness et al., 2012).	A song based on a familiar tune was sung at the beginning and a similar song at the end of each session. Singing was used, rather than simple chanting in order to utilize the variations in pitch provided by the melody. The therapist began the song, after which the child imitated each phrase.	Greeting song: "Hello (child's name), ( <i>Hello – therapist's name</i> ) How are you? ( <i>How are you?</i> ) We will play together ( <i>We will play together</i> ) You and I ( <i>You and I</i> )"  Good-bye song: "Bye-bye (child's name), ( <i>Bye-bye – therapist's name</i> ) You were good! ( <i>You were good!</i> ) We played well together ( <i>We played well together</i> ) You and I ( <i>You and I</i> )"
To elicit object naming. The therapist modelled the desired response, after which the child had to imitate the therapist.	Among the earliest concerns of parents with children with ASD are delays in speech and language development, specifically the acquisition and development of receptive and expressive language (Guinchat et al., 2011). Object naming is also an important aspect of pragmatic skills (Shipley & McAfee, 2009), which are known to be impaired in children with ASD (Grossman et al., 2010).	(Name of child), I have five pictures here. I want you to tell me what you see on each picture. (If the child did not spontaneously respond, a cue was given by the therapist, using PVS: " <b>This is an apple</b> "). (See Appendix B for PVS procedures).	Picture cards
To facilitate non-verbal imitation behaviour, as well as taking turns.	Atypical social interaction, which includes atypical eye-gaze, imitation, and social reciprocity, is a hallmark of children with ASD (Guinchat et al., 2011).	Two empty coffee tins were used by the therapist to create simple, rhythmic patterns, which the child had to imitate after listening to each rhythmic pattern carefully.	Two empty coffee tins.

**Material used during treatment sessions: Table 2.4 continued**

<p>To facilitate following one-step instructions.</p>	<p>Receptive language, which includes following instructions, is an important pre-cursor to later academic success (Prelock &amp; Nelson, 2012).</p>	<p>The therapist named the colour of each block, using PVS (see Appendix B). The child was then instructed to name the colours of the blocks, as well as to follow commands (“give me the blue block”). The command was intoned (said using two different pitches; one low and one high). Example: “<b>This</b> is the <b>yellow/blue/red/green</b> block” (while showing the appropriate block). Commands: “<b>Give</b> me the <b>yellow/blue/red/green</b> block”.</p>	<p>Brightly coloured building blocks.</p>
<p>To elicit picture description and expansion on a topic.</p>	<p>Deficits in expressive language lead to reduced social interaction with peers, as well as poor pragmatic skills (Volkmar et al., 2005).</p>	<p>Drawing different shapes with crayons and stencils provided the therapist with an opportunity to model a sentence or a question using PVS, giving the child a chance to describe a picture and expand on a topic. Example: (Name of child), let us draw some pictures with these stencils. Sentences were modelled, e.g. “<b>This</b> is a <b>fishing</b> boat”, and then questions were intoned about the picture, e.g. “<b>What</b> kind of <b>boat</b> is <b>this</b>? “<b>What</b> is it <b>floating</b> on?”</p>	<p>Stencils, paper and crayons.</p>
<p>To teach grouping and categorization skills.</p>	<p>As children with ASD reach school-going age, delays in language-based tasks, such as problem-solving and symbolic thinking, become more apparent (Volkmar et al., 2005).</p>	<p>“<b>This</b> is an/a (<b>apple/banana/grape/peach</b>).” “<b>Give</b> me the <b>red/yellow/purple</b> fruit”. “<b>Where</b> are <b>all</b> the <b>apples/grapes/bananas</b>?” (See Appendix B for a description of the of the PVS procedures used by the researcher).</p>	<p>Plastic fruit.</p>
<p>To teach requesting behaviour.</p>	<p>Verbal, as well as non-verbal requesting behaviour of children with ASD seems to be impaired (Paparella et al., 2011). Requesting is an important skill for the development of social-communicative behaviour.</p>	<p>The bubbles were shown to the child, while the therapist waited for a request. If the child did not respond, a probing question was intoned “<b>would</b> you like to <b>blow</b> some <b>bubbles</b>?”</p>	<p>Bubbles.</p>

**Material used during treatment sessions: Table 2.4 continued**

<p>To describe events and sequence actions.</p>	<p>Expressive language behaviour such as describing events in sequence is an important indicator for the development of pragmatic skills (Groen et al., 2008).</p>	<p>“(Name of child), we are going to read from this book now”. While the child paged through the book, the therapist modelled an appropriate sentence, using PVS (e.g. “<b>Suzy</b> fell <b>out</b> of the <b>tree</b>”), after which the child had to imitate the therapist. After each page, the therapist asked a probe-question: e.g. “<b>what hap-pened</b> to <b>Suzy</b>?”</p>	<p>A book containing large colourful pictures.</p>
<p>To facilitate role-play and to teach object function.</p>	<p>Theory of mind seems to be severely impaired in children with ASD (Prelock &amp; Nelson, 2012). Role-play is an important tool for improving theory of mind in children with ASD. Knowing object functions is an important pragmatic skill (Shiple &amp; McAfee, 2009). Deficits in theory of mind and pragmatic skills complicate the ability of the child with ASD to fully engage in the give-and-take of conversational discourse expected during social exchanges (Prelock &amp; Nelson, 2012).</p>	<p>“(Name of child), Nando is very sick today; we need to help him. You will be the doctor today – let us get everything you need to help Nando.” <b>This</b> is the <b>stethoscope/bandage/plaster</b>”.  <b>Listen</b> to the <b>heart</b> with the <b>stethoscope</b>; <b>close</b> the <b>scratch</b> with the <b>plaster</b>; put a <b>bandage around</b> Nando’s <b>paw</b>. Probe-questions: “<b>How</b> will we <b>close</b> the <b>scratch</b>? <b>What</b> will we use to <b>listen</b> to Nando’s <b>heart</b>? <b>Where</b> must the <b>bandage</b> go”?</p>	<p>Toy medical kit.</p>
<p>To re-direct the child’s attention to the current task by using songs.</p>	<p>It was noticed that the children sometimes lost motivation to participate, and that singing a song together re-focused their attention to the task at hand.</p>	<p>The therapist began the song, after which the child joined in. “(Name of child), we are going to sing some songs now. I will sing the song for you, and then we will sing the song together, and then you must sing the song alone”.</p>	<p>Familiar nursery songs.</p>

### **2.6.3 Apparatus for data collection and analysis**

The apparatus used for data collection included a video camera positioned on a tripod, compact discs, a digital video disc player, a remote control and a television monitor.

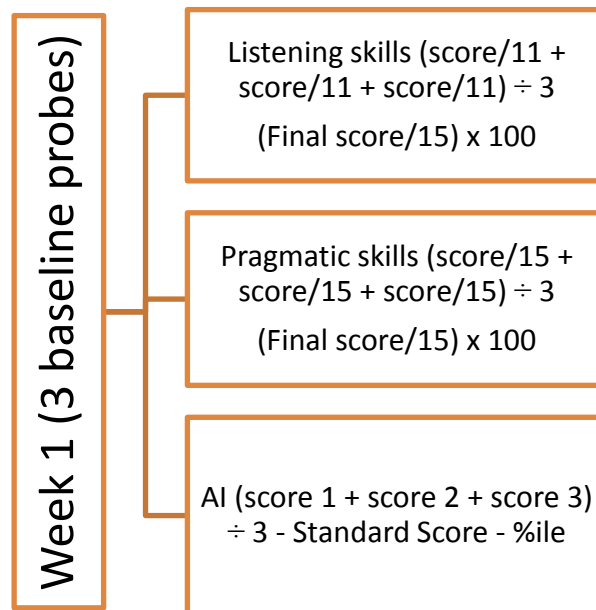
## **2.7 DATA COLLECTION AND ANALYSIS PROCEDURES**

The data collection was done during Week 1 (three pre-treatment baseline probes), Week 5 (two post-treatment probes) and Week 8 (one maintenance probe) by means of videotaping behaviour and reactions during interaction sessions. All the assessment probes were watched, analysed and scored directly after each session by the researcher and an external rater. The external rater was a professionally trained speech-language pathologist with a specific interest in children with ASD. The three behavioural observation checklists detailed in Appendix D were used to score behaviours and reactions relating to listening skills, pragmatic skills and social-interaction behaviour.

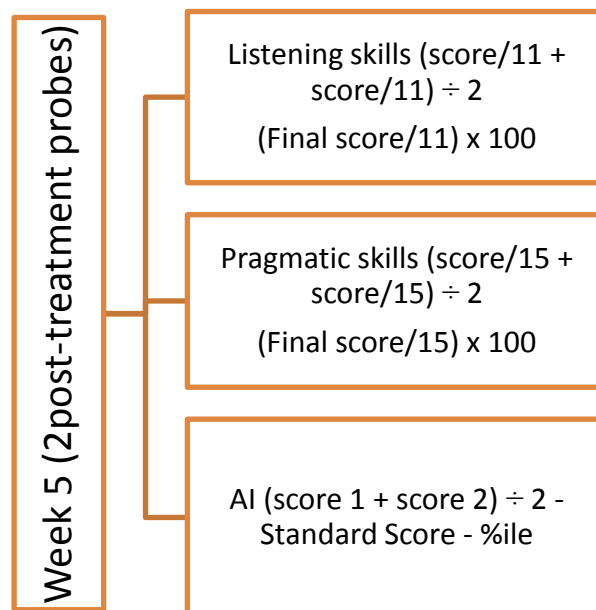
The external rater was included for the specific purpose of recording data with the researcher. It is challenging to observe, participate, and record data simultaneously, therefore every interaction session with each participant was video-recorded (Uys, 2002). All scores were assigned directly after watching the recordings of each session. The researcher and the external rater watched all the recorded sessions individually, and scored behaviours according to the three behaviour checklists (Appendix D). The external rater scored the participants on a separate sheet, using a different room to watch the video recordings. The listening skills checklist comprised of eleven behaviours, the pragmatic checklist detailed fifteen behaviours, and the GARS-2 included forty-two items (fourteen items on stereotyped behaviours, fourteen items on communication, and fourteen items on social interaction). For the listening skills and pragmatic skills checklists, a score of 1 was given if the behaviour was observed during the session, while a score of 0 was given if the behaviour was not observed during the session. For the GARS-2, a score of 1 was given if the behaviour was observed 0-2 times during the session; a score of 2 was given if the behaviour was observed 3-5 times during the session; a score of 3 was given if the behaviour was observed more than 5 times during the session, while a score of 0

was given if the behaviour was not observed during a session. The raw scores were converted to standard scores, and subsequently converted to a percentile for each participant (see Appendix D for the conversion tables).

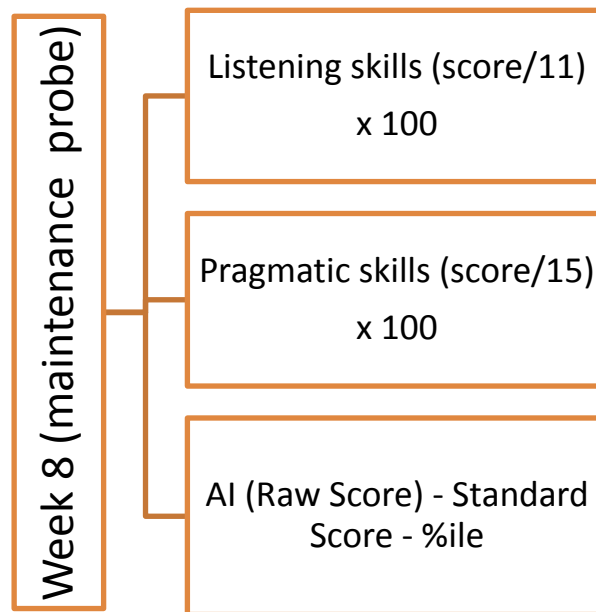
Figures 2.2-2.4 depict how the recorded data were analysed to obtain a mean score for week 1 (3 baseline probes), week 5 (2 post-treatment probes) and week 8 (maintenance probe).



**Figure 2.2: Data analysis of week 1**



**Figure 2.3 Data analysis of week 5**



**Figure 2.4 Data analysis of week 8**

### 2.7.1 Reliability and validity

The external rater watched and scored the video-recordings of the three pre-treatment probes, two post-treatment probes, and the maintenance probe over the eight-week research period. Independent blind scoring was done by both the researcher and external rater for each item on the three behaviour checklists after each assessment probe. This means that the researcher and the external rater watched each recorded session individually in different rooms, and using different scoring sheets. The scoring was done directly after each session. A correlation calculation between the scores of the researcher and external rater for each item on each of the three behavioural checklists was used to determine the inter-rater reliability of the three baseline probes, the two post-treatment probes, and the maintenance probe (Schiavetti & Metz, 2006). There was a direct correlation in the researcher's and external rater's scoring in 98.3% of the cases, as obtained by the *Kappa* statistical method. This was significant on a 95% level. The conclusion can therefore be made that there was a significant correlation between the two different raters (Table 2.5). The scores for each item on the three behaviour checklists over the research period are detailed in Appendix E.

**Table 2.5: Inter-rater reliability mean scores of the researcher and the external rater**

Session (Participant 1)	Listening skills (11 items)		Pragmatic skills (15 items)		GARS-2 (42 items, %ile)	
	*R	**ER	R	ER	R	ER
Pre-treatment 1	3	3	4	4	84	82
Pre-treatment 2	3	4	5	4	86	86
Pre-treatment 3	2	3	5	5	84	84
Post-treatment 1	6	6	10	10	35	37
Post-treatment 2	6	7	10	10	32	35
Maintenance probe	4	4	6	7	47	47
Session (Participant 2)	Listening skills (11 items)		Pragmatic skills (15 items)		GARS-2 (42 items, %ile)	
	*R	**ER	R	ER	R	ER
Pre-treatment 1	3	3	3	3	98	99
Pre-treatment 2	4	3	2	3	98	98
Pre-treatment 3	3	3	3	3	99	98
Post-treatment 1	6	5	10	9	96	97
Post-treatment 2	6	6	8	10	96	96
Maintenance probe	4	4	5	6	97	97
Session (Participant 3)	Listening skills (11 items)		Pragmatic skills (15 items)		GARS-2 (42 items, %ile)	
	*R	**ER	R	ER	R	ER
Pre-treatment 1	4	3	9	8	87	86
Pre-treatment 2	4	3	10	9	89	87
Pre-treatment 3	5	4	9	9	87	87
Post-treatment 1	6	6	10	10	42	39
Post-treatment 2	7	6	11	10	39	37
Maintenance probe	3	3	6	7	79	77

\*R = Researcher

\*\*ER = External Rater

## 2.8 SUMMARY

In this chapter the design of the research was explained. Specific forms of data collection were developed to score and measure communication-related skills. An external rater was used to help the researcher provide objective, unbiased scores and measurements of behaviours. Reliability control measures were established where an external rater assisted the researcher with counter checks and the data analysis methods were approved by a statistician.



## CHAPTER 3

### RESULTS

#### 3.1 CHAPTER ORIENTATION

In this chapter, the results are presented, followed by the interpretation and discussion in Chapter 4. The main research goal defined in Chapter 2 was to determine if the use of prosodically varied speech by the clinician during traditional language treatment effected change in the following areas:

- Listening skills (as determined by the *BLM G-5 (2010) Listening Skills Observation Checklist*)
- Pragmatic skills (as determined by the *Pragmatic Skills Checklist - Shipley & McAfee, 2009, form 8-7*)
- Stereotyped, social-communication and social-interaction behaviour (as determined by the *Gilliam Autism Rating Scale, 2<sup>nd</sup> edition*).

Following three pre-treatment baseline probes, prosodically varied speech within a traditional language treatment framework was presented for three weeks. Two post-treatment probes were executed after the three-week period of treatment. The treatment was then withdrawn for two weeks, after which a maintenance probe was administered. Three children participated in this study. Assessment of the value of prosodically varied speech within a traditional language therapy framework was based on behavioural changes noted after the period of application of the treatment, as well as the maintenance of the behaviours after a two-week period of withdrawal. The analysis was based on the performance of the participants in the areas of listening, pragmatics, and social-interaction behaviour.

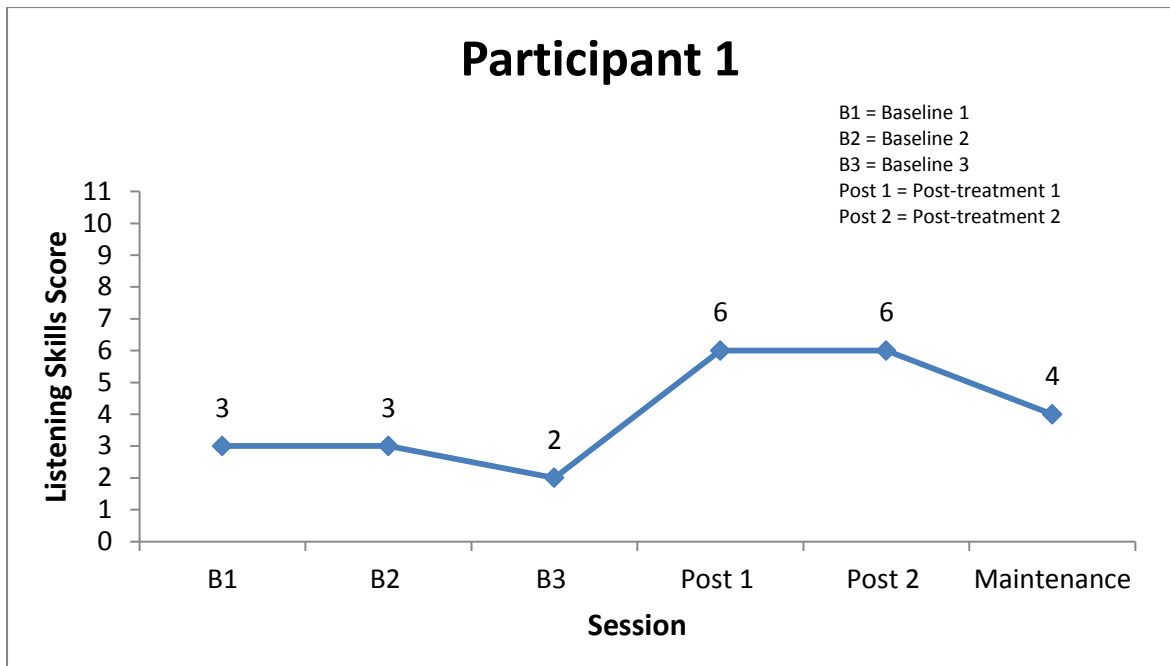
## **3.2 RESULTS OF USING A COMBINED PROSODIC AND LINGUISTIC THERAPY APPROACH FOR THE TREATMENT OF CHILDREN WITH ASD**

The research question was whether the use of prosodically varied speech within a traditional language therapy framework would bring about change in the listening skills, pragmatic skills, and social-interaction behaviour of three children with ASD. The researcher aimed to answer this question by examining the performance of the three participants over eight weeks. The phases of the study are described in Figure 2.1 in Chapter 2.

Statistical significance was not calculated for each individual due to the limited data. It is clear from "eyeball estimation" (inspecting data and quickly making an educated guess about the approximate magnitude of relevant statistics - Hurlburt, 2007), however, that all the participants showed a positive change in performance across all areas, regardless of their pre-treatment performance level.

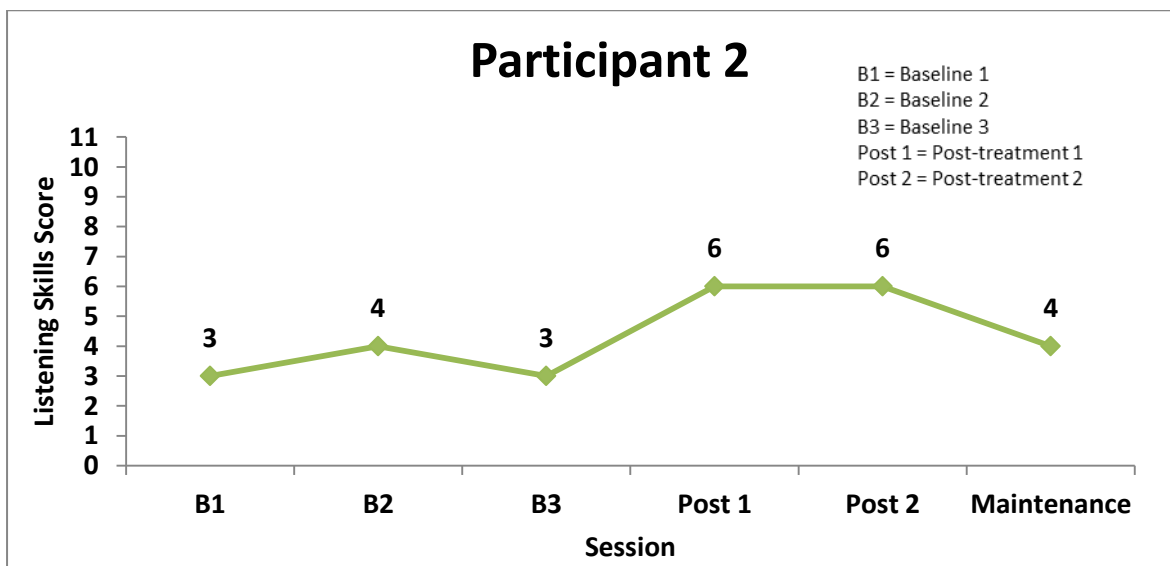
### **3.2.1 Listening skills of the three participants over the research period**

Figures 3.1-3.3 depict the change in the listening skills of the three participants during the three baseline probes (week 1), the two post-treatment probes (week 5) and the maintenance probe (week 8). The listening skills scores presented below are the raw scores obtained out of a total of eleven listening behaviours, as determined by the *BLM G-5 (2010) Listening Skills Observation Checklist*.



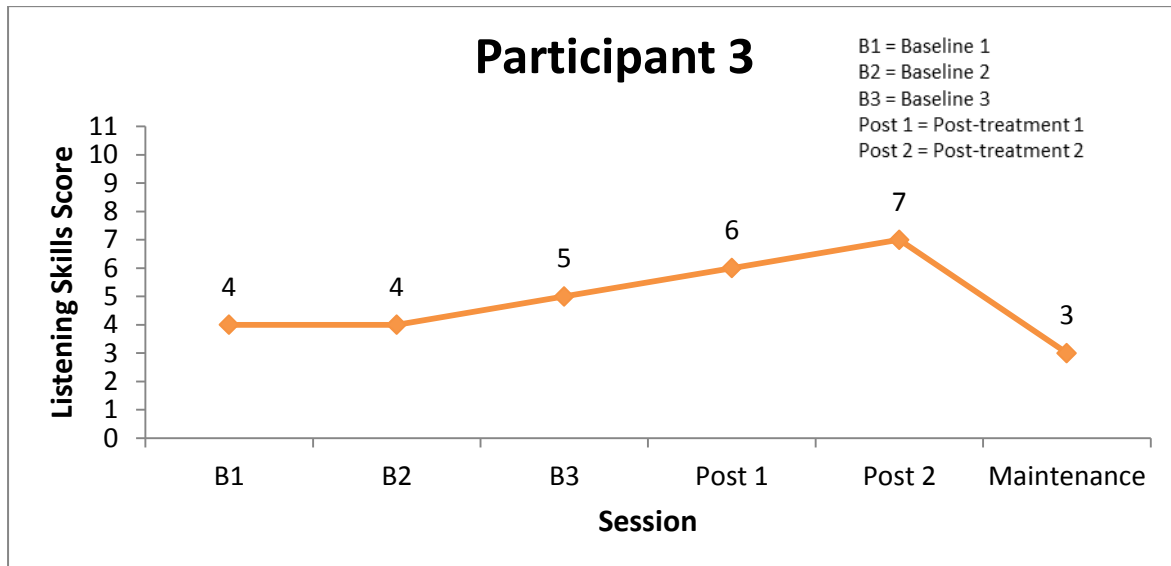
**Figure 3.1 Listening skills score of participant 1**

Figure 3.1 depicts a noticeable change in the raw listening skills score, which is indicative of positive change from week one (pre-treatment) to week five (post-treatment). Although the final maintenance score is lower than the post-treatment score, it is higher than the initial baseline scores from week one.



**Figure 3.2 Listening skills score of participant 2**

Figure 3.2 indicates a positive change in the raw listening skills score from the pre-treatment baseline probes to the post-treatment probes. Although the final maintenance score is lower than the post-treatment score, it is higher than the initial baseline scores from week one.

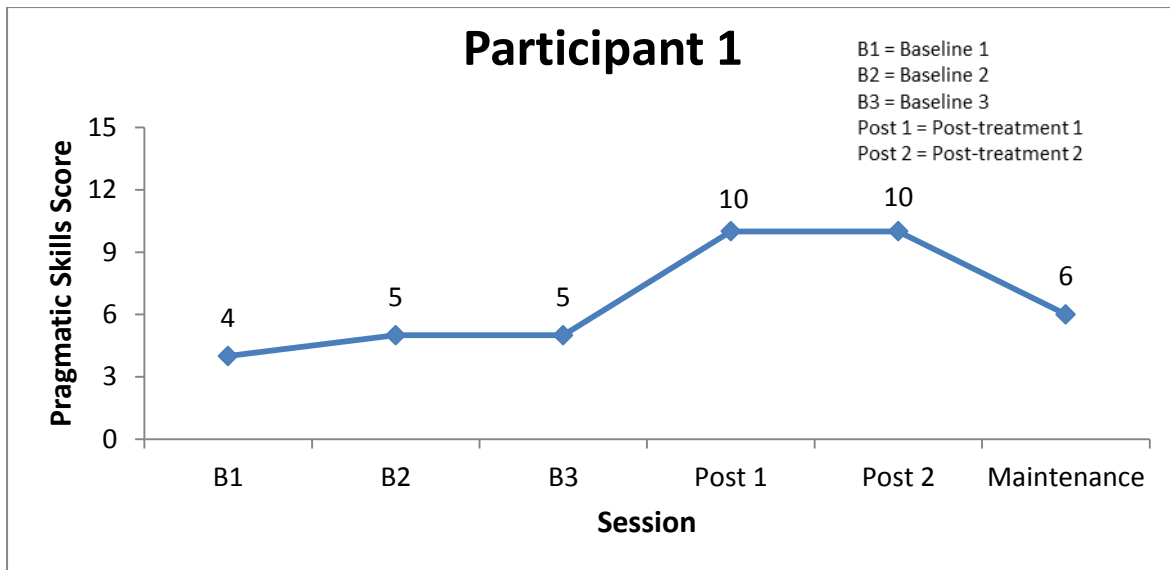


**Figure 3.3 Listening skills score of participant 3**

Figure 3.3 shows a positive change in the raw listening skills score at the post-treatment phase, when comparing the score to the pre-treatment baseline scores. There is a decline in performance during the final maintenance probe.

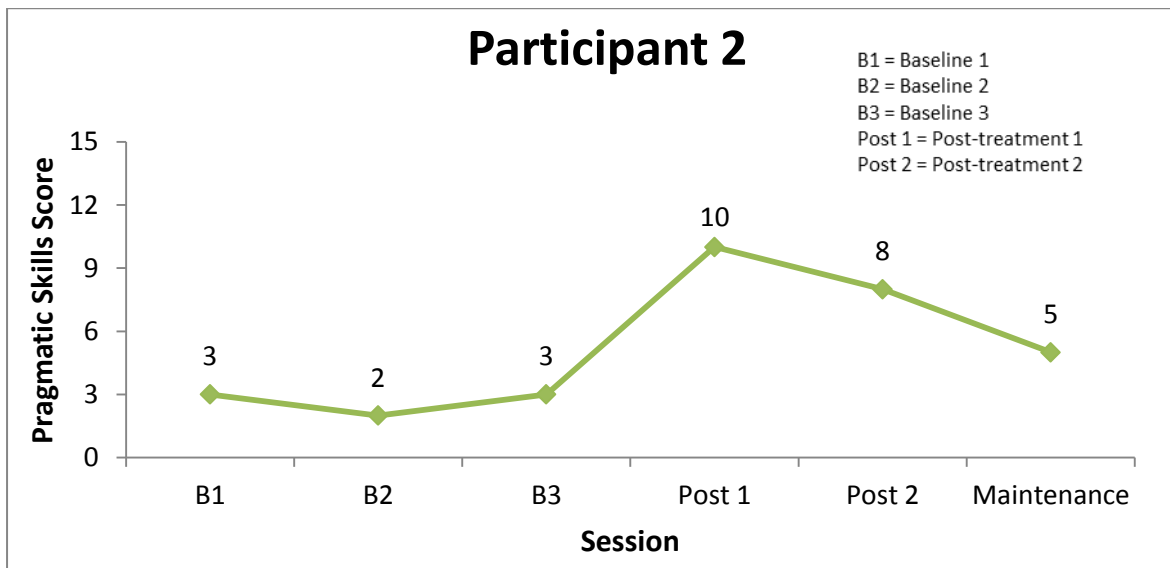
### 3.2.2 Pragmatic skills of the three participants over the research period

Figures 3.4-3.6 depict the change in the pragmatic skills behaviour of the three participants during the three baseline probes (week 1), the two post-treatment probes (week 5) and the maintenance probe (week 8). The pragmatic skills scores presented below are the raw scores obtained out of a total of fifteen pragmatic behaviours, as determined by the *Pragmatic Skills Checklist - Shipley & McAfee, 2009, form 8-7*.



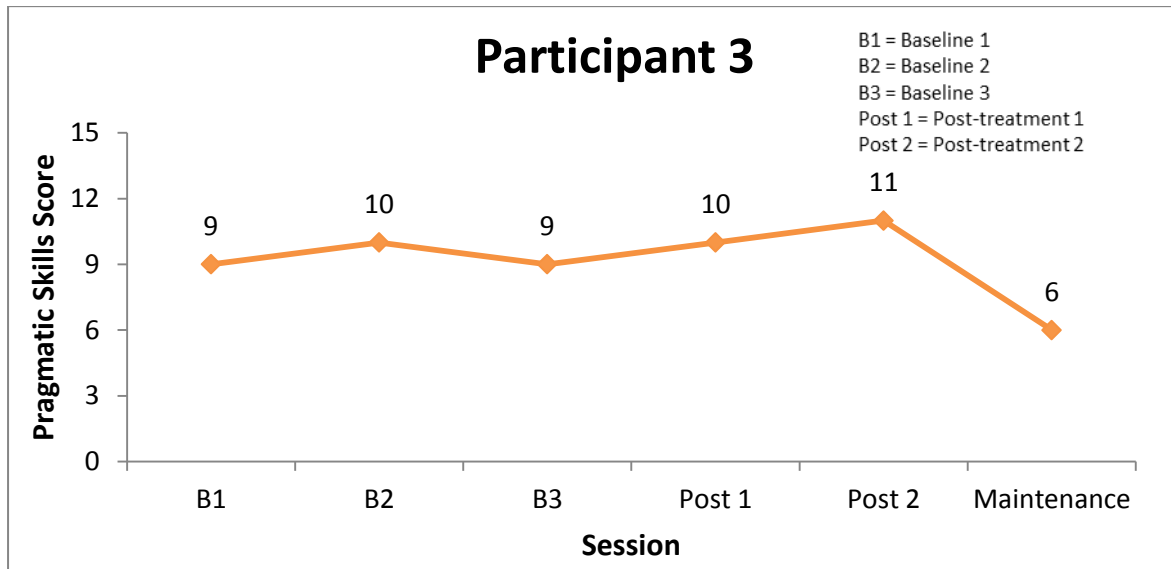
**Figure 3.4 Pragmatic skills score of participant 1**

Figure 3.4 depicts a noticeable change in the raw pragmatic skills score, which is indicative of positive change from week one (pre-treatment) to week five (post-treatment). Although there was a decline in the final maintenance probe, the raw maintenance score is still higher than the initial baseline probes.



**Figure 3.5 Pragmatic skills score of participant 2**

Figure 3.5 indicates a positive change in the raw pragmatic skills score from the pre-treatment baseline probes to the post-treatment probes. Although there was a decline in the final maintenance probe, the raw maintenance score is still higher than the initial baseline probes.

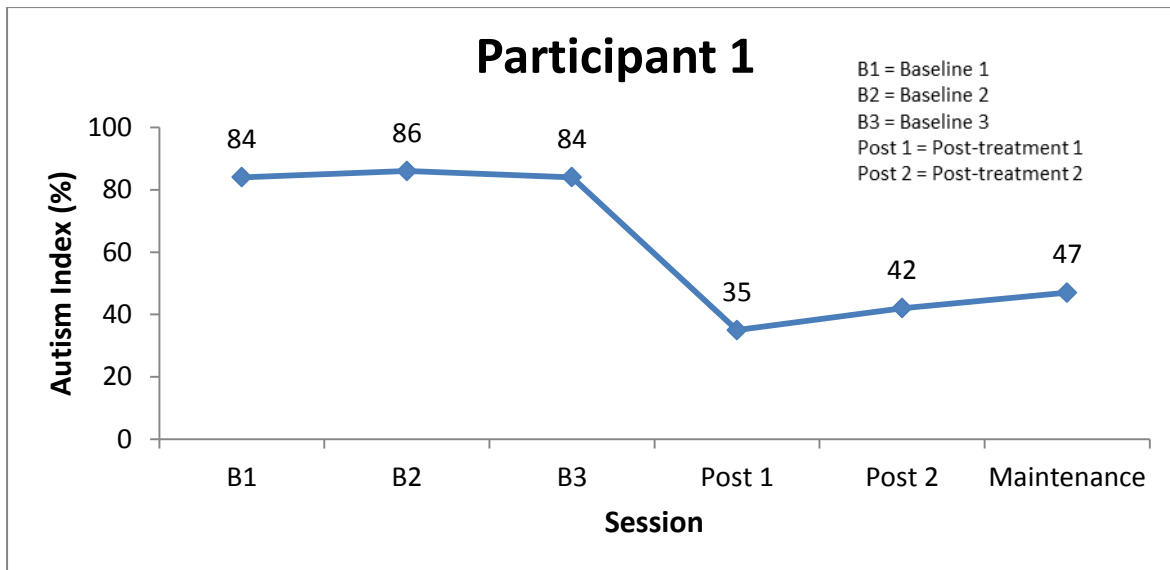


**Figure 3.6 Pragmatic skills score of participant 3**

Figure 3.6 shows a slight positive change in the raw pragmatic skills scores at the post-treatment phase, when comparing the scores to the three pre-treatment baseline scores. There is a decline in the graph towards the final maintenance score.

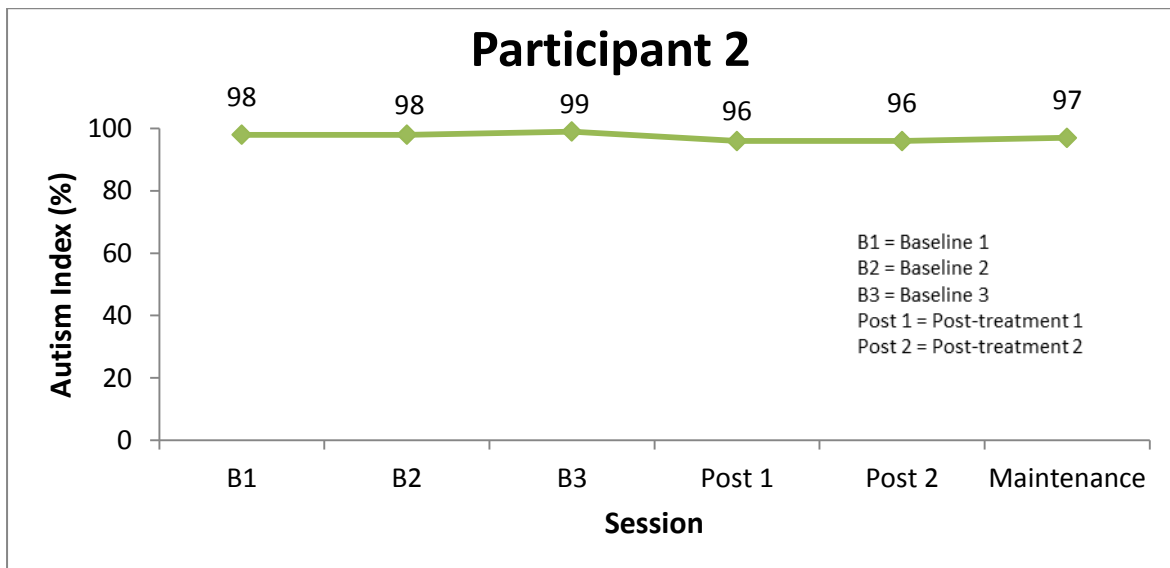
### 3.2.3 Autism Index of the three participants over the research period

Figures 3.7-3.9 depict the change in the Autism Index (%) of the three participants during the three baseline probes (week 1), the two post-treatment probes (week 5) and the maintenance probe (week 8). The Autism Index (AI) percentile was determined by the *Gilliam Autism Rating Scale, 2<sup>nd</sup> edition*. The Autism Index was calculated by converting the raw scores to standard scores, and then obtaining a percentile (Appendix D). A lower AI score indicates decrease in autistic-type behaviours.



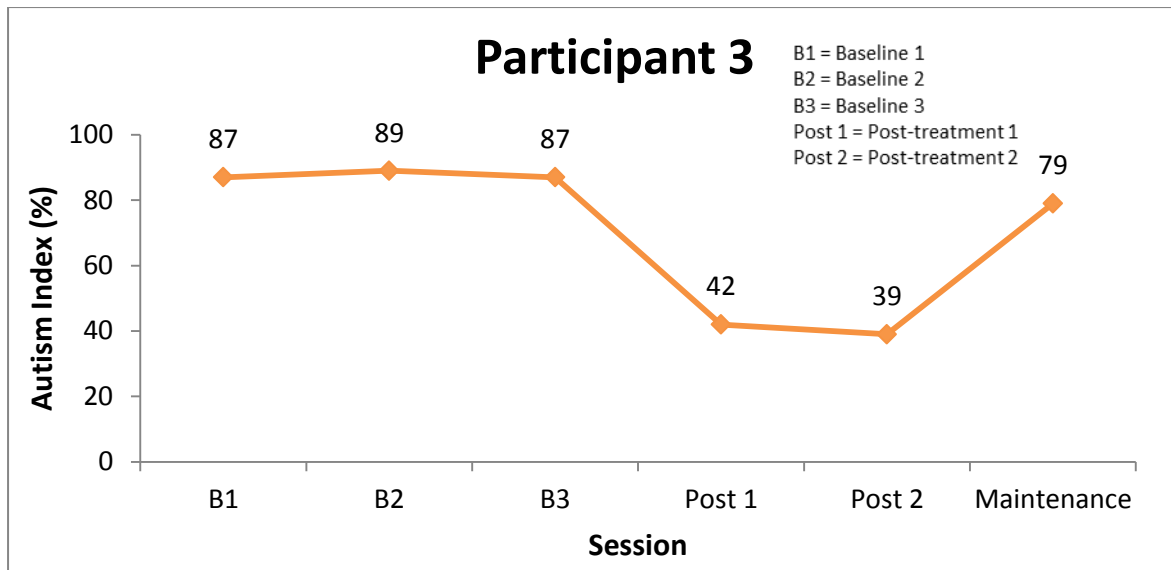
**Figure 3.7 Autism Index for participant 1**

Figure 3.7 depicts a noticeable change in the Autism Index indicative of positive change from week one (pre-treatment) to week five (post-treatment). Although there is a decline in performance with the final maintenance probe, the score is better than for the initial baseline probes.



**Figure 3.8 Autism Index for participant 2**

Figure 3.8 shows no significant change in the Autism Index during the three baseline probes (week 1), the two post-treatment probes (week 5) and the maintenance probe (week 8).



**Figure 3.9 Autism Index for participant 3**

Figure 3.9 shows a positive change in the Autism Index at the post-treatment phase, when comparing the score to the pre-treatment baseline scores. There is a decline in performance for the final maintenance probe.

### 3.3 OVERALL PERFORMANCE AFTER THREE WEEKS OF TREATMENT

When comparing the pre-treatment performance with the level of performance after three weeks of treatment, the differences in performance highlight the heterogeneity of the population with ASD. These individual differences in performance are presented in Table 3.1. All raw scores were converted to percentages by dividing the raw score by the total number of items in the assessment scale, and multiplying this score by 100. In the case of the GARS-2 (Autism Index), the percentile score for each participant is presented.



**Table 3.1 Overall performance of each participant after three weeks of treatment**

	<b>Area</b>	<b>Week 1 (Pre-treatment average)</b>	<b>Week 5 (post-treatment average)</b>	<b>Change in behaviour</b>
1	Listening skills	27.2%	54.5%	27.3%
	Pragmatic skills	33.3%	66.7%	33.3%
	Autism Index	84 <sup>th</sup> percentile	35 <sup>th</sup> percentile	49 percentile points
2	Listening skills	27.2%	54.5%	27.3%
	Pragmatic skills	20%	66.7%	46.7%
	Autism Index	98 <sup>th</sup> percentile	96 <sup>th</sup> percentile	2 percentile points
3	Listening skills	36.4%	54.5%	18.1%
	Pragmatic skills	60%	66.7%	6.7%
	Autism Index	87 <sup>th</sup> percentile	39 <sup>th</sup> percentile	48 percentile points

### 3.4 SUMMARY

In this chapter, the results of the empirical research were presented. The results of the research were based on the performance of the participants during pre-treatment, post-treatment and maintenance probes. Performance in each of the three communication-related areas (listening skills, pragmatic skills, and social-interaction behaviour) for each participant was presented. The average performance across all three areas for each participant was also included.

## CHAPTER 4

### DISCUSSION

#### 4.1 CHAPTER ORIENTATION

In this chapter, the results are interpreted and discussed. The format of a pre-treatment post-treatment single participant design (Leedy & Ormrod, 2005) is used, and the data obtained requires a quantitative, as well as a qualitative approach. In a study using a heterogeneous population (such as the ASD population), all quantitative results have to be interpreted and explained within a qualitative framework, in order to reveal new meaning (Uys, 2002).

#### 4.2 DISCUSSION OF THE RESULTS OBTAINED BY USING A COMBINED PROSODIC AND LINGUISTIC TREATMENT APPROACH FOR CHILDREN WITH ASD

Figures 3.1-3.9 indicate that there were inter-participant differences in the scores for the three communication-related areas. On both the pre-treatment probes and post-treatment probes, discrepancies were evident. Because ASD is a spectrum disorder, where every individual presents with a unique profile of strengths and weaknesses, the results of each participant will be discussed individually.

##### 4.2.1 Discussion of the results from participant 1

Participant 1 was diagnosed with a moderate degree of ASD, and his level of communicative functioning was two-word utterances. Participant 1 showed positive behavioural changes in all three performance areas (listening skills, pragmatic skills, and social-interaction skills). Prosodically varied speech was used within a traditional language treatment framework to treat different communication-related areas. The three different areas (listening skills, pragmatic skills, and social-interaction skills)

were not targeted separately, but in an integrated manner through a telescopic goal approach (Nelson, 2009). In spite of the fact that separate instruction was not included in the therapy plan, the performance of participant 1 in all three areas indicated positive change. This led the researcher to assume that the use of prosodically varied speech together with a traditional language treatment approach seems to be effective in targeting more than one communication-related area in a session in at least some cases.

#### **4.2.2 Discussion of the results from participant 2**

Participant 2 was diagnosed with a severe degree of ASD, and his level of communicative function was mostly gestures and single words. Participant 2 did not show any observable change in the social-interaction-skills domain. This lack of change in behaviour is a true reflection of the level of functioning of participant 2. Of all the participants, participant 2 showed the most severe autistic behaviours (excessive hand-flapping, inability to initiate and maintain a conversation topic and a low desire to communicate with others). However, participant 2 showed positive behavioural changes in the listening and pragmatic skills areas, indicating that he benefitted from the treatment for those two areas. The positive change in behaviour from participant 2 seems to lend further support to the positive effects of melodic-based interventions previously found by various researchers (Miller and Toca 1979; Sandiford et al., 2012; Wan et al. 2011). Participant 2, who had the lowest mean baseline score (16.4%), was nonetheless not the one who showed the smallest measure of positive change in behaviour. Prosodically varied speech within a traditional language therapy framework seemed to bring about positive change in some forms of behaviour, regardless of the low level of functioning of participant 2.

#### **4.2.3 Discussion of the results from participant 3**

Participant 3 was diagnosed with a moderate degree of ASD, and his level of communicative function was full sentences. It is interesting to note that participant 3, who had the highest percentage mean score on the pre-treatment probes (36.5%), did not show the largest percentage of positive change. Although participant 3 showed positive behavioural changes between the pre-treatment and the post-

treatment scores in all three communication-related areas, a plateau effect was noted, especially with regard to his performance in listening and pragmatic skills. The fact that participant 3 had the highest mean baseline scores, but did not show the greatest amount of positive change, could indicate the need for a greater variety of activities during treatment. Further research incorporating the implementation of different aims and activities in the treatment programme may be necessary to examine the full benefits of using prosodically varied speech within a traditional language treatment framework. In addition, research looking into initial treatment with PVS in conjunction with traditional language therapy, followed by the exclusive use of traditional language therapy, may also be warranted. This will determine if using PVS initially will produce a more positive effect in the therapeutic success of traditional language therapy.

#### **4.3 GENERAL DISCUSSION OF THE BEHAVIOUR OF THE PARTICIPANTS**

Figures 3.1-3.9 depict a positive change in performance from week one to week five for all of the participants in all three areas of treatment. All of the participants showed a marked decline in performance after the withdrawal phase. This decline in performance may be attributed to the fact that the participants had a two-week school holiday and were not in a structured classroom environment where they might have had the opportunity to maintain new skills learned during treatment. Many studies have reported on the limited ability of children with ASD to generalize skills, especially with regard to social reciprocity (Leach & Laroque, 2006), reciprocal imitation skills (Ingersoll & Schreibman, 2006), expressive prosody (Bellon-Harn et al., 2007) and speech output (Wan et al., 2011). On the other hand, the average scores for all of the participants in all the communication areas after the withdrawal phase were higher than their pre-evaluation probes, indicating that they retained some of the skills learned during treatment. This finding is in line with literature reports indicating that children with ASD display receptive prosodic preferences (Lamers & Hall, 2003), can recall stressed words better than unstressed words after intervention (Smith & Robb, 2005), and are more inclined to respond to and retain melody- and rhythm-based information (Wan et al., 2011).

The change in the behaviour of the participants in this study may be attributed to numerous factors. During the study it was observed that the participants demonstrated sustained interest in the activities used in conjunction with the prosodically varied speech treatment. Multiple studies suggest that individuals with ASD demonstrate right-hemispheric strengths (Herbert et al., 2005; Lazarev et al., 2010). If aspects of melody and rhythm are processed in the right hemisphere of the brain (Hoffman, 2008; Ono et al., 2011), then it may be expected that individuals with ASD would show a preference for tasks incorporating melodic and rhythmic stimuli. Prosodically varied speech therefore seems to have a positive effect when used in conjunction with traditional language therapy.

During the treatment sessions, a telescopic goal approach was used. Treatment aims which are naturally related to many different communication areas (listening skills, pragmatic skills, and social-interaction skills) were used in each session (Nelson, 2009). It seemed that the participants felt more confident using their newly acquired skills, which supported their motivation to participate maximally during the interaction sessions.

A further explanation for the positive change in the behaviour of the participants may be that during the interaction sessions, familiar activities were selected to cater for the developmental level and interests of the participants. This may also have contributed to their sustained motivation and positive behavioural change after treatment sessions.

Since this was a small convenience sample, the researcher documented observations of behaviours of each participant during treatment sessions to supplement the visual estimation analyses of the research. It was encouraging to note that all three participants could sing the greeting song accurately and with appropriate melodic contours by the second treatment session. All the participants responded consistently to their names being called in a two-tone (the second tone a third above the first), melodious way. They did not respond consistently in this manner when the researcher called their names using normal speech. During the treatment sessions, the participants often lost interest in a specific activity or became distracted. When the researcher started singing a familiar song (twinkle-twinkle little

star), however, they immediately turned around, made eye-contact, and started singing as well. This was a very effective method to re-direct their attention to the activity at hand.

#### **4.5 LEVEL OF EVIDENCE OBTAINED**

This research was a proof of concept study. Proof of concept is a realisation or demonstration, the purpose of which is to verify that a concept or theory has the potential of being used successfully; in this case, for clinical application. Proof of concept in this study was therefore a prototype that was designed to determine the feasibility of a treatment plan. This research was classified as a Phase I study (Fey & Finestack, 2009), where the treatment and its hypothesized effects were identified. A small number of participants were recruited, and initial approximations of candidacy criteria were established. The treatment protocol, as well as specific outcome measures, was defined. This study was observational, and the results suggested that using prosodically varied speech within a traditional language therapy framework effected behavioural change in three participants across three communication-related areas. Due to limitations in the design of the study, it is not possible to distinguish whether the sole use of PVS was responsible for changing the behaviour of the participants. It can be concluded, however, that the use of PVS within a traditional language treatment framework effected change in behaviour and did no harm to the participants.

#### **4.4 SUMMARY**

All of the participants showed positive behavioural changes with the use of prosodically varied speech within a traditional speech-language treatment approach. They all showed positive changes in their performances after the treatment phase. It was noted that although the performances of the participants declined during the withdrawal period, the scores of the maintenance evaluation probe were still higher than their initial pre-treatment evaluation probes. There were discrepancies in the performance between the different participants. Although all three participants showed severe impairments in communication-related skills, their abilities were different; and this influenced their performance in the three different communication-

related areas. The participant who scored the lowest on the mean baseline probes was not the participant who showed the smallest measure of positive change after treatment. It is important to realise that children with ASD may often present a skewed clinical picture of their functional abilities.

## CHAPTER 5

### CONCLUSIONS

#### 5.1 CHAPTER ORIENTATION

The conclusions are presented according to the aims of the research as stipulated in Chapter 2. This is followed by a discussion of the implications of the findings for future research as well as for clinical practice. A discussion of the strengths and limitations of the study and final comments conclude this chapter.

The main aim of this study was to evaluate whether the use of a combined prosodic and linguistic approach would have any effect on the listening skills, pragmatic skills, and social-interaction behaviour of three young children with Autism Spectrum Disorder. Three sub-aims were formulated in order to achieve the main aim. The conclusions reached by the researcher will be presented and discussed in terms of the sub-aims.

#### 5.2 CONCLUSIONS

##### **5.2.1 Change in listening skills, pragmatic skills, and social-interaction behaviour after the use of prosodically varied speech within a traditional language therapy framework**

The results were indicative of positive behavioural change in all three communication-related areas (listening skills, pragmatic skills, and social-interaction behaviour) for all three participants. The positive change in behaviour of all three participants in the different communication-related areas is in line with recent findings of similar studies. Results from research on auditory factors in ASD indicate that many individuals have exceptional pitch-discrimination abilities (Heaton, 2009), and generally show limited processing of social and more complex sounds such as



connected speech (Ouimet et al., 2012). Findings from the current study demonstrated that the use of prosodically varied speech intervention within the framework of a traditional language treatment approach led not only to positive change directly after the treatment phase, but also to a degree of maintained behaviour after the two-week withdrawal phase. A recent study investigating the efficacy of melodic-based communication therapy to elicit speech output in non-verbal children with ASD (Sandiford et al., 2013) reported that both taught and untaught words were generalised to the home environment. The ability of children with ASD to generalise skills taught using melodic-based stimuli is further supported by other recent findings indicating that skills taught using intonation are generalised to the production of words not taught during therapy (Wan et al. 2011).

An important finding is that the behavioural change did not occur in a linear fashion, but rather as a continuous process where the interdependency of the skills becomes clear. Because treatment occurred within a combined prosodic and linguistic framework, the areas that were targeted were expected to change in a positive way (Prelock & Nelson, 2012). Due to the nature of the research design (pre-test, post-test), and the fact that a combined prosodic and linguistic approach was used, no final conclusions can be drawn in terms of the efficacy of using specifically prosodically varied speech for the treatment of communication-related skills in children with ASD.

### **5.3 IMPLICATIONS FOR FURTHER RESEARCH**

As is the case with all research, the method and findings of this research project inevitably lead to recommendations for further research.

- The intervention addressed three communication-related skills, namely listening, pragmatic, and social-interaction skills. Other communication areas, such as receptive language and social-emotional skills, were not addressed directly. A study focussing on facilitating receptive language skills and social-emotional skills using prosodically varied speech would be valuable.

- The methodology used in this research required individual participants, and therefore it is difficult to generalise the results to a larger population. Another project could investigate the use of a combined prosodic and linguistic approach within a group context.
- Due to the fact that only three children with ASD were included in the study, the findings lack external validity. Prosodically varied speech could be used in other cultural and social contexts to determine its external validity.
- Although many communication-related behaviours were elicited in this study, evaluation of daily interactions was limited. Future research could expand the evaluation protocol in order to include a greater variety of behaviours in each communication-related area.

#### **5.4 IMPLICATIONS FOR CLINICAL PRACTICE**

Although highly qualified, experienced and skilled professionals should be responsible for developing structured intervention techniques and activities, caregivers and teachers can be trained to use certain aspects of prosodically varied speech to facilitate communication-related skills in children with ASD. As mentioned in Chapter 2, singing phrases on tones varying in thirds comes naturally to everybody and no special musical training is needed. This is an advantage, especially in the South African context where skilled professionals are scarce and in high demand.

#### **5.5 CRITICAL EVALUATION OF THE STUDY**

Since all research results are determined by the theoretical foundations and the methodology of the inquiry (Schiavetti & Metz, 2006), a critical evaluation of the whole research process is necessary.

### 5.5.1 Strengths

- The identification of communication-related behaviour referents contribute to research and intervention in that observation of behaviour is measurable.
- During the different phases of the study, a high inter-rater reliability was determined. This reliability is regarded as a strength, as change in behaviour through the use of a combined prosodic and linguistic treatment approach could be determined reliably.

### 5.5.2 Limitations

- A number of problems were experienced with the selection of the participant sample. Although the sample was criterion-based, it was not possible to select a homogeneous group, as the ASD-population is heterogeneous.
- A large sample could not be included, as each participant had to be treated during school hours in the treatment period. A randomized controlled trial would have allowed for stricter control in terms of external variables, which could have influenced the results.
- For the purpose of this study, the listening and pragmatic behaviours were only scored once if they were observed during the probe sessions. The frequency of the behaviour elicited during the sessions was not measured. Therefore, a maximum score of 11 for listening skills and 15 for pragmatic skills could be obtained. This analysis procedure obscured subtle changes in behaviour.
- This research project was an exploratory proof-of-concept study and any positive changes in the behaviour of the participants cannot be ascribed unequivocally to the specific intervention but may only mean that the use of prosodically-varied speech within a traditional language treatment framework did not harm the participants or inhibit their performance.

## 5.6 FINAL COMMENTS

In this Chapter, conclusions are presented, followed by an answer to the research question of whether the use of prosodically varied speech in the framework of a traditional language treatment approach would bring about change in the listening skills, pragmatic skills, and social-interaction behaviour of three young children with ASD. From the evaluation of the research, it is evident that although valuable contributions were made, especially with regard to the implication of service delivery, there are still a number of factors which should be addressed in future research.

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# APPENDICES

# **Appendix A1:**

## **DSM-IV Diagnostic Criteria for Autistic Disorder**

- A. A total of six (or more) items from (1), (2) and (3), with at least two from (1) and one each from (2) and (3)
- (1) Qualitative impairment in social interaction, as manifested by at least two of the following:
- (a) Marked impairment in the use of multiple nonverbal behaviours such as eye-to-eye gaze, facial expression, body postures and gestures to regulate social interaction
  - (b) Failure to develop peer relationships appropriate to developmental level
  - (c) A lack of spontaneous seeking to share enjoyment, interests or achievements with other people (e.g. by a lack of showing, bringing or pointing out objects of interest)
  - (d) Lack of social or emotional reciprocity
- (2) Qualitative impairment in communication, as manifested by at least two of the following:
- (a) Delay in, or total lack of the development of spoken language (not accompanied by an 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 stereotyped and restricted patterns of interest that are abnormal either in intensity or in 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: (a) social interaction, (b) language as used in social communication, or (c) symbolic or imaginative play.
- C. Disturbance is not better accounted for by Rett's disorder or by childhood disintegrative disorder.

# **Appendix A2:**

## **DSM-V Diagnostic Criteria for Autistic Disorder**

- A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history (examples are illustrative, not exhaustive):
1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.
  2. Deficits in nonverbal communicative behaviours used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.
  3. Deficits in developing, maintaining, and understand relationships, ranging, for example, from difficulties adjusting behaviour to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.

**Severity is based on social communication impairments and restricted, repetitive patterns of behaviour.**

- B. Restricted, repetitive patterns of behaviour, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive):
1. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypes, lining up toys or flipping objects, echolalia, idiosyncratic phrases).
  2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behaviour (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat same food every day).
  3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests).
  4. Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment (e.g. apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).



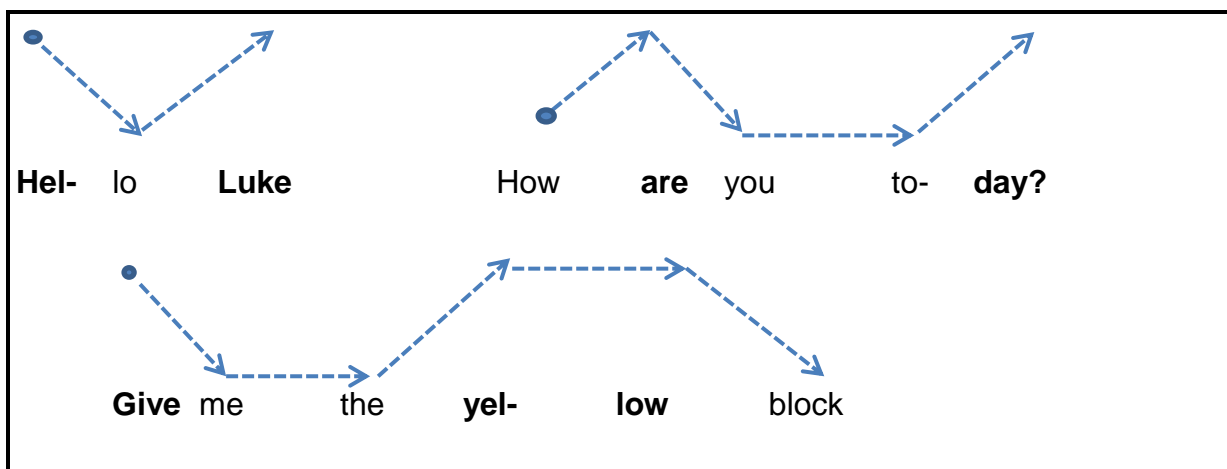
- C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life).
- D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.
- E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnoses of autism spectrum disorder and intellectual disability, social communication should be below that expected for general developmental level.

**Note:** Individuals with a well-established DSM-IV diagnosis of autistic disorder, Asperger's disorder, or pervasive developmental disorder not otherwise specified should be given the diagnosis of autism spectrum disorder. Individuals who have marked deficits in social communication, but whose symptoms do not otherwise meet criteria for autism spectrum disorder, should be evaluated for social (pragmatic) communication disorder.

# **Appendix B**

**Prosodically Varied Speech (PVS)  
description and procedures  
(adapted from the Melodic  
Intonation Therapy (MIT)  
programme from Helm-Estabrooks  
et al., 1989)**

The original programme of music intonation therapy was originally designed to lead non-fluent aphasic patients from intoning simple, 2–3 syllable phrases, to speaking phrases of 5 or more syllables across three levels of treatment. PVS does not include three levels of treatment and only utilizes two prosodic aspect namely pitch (high or low notes) and stress-variation. Phrases are intoned on just two pitches, stress is determined by the phrases' natural prosody [e.g., stressed syllables are sung on the higher of the 2 pitches, unaccented syllables on the lower pitch (see figure B1).



**Figure B1: Intoned phrase construction:** Phrases are intoned on just two pitches; melodic contour is determined by the natural prosody of speech (e.g., stressed syllables are sung on the higher of the two pitches). Adapted from Helm-Estabrooks et al. (1989).

Table B2 below describe the administration of the treatment procedures and degree of support provided by the therapist.

**Table B2: Steps and procedures in PVS**

Adapted from Helm-Estabrooks et al. (1989)

Step	Procedure
1. Humming	The therapist introduces the target phrase by showing a visual cue, humming the phrase 1x at a rate of 1 syllable per second, then intoning (PVS) the phrase 2x as shown in Figure B1.
2. Unison intoning	The therapist and the participant intone (PVS) the target phrase together.
3. Unison intoning with fading	The therapist and participant begin to intone (PVS) the target phrase together, but halfway through, the therapist fades out while the participant continues to intone the rest of the phrase with no further verbal or facial cueing.
4. Immediate repetition	The therapist intones the target phrase while the participant listens. The participant immediately repeats the phrase.
5. Response to a probe question	Immediately following the participant's repetition of the target phrase (step 4), the therapist quickly intones a question (e.g. " <i>What did Peter do?</i> ") and the participant answers by intoning the target phrase.

**Procedure:**

Seated across a table from the participant, the therapist showed a visual cue and introduced a word/phrase (e.g., "**This** is the **yellow** block"). The accented/ stressed syllable(s) was intoned on the higher of the 2 pitches, unaccented syllable(s) on the lower pitch (Figure B1). The starting pitch rested comfortably in the researcher's voice range, and the other pitch was a minor 3rd (3 semitones) above or below. These 2 pitches create the interval of a minor 3rd, which is universally familiar, requires no special singing skill, and provides a good approximation of the prosody of speech that still falls into the category of intoning (Helm-Estabrooks et al., 1989).

# **Appendix C1**

## **Letter of informed consent: Head of Autism Clinic**



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

**FACULTY OF HUMANITIES  
RESEARCH ETHICS COMMITTEE**

**Letter of informed consent**

**October 2011**

**Head of the Autism Clinic, DASHA School Nelspruit**

**PERMISSION TO CONDUCT A RESEARCH PROJECT THAT INVOLVES  
CHILDREN ON THE AUTISM SPECTRUM AT YOUR AUTISM CLINIC**

I am a postgraduate student in Communication Pathology at the University of Pretoria and am required to conduct a research project in partial fulfilment of my Master's degree. The title of the study is: **A combined linguistic and prosodic treatment approach for language-communication skills in children with autism spectrum disorders: A proof of concept study.**

My research project will involve three single case studies with children who are on the autism spectrum. The purpose of this study is to determine whether the use of prosodically varied speech within a traditional language treatment framework will have any effect on the communication behaviours of these children.

I would like to request permission to involve three of the children at your autism clinic in my study. The participants have to adhere to specific selection criteria, which include having some degree of functional speech, minimal hyper hearing, aged between six and nine years and being able to attend two weekly thirty-minute therapy sessions for eight weeks.

Participation in this study is voluntary and participants or their parents have the right to withdraw from the study at any time without negative consequences. Confidentiality will be maintained throughout the course of the study.

Information and results of this research project will be available in the format of a research report at the library of the University of Pretoria as well as in a possible article publication. All raw data will be stored for 15 years before being destroyed.

Please complete the attached form if you provide permission for conducting the research on autistic children at your clinic.

Kind regards,

---

Silva Kuschke

**MCommunication Pathology student**

---

Prof. Bart Vinck

**Research Supervisor**

---

Ms. Salomé Geertsema

**Research Co-supervisor**

---

Prof. Bart Vinck

**HEAD: DEPT. COMMUNICATION PATHOLOGY**

Please complete the form below

Dear Silva

I hereby give permission to make use of three of the autistic children at Dasha School's Autism Clinic in the research project described. I will ensure that the participants as well as their parents are aware that participation in the study is voluntary.

Kind regards,

\_\_\_\_\_

\_\_\_\_\_

Date

HEAD: AUTISM CLINIC, DASHA SCHOOL



# Appendix C2

## Parental letter of informed consent



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

**FACULTY OF HUMANITIES  
RESEARCH ETHICS COMMITTEE**

**Parental letter of informed consent**

**August 2011**

**Dear Parent/Caregiver**

**PERMISSION TO CONDUCT A RESEARCH PROJECT THAT INVOLVES  
CHILDREN ON THE AUTISM SPECTRUM**

I am a postgraduate student in Communication Pathology at the University of Pretoria and am required to conduct a research project in partial fulfilment of my Master's degree. The title of the study is: **A combined linguistic and prosodic treatment approach for language-communication skills in children with autism spectrum disorders: A proof of concept study.**

My research project will involve three single case studies with children who are on the autism spectrum. The purpose of this study is to determine whether the use of prosodically varied speech within a traditional language treatment framework will have any effect on the communication behaviours of these children.

I would like to request permission to involve your child in my study. The participants have to adhere to specific selection criteria, which include having some degree of functional speech, minimal hyper hearing, aged between six and nine years and being able to attend two weekly thirty-minute therapy session for eight weeks.

Participation in this study is voluntary and participants or their parents have the right to withdraw from the study at any time without negative consequences. Confidentiality will be maintained throughout the course of the study.

Information and results of this research project will be available in the format of a research report at the library of the University of Pretoria as well as in a possible article publication. All raw data will be stored for 15 years before being destroyed.

Please complete the attached form if you provide permission for conducting the research on your child.

Kind regards,

---

Silva Kuschke

**MCommunication Pathology student**

---

Prof. Bart Vinck

**Research Supervisor**

---

Ms. Salomé Geertsema

**Research Co-supervisor**

---

Prof. Bart Vinck

**HEAD: DEPT. COMMUNICATION PATHOLOGY**

Please complete the form below

Dear Silva

I hereby give you permission to involve my child in the research project described above. I am aware that participation in the study is voluntary.

Kind regards,

---

Parent/Caregiver

---

Date

# **Appendix C3**

## **Letter of informed assent**



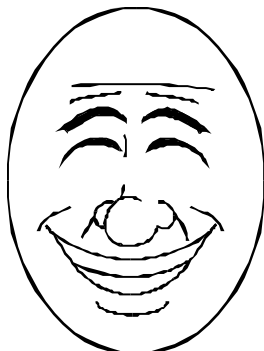
UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

**FACULTY OF HUMANITIES  
RESEARCH ETHICS COMMITTEE**

**Letter of informed assent**

**The content of this letter will be explained to each participant and a video recording will be made of their assent by means of pointing to the appropriate picture. This procedure will be followed prior to every therapy session in order for the participants to know that they may withdraw from the study at any point.**

We will be playing fun games and singing together for 30 minutes twice every week. There will be one other person in the room with us to help us sing and make a movie. Please point to the happy face if you want to play with us and to the sad face if you don't want to play with us.



# **Appendix D 1- D3**

## **Description of assessment tools for pre- and post-intervention**

## Appendix D1

### **Gilliam Autism Rating Scale – Second Edition (GARS – 2):**

**Author:** James E. Gilliam

- **Administration:** 5-10 minutes, individual
- **Qualification level:** B-Level
- **Ages / Grades:** Ages: 3:0 - 22:0 years

GARS-2, a revision of the popular Gilliam Autism Rating Scale, assists teachers, parents, and clinicians in identifying and diagnosing autism in individuals ages 3 through 22. It also helps estimate the severity of the child's disorder. Items on the GARS-2 are based on the definitions of autism adopted by the Autism Society of America and the *Diagnostic and Statistical Manual of Mental Disorders: Fourth Edition-Text Revision* (DSM-IV-TR).

The instrument consists of 42 clearly stated items describing the characteristic behaviours of persons with autism. The items are grouped into three subscales:

- Stereotyped Behaviours
- Communication
- Social Interaction

Using objective, frequency-based ratings, the entire scale can be completed and scored in 5 to 10 minutes. A structured interview form is included for gathering diagnostically important information from the child's parents.



**Section I. Identifying information**

Individual's Name \_\_\_\_\_ Male  Female  Grade \_\_\_\_\_

Year    Month    Day

Date of Rating    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    School \_\_\_\_\_

Date of Birth    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    Rater's Name \_\_\_\_\_

Age    \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_    Examiner's Name \_\_\_\_\_

Examiner's Title \_\_\_\_\_

**Section II. Score Summary**

Subscales	Raw Score	Standard Score	%ile	<i>SEM</i>
Stereotyped Behaviors	_____	_____	_____	1
Communication	_____	_____	_____	1
Social Interaction	_____	_____	_____	1
Sum of Standard Scores	_____			
Autism Index	<input type="text"/>	<input type="text"/>		4

**Section III. Interpretation Guide**

Subscale Standard Score	Autism Index	Probability of Autism
7 or Higher	85 or Higher	Very Likely
4 to 6	70 to 84	Possibly
1 to 5	69 or less	Unlikely

## **Section V. Individual Item Responses**

### **Subscale 1: Stereotyped Behaviors**

**Directions:** Rate the following items according to the frequency of occurrence. Use the following guidelines for your rating:

- 0 Never Observed – You have never seen the individual behave in this manner.
- 1 Seldom Observed – Individual behaves in this manner 1-2 times per 6-hour period.
- 2 Sometimes Observed – Individual behaves in this manner 3-4 times per 6-hour period.
- 3 Frequently Observed – Individual behaves in this manner at least 5-6 times per 6-hour period.

Circle the number that best describes your observations of the individual's typical behavior under ordinary circumstances (i.e. in most places, with familiar people, and in usual daily activities). Remember to rate everything. If you are uncertain about how to rate an item, delay the rating and observe the individual for a 6-hour period and then determine your rating. REMEMBER: EVERY ITEM SHOULD RECEIVE A SCORE.

	Never Observed	Seldom Observed	Sometimes Observed	Frequently Observed
1. Avoids establishing eye contact; looks away when eye contact is made	0	1	2	3
2. Stares at hands, objects, or items in the environment for at least 5 seconds.	0	1	2	3
3. Flicks fingers rapidly in front of eyes for periods of 5 seconds or more.	0	1	2	3
4. Eats specific foods and refuses to eat what most people will usually eat.	0	1	2	3
5. Licks, tastes, or attempts to eat inedible objects (e.g. person's hand, toys or books).	0	1	2	3
6. Smells or sniffs objects (e.g. toys, person's hand or hair)	0	1	2	3
7. Whirls, turns in circles.	0	1	2	3
8. Spins objects not designed for spinning (e.g. sauces, cups or glasses)	0	1	2	3
9. Rocks back and forth while seated or standing.	0	1	2	3
10. Makes rapid lunging, darting movements when moving from place to place.	0	1	2	3
11. Prances (i.e. walks on tiptoes)	0	1	2	3
12. Flaps hands or fingers in front of face or at sides.	0	1	2	3
13. Makes high-pitched sounds (e.g. eee eee-eee-eee) or other vocalizations for self-stimulation.	0	1	2	3
14. Slaps, hits, or bites self or attempts to injure self in other ways.	0	1	2	3

Subtotals \_\_\_ + \_\_\_ + \_\_\_ + \_\_\_

**Stereotyped Behaviors Total Raw Score**



## Section V. Continued.

### Subscale 3: Social Interaction

**Directions:** Rate the following items according to the frequency of occurrence. Use the following guidelines for your rating:

- 0 Never Observed – You have never seen the individual behave in this manner.
- 1 Seldom Observed – Individual behaves in this manner 1-2 times per 6-hour period.
- 2 Sometimes Observed – Individual behaves in this manner 3-4 times per 6-hour period.
- 3 Frequently Observed – Individual behaves in this manner at least 5-6 times per 6-hour period.

Circle the number that best describes your observations of the individual's typical behavior under ordinary circumstances (i.e. in most places, with familiar people, and in usual daily activities). Remember to rate everything. If you are uncertain about how to rate an item, delay the rating and observe the individual for a 6-hour period and then determine your rating. REMEMBER: EVERY ITEM SHOULD RECEIVE A SCORE.

	Never Observed	Seldom Observed	Sometimes Observed	Frequently Observed
29. Avoids eye contact; looks away when someone looks at him or her.	0	1	2	3
30. Stares or looks unhappy or unexcited when praised, humored or entertained.	0	1	2	3
31. Resists physical contact from others (e.g. hugs, pats or being held affectionately)	0	1	2	3
32. Does not imitate other people when imitation is required or desirable, such as in games or learning activities.	0	1	2	3
33. Withdraws remains aloof, or acts standoffish in group situations.	0	1	2	3
34. Behaves in an unreasonably fearful, frightened manner.	0	1	2	3
35. Is unaffectionate; does not give affectionate responses (e.g. hugs and kisses)	0	1	2	3
36. Shows no recognition that a person is present (i.e. looks through people).	0	1	2	3
37. Laughs, giggles or cries inappropriately.	0	1	2	3
38. Uses toys or objects inappropriately (e.g. spins toy cars, takes action toys apart).	0	1	2	3
39. Does certain things repetitively, ritualistically.	0	1	2	3
40. Becomes upset when routines are changed.	0	1	2	3
41. Responds negatively or with temper tantrums when given commands, requests or directions.	0	1	2	3
42. Lines up objects in precise, orderly fashion and becomes upset when the order is disturbed.	0	1	2	3

Subtotals      \_\_\_ + \_\_\_ + \_\_\_ + \_\_\_

**Social Interaction Total Raw Score**

## Appendix D2

### Pragmatic Skills Checklist

#### Assessment of Pragmatic Skills (Shipley & McAfee, 2009 -Form 8-7)

Name: \_\_\_\_\_ Age: \_\_\_\_\_ Date: \_\_\_\_\_

Examiner's name: \_\_\_\_\_

**Instructions:** Use activities such as those suggested in the right-hand column to elicit the desired pragmatic behaviours. Mark a plus (+) or a check (✓) if the response is correct or appropriate and a minus (-) or a zero (0) if the response is incorrect, not present or inappropriate.

*(For the purpose of this study, the pragmatic behaviour was only scored once if it was observed during the session: the frequency of the behaviour elicited during the session was not measured. Therefore, a maximum score of 15 could be obtained).*

#### Pragmatic Behaviour

#### Sample Activities

\_\_\_\_\_ Respond to greetings

Observe the client's response when you say "Hi! How are you?"

\_\_\_\_\_ Make requests

Ask the client to draw a circle but don't immediately provide a pencil.

\_\_\_\_\_ Describe events

Ask the client what he or she did this morning.

\_\_\_\_\_ Take turns

Ask the client to alternately count or recite the alphabet with you (e.g. you say *a*, client says *b*, you say *c*, client says *d*).

\_\_\_\_\_ Follow commands

Ask the client to turn his or her paper over and draw a happy face or a square.

\_\_\_\_\_ Make eye contact

Consider whether the client has maintained normal eye contact during other parts of this assessment.

\_\_\_\_\_ Repeat

Ask the client to repeat the following sentences:  
Michael is seven years old.  
The oven door was open.  
She got a new book for her birthday.

\_\_\_\_\_ Attend to tasks

Consider how the client has attended to this assessment. Ask the client to describe a picture you provide.

\_\_\_\_\_ Maintain topic

Ask the client to tell you about a recent movie or TV show he or she has watched.

\_\_\_\_\_ Role-play

Ask the client to be the “teacher” for a while and give you things to complete. Pretend you are in a fast-food restaurant. Tell the client to be the cashier while you pretend to be the customer.

\_\_\_\_\_ Sequence actions

Ask the client to describe the steps in making the bed, buying groceries or writing a letter.

\_\_\_\_\_ Define words

Ask the client to define words such as:  
scissors  
kitchen  
computer

\_\_\_\_\_ Categorize

Ask the client if the following words are days or months:  
Sunday  
June  
April  
Wednesday

Ask the client to name several farm animals, foods or sports.

\_\_\_\_\_ Understand object functions

Ask the client to show you how to use a scissors. Ask what a ruler is used for.

\_\_\_\_\_ Initiate activity or dialogue

Place an odd-looking object on the table and see if the client asks what it is.

## Appendix D3

### Listening Skills: Observation Checklist BLM G-5

Student: \_\_\_\_\_ Class: \_\_\_\_\_

Observer: \_\_\_\_\_ Date: \_\_\_\_\_

Active listening skills	Observed	Remarks
Focuses on the purpose of listening (e.g., to provide information, answer specific questions, give examples, et cetera)		
Looks at speaker		
Controls personal activity level		
Demonstrates responsive reaction (e.g., nods, smiles)		
Shows appreciation for speaker's ideas		
Draws reasonable conclusions from material Heard		
Asks for clarification or examples when appropriate		
Withholds judgment on ideas until presentation is completed		
Uses respectful language in any feedback/questions		
Discerns exaggeration, bias, prejudice, or emotional hype in language		
Can identify main argument or ideas after presentation is complete		

# Appendix E

## Summary of raw data



\*R = Researcher \*ER = External Rater

Listening skills: Participant 1	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
<b>Focuses on the purpose of listening</b>	0	0	0	0	0	0	1	1	0	1	0	0
<b>Looks at speaker</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Controls personal activity level</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Demonstrates responsive reaction</b>	1	1	1	1	1	1	1	1	1	1	1	0
<b>Shows appreciation for speaker's ideas</b>	0	1	0	1	0	1	0	1	1	1	0	0
<b>Draws reasonable conclusions from material heard</b>	1	0	1	1	0	0	0	0	0	0	0	0
<b>Asks for clarification or examples when appropriate</b>	0	0	0	0	0	0	0	0	0	0	0	1
<b>Does not interrupt speaker</b>	0	0	0	0	0	0	1	1	1	1	1	1
<b>Uses respectful language in any interaction</b>	0	0	0	0	0	0	1	0	1	1	0	0
<b>Discerns exaggeration or emotional aspects in language</b>	0	0	0	0	0	0	1	1	1	1	1	1
<b>Can identify main argument or ideas after presentation is complete</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total:</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>3</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>4</b>	<b>4</b>

Pragmatic Skills:	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance	
Participant 1											Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
<b>Respond to greetings</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Make requests</b>	0	0	1	1	0	0	0	1	1	1	0	0
<b>Describe events</b>	0	0	0	0	0	0	1	0	0	0	0	1
<b>Take turns</b>	0	0	0	0	0	0	1	1	1	1	1	1
<b>Follow commands</b>	0	0	0	0	1	0	1	1	1	1	0	0
<b>Make eye-contact</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Repeat words/phrases</b>	0	0	0	0	1	1	1	1	1	1	1	1
<b>Attend to tasks</b>	1	0	1	0	0	1	1	1	1	1	0	0
<b>Maintain topic</b>	0	1	0	0	0	0	0	0	0	0	0	0
<b>Role-play</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sequence actions</b>	0	0	0	0	0	0	0	0	1	0	0	0
<b>Name words</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Categorize objects</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Understand object functions</b>	0	0	0	0	0	0	1	1	0	1	1	1
<b>Initiate activity or dialogue</b>	0	0	0	0	0	0	1	1	1	1	0	0
<b>Total:</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>6</b>	<b>7</b>

GARS-2: Participant 1	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
Stereotyped behaviours:												
Item 1	3	3	3	3	3	3	2	2	2	2	2	2
Item 2	3	3	3	3	3	3	2	2	1	2	2	2
Item 3	0	0	1	0	1	0	0	1	1	1	2	2
Item 4	2	2	2	2	1	2	1	1	1	1	1	1
Item 5	1	1	1	2	2	2	1	1	1	1	1	2
Item 6	2	2	1	1	1	1	1	1	1	1	2	2
Item 7	2	2	3	2	2	2	2	2	2	2	1	1
Item 8	0	0	1	1	1	1	1	1	1	1	1	1
Item 9	2	2	1	1	2	1	1	1	1	1	1	1
Item 10	0	1	1	1	1	1	1	1	1	1	2	2
Item 11	3	2	2	2	1	2	1	1	1	1	1	1
Item 12	1	1	1	1	1	1	1	1	1	1	1	1
Item 13	2	2	2	2	2	2	1	2	2	2	2	2
Item 14	0	0	0	0	0	0	0	0	0	0	0	0
Raw Score:	<b>21</b>	<b>21</b>	<b>22</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>15</b>	<b>17</b>	<b>16</b>	<b>17</b>	<b>19</b>	<b>20</b>
Standard Score:	<b>10</b>	<b>10</b>	<b>11</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>8</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>10</b>
Communication:												
Item 1	2	2	2	2	2	2	1	2	2	1	2	2
Item 2	2	2	2	3	2	3	2	1	1	2	1	2
Item 3	2	2	2	2	2	2	1	1	1	1	1	1
Item 4	3	3	3	3	3	3	2	2	2	1	2	2
Item 5	1	1	2	2	2	2	1	1	2	1	2	1
Item 6	2	2	1	2	2	2	1	1	1	1	1	1
Item 7	3	3	3	3	3	3	2	2	1	1	2	2
Item 8	3	3	3	3	3	3	1	2	2	2	1	1
Item 9	3	3	3	3	3	3	2	2	1	2	1	1
Item 10	3	3	3	3	3	3	2	2	2	1	2	2
Item 11	3	3	3	3	3	3	1	1	1	2	1	1
Item 12	2	2	2	2	2	2	1	1	1	1	1	1
Item 13	2	2	2	2	3	3	1	1	1	1	1	1
Item 14	3	3	3	3	2	2	1	1	1	1	1	1
Raw score:	<b>34</b>	<b>34</b>	<b>34</b>	<b>36</b>	<b>35</b>	<b>36</b>	<b>19</b>	<b>20</b>	<b>19</b>	<b>18</b>	<b>19</b>	<b>19</b>
Standard score:	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>9</b>	<b>10</b>	<b>10</b>
Social Interaction:												
Item 1	3	3	2	3	3	3	3	2	2	2	3	3
Item 2	3	3	3	3	2	3	3	2	2	2	3	3

<b>Item 3</b>	0	0	1	1	2	2	2	2	1	2	2	2
<b>Item 4</b>	2	1	0	1	1	1	2	1	1	1	2	2
<b>Item 5</b>	2	1	1	1	1	1	1	1	1	1	2	2
<b>Item 6</b>	1	2	2	1	1	1	1	1	1	1	2	1
<b>Item 7</b>	1	1	1	1	1	1	1	2	2	2	1	2
<b>Item 8</b>	3	3	3	3	2	2	1	2	2	1	1	1
<b>Item 9</b>	0	0	1	1	2	2	2	1	1	1	1	1
<b>Item 10</b>	3	3	2	2	2	2	1	1	1	1	1	2
<b>Item 11</b>	2	2	2	2	2	2	1	1	1	1	1	1
<b>Item 12</b>	2	2	2	2	2	2	1	2	2	1	1	1
<b>Item 13</b>	1	1	1	1	1	1	1	1	1	2	1	1
<b>Item 14</b>	3	3	3	3	3	3	1	1	1	2	1	1
<i>Raw score:</i>	<b>26</b>	<b>25</b>	<b>24</b>	<b>25</b>	<b>25</b>	<b>26</b>	<b>21</b>	<b>20</b>	<b>19</b>	<b>20</b>	<b>22</b>	<b>23</b>
<i>Standard score:</i>	<b>11</b>	<b>11</b>	<b>10</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>10</b>	<b>10</b>
Total Standard Score:	<b>37</b>	<b>37</b>	<b>37</b>	<b>37</b>	<b>37</b>	<b>37</b>	<b>27</b>	<b>28</b>	<b>27</b>	<b>27</b>	<b>30</b>	<b>30</b>
Autism Index:	<b>115</b>	<b>114</b>	<b>116</b>	<b>116</b>	<b>115</b>	<b>115</b>	<b>94</b>	<b>95</b>	<b>93</b>	<b>94</b>	<b>99</b>	<b>99</b>
%ile:	<b>84</b>	<b>82</b>	<b>86</b>	<b>86</b>	<b>84</b>	<b>84</b>	<b>35</b>	<b>37</b>	<b>32</b>	<b>35</b>	<b>47</b>	<b>47</b>

Listening skills: Participant 2	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
<b>Focuses on the purpose of listening</b>	0	0	0	0	0	0	1	0	1	1	0	0
<b>Looks at speaker</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Controls personal activity level</b>	0	0	0	0	0	0	1	1	1	1	0	0
<b>Demonstrates responsive reaction</b>	1	1	1	1	1	1	1	1	1	1	1	0
<b>Shows appreciation for speaker's ideas</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Draws reasonable conclusions from material heard</b>	0	0	0	0	0	1	0	1	0	1	0	1
<b>Asks for clarification or examples when appropriate</b>	0	0	1	0	0	0	0	0	0	0	0	0
<b>Does not interrupt speaker</b>	1	1	1	1	1	0	1	0	1	0	1	1
<b>Uses respectful language in any interaction</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Discerns exaggeration or emotional aspects in language</b>	0	0	0	0	0	0	1	1	1	1	1	1
<b>Can identify main argument or ideas after presentation is complete</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total:</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>4</b>

Pragmatic Skills: Participant 2	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
<b>Respond to greetings</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Make requests</b>	0	0	0	0	0	0	0	0	0	1	0	0
<b>Describe events</b>	0	0	0	0	0	0	0	0	0	1	0	0
<b>Take turns</b>	0	0	0	0	0	0	1	1	1	1	1	1
<b>Follow commands</b>	0	0	0	0	0	0	1	1	0	0	0	0
<b>Make eye-contact</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Repeat words/phrases</b>	1	1	0	1	1	1	1	1	1	1	1	1
<b>Attend to tasks</b>	0	0	0	0	0	0	1	1	0	1	0	0
<b>Maintain topic</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Role-play</b>	0	0	0	0	0	0	0	0	1	0	0	0
<b>Sequence actions</b>	0	0	0	0	0	0	0	0	0	0	0	1
<b>Name words</b>	0	0	0	0	0	0	1	1	1	1	1	1
<b>Categorize objects</b>	0	0	0	0	0	0	1	1	1	1	0	0
<b>Understand object functions</b>	0	0	0	0	0	0	1	1	1	1	0	0
<b>Initiate activity or dialogue</b>	0	0	0	0	0	0	1	0	0	0	0	0
<b>Total:</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>10</b>	<b>9</b>	<b>8</b>	<b>10</b>	<b>5</b>	<b>6</b>

GARS-2: Participant 2	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe		
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER	
Stereotyped behaviours:													
Item 1	2	3	3	2	2	2	2	2	2	2	2	2	2
Item 2	2	2	3	3	3	3	2	2	2	2	2	2	2
Item 3	2	2	2	2	2	2	2	2	2	2	2	2	2
Item 4	2	2	2	2	2	2	2	1	2	3	3	3	3
Item 5	3	3	3	3	3	3	3	3	3	2	2	2	2
Item 6	2	2	2	2	2	2	2	2	2	2	2	2	3
Item 7	2	2	2	2	2	2	3	3	3	3	2	2	2
Item 8	1	1	2	2	2	2	2	2	2	2	2	2	2
Item 9	1	1	2	2	2	2	2	2	1	1	1	1	1
Item 10	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 11	2	2	2	2	3	2	2	2	2	2	2	2	2
Item 12	2	2	2	2	2	2	2	2	3	3	3	3	3
Item 13	2	2	2	2	2	2	2	2	2	2	2	2	2
Item 14	3	3	2	2	2	2	2	2	2	2	2	2	2
Raw score:	<b>27</b>	<b>28</b>	<b>30</b>	<b>29</b>	<b>30</b>	<b>29</b>	<b>29</b>	<b>28</b>	<b>29</b>	<b>29</b>	<b>28</b>	<b>29</b>	<b>29</b>
Standard score:	<b>13</b>	<b>13</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>
Communication:													
Item 1	3	3	3	3	2	2	2	2	3	3	3	3	3
Item 2	3	3	3	3	3	3	2	2	3	3	3	3	3
Item 3	3	2	3	3	2	3	3	3	3	3	3	3	2
Item 4	2	2	3	3	3	3	3	2	3	3	3	3	2
Item 5	2	2	2	2	2	2	2	3	3	3	3	3	3
Item 6	2	2	2	2	2	3	2	2	2	2	2	2	2
Item 7	2	2	2	3	3	3	3	3	3	3	3	3	3
Item 8	3	3	3	3	3	3	3	3	3	3	3	3	3
Item 9	2	2	2	2	2	2	2	2	1	1	2	2	2
Item 10	2	2	2	2	2	2	2	2	1	1	1	1	1
Item 11	2	2	2	2	2	2	2	2	2	2	3	3	3
Item 12	3	3	3	3	3	3	3	3	3	3	3	3	3
Item 13	3	3	3	3	3	3	3	3	3	2	2	2	2
Item 14	3	3	3	3	3	3	3	3	3	3	3	3	3
Raw score:	<b>35</b>	<b>34</b>	<b>36</b>	<b>37</b>	<b>35</b>	<b>37</b>	<b>35</b>	<b>35</b>	<b>36</b>	<b>35</b>	<b>37</b>	<b>35</b>	<b>35</b>
Standard score:	<b>16</b>	<b>16</b>	<b>16</b>	<b>17</b>	<b>16</b>	<b>17</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>17</b>	<b>16</b>	<b>16</b>
Social Interaction:													
Item 1	3	3	3	3	3	3	3	3	3	3	3	3	3
Item 2	2	3	3	3	3	3	3	3	3	3	3	3	3

<b>Item 3</b>	2	2	2	2	3	3	2	3	2	2	2	2
<b>Item 4</b>	1	2	2	2	2	2	2	2	2	2	2	2
<b>Item 5</b>	2	2	2	2	2	2	2	2	2	2	2	2
<b>Item 6</b>	1	1	2	2	2	2	2	2	2	2	2	2
<b>Item 7</b>	1	2	1	2	1	2	2	2	2	1	2	2
<b>Item 8</b>	2	2	2	2	2	3	3	3	3	3	3	3
<b>Item 9</b>	2	2	2	2	2	2	2	2	2	2	2	2
<b>Item 10</b>	2	2	2	2	2	2	2	2	2	2	2	2
<b>Item 11</b>	3	3	2	2	2	2	2	2	2	2	2	3
<b>Item 12</b>	3	3	3	3	3	2	2	3	3	3	3	3
<b>Item 13</b>	3	3	3	3	3	2	2	2	2	2	2	2
<b>Item 14</b>	3	3	3	3	3	3	2	2	2	2	2	2
Raw score:	<b>30</b>	<b>33</b>	<b>32</b>	<b>33</b>	<b>33</b>	<b>33</b>	<b>31</b>	<b>33</b>	<b>32</b>	<b>31</b>	<b>32</b>	<b>33</b>
Standard score:	<b>13</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>14</b>
Total Standard Score:	<b>43</b>	<b>44</b>	<b>43</b>	<b>44</b>	<b>44</b>	<b>44</b>	<b>42</b>	<b>43</b>	<b>42</b>	<b>42</b>	<b>43</b>	<b>43</b>
Autism Index:	<b>128</b>	<b>131</b>	<b>127</b>	<b>131</b>	<b>131</b>	<b>130</b>	<b>126</b>	<b>127</b>	<b>126</b>	<b>126</b>	<b>127</b>	<b>127</b>
%ile:	<b>98</b>	<b>99</b>	<b>98</b>	<b>99</b>	<b>99</b>	<b>98</b>	<b>96</b>	<b>97</b>	<b>96</b>	<b>96</b>	<b>97</b>	<b>97</b>



Listening skills: Participant 3	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
<b>Focuses on the purpose of listening</b>	0	0	0	0	0	0	1	1	1	1	0	0
<b>Looks at speaker</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Controls personal activity level</b>	0	0	1	1		0	0	0	0	0	0	0
<b>Demonstrates responsive reaction</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Shows appreciation for speaker's ideas</b>	0	0	0	0	1	0	1	1	1	1	0	0
<b>Draws reasonable conclusions from material heard</b>	0	0	0	0	0	0	0	0	1	0	0	0
<b>Asks for clarification or examples when appropriate</b>	1	0	0	0	1	1	0	0	0	0	1	1
<b>Does not interrupt speaker</b>	0	0	0	0	1	1	1	1	1	1	0	0
<b>Uses respectful language in any interaction</b>	1	1	1	0	0	0	0	0	0	0	0	0
<b>Discerns exaggeration or emotional aspects in language</b>	0	0	0	0	0	0	1	1	1	1	0	0
<b>Can identify main argument or ideas after presentation is complete</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total:</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>6</b>	<b>3</b>	<b>3</b>

Pragmatic Skills: Participant 3	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
<b>Respond to greetings</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Make requests</b>	0	0	0	0	1	1	1	1	1	1	0	0
<b>Describe events</b>	1	0	0	0	0	0	0	0	1	1	0	0
<b>Take turns</b>	0	0	1	1	1	0	1	1	1	1	0	0
<b>Follow commands</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Make eye-contact</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Repeat words/phrases</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Attend to tasks</b>	0	0	1	1	0	1	1	1	1	0	0	0
<b>Maintain topic</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Role-play</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sequence actions</b>	1	1	1	1	1	1	0	1	1	1	0	0
<b>Name words</b>	1	1	1	1	1	1	1	1	1	1	1	1
<b>Categorize objects</b>	1	1	1	0	0	0	1	0	1	1	1	1
<b>Understand object functions</b>	1	1	0	0	0	0	0	0	0	0	0	0
<b>Initiate activity or dialogue</b>	0	0	1	1	1	1	1	1	0	0	0	1
<b>Total:</b>	<b>9</b>	<b>8</b>	<b>10</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>11</b>	<b>10</b>	<b>6</b>	<b>7</b>

GARS-2: Participant 3	Pre-treatment 1		Pre-treatment 2		Pre-treatment 3		Post-treatment 1		Post-treatment 2		Maintenance Probe	
	R	ER	R	ER	R	ER	R	ER	R	ER	R	ER
Stereotyped behaviours:												
Item 1	3	3	3	3	3	3	1	1	2	2	3	3
Item 2	1	2	2	2	2	2	1	1	1	2	1	1
Item 3	3	3	3	3	3	3	2	2	2	2	3	2
Item 4	1	1	1	1	1	1	1	1	1	1	1	1
Item 5	1	1	2	2	2	2	1	1	1	1	1	1
Item 6	1	1	2	1	2	2	1	2	1	1	2	2
Item 7	2	2	2	2	2	2	1	1	1	2	2	2
Item 8	2	2	2	2	2	2	2	2	2	2	2	2
Item 9	1	1	1	1	1	1	1	1	1	1	1	1
Item 10	3	3	3	3	3	2	2	2	2	2	2	2
Item 11	3	3	3	3	3	3	2	2	2	2	3	3
Item 12	3	3	3	3	3	3	1	1	1	1	3	3
Item 13	2	2	2	2	2	2	2	2	2	2	2	2
Item 14	1	1	1	1	1	1	1	1	1	1	1	1
Raw score:	<b>27</b>	<b>28</b>	<b>30</b>	<b>29</b>	<b>30</b>	<b>29</b>	<b>19</b>	<b>20</b>	<b>20</b>	<b>22</b>	<b>27</b>	<b>26</b>
Standard score:	<b>13</b>	<b>13</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>13</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>11</b>	<b>13</b>	<b>12</b>
Communication:												
Item 1	3	3	3	3	3	3	2	2	2	1	2	2
Item 2	3	3	3	3	3	3	2	2	2	1	2	2
Item 3	1	2	2	2	2	2	1	1	1	1	1	1
Item 4	2	2	1	1	1	2	1	1	1	2	2	2
Item 5	1	1	1	1	1	1	1	1	2	1	1	1
Item 6	1	1	1	1	1	1	1	1	1	1	1	1
Item 7	2	2	2	2	2	2	2	2	1	1	1	1
Item 8	2	2	2	2	2	2	1	2	2	1	2	2
Item 9	1	1	1	2	1	1	1	1	1	1	1	1
Item 10	2	2	2	1	1	1	1	1	1	1	1	2
Item 11	2	2	2	2	2	2	1	1	1	1	2	2
Item 12	1	1	1	1	1	1	1	1	1	1	1	1
Item 13	1	1	1	1	1	1	1	1	1	1	2	2
Item 14	2	2	2	2	2	2	1	1	1	1	1	1
Raw Score:	<b>24</b>	<b>25</b>	<b>24</b>	<b>24</b>	<b>23</b>	<b>24</b>	<b>17</b>	<b>18</b>	<b>18</b>	<b>15</b>	<b>20</b>	<b>21</b>
Standard score:	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>11</b>	<b>12</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>8</b>	<b>10</b>	<b>11</b>

Social Interaction:													
Item 1	1	1	1	1	1	1	0	0	0	0	1	1	1
Item 2	1	1	1	1	1	1	0	0	0	1	1	1	1
Item 3	0	0	0	1	1	1	0	0	0	0	1	1	1
Item 4	1	1	1	0	0	1	1	1	1	1	0	0	0
Item 5	0	0	0	0	1	0	0	0	0	0	0	0	0
Item 6	0	0	0	0	0	0	0	0	0	0	0	0	0
Item 7	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 8	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 9	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 10	2	2	2	1	1	1	1	1	1	1	1	2	1
Item 11	1	1	1	2	2	2	1	1	1	1	1	1	2
Item 12	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 13	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 14	2	1	1	1	1	1	1	1	1	1	1	1	1
<i>Raw score:</i>													
Standard score:	13	12	12	12	13	13	9	9	9	9	12	12	12
Total Standard	38	37	39	38	38	38	28	28	28	28	35	35	35
<i>Score:</i>													
Autism Index:	117	116	118	117	117	117	97	96	96	95	112	111	111
%ile:	87	86	89	87	87	87	42	39	39	37	79	77	77

# **Appendix F**

## **Title Registration**



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA  
Faculty of Humanities

Our Ref: 04382463

25 February 2015

Ms S Kuschke  
PO Box 4731  
WHITE RIVER  
1240

Dear Ms Kuschke

**TITLE REGISTRATION: FIELD OF STUDY – MCOMMUNICATION PATHOLOGY**

I have pleasure in informing you that the following has been approved:

**TITLE:** A combined linguistic and prosodic treatment approach for language-communication skills in children with autism spectrum disorders: A proof of concept study

**SUPERVISOR:** Prof B Vinck

**CO-SUPERVISOR:** Mrs S Geertsema

I would like to draw your attention to the following:

1. **ENROLMENT PERIOD**
  - (a) You must be enrolled as a student for at least one academic year before submission of your dissertation/essay.
  - (b) Your enrolment as a student must be renewed annually before 31 March, until you have complied with all the requirements for the degree. You will only be able to have supervision if you provide a proof of registration to your supervisor.
2. **APPROVAL FOR SUBMISSION**

On completion of your dissertation/essay enough copies for each examiner must be submitted to Student Administration, together with the prescribed examination enrolment form signed by you, which includes a statement by your director of studies that he/she approves of the submission of your dissertation/essay.
3. **NOTIFICATION BEFORE SUBMISSION**

You are required to notify me at least three months in advance of your intention to submit your dissertation/essay for examination.
4. **INSTRUCTIONS REGARDING THE PREPARATION OF THE DISSERTATION/ESSAY AND THE SUMMARY APPEAR ON THE REVERSE SIDE OF THIS LETTER.**

Yours sincerely

for DEAN: FACULTY OF HUMANITIES

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