Gesture in Children with Early Language Delay as a Predictor of later Language Profiles: A Follow-Up Study

Department of Clinical Therapies
University of Limerick
Final Year Project

Submitted by: Rosalind Fitzgerald
Supervisor: Dr. Carol-Anne Murphy
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# Table of Contents

- Abstract ............................................................................................................................. Page 1
- Introduction ...................................................................................................................... Page 2
- Methodology .................................................................................................................. Page
- Results ............................................................................................................................. Page
- Discussion ....................................................................................................................... Page
- Conclusion ....................................................................................................................... Page
- References
Abstract

**Background:** A link between gesture and early language development is well-established (Owens, 2005; Iverson & Goldin-Meadow, 2005). O’Neill and Chiat (2012) found a significant correlation between symbolic comprehension and gesture and profiles of language delay in $n=22$ children aged 2-3 years at time 1 (T1). It is not known whether gesture can be used as a clinical marker to predict later language impairment (LI).

**Objectives:** The current longitudinal study aimed to follow up these children two years later and explore the following questions: Does early gesture use and symbolic skills predict later language profiles? Do specific clinical markers: word/non-word repetition and sentence repetition predict persistent language impairment? Does children’s language status and profile change over time?

**Methods:** Participants were 15 children ages 4; 3 – 5; 10 who had been identified as either having mixed receptive and expressive language deficits (RELD) or expressive language deficits (ELD) at T1 by O’Neill and Chiat (2012). The children were assessed using standardised assessments of language, speech, non-word repetition and morphosyntax. Data was analysed using SPSS (v22).

**Results:** The strong correlation between early gesture, symbolic comprehension and language delay at T1 was not evident at T2. Children in the RELD group ($n=6$) at T1 had persistent language difficulties at T2. Four of these continued to have receptive difficulties. Three presented with co-occurring speech difficulties. Seven children in the ELD group ($n=9$) at T1 presented with language skills within normal limits at T2 (Wilcoxon Signed Rank test comparing expressive scores from T1 to T2, $z=-2.814$, $p<.05$). Despite having an expressive only language impairment at T1, two of these children presented with a receptive only impairment at T2. Seven of these presented with co-occurring speech difficulties.

**Conclusions:** It is well established that there is a need for longitudinal studies following language trajectories and outcomes of children with language delays. This study adds to the literature on the fluid profiles of early language delay and impairment. The children with RELD had persistent difficulties whereas children with ELD showed higher rates of ‘recovery’. These findings are important clinically in terms of prioritisation and intervention to address the varying needs of the children. At T1 there was a strong correlation found between gesture and symbolic comprehension. However, at T2 those relationships no longer prevailed, while it was predicting severity at T1 it did not predict persistence at T2. However, when a partial correlation controlling for age was examined there was a statistically significant relationship between symbolic comprehension T1 and direct language measures T2. Further research is warranted on a larger sample.

**Keywords:** Gesture, Symbolic Comprehension, Receptive, Expressive, Language disorders, Longitudinal studies, Subgroups, Early Predictors.
Introduction

The current provision of Speech and Language therapy in Ireland is far from ideal. It has been described recently as “a system that cannot cope with demand” (Conroy & Noone 2014). According to Conroy & Noone approximately 3,000 children have been waiting more than 12 months for speech and language therapy. Additionally, 1,940 children remain waiting for assessments for more than 12 months. Given the limited availability of resources it is of paramount importance that we are able to identify those most at risk of persistent long term language difficulties in order to ensure targeted delivery to those who need it most. Chiat & Roy (2013) highlight the clinical importance of distinguishing children with transient impairments (i.e., those considered late talkers) from those at risk of long term language impairments (LI).

It is highlighted within the literature that children with LI have an increased risk for persistent communication, literacy and psychosocial problems throughout their lives (Whitehouse et al. 2009; Chiat & Roy 2013). Early identification is crucial in reducing the long term consequences and impact associated with LI (IASLT 2007).

This is undoubtedly a difficult task. Early identification is challenging in relation to the ‘fluid profiles’ with which children with LI present (Desmarais et al., 2008; Law, Tomblin et al. 2008; Eadie et al. 2013). Reilly et al. (2009) highlights the fact that some children presenting with appropriate early communication and language skills later go on to exhibit language impairments, equally children who appeared impaired at one point no longer presented with difficulties in follow up studies. By school age, children with language difficulties are known to have varied profiles (Chiat & Roy 2008).

The need for and potential of clinical markers to support identification has been highlighted by a number of researchers (Wake 2014; Conti-Ramsden & Botting 2001; Desmarais et al 2008; Chiat and Roy 2008). Several studies have looked at identifying more sensitive markers of risk to assist in screening for early language delay (Reilly et al. 2009; O’Neill &
Chiat 2012; Chiat & Roy 2013). However due to the fluid nature of language impairments combined with measures which lack specific discriminating power this remains a challenging issue. Eadie et al. (2013) report the limitations of standardised tests in terms of sensitivity and specificity particularly for younger children. Law et al. (2000) highlight the difficulty in establishing a “true gold standard assessment”. This highlights the need and potential for clinical markers to support identification of children as an adjunct to broad based standardised assessments.

O’Neill & Chiat (2012) sought to identify more sensitive markers of impairment and examined gesture use and symbolic comprehension in two subgroups of children (n=22) aged 2-3 years; expressive language delay (ELD) and mixed receptive and expressive delay (RELD). Findings indicated a strong statistically significant correlation between both symbolic comprehension and gesture use and profiles of language delay.

Language and Gesture

A wealth of literature highlights the well-established link between gesture and language in early development. Early communication development is complex and is underpinned by cognitive, social, psychological and physiological factors (Nelson et al. 2006). According to Iverson & Thelen (1999, p20) gesture, speech and language are ‘tightly coupled’ neurologically and developmentally.

Between 8 to 10 months, children start to show evidence of word comprehension (Bates and Dick 2002), which coincides with the emergence of deictic gestures, that is, giving, pointing, and showing. Comprehension is considered the foundation for expressive skills and strongly linked to cognitive skills (Desmarais et al. 2008). Between 9 and 12 months children typically begin to use gesture to intentionally communicate (Iverson & Goldin-Meadow 2005). According to Owens (2008) at approximately 12 months these early intentions then gradually obtain a verbal form, known as words. This is when children enter what is called the ‘locutionary stage’ and begin to produce their first words. Is this a coincidence or a causal relationship? Several studies indicate that items found initially in
children’s gestural repertoires also appeared in their verbal lexicon suggesting a direct correlation between gesture and vocabulary (Iverson & Meadow 2005; Rowe & Goldin-Meadow 2009).

Bavin et al. (2008) highlight the importance of these early communication behaviours as important precursors for later speech and language development. In addition to this it is proposed that gesture may play a valuable role in clinical practice in terms of diagnosis, prognosis, goal selection and intervention for children with LI (Capone & McGregor 2004). A study by Iverson & Goldin-Meadow (2005) entitled “Gesture paves the way for language Development” emphasises the fact that young children communicate using gesture before they are able to speak. This is an important point to consider in terms of utilising gesture as a clinical marker to identify LI. Furthermore, Rowe & Goldin-Meadow (2008) found that early gestures that children use could be indicative of their potential for learning particular aspects of language.

It is important to consider typical development in the light of language impairment as it provides a guide to the developmental stages. However, what happens when a child does not follow this path of development, if there appears to be a slow emergence of language? Are there clues within particular profiles, early signs that can help us identify potential predictors of those who will go on to have persistent language impairments and those will resolve?

**Language Impairment**

A language disorder is defined as impaired comprehension and/or use of spoken language, written and/or other symbol systems (ASHA, 2014). Children with language impairments make up a heterogeneous group. Chiat and Roy (2008) state that concerns regarding a child’s language typically emerge when children reach 3-4 years of age, with children of 4 years making up a large proportion of first time referrals. Difficulties may be persistent or transient, they may present as: receptive and expressive language difficulties (R/ELI), expressive language impairment (ELI), receptive language impairment (RLI), it may include coexisting speech delay/disorder or wider learning difficulties. A diagnosis of
developmental LI is typically made in the preschool years when there is a marked discrepancy between a child’s language skills and what would be expected for their age (Eadie et al 2013). Language impairments are usually identified by a standardised language assessment, comparing a child’s auditory comprehension (AC) and expressive communication (EC) to that of another child of the same age range. Language impairment is typically defined relative to population norms, with exact cut-off points varying (Ukoumunne et al. 2011). How do we distinguish between children with language impairment from children who are merely late talkers?

**Transient v Persistent language difficulties.**

Chiat & Roy (2013) state that “with each year from age 2 to 5, roughly half the children with delay, and move into normal range”. Similarly, Whitehouse et al (2011), found that approximately 70-80% of 2 year old late talking children develop normal language skills in later years. Reilly et al. (2009) reported that “late talking” affects between 10–20% of 24-month-olds and also emphasises that some children present with appropriate early communication and language skills, but later go on to exhibit language impairments. This raises the key question of assessment and the challenges related to identifying clinical markers and more sensitive measures of identification.

Roos and Weisemer (2008) state a proportion of children will continue to persist with difficulties throughout school years and into adulthood. These children are identified as children with ‘Specific Language Impairment’ (SLI). There is some evidence to suggest that gesture is also delayed in children with SLI (Hill et al. 1998).

However it is important to note that previous studies which looked at characteristics of late talking children have varied in their definition of “late talkers” and the clinical thresholds for identification making it difficult to compare results across studies (Desmarais et al. 2008). Eadie et al. (2013) suggest that the inconsistency observed in developmental language pathways may be the due to a combination of limitations for example, measurement instruments, individual children’s abilities and the mixed nature of the boundaries defining
Desmarais et al (2008) highlights studies of ‘late talkers’ to date have not distinguished between subgroups of this population in terms of receptive and expressive delay.

**Challenges of identification**

Limitations in measurement instruments are evident, particularly with this young age group. Eadie et al. (2013) report the limitations of standardised tests in terms of sensitivity and specificity particularly for younger children. Nelson et al. (2006) emphasises that there are many difficulties regarding early screening. Research highlights the importance of not treating children based on a single screening at one point in time (Reilly *et al.* 2009). Researchers involved in the ELVS longitudinal study (Reilly et al 2009) used a variety of assessments for example, checklists, parent measures and standardised assessments to examine a range of risk factors and predictors of LI but did not focus on specific tests of clinical markers of language impairment. Chiat and Roy (2008) looked at the potential of very early processing skills (VEPS) phonological processing skills and sociocognitive abilities, which they hypothesised would act as a predictor of later language profiles. Results indicated VEPS are positively correlated with morpho-syntactic development. A further finding from their study concluded that general language tests such as the PLS offer a good starting point for assessment but further highlight the lack of specificity of such measures alone in identifying specific skills underlying children’s language performance.

Reilly *et al.* (2014) states that in considering the fluid nature of language impairments that identification needs to be supported by comprehensive assessment which takes place over time.

**Clinical Markers**

The term clinical marker was first introduced to the language domain by Rice and Wexler (1996) to refer to highly accurate diagnostic tasks based on a characteristic of behaviours that related to SLI. Previous studies indicate non-word repetition as a valuable marker of language impairment (Conti-Ramsden *et al.* 2001). High values of sensitivity and specificity for nonword repetition performance have been reported. Poll et al (2010) highlights that nonword repetition tasks, which tap into both short-term phonological memory and
phonological processing, have been shown to result in much higher rates of identification of children with SLI when compared to traditional standardised tests. Fewer studies have focused on sentence repetition. Chiat and Roy (2008) administered sentence repetition to a sample of 187 children and found performance was significantly correlated with several different standardised assessments such as the PLS 3, Renfrew Action Picture Test, and Clinical Evaluation of Language Fundamentals- Preschool-edition. The value of these measures have also been established across a range of other languages (Stokes et al 2006). The value and potential of clinical markers has been highlighted, identification of further clinical markers offers the potential of earlier and more accurate identification of persistent LI.

Current study

There is a dearth of longitudinal cohort studies that focus on specific clinical markers to predict later language profiles. Karmiloff-Smith (1998) highlights the importance of “development in discussing developmental disorders”. Cohort studies offer a design where samples at a particular age range are followed to explore their different trajectories as they develop (The UK Longitudinal Studies Centre 2014). The relationship between gesture and language has been highlighted. Rowe and Goldin-Meadow (2008) suggest that early gesture may be a more fine-tuned predictor of later language development. It is reported throughout the literature that further research into this area is needed. O Neill & Chiat (2012) looked at gesture use and symbolic skills in two subgroups of children with language delay, those with expressive language delay only (ELD) and those with both receptive and expressive language delay (RELD). They found that the two groups differed in terms of both the frequency and type of gestures that they used and their symbolic skills. These findings point towards different underlying skills in these groups of children, support the current research on subgrouping children with language delay and highlight the importance of further research in these subgroup. Findings revealed a significant
correlation between both symbolic comprehension and gesture and profiles of language delay in n = 22 children aged 2-3 years at T1. However, an investigation of the predictive relation between early gesture, symbolic comprehension and later language profiles has not been conducted. The current study proposes to follow up O’Neill and Chiat’s (2012) study, when the children are two years older.

Aims
This study aims to answer the following questions:

1. Does early gesture use and symbolic skills predict later language profiles?
2. Do specific clinical markers; word/non word repetition and sentence repetition predict persistent language impairment?
3. Does children’s language status and profile change over time, are findings on fluid profiles consistent in this group?

Methodology

Ethics
Ethical approval for the study was obtained from the Health Service Executive North East Regional Ethics Committee and the City University School of Health Sciences Research Ethics Committee. Written consent was obtained from parents prior to commencing assessment. The research was supervised by the clinician who had conducted the T1 research and a university lecturer.

Participants
The participants in this study were part of the original cohort of 22 children who were recruited to O’Neill and Chiat’s (2012) study at T1. The referral criteria for participation in the original study at T1 were:

Aged 24 to 36 months.
Participants matching the referral criteria were recruited through Speech and Language Therapists and Public Health Nurses working in Primary care settings in the East of Ireland. All children whose parents gave consent were included in the study. The sample at T1 comprised 22 monolingual English-speaking children, of whom 16 were boys, ranging in age from 24 to 35 months (M=28.9; SD 3.59).

Participants were allocated to one of two subgroups based on performance on the Auditory Comprehension (AC) and Expressive Communication (EC) standard scores of the Preschool language Scale-Third Edition (PLS 3(UK); Zimmerman, Steiner, Pond, Boucher & Lewis, 1997). Twelve of the 22 children met the criteria for expressive Language Delay (ELD).

The referral criteria for participants at Time 2 (T2) were:

- Participants that were part of the original study.

On receipt of ethical approval for the T2 study, letters were sent to the 22 parents whose children took place in the original study at T1 inviting them to take part. All details were outlined and parents were asked to contact the lead researcher if they wished to take part. All participants were made aware of the purpose of the study and participated on a voluntary basis.
The sample at T2 comprised 15 of the original sample, of whom 11 were boys, ranging in age from 46 to 60 months (M=54.43; SD 3.67) followed up roughly 18 months later. The remaining 7 children did not choose to participate in the T2 study.

**The assessors**
Four post-graduate speech and language therapy students and clinic based researcher carried out assessments. Prior to commencing testing, the student researchers attended a training day with this researcher to ensure continuity and accuracy in administration of assessments and scoring.

**Blinding**
The student researchers were blind to the group status of each child at T1. This was designed to ensure all children were assessed in the same way without the student researchers knowing the level of their impairment at T1.

**Time 1 Measurements:**
The first stage of the study assessed language, gesture skills and symbolic comprehension.

**Language and Gesture Skills:** Receptive and Expressive language skills were assessed using the Pre-school Language Scale-Third Edition (PLS-3) (UK) (Zimmerman *et al.* 1997).

**Symbolic development:** This was assessed using the Communication Temptations Portion of the Communication and symbolic Behaviour Scales (CSBS; Wetherby & Prizant, 1993).

**Vocabulary comprehension production and gesture production:** To assess these the MacArthur-bates Communicative Development Inventory: Words and Gestures (CDI) (Fenson et al 1993) was used. This inventory is a parental checklist of early communication development looking at vocabulary comprehension, production and gesture production.

**Symbolic comprehension task:** Symbolic Comprehension was assessed using a subtest of the Early Sociocognitive Battery (ESB; Roy & Chiat, 2005). This subtest draws on a procedure developed by Tomasello, Striano and Rochat (1999), which takes the form of a game in which the researcher requests the child to find an object from a set of six, using
symbolic representation to indicate which object the child should find. There are three symbolic conditions including gestures, miniature object and substitute object (i.e. where one object is used to represent the other). One point is awarded for correct selection of each target object in each of the three conditions, with a maximum score of 18.

**Time 2 Measurements:**

**Language abilities:** At T2, measures of language were repeated using the Preschool Language Scale-Fourth Edition (PLS-4) (UK), Auditory and Expressive (Zimmerman et al 1997). The PLS-4 is a language assessment for children of 2 weeks of age up to 6 years 11 months of age. It is comprised of two standardised subtests of Auditory Comprehension (AC) and Expressive Communication (EC) which assess receptive and expressive language abilities. A mean standard score is 100, with scores between 85-115 considered to be within the average range of ability.

**Nonverbal abilities:** Nonverbal ability was measured using the Raven’s- Educational Coloured Progressive Matrices (CPM). This is designed to provide a brief non-verbal measure of general ability that uses nonverbal stimuli including visual patterns and shapes. The CPM is made up of diagrammatic puzzles that are designed to assess intellectual processes of young children from 4 -11 years. A mean standard score is 100, with scores between 85-115 considered to be within the average range of ability.

**Early Phonological and morphosyntactic processing abilities:** Phonological and morphosyntactic processing ability was assessed using the Early Repetition Battery (ERB) (Seeff-Gabriel, Chiat & Roy 2008). The ERB is a UK-developed and standardised test battery, for use with children between the ages of 2:00 -5:11. It was co-normed with the PLS -4 on a sample of UK children. It is designed to assess phonological and morphosyntactic processing ability. The test consists of two expressive tasks: PSRep (Preschool Repetition Test) which assesses repetition of single word/non-words and an SIT (Sentence Imitation Test) which assesses repetition of sentences.
**Phonological skills:** The Diagnostic Evaluation of Articulation and Phonology (DEAP) (Dodd et al. 2002) was used to assess phonological skills. The phonology assessment required participants to name 50 coloured pictures. Each word elicited was phonologically transcribed by student researcher. Developmental and non-developmental errors were identified. A percentage consonant correct score was obtained and children who scored below -1.25SD below the mean (Mean =10, SD 4) were considered to have a speech impairment. A mean standard score is 10, with scores between 7-13 considered to be within the average range.

**Social Communication/pragmatic skills:** The Children’s Communication Checklist (CCC-2; Bishop, 2003) was used to identify pragmatic difficulties in children with communicative difficulties and to assist in screening children who merit further assessment for an autism spectrum disorder. It is designed to be completed by an adult who has regular contact with the child typically a parent. It consists of 70 questions in total.

**Interviews:** Interview with parents were carried out by the clinical researcher, to determine if children had received any speech and language therapy intervention since they took part in original study or if they had received any other diagnoses since T1 study.

**ELI, RELI, RLI and RL subgroups**

The Time 2 (T2) cohort was divided into one of four subgroups based on performance on Auditory Comprehension and Expressive Communication standard scores of the Preschool Language Scale-Fourth Edition (PLS- 4 (UK); Zimmerman, Steiner & Pond, 2002 ). The four subgroups are detailed in Table 1.

**Table 1: Subgroups, age, mean, median, range and standard deviation (SD).**

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>N</th>
<th>Mean age (months)</th>
<th>Median</th>
<th>Range</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive expressive language impairment (RELI)</td>
<td>2</td>
<td>55.50</td>
<td>55.50</td>
<td>9</td>
<td>6.364</td>
</tr>
</tbody>
</table>
Criteria for expressive only language impairment (ELI) were auditory comprehension score above - 1.25 SD of the mean (Mean=100, SD=19) and expressive communication score at least - 1.25 SD below the mean. Two of the fifteen children met these criteria for ELI. Criteria for receptive only language impairment (RLI) were expressive communication score above - 1.25 SD of the mean and auditory comprehension score at least 1.25 SD below the mean. Four of the fifteen children met these criteria for RLI. Criteria for mixed receptive and expressive language impairment (RELI) were both auditory comprehension and expressive communication scores at least 1.25 SD below the mean. Two of the fifteen children met the criteria for RELI. Criteria for resolved language (RL) were both receptive and expressive communication scores within the mean and not at -1.25 SD from the mean or lower. Seven of the fifteen children met the criteria for RL. Children who were originally in the RELD subgroup made up nine of the children in T2. Children who were originally in the ELD group made up six of the children in T2.

In the original data set -1.0 SD was used to determine delay. However, in line with current literature language impairment was defined as a score more than 1.25 SD below the mean (Records & Tomblin 1994; Reilly et al 2014). Descriptive information for each subgroup detailed in Table 2.

Table 2: Means, Medians, standard deviations (SD), range and PLS-4 standard scores Auditory Comprehension (AC) and Expressive Communication (EC) of children according to subgroup (RL, RELI, ELI, RLI).

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Mean (AC)</th>
<th>Median (AC)</th>
<th>SD (AC)</th>
<th>Range (AC)</th>
<th>Mean (EC)</th>
<th>Median (EC)</th>
<th>SD (EC)</th>
<th>Range (EC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolved language (RL)</td>
<td>54.71</td>
<td>55.00</td>
<td>2.563</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Expressive language impairment (ELI)</td>
<td>59.00</td>
<td>59.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Receptive language impairment (RLI)</td>
<td>56.14</td>
<td>55.00</td>
<td>4.849</td>
<td>19</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### PLS Auditory Comprehension (AC) vs. PLS Expressive Communication (EC)

<table>
<thead>
<tr>
<th></th>
<th>PLS Auditory Comprehension (AC)</th>
<th>PLS Expressive Communication (EC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>RL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 7</td>
<td>92.86</td>
<td>93.00</td>
</tr>
<tr>
<td>RELI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N= 2</td>
<td>72.50</td>
<td>72.50</td>
</tr>
<tr>
<td>ELI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=2</td>
<td>95.50</td>
<td>95.50</td>
</tr>
<tr>
<td>RLI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=4</td>
<td>74.75</td>
<td>74.75</td>
</tr>
</tbody>
</table>

**Speech Difficulties**

Criteria for a speech impairment was a score below -1.25SD below the mean (Mean=10, SD 4) on the DEAP assessment. The mean standard score is 10 with the average range from 7-13. Ten children n=14 presented with speech impairments at T2.

**Procedures**

At T2, all children were seen in local clinics, in two/three sessions each lasting 1 to 1.5 hours. For many assessments were conducted in an unfamiliar clinic room. Parents remained present during assessments. Each child sat at a small table across from the student SLT researcher. In almost all cases, two student SLTs were present, enabling one to administer the assessment and the other to double score assessments and take notes throughout the session. The first session comprised of a game to build a rapport between the child and the student SLT. The PLS-4 was then administered followed by a short movement break. Following this the DEAP phonology assessment was administered. Speech assessments were audio recorded in order to analyse them further after the session and ensure accuracy. Breaks were incorporated throughout depending on the child’s needs and a game at the end was used as a motivator designed to maximise the children’s engagement. The CCC questionnaires were given to parents to fill out and return at the next session. During the second session, the ERB and the Raven assessment were administered. While a high level of cooperation was achieved, compliance varied across
tasks and sessions were based on the pace of the child. Therefore, some children required three sessions to complete the assessments and some children did not complete all assessments. An activity was terminated if the child lost interest and it was deemed that it would not be representative of the child’s ability. Following assessments parents received a report detailing the child’s results from these assessments. Parents were informed if they had any queries regarding these that the clinic based researcher would be happy to discuss the results in detail and discuss any recommendations for going forward.

**Inter-rater reliability**

Scoring of assessments was carried out on site by the student researcher administering the assessment and the student observing the assessment. Results were then cross checked to assess the reliability of the results. This was aimed to increase internal validity. The student researchers listened back to the recording where scores were not in agreement and when necessary consulted with the clinician. All scores were re-checked to ensure accuracy of results. The CCC was scored up using the computer programme; the scores were put into computer and doubled checked by the clinic based researcher.

**Design of the study**

A longitudinal cohort study design was adopted to obtain further in-depth information on the language trajectories and outcomes of the original T1 cohort two years on and to add to the literature on the profiles of children with LI.

**Statistical analysis:**

Analyses reported below were undertaken using SPSS (SPSS V22). Descriptive statistics were calculated for the mean, median, standard deviation and range, of the group across assessments. Histograms were reviewed with Shapiro Wilk’s test results analysed to assess normality. A Wilcoxon Signed Rank test was used to compare matched samples of T1 PLS scores and T2 PLS scores. Correlational analysis (with exploration of scatter plots) was used to determine relationships between T1 and T2 variables and
between pairs of T2 variables. The strength of the relationship was determined using Spearman’s correlation coefficient.

**Results**

This study was designed to follow up the participants of the original study at T1 and further investigate if the children’s language status and profile changed over time. It investigated whether distal gestures, conventional gestures, symbolic comprehension and language scores at T1 were related to later language outcomes at T2. It examined the within T2 relationships between specific clinical markers: word/non word repetition, sentence repetition and speech and language at T2.

Table 3. Illustrates descriptive information on all measures used and scores obtained for each group.
Table 3. Mean, median, standard deviation (SD) and range scores according to group, for PLS AC, PLS EC, DEAP phonological assessment; Early Repetition Battery subtests - Word & Non Word Repetition, Sentence Repetition; Raven Cognitive screen and Children’s Communication Checklist.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>Median</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RL N=7</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLS AC</td>
<td>92.86</td>
<td>93.00</td>
<td>5</td>
<td>14</td>
<td>92.50</td>
<td>72.50</td>
<td>13</td>
<td>95.50</td>
</tr>
<tr>
<td>PLS EC</td>
<td>90.57</td>
<td>91.00</td>
<td>5.19</td>
<td>13</td>
<td>64.50</td>
<td>64.50</td>
<td>14.84</td>
<td>68.50</td>
</tr>
<tr>
<td>DEAP PCC</td>
<td>5.00</td>
<td>3.00</td>
<td>2.76</td>
<td>7</td>
<td>6.50</td>
<td>6.50</td>
<td>3.56</td>
<td>5</td>
</tr>
<tr>
<td><strong>RELI N=2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLS AC</td>
<td>95.50</td>
<td>.707</td>
<td>1</td>
<td>13</td>
<td>95.50</td>
<td>95.50</td>
<td>.707</td>
<td>1</td>
</tr>
<tr>
<td>PLS EC</td>
<td>68.50</td>
<td>68.50</td>
<td>12.02</td>
<td>17</td>
<td>68.50</td>
<td>68.50</td>
<td>12.02</td>
<td>17</td>
</tr>
<tr>
<td>DEAP PCC</td>
<td>3.00</td>
<td>3.00</td>
<td>0</td>
<td>0</td>
<td>3.00</td>
<td>3.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>ELI N=2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLS AC</td>
<td>74.75</td>
<td>3.30</td>
<td>8</td>
<td></td>
<td>74.75</td>
<td>3.30</td>
<td>8</td>
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<tr>
<td>PLS EC</td>
<td>86.50</td>
<td>2.64</td>
<td>6</td>
<td></td>
<td>86.50</td>
<td>2.64</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>DEAP PCC</td>
<td>4.00</td>
<td>2.00</td>
<td>4</td>
<td></td>
<td>4.00</td>
<td>2.00</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>RLI N=4</strong></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>PLS AC</td>
<td>79.00</td>
<td>5.65</td>
<td>8</td>
<td></td>
<td>79.00</td>
<td>5.65</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>PLS EC</td>
<td>79.50</td>
<td>9.19</td>
<td>13</td>
<td></td>
<td>79.50</td>
<td>9.19</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>DEAP PCC</td>
<td>101.33</td>
<td>2.30</td>
<td>4</td>
<td></td>
<td>101.33</td>
<td>2.30</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>ERB W/NW</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLS AC</td>
<td>100.00</td>
<td>102.50</td>
<td>21.4</td>
<td>60</td>
<td>102.50</td>
<td>92.50</td>
<td>17.67</td>
<td>25</td>
</tr>
<tr>
<td>PLS EC</td>
<td>85.17</td>
<td>86.50</td>
<td>15.2</td>
<td>42</td>
<td>68.00</td>
<td>68.00</td>
<td>2.82</td>
<td>4</td>
</tr>
<tr>
<td>DEAP PCC</td>
<td>105.50</td>
<td>105.50</td>
<td>.707</td>
<td>1</td>
<td>105.50</td>
<td>105.50</td>
<td>.707</td>
<td>1</td>
</tr>
<tr>
<td><strong>ERB S/RP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLS AC</td>
<td>70.67</td>
<td>73.50</td>
<td>14.94</td>
<td>43</td>
<td>68.00</td>
<td>68.00</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>PLS EC</td>
<td>92.50</td>
<td>92.50</td>
<td>17.67</td>
<td>25</td>
<td>68.00</td>
<td>68.00</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>DEAP PCC</td>
<td>42.00</td>
<td>42.00</td>
<td>0</td>
<td>0</td>
<td>42.00</td>
<td>42.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Raven</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLS AC</td>
<td>56.50</td>
<td>7.85</td>
<td>19</td>
<td></td>
<td>56.50</td>
<td>7.85</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>PLS EC</td>
<td>100.00</td>
<td>102.50</td>
<td>21.4</td>
<td>60</td>
<td>102.50</td>
<td>92.50</td>
<td>17.67</td>
<td>25</td>
</tr>
</tbody>
</table>
Tests of Normality

The Shapiro-Wilk W test for normality was used to calculate the probability that the data comes from normal distribution. This test is used for samples of <50 participants. A non-significant result (Sig. value > .05) indicates normality (Pallant 2013). Table 4 shows that the data was normally distributed on a number of the variables.

Table 4. Analysis of scores for PLS AC, ERB W/Non word repetition, ERB sentence repetition, ERB function word and CCC for the entire data set.

<table>
<thead>
<tr>
<th>T2 Measures</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Trimmed Mean 5%</th>
<th>Range</th>
<th>Skewness</th>
<th>Test of Normality</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLS Auditory Comprehension T2</td>
<td>15</td>
<td>85.67</td>
<td>10.847</td>
<td>86.07</td>
<td>32</td>
<td>-.443</td>
<td>.086</td>
</tr>
<tr>
<td>ERB Word/Non word repetition T2</td>
<td>12</td>
<td>84.83</td>
<td>17.087</td>
<td>84.48</td>
<td>72</td>
<td>.522</td>
<td>.282</td>
</tr>
<tr>
<td>ERB sentence repetition T2</td>
<td>12</td>
<td>78.00</td>
<td>13.850</td>
<td>77.17</td>
<td>45</td>
<td>.948</td>
<td>.105</td>
</tr>
<tr>
<td>ERB function word T2</td>
<td>10</td>
<td>80.50</td>
<td>9.372</td>
<td>80.33</td>
<td>32</td>
<td>.510</td>
<td>.781</td>
</tr>
<tr>
<td>ERB Inflection score T2</td>
<td>10</td>
<td>83.40</td>
<td>17.379</td>
<td>82.67</td>
<td>48</td>
<td>.726</td>
<td>.149</td>
</tr>
<tr>
<td>CCC T2</td>
<td>12</td>
<td>63.33</td>
<td>14.424</td>
<td>62.93</td>
<td>50</td>
<td>.383</td>
<td>.946</td>
</tr>
</tbody>
</table>

*Test of Normality: Shapiro-Wilks sig >.05

However, in contrast to this a number of variables did not follow normal distribution and violated the Shapiro-Wilk test of normality. Table 5 provides details on these variables.
Table 5. Analysis of scores for PLS EC, DEAP PCC, Raven, and the ERB content score.

<table>
<thead>
<tr>
<th>T2 Measures</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Trimmed Mean 5%</th>
<th>Range</th>
<th>Skewness</th>
<th>Test of Normality</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLS Expressive Comprehension (EC) T2</td>
<td>15</td>
<td>83.33</td>
<td>10.293</td>
<td>84.15</td>
<td>42</td>
<td>-1.435</td>
<td>.20</td>
</tr>
<tr>
<td>DEAP PCC Score T2</td>
<td>14</td>
<td>4.79</td>
<td>2.517</td>
<td>4.60</td>
<td>7</td>
<td>1.092</td>
<td>.001</td>
</tr>
<tr>
<td>Ravens colour progressive matrices T2</td>
<td>13</td>
<td>100.00</td>
<td>99.44</td>
<td>15.281</td>
<td>60</td>
<td>.332</td>
<td>.043</td>
</tr>
<tr>
<td>ERB Content Word T2</td>
<td>10</td>
<td>88.10</td>
<td>87.33</td>
<td>15.044</td>
<td>40</td>
<td>1.340</td>
<td>.006</td>
</tr>
</tbody>
</table>

The data was unevenly distributed (Mean = 83.07 trimmed mean 5% 83.96, SD= 12.256). The Shapiro-Wilks’ test of normality indicated uneven distribution as p = .020. The histogram (Figure 1) shows strong negative skew with regards to T2 PLS EC scores.
Figure 1. PLS Scores T2.

Figure 2. DEAP assessment scores T2
The DEAP PCC scores were also unevenly distributed and did not meet the normality assumption. (Mean = 4.79 trimmed mean 5% 4.60, SD= 2.517). The Shapirio Wilk test of normality indicated uneven distribution as p=.001. The histogram Figure 2 shows strong positive skew with regards to scores on the DEAP assessment.

Due to the non-normal distributions on key variables, non-parametric testing was used.

**Relationship between matched samples: PLS T1 and PLS T2.**

Analysis was carried out to determine if there is a difference between AC scores at T1 and T2 and EC scores T1 and T2. As the data for EC scores was not normally distributed a Wilcoxon Signed Rank non-parametric test was used.

**Auditory Comprehension (AC) – AC T1 v AC T2.**

A Wilcoxon Signed Rank test for matched samples was used to look at T1 and T2 AC PLS scores. There was no statistically significant difference between AC scores at T1 and AC scores at T2 (Wilcoxon, N=15, z= -.22, two tailed p>.05, with a small effect size (r=-.06). The median score on the auditory comprehension measure decreased from T1 (Md=93) to T2 (Md=89).

**Expressive Communication (EC) – EC T1 v EC T2.**

A Wilcoxon Signed Rank Test revealed a statistically significant difference between EC scores from T1 to T2, z= -2.814, p < .05, with a large effect size (r= 0.73) Cohen’s (1998) criteria. The median score on the EC measure increased from T1 (Md=72) to T2 (Md=86). Figure 3 presents the results of the Wilcoxon Signed Rank test.
Fluidity of profiles

Results indicated fluidity of profiles. Eight children (n=15) continued to have a LI at T2. As is evident in Figure 4, the T1 expressive language delay (ELD) group (n=9) had a high ‘recovery’ rate at T2 (Wilcoxon Signed Rank test comparing expressive scores T1-T2, z= -2.814, p< .05). Seven out of the nine children presented with resolved language (RL) (Mean =100, SD 81). Despite having an expressive only impairment at T1, Two of these children presented with a receptive only impairment (RI) at T2. Seven out of nine of these children presented with co-occurring speech difficulties at T2.

Figure 4. Flow of participants from ELD group T1 to subgroups T2.
T1 receptive, expressive language delay (RELD) group (n=6) had persistent language difficulties at T2. Four of these children continued to have receptive language difficulties. Two of these had resolved receptive language difficulties but persisted to have expressive language difficulties at T2. Three children presented with co-occurring speech difficulties. See Figure 5 below.

**Fig 5. Flow of participants from RELD group T1 to subgroups T2**
Relationships between Early Gesture, Symbolic Comprehension and Language.
In accordance with the main aim of the study, correlational analysis was used to evaluate whether specific T1 measures may be predictive of T2 outcomes. Relations between Language (PLS-4), Distal Gesture, Conventional Gesture and Symbolic Comprehension were examined. Scatter plots were used to explore the relationships between the T1 and T2 variables.

**Fig 6. Scatter plot illustrating a moderate positive linear relationship between PLS Auditory (receptive) T1 and PLS Expressive T2.**
Figure 7. Scatter plot illustrating weak positive linear relationship between Symbolic Comprehension T1 and Receptive Language T2.
Figure 8. Scatter plot illustrating a moderate positive linear relationship between Symbolic Comprehension T1 and Expressive Language T2.

$R^2$ Linear = 0.410
The results of the correlational analysis between T1 and T2 direct measures of language are presented in Table 6. Partial correlation controlling for age is presented in Table 7.

**Table 6. Spearman’s values for correlations between direct measures of Language T1 and T2 and presence of language impairment (LI).**

<table>
<thead>
<tr>
<th></th>
<th>Auditory PLS (AC) T2</th>
<th>Expressive PLS (EC) T2</th>
<th>Language Impairment (LI) T2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auditory PLS (AC) T1</strong></td>
<td>.566*</td>
<td>.675**</td>
<td>.750**</td>
</tr>
<tr>
<td></td>
<td>.028</td>
<td>.006</td>
<td>.01</td>
</tr>
<tr>
<td><strong>Expressive PLS (EC) T1</strong></td>
<td>.256</td>
<td>.424</td>
<td>.584*</td>
</tr>
<tr>
<td></td>
<td>.357</td>
<td>.115</td>
<td>.022</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

**Table 7. Partial correlations controlling for age between direct measures of Language T1 and T2 and presence of language impairment (LI).**

<table>
<thead>
<tr>
<th></th>
<th>Auditory PLS T2</th>
<th>Expressive PLS T2</th>
<th>Language Impairment (LI) T2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auditory PLS (AC) T1</strong></td>
<td>.601*</td>
<td>.735**</td>
<td>.734**</td>
</tr>
<tr>
<td></td>
<td>.030</td>
<td>.004</td>
<td>.004</td>
</tr>
<tr>
<td><strong>Expressive PLS (EC) T1</strong></td>
<td>.344</td>
<td>.277</td>
<td>.493</td>
</tr>
<tr>
<td></td>
<td>.249</td>
<td>.360</td>
<td>.087</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

Language Impairment (LI) T2 group was determined by a standard cut of point of -1.25SD below the mean on either Auditory or Expressive scores on the PLS-4 and included any children who persisted to have language impairment at T2 n=8.
As is evident in Table 6 Auditory PLS (AC) T1 was a modest predictor of general language outcome, both auditory, expressive and language impairment. There is a statistically significant modest positive correlation between AC T1 and AC T2 (\(\rho=.566, \text{ df } =13, p<0.05\)). A modest positive correlation was indicated between AC T1 and EC T2 (\(\rho=.675, \text{ df } =13, p<0.05\)). A large positive correlation between AC T1 and the presence of LI at T2 (\(\rho=.750, \text{ df } =13, p=.01\)) was found. When age was controlled for in the partial correlation these relationships remained statistically significant with modest/strong positive correlations.

There is a modest relationship between EC T1 and presence of LI T2 (\(\rho=.584, \text{ df } =13, p<0.05\)). However, when age was controlled for this was no longer evident.

The results of the correlational analysis between T1 variables Symbolic comprehension, gesture and direct measures of language T2 are presented in Table 8. Partial correlation controlling for age is presented in Table 9.

**Table 8. Spearman’s values for correlations between Symbolic Comprehension, Gesture and direct measures of Language T2.**

<table>
<thead>
<tr>
<th></th>
<th>Auditory PLS T2</th>
<th>Expressive PLS T2</th>
<th>Language Impairment T2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symbolic Comprehension T1</strong></td>
<td>.412</td>
<td>.710**</td>
<td>.715**</td>
</tr>
<tr>
<td></td>
<td>.127</td>
<td>.003</td>
<td>.003</td>
</tr>
<tr>
<td><strong>Distal Gesture T1</strong></td>
<td>.100</td>
<td>.461</td>
<td>.557*</td>
</tr>
<tr>
<td></td>
<td>.724</td>
<td>.084</td>
<td>.031</td>
</tr>
<tr>
<td><strong>Conventional Gesture T1</strong></td>
<td>.084</td>
<td>.388</td>
<td>.499</td>
</tr>
<tr>
<td></td>
<td>.776</td>
<td>.154</td>
<td>.058</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)
Table 9. Partial correlations controlling for age between T1 variables: Symbolic Comprehension, Gesture and direct measures of Language T2.

<table>
<thead>
<tr>
<th></th>
<th>Auditory PLS T2</th>
<th>Expressive PLS T2</th>
<th>Language Impairment T2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symbolic Comprehension T1</strong></td>
<td><strong>.567</strong>*</td>
<td><strong>.624</strong>*</td>
<td><strong>.655</strong>*</td>
</tr>
<tr>
<td></td>
<td>.043</td>
<td>.023</td>
<td>.015</td>
</tr>
<tr>
<td><strong>Distal Gesture T1</strong></td>
<td>.219</td>
<td>.397</td>
<td>.365</td>
</tr>
<tr>
<td></td>
<td>.473</td>
<td>.179</td>
<td>.220</td>
</tr>
<tr>
<td><strong>Conventional gesture T1</strong></td>
<td>.217</td>
<td>.533</td>
<td>.462</td>
</tr>
<tr>
<td></td>
<td>.477</td>
<td>.061</td>
<td>.112</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

Table 8 shows that there is a moderate relationship between symbolic comprehension T1 and AC T2, albeit not significant (rho=.412, df =13, p> 0.05). However, partial correlations indicated a moderate positive relationship, which is statistically significant (rho= .567, df =13, p<0.05). There is a moderate correlation between symbolic comprehension and AC T2, EC T2 and language impairment when age is controlled for, which are all statistically significant (p<0.05).

In contrast to the T1 study, there is a strong positive correlation between symbolic comprehension scores T1 and expressive scores at T2, which was statistically significant (rho=.710, df =13, p< 0.05). This remained statistically significant when age was controlled for. A large positive correlation between symbolic comprehension and presence of an impairment at T2 (rho=.715, df 13, p<0.01) was found.
RELI, RL, ELI, RLI subgroup scores on T1 variables; Symbolic Comprehension, Conventional Gesture and Distal Gesture.

At a group level the following box plots show that the children who at T2 present with resolved language (RL) were the children with higher symbolic scores at T1 as indicated by the box and whiskers in Figure 9a. However the children with RI only also show higher scores on symbolic comprehension. This is also evident Fig 9c to a lesser extent, where the children with RL at T2 show higher distal gesture scores at T1. This indicates an overlap between the two groups, see Figure 9 below.

Figure 9. Box Plots representing the mean a) Symbolic Comprehension b) Conventional Gestures c) Distal Comprehension obtained at T1 by T2 groups RL, RELI, ELI and RLI
b.

![Boxplot for Convention Gesture T1](image)

![Boxplot for Distal Gesture T1](image)

c.
Clinical Markers

Analysis of specific clinical markers: word/non word repetition and sentence repetition in the identification of impairment at T2 was undertaken using Spearman’s values for correlations between clinical markers and direct measures of language T2. Results presented in Table 10 below.

<table>
<thead>
<tr>
<th>Clinical Markers assessments at T2</th>
<th>Auditory PLS T2</th>
<th>Expressive PLS T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERB W/Non-Word T2</td>
<td>-.300</td>
<td>-.019</td>
</tr>
<tr>
<td></td>
<td>.344</td>
<td>.952</td>
</tr>
<tr>
<td>ERB Sentence Repetition T2</td>
<td>-.095</td>
<td>.629*</td>
</tr>
<tr>
<td></td>
<td>.769</td>
<td>.028</td>
</tr>
<tr>
<td>ERB content word T2</td>
<td>.138</td>
<td>.874**</td>
</tr>
<tr>
<td></td>
<td>.703</td>
<td>.001</td>
</tr>
<tr>
<td>ERB function word T2</td>
<td>-.130</td>
<td>.691*</td>
</tr>
<tr>
<td></td>
<td>.721</td>
<td>.027</td>
</tr>
<tr>
<td>ERB inflection word T2</td>
<td>-.201</td>
<td>.439</td>
</tr>
<tr>
<td></td>
<td>.577</td>
<td>.204</td>
</tr>
<tr>
<td>DEAP PCC T2</td>
<td>-.197</td>
<td>-.212</td>
</tr>
<tr>
<td></td>
<td>.500</td>
<td>.468</td>
</tr>
</tbody>
</table>

Word Non word measures were not found to be significantly related to language profiles at T2 which is in contrast to findings in previous studies which indicate non word repetition to be a relatively reliable marker of language impairment. A moderate positive correlation
between sentence repetition and expressive language PLS T2, which was statistically significant (rho=.629, df= 10, p<0.05). A negative correlation between sentence repetition and AC T2 (rho= -.095 n= 10, p=.769) is evident. A large significant correlation between ERB content word score and EC PLS score, which is statistically significant (rho=.874, df= 8, p<0.01) was found. A moderate correlation between ERB function word and EC PLS score is also evident in the above table (rho=.691, df= 8, p< 0.05).

Discussion
A considerable amount of literature has been published on distinguishing children who are at risk of persistent language impairments from those with transient impairments and given fluid profiles, reliably identifying impairments at a point in time. This study is a follow up to O’Neill and Chiat’s (2012) T1 study.

Fluidity of profiles

The results showed a high level of movement between subgroups in line with previous studies. Children who had presented with RELI at T1 (n=6) at T2 presented as RLI, ELI or RI only. There was no obvious pattern of movement identified amongst the group with two children going to each subgroup. However, despite the fluidity of profiles all children who presented as RELI at T1 did persist to have language impairments at T2, four of whom had receptive difficulties. These findings mirror previous studies which found receptive language to be the strongest predictor of persistence difficulties (Chiat and Roy 2008). Paul and Roth (2011) state that a key risk factors for persistent impairment includes the presence of both receptive and expressive language difficulties.

In contrast, the children who presented with ELD at T1 showed high rates of recovery at T2, with seven out of nine no longer having language difficulties at T2 albeit, seven of these presented with speech impairments. Interestingly two children who presented with ELD at T1 presented with RLI at T2. In analysing these two participants, one had reported fluid in his ear which may have contributed to temporary hearing loss impacting on his score. The other participant presented with features which may be characteristic of autism spectrum disorder which would require further assessment. The other two participants who presented as RLI had mixed receptive and expressive LI at T1. Again, one of these participants reported hearing difficulties and was attending an ENT doctor which may have contributed to lower scores on AC PLS assessment. The other participant
had a diagnosis of SLI at T2. In considering these varied profiles and level of movement within these
two subgroups it is important to consider the limitations of standardised assessments alone in
accurately detecting persistent language impairments and indeed the need for more sensitive
measures (Reilly et al 2013).

Relationship between Early gesture, symbolic comprehension and later language profiles.

At T1 O’Neill and Chiat (2012) found a significant correlation between both symbolic
comprehension and gesture and profiles of language delay at T1. At T2 these strong
relationships no longer prevailed. Surprisingly, large significant correlations were found
between early symbolic comprehension scores and expressive language at T2.

While strong relationships no longer prevailed with receptive language scores at T2, when a
partial correlation was carried out controlling for age this revealed moderate correlations
between symbolic comprehension and direct language measures as well as impairment,
which were all statistically significant (p<0.05). In looking at group effects there was also
evidence that children who had higher symbolic comprehension at T1 made up the resolved
language group at T2. Although there was an overlap with RLI only group also scoring
higher on symbolic comprehension at T1. Nonetheless, due to the small sample size this
warrants further investigation. Early symbolic comprehension may be a potentially useful
risk marker clinically in terms of identifying persistent language impairment.

Clinical markers
With growing waiting lists and increasingly early referrals reported, Speech and Language
therapists are keen to identify accurate clinical markers to assist in the identification of
children who will persist from those who will recover. In examining the potential of specific
clinical markers; nonword repetition and sentence repetition in predicting persistent
impairment. This study did not find correlations between scores on these clinical markers
and persistent impairment. However due to missing data scores for three children, leaving
a sample of n=12 this does not adequately reflect their usefulness given the large body of
research which has found positive correlations (Conti-Ramsden et al 2001).
Results indicated that there was significant relationship between sentence repetition and expressive language scores T2. Further findings indicated relationships between content word scores; which include nouns, verbs and adjectives with T2 expressive scores suggesting that vocabulary size has an impact on expressive language scores.

**Clinical Implications of findings**

Turning to clinical implications, our study added to the literature regarding the fluid profiles of children with language delays and the need for reviews and ongoing evaluation to ensure appropriate case management. Our findings suggest that children with RELD are more at risk of persisting with language difficulties at T2. The results showed early receptive language scores at T1 were a strong overall predictor of persistent impairment at T2 as well as general language outcome both auditory and expressive. In contrast, children within the ELD group at time 1 showed high rates of recovery. These findings concur with previous studies. Our findings suggest that tests such as the PLS -4 are robust in terms of identifying language impairment, since performance on the auditory comprehension section at T1 was predictive of impairment at T2. These findings concur with Roy and Chiat (2008).

However in considering clinical implication, limitations must be considered in terms of the small sample size and the generalizability of findings to children outside of the research participants.

**Future Research**
Larger scale longitudinal studies are warranted to investigate the usefulness of symbolic comprehension and gesture as a predictor of later language profiles in subgroups of children. Furthermore, a T3 study looking at the trajectory of the same group of children looking at specific clinical markers and their predictive power at T3 is warranted. Law et al. (2008 p746) suggests that to obtain effective trajectories, it is important to consider the number of observations and the intervals between the time points. Growth curve modeling involves the estimation of parameters in the model. In the case of growth analysis, a minimum of three time points is needed to estimate the intercept and slope’. A larger sample size would also have allowed for statistical comparisons between diagnostic
categories (RELI, ELI, RLI, RL) at T2 on the T1 variables of interest (gesture and symbolic comprehension) and their scores on the T2 clinical marker tests. This would also provide scope for regression analysis to develop models that predict outcome. In outlining the fluid trajectories of children with LI and the limitations of standardized assessments alone. Our findings highlight the need and potential for more sensitive clinical markers to assist in the accurate identification of children with persistent LI and highlight the need for further research in this area.

Limitations
Loss of participants from the T1 study meant that an already relatively small sample size was reduced further. The small sample used in the current study (n=15) may have impacted on the reliability of results. Evidence suggests that a small sample size reduces the power of statistical analysis.

A further limitation was the timescale and availability of parents to attend subsequent sessions which resulted in missing data for some participants. This impacted on the level of analysis which could be carried out particularly on clinical marker analysis.

Although a high level of compliance was noted during assessments, some sessions were long lasting up to 1.5 hours this may have impacted on attention levels and in turn scores.

Conclusion
In conclusion, despite a small sample size our findings make a useful contribution in adding to the literature on ‘fluid profiles’ of children with early language delay and impairment which supports previous studies. Both clinically and theoretically inferences form our study highlight some wider issues. First, the need and potential of clinical markers to support identification of language impairment. The usefulness of specific clinical markers (nonword repetition and sentence repetition) in identifying persistent impairment. Second, the potential of gesture and symbolic comprehension as a potential risk marker for later language impairment. Thirdly this study opens up the door for a third study which would allow us to further investigate the fluid trajectories of children with a LI and examine the usefulness of these clinical markers in school aged children at a later date.


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