Too Young for Meta?
The Use of Shape Coding, Rehearsal and Comprehension Monitoring to treat Oral Comprehension Deficits in a Young School Age Child: A Pilot Study

Author: Bridget Scanlon
Student Number: 11012153
Supervisor: Dr. Carol-Anne Murphy

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1 Abstract

Background: Previous studies have highlighted the resistance of receptive language impairment (RLI) to intervention. This is especially evident where interventions aim to treat oral comprehension deficits in children in the younger school age population. Current theories of oral comprehension impairments centre on deficits in underlying linguistic knowledge and/or deficits of specific or general processing.

Objectives: The aim of this study was to identify the nature of oral comprehension deficits in 1 child with RLI (6:6, female) and to tailor an intervention package to treat those specific deficits.

Methodology: A two-pronged treatment approach was used, that combined both metalinguistic interventions such as Shape Coding and metacognitive interventions such as Rehearsal strategies. The child was also taught to use Comprehension Monitoring strategies. A single case study design was employed, which compared treated and untreated targets pre/post therapy; with MLU scores pre/post therapy compared as a further control measure.

Results: While outcome measures showed considerable improvement in the comprehension of treated targets within sessions, statistical analysis of pre/post-therapy assessment results did not yield statistically significant results. MLU and untreated controls remained unchanged. Qualitative data showed successful use of comprehension monitoring and rehearsal strategies within sessions, but these strategies were not observed to have generalized in situations outside of therapy.

Conclusion: Although findings were not statistically significant, it was clear that gains were made on treated targets and strategies within sessions. A more in-depth study is required to understand why these gains did not generalize post therapy.
2 Introduction

2.1 What is Oral Comprehension?

Spoken language comprehension follows certain stages of cognitive processing (Owens, 2012). Describing the nature of these stages is still somewhat controversial and current theories offer differing views as to levels of interactiveness of top down and bottom up processing (Eysenck & Keane, 2000). It is largely accepted however that to understand spoken language, the listener must first recognise/perceive the speech sounds or acoustic signal (Bishop, 1997). This signal is then encoded into a phonological representation where access to the phonological input lexicon allows for syntactic and thematic roles to be assigned as well as verb argument structure; finally, the semantic system is accessed and meaning is assigned to the representation (Bishop, 1997). Words are held in working memory to be processed or integrated with the rest of the incoming sentence (Owens, 2012). Cues play a role in parsing the sentences into meaningful units of language (Eysenck and Keane, 2000). Deficits in areas of working memory, attention, perception, building/retrieval of phonological/semantic representations, may lead to difficulties with the comprehension of spoken language (Bishop, 1997)

2.2 Children with Primary Language Impairment

Primary language impairment, describes children whose comprehension and/or expressive language skills is significantly impaired, despite showing typical cognitive abilities (IASLT, 2007). Where this discrepancy is present, in the absence of any social, environmental, sensory or educational deficits, a diagnosis of specific language impairment (SLI) is applied (IASLT, 2007). Research also points to the presence of certain robust clinical markers to indicate SLI, these include problems with grammatical morphology (Rice et al, 2000), omission of auxiliary verbs (Conti-Ramsden, 2003), performance on non-word repetition tasks (Conti-Ramsden, 2003) and poor performance on sentence repetition tasks (Paul, 2007). Children with
primary language impairment are a heterogeneous population, and one subtype is those with receptive language difficulties.

2.3 Receptive Language Impairment (RLI)

RLI relates to children who have problems understanding both written and spoken language (Boyle et al, 2010). They may present as having particular difficulty with understanding and using the rules of morphology (Boyle et al, 2010), difficulty with understanding complex syntactic structures such as passives, wh-questions or reversible sentences (Van Der Lely et al, 2011), comprehension of lexical items, following verbal directions or inferring meaning from conversation (Boyle et al, 2010). They may also have difficulty retaining information in working memory long enough (Arhibald & Gathercole, 2006) to process and extract accurate phonological representations (Bishop, 1997). Research has shown RLI to be more resistant to intervention than expressive language impairment or phonological delay (Boyle et al, 2010) and therefore children with RLI are more likely to have a language impairment that persists in the long term and has effects on social and academic attainment (Law et al, 2004; Cirrin & Gillam, 2008).

Oral comprehension deficits are believed to be caused either by deficits in underlying linguistic knowledge or by processing deficits of a specific or general nature (Boyle et al, 2010). Linguistic accounts see errors in morphology and syntax as caused by underlying deficits in linguistic representations, which prevent children from understanding the rules of morphosyntax for instance, (Joanisse & Seidenberg, 1998). However these deficits effect ‘linguistic’ modules only and cannot explain more generalised processing deficits (Boyle et al, 2010). On the other hand, processing deficit theories range from the specific auditory processing deficits proposed by Tallal (as cited in Boyle et al, 2010) to deficits of general processing capacity which can explain difficulties in the use of morphosyntax by children with SLI (Bishop, 1997). This theory suggests that surface features of languages, such as morphemes, may be more difficult to acquire, particularly if they must be perceived and processed quickly in the context of running speech (Bishop, 1997). This is made more difficult by slower
cognitive processing speeds and deficits in phonological working memory capacity found in children with RLI (Montgomery et al, 2010).

2.4 Current Reviews of the Evidence Base

Law et al, (2004) completed a systematic review of the efficacy of speech and language intervention as part of the Cochrane review. Results illustrated a significantly positive effect for interventions for expressive language therapy. The review found no support for interventions that target receptive language difficulties. Cirrin & Gillam, (2008) examined the efficacy of interventions on the school age population and found a lack of evidence for interventions in this age group. A review of auditory processing research, by Fey et al, (2011) found some support for auditory processing interventions but due to poor design improvements could not be attributed to the interventions themselves. Boyle et al, (2010) reviewed 4 recent RCTs of interventions for RLI. They found no significant differences between treatments and controls. They highlighted the resistance of RLI to interventions and recommended investigating the use of strategies to help children to cope with their comprehension deficits (Boyle et al, 2010). Law et al, (2008) found that comprehension deficits were predominately targeted with either metalinguistic approaches or by introducing metacognitive strategies.

2.5 Metalinguistic Interventions

Shape Coding (SC) (Ebbels, 2007; 2012), is a metalinguistic intervention that explicitly teaches the rules of grammar and morphology using shapes and colours to represent different parts of sentences and words. It can be used to teach movement of passive sentences and questions, verb tenses, verb argument structure and thematic role assignment (Ebbels, 2007). Ebbels, (2007) reported its use in 3 studies that targeted: 1. comprehensions of dative and prepositions forms, 2. Comprehension of comparative questions and 3, Verb morphology (past tense forms). Participants were aged between 11-13 years, with 3 children included in the first study, 2 in the second and 9 in the third study. Participants received 1 therapy session per week x 10 weeks. Ebbels,
(2007) employed a single case study design. Participants were explicitly taught grammatical rules such as thematic roles, verb tenses, and argument structures through the use of a coding system. Improvements were noted on comprehension of treated items in post therapy scores. SC is useful in teaching older children with SLI the rules of grammar; specifically sentence structure, predicative argument structure and verb/noun morphology. In a randomized control trial (2012), Ebbels successfully used SC to improve comprehension of coordinating conjunctions in 14 older school-age children (mean age: 13:6). Findings showed that just 4 hours of SC therapy significantly improved comprehension of the coordinating conjunctions treated (Ebbel, 2012).

Colourful Semantics, by Bolderson et al, (2011) explicitly taught sentence structure by colour coding different parts of sentences, e.g. verb, nouns etc. Participants were between 5-6 years of age and received 45 min session x2 per week for 8 weeks. This was a single case study design with a repeated baselines measure. 10 verbs to be taught were matched for obligatory and optional arguments with a set of untreated verbs that acted as controls. Findings showed improvements on expressive language scores post therapy that were unchanged at repeated baseline. In contrast, there were no significant improvements on comprehension scores on tests of receptive grammar.

2.6 Metacognitive Strategies of Visualization and Rehearsal

Visualizing and Verbalising (V&V), (Dixon et al, 2001) used strategies of visualisation to help children to comprehend and remember information that they have heard/read about a topic. First introduced by Bell (1987), V&V was developed to improve mental imagery skills and aid comprehension. Dixon et al (2001) tested this therapy by implementing the V&V programme with 8 children between 9 and 15 over a 10 week period. There were 2 conditions; V&V versus traditional therapy. Findings showed that V&V made no significant difference to oral comprehension over traditional therapy. This paper was confounded by an unclear description of the experimental design as well as the lack of a control group. It was suggested by Dixon et al that V&V
placed a high demand on processing and working memory, something that may already be impaired in children with comprehension difficulties.

Other interventions that utilized mental imagery found it effective in answering literal questions about short narratives in reading comprehension (Joffe et al, 2007; Center et al, 1999).

Gill & Klecan-Aker, (2003) found visualisation and rehearsal strategies of benefit to clients with SLI who had difficulty following verbal directions. Thirty participants aged 6 -11 years, received 2x 30mins sessions of language therapy per week for 5 weeks. Participants were taught rehearsal or rehearsal and visualisation strategies for the first 15min of every session, to improve ability following verbal instructions (Gill & Klecan-Aker, 2003). Post therapy, both groups made significant improvements on standardized assessments of ability to follow directions, versus traditional therapy. However, only the rehearsal and visualisation group had maintained significant gains 6 months post therapy (Gill & Klecan-Acker, 2003).

2.7 Metacognitive Strategies for Coping Comprehension Breakdown

Boyle et al, 2010 acknowledged the necessity to teach children positive methods to cope with breakdowns in comprehension. One method is through comprehension monitoring (Bianco et al, 2010). This aims to teach children to recognise when they have not understood something and to act on it by seeking clarification and letting the speaker know they have not understood.

2.8 Implicit Treatment Approaches for Children with RLI

In contrast to the explicit teaching methods outlined in Ebbels (2007; 2012) and Bolderson et al, (2011), other studies have investigated the use of implicit therapy approaches in the teaching of grammatical structures to children with SLI. Camarata et al, (2009) reported secondary improvements in receptive language, in a study targeting expressive grammar in 27 children with SLI. In the study, an implicit treatment approach was undertaken. This approach included the use of imitation and modelling, conversation recasting and milieu teaching to target grammatical and syntactic structures. In an earlier study by Camarata et al, (1996) conversation recasting was
found to be more successful than imitation when treating grammar to children with SLI. It involved the therapist following the child’s lead in conversation, while consistently modelling the target structures. Camarata et al, (2009) found that receptive language significantly improved post therapy, even though this was not the direct target of therapy. Both Camarata et al, (2009) and Fey et al, (1997; 2003) recommend the use of implicit therapy approaches when treating both expressive and receptive language in children with language impairment. Through the use of these implicit approaches, the aim is to make the target more salient to the child, while rarely isolating the structure from its linguistic context (e.g. conversation recasting). Camarata et al, (2009) proposed that these approaches can elicit a ‘cross over’ effect between expressive and receptive language learning.

In addition to this, Alt (2012) discussed the importance of exposure and input when planning intervention for children with language impairment. In her paper, she proposed certain principles that should be taken into account when planning intervention, such as the frequency of therapy; the type of input and level of exposure; and the importance of sleep in the consolidation of learning (Alt, 2012). Her research refers to the importance of preventing isolation of grammatical structures in therapy and suggests that children with language impairment may successfully learn structures despite the complexity of the linguistic context (Alt, 2012). She also highlights the need for more exposure, repetition and reinforcement of treated items for therapy to have an effect on this population.

2.8 Summary and Aims

It is clear from previous reviews that gaps in the literature exist regarding interventions targeting RLI and more specifically oral comprehension deficits (Law et al, 2003; Boyle et al, 2010). Further gaps appear in the younger school age populations (Cirrin & Gillam, 2008). Due to the heterogeneity of oral comprehension deficits in children with RLI, the current study seeks to develop a single case study design on a client of younger school age, in which specific underlying comprehension deficits are outlined through rigorous assessment, and interventions are tailored that treat those specific deficits. As a metalinguistic approach, SC (Ebbels, 2007; 2012) appears to be the most
flexible and comprehensive intervention tool available. Depending on the child’s comprehension difficulties it will be considered along with other metacognitive strategies tailored to suit the child’s specific needs.
3 Method

3.1 Design

This pilot study was a single case study carried out as part of a case series involving children aged 6-9 years. Franklin (1997), states that single case study design may be more beneficial than randomized control studies, when investigating the effect of treatment on a heterogeneous population such as children with RLI. Single case studies allow for more detailed investigation into an individual client and more flexibility in adapting the treatment to meet their needs (Pring, 2005). In Robey & Schultz’s (1998) 5 phase model of efficacy research, single case studies are most efficient at phases 1 and 2, where the aim is to show that treatment is beneficial and warrants further investigation. As the current research is a pilot study aiming to investigate the efficacy of treating oral comprehension deficits in a younger school age child, it can be placed at phase 2 of this model. In phase 2, exclusionary criteria are set to select clients, while outcomes measures and controls are used to measure the efficacy of the treatment (Pring, 2005). Controls are an important aspect of single case study design, in order to identify a treatment specific effect (Franklin, 1997). The participant was assessed at baseline, using standardized tests of language comprehension; following this, criterion referenced assessment probes were administered to identify targets for the therapy. Once identified, targets were then divided into treated and untreated items. The untreated items acted as a control and were assessed again at the post treatment phase. Another area of language which was not being treated (Mean Length of Utterance), was also assessed at baseline and again post therapy, to act as a further control measure. A generalization probe was also identified from the untreated items. This was reassessed post therapy, to identify any generalization of the therapy. Outcome measures for each session were also recorded as well as qualitative data from clinical observation and parent and teacher report.
3.2 Participant Selection Procedure

The participant was recruited from the caseload of a Speech and Language therapist in the local HSE area. In order to select the participant, the following exclusionary and inclusionary criteria were set:

3.2.1 Inclusionary criteria:
That the Participant should:

- Have English as first language
- be aged 6-9 years at time of recruitment
- Have a diagnosis of primary language difficulties that included clinically significant language comprehension impairment (they must have receptive language impairment but may also display expressive language impairment). These children will typically have scored -2SD below the mean in either:
  - the receptive language index (RLI) of the Clinical Evaluation of Language Fundamentals 4 (CELF-4)
  - Test of Receptive Grammar (TROG-2)
  - The receptive portions of either the Reynell Developmental Language Scales (RDLS) or the Preschool Language Survey 4(PLS-4)

3.2.2 Exclusionary criteria:

- Children with a primary diagnosis of intellectual and/or sensory impairments and/or emotional/behavioural difficulties.
- Children with identified visuo-spatial processing difficulties.
- Children whose first language is not English.

A letter outlining the nature of the study and the criteria for recruitment was sent to the SLT and a suitable participant was selected.

3.3 Participant

K (6:6) was a young girl who had been assessed and was awaiting intervention for language impairment at the time of the study. She had 1 non-identical twin sister, who
did not appear to have language impairment, and 2 younger brothers. English was the only language spoken at home. Hearing and vision were normal, and K did not have any known co-morbid medical issues. Her teacher reported that K’s language impairment was impacting on her learning in class; she found school work difficult and appeared to ‘zone out’ during classroom activities. She was accompanied to each session by her twin sister and her mother. On referral to speech and language therapy services at the age of 6:1, the Clinical Evaluation of Language Fundamentals 4th Edition (CELF-4; Semel et al, 2006) had been administered. Since that time she had been awaiting intervention. She appeared to have typical speech and presented with age appropriate speech errors. Her CELF-4 scores indicated severe receptive and expressive language impairment. Both her receptive and expressive language scores were more than -2 SD below the mean. At the time of the study, she had not had any psychological assessment. Table 1 outlines her CELF-4 standard and subtest scores:

Table 1: CELF-4 Subtest and Standard Scores

<table>
<thead>
<tr>
<th>Subtests</th>
<th>Scores</th>
<th>Standard Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts &amp; Following Directions</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Word Structure</td>
<td>8</td>
<td>Core Language score 66</td>
</tr>
<tr>
<td>Recalling Sentences</td>
<td>4</td>
<td>Receptive Language Score 65</td>
</tr>
<tr>
<td>Formulating Sentences</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Word Classes-Receptive</td>
<td>6</td>
<td>Expressive Language Score 65</td>
</tr>
<tr>
<td>Sentence Structure</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Expressive Vocabulary</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Word Classes-Expressive</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Word Classes-Total</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

With the exception of the Word Structure subtest score, which captures expressive morphology, all subtests scores were in the impaired range. The Formulating Sentences subtest score, which reflects the ability to form simple, compound and complex sentences, was the lowest scoring (1). Receptively, K scored lowest on the
Sentence Structure subtest (3), which reflects deficits in her comprehension of these sentence structures.

It was initially understood K was not attending any speech and language therapy. On recruitment it was learned that K had begun to attend a private speech and language therapist (PSLT), prior to this study. As the initial assessment phase had already been completed, it was decided that K would continue participating in this study. K’s mother agreed to reduced attendance at private SLT sessions for the duration of the study, although her PSLT had advised a break and the Principal Investigator (PI) and student SLT agreed with this recommendation in light of the proposed twice weekly intervention offered in the study. K attended 2 sessions of private speech and language therapy while partaking in this research, which took place during week 2 and week 5 of the study. Based on parental report private therapy had been targeting areas of semantic categories and vocabulary learning and the PSLT was not targeting areas of receptive grammar.

3.4 Initial Assessment Data

Baseline assessments highlighted K’s strengths and weaknesses in terms of oral comprehension. Table 2, 3 and 4 outline the results of assessments administered at baseline. She appeared to have a relative strength in her comprehension of semantics/vocabulary at the single word level (Table 2), scoring a standard score of 81 on the British Picture Vocabulary Scale: third edition (BPVS-III; Dunn & Dunn, 2009). Subtests of Digit Recall, Block Recall and Backward Digit Recall were completed on the Working Memory Test Battery for Children (WMB-C; Pickering & Gathercole, 2001). These subtests measured K’s phonological loop, visuo-spatial processing and central executive, respectively. Her standard subtest scores showed deficits in the area of visuo-spatial processing, while her phonological loop and central executive appeared less impaired (Table 3).
Her standard score on the Test for Reception of Grammar: version 2 (TROG-2; Bishop, 2003) indicated her main area of language deficit to be that of receptive grammar, specifically understanding of complex sentence structure (Table 4).

Table 2: Baseline Assessment Results on BPVS-III

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<table>
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<tbody>
<tr>
<td><strong>Results of BPVS-III</strong></td>
<td></td>
</tr>
<tr>
<td>Raw Score</td>
<td>75</td>
</tr>
<tr>
<td>Standardised Score</td>
<td>81</td>
</tr>
<tr>
<td>Percentile Rank</td>
<td>11</td>
</tr>
<tr>
<td>Age equivalent</td>
<td>5;05  5;01-5;11</td>
</tr>
<tr>
<td>Sets completed</td>
<td>3-8</td>
</tr>
</tbody>
</table>

Table 3: Baseline Assessment Results on WMB-C

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Standard Score</th>
<th>Percentage Rank</th>
<th>Span Score and % of Population at same Span Score Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digit Recall</td>
<td>83</td>
<td>13</td>
<td>3 = 29%</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>6</td>
<td>2 = 8%</td>
</tr>
<tr>
<td>Backward Digit Recall</td>
<td>84</td>
<td>14</td>
<td>2 = 53%</td>
</tr>
</tbody>
</table>

Table 4: Baseline Assessment Results on TROG-2

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<table>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Results of TROG-2</strong></td>
<td></td>
</tr>
<tr>
<td>Total Blocks Passed</td>
<td>6</td>
</tr>
<tr>
<td>Standard Score</td>
<td>72</td>
</tr>
<tr>
<td>Percentile</td>
<td>3</td>
</tr>
<tr>
<td>Age equivalent</td>
<td>4;9</td>
</tr>
</tbody>
</table>
At baseline, her Mean Length of Utterance-word (MLUw), raw score was 5.81 and her MLUw standard score at baseline was 82. Both MLUw raw scores and standard scores were derived from the Expression, Reception and Recall of Narrative Instrument (ERRNI; Bishop, 2004). The MLUw standard score was obtained as an expressive language control, to be measured again post therapy as part of the study design. MLUw was chosen as a suitable control, as it was another area of language, i.e. expressive length of utterance, not being targeted by the treatment.

Following administration, the Student Therapist (ST) was able to identify areas of deficit by analysing the blocks that K failed on the TROG-2. These areas of receptive grammar were probed further, using specifically developed assessment probes. For each block K failed, the ST administered a probe that consisted of 10 test items. K completed 10 assessment probes. The results showed difficulties across the board for comprehension of complex sentence structures, (Table 5).

Table 5: Results of Criterion Referenced Assessment Probes

<table>
<thead>
<tr>
<th>(Block on TROG-2)/Probe Completed</th>
<th>Total items Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>(B) Negative</td>
<td>6/10</td>
</tr>
<tr>
<td>(H) Not only X but also Y</td>
<td>2/10</td>
</tr>
<tr>
<td>(D) Three Elements</td>
<td>5/10</td>
</tr>
<tr>
<td>(L) Zero Anaphor</td>
<td>5/10</td>
</tr>
<tr>
<td>(O) Neither/nor</td>
<td>2/10</td>
</tr>
<tr>
<td>(G) Relative clause in subject</td>
<td>1/10</td>
</tr>
<tr>
<td>(K) Reversible Passives</td>
<td>5/10</td>
</tr>
<tr>
<td>(M) Pronoun Gender/Number</td>
<td>3/10</td>
</tr>
<tr>
<td>(N) Pronoun Binding</td>
<td>2/10</td>
</tr>
<tr>
<td>(P) And/but not</td>
<td>2/10</td>
</tr>
</tbody>
</table>

K’s baseline scores on the probes indicated poor understanding of several syntactic structures and consequently a range of structures that could be targeted in therapy. The chosen structures for treatment, “and/but not” and ‘neither/nor’ were amenable
to a metalinguistic approach, considered developmentally appropriate language constructs for instruction with a child of 6:6 and had been effectively treated in Ebbels, (2012). Both involved concepts of negation. Other low scoring probe items were considered: For example “three elements” was also low scoring, but this structure could be targeted via cognitive and meta-cognitive approaches. Considering K's age and profile, the timeframe available and the protocols outlined in the published research on the use of SC, other structures would have required metalinguistic instruction to a more advanced level. For example, “and but not” can be taught without explicit instruction on embedding or movement, in contrast to relative clause in subject or reversible passives.

An untreated item, ‘pronoun binding’ was chosen as a control for therapy, with a further untreated item, ‘reversible passives’ probed post therapy to see if generalization had occurred. In Ebbels (2012) group study generalisation to untreated passives was reported and it would be of interest to see if the explicit metalinguistic instruction with a younger child could generalise to untreated structures.

3.5 Clinical Observations during Assessment Phase

During initial assessment, the ST noted that K appeared highly aware of her language difficulties and may have been aware of certain difference between her and her twin sister, who was present during all assessment sessions. K presented with some anxious behaviours before and during assessments; and these behaviours presented during the baseline phase and again during the re-assessment phase of the study. Her attention fluctuated during assessments and tasks that she found difficult. Frequently, the ST had to prompt her to wait to hear the whole sentence before responding, i.e., she would begin pointing to pictures before the ST had completed presenting the test sentence.

Expressively, K spoke in short 1-2 word utterances. She spoke little and appeared quite shy in the sessions. She took considerable time to answer questions put to her, and would often wait for a duration until further cues were provided to her. Frequently, she would answer without speaking at all, using only non-verbal communication, such as nodding or shaking her head for yes or no. She was compliant
during assessment and treatment phases. She appeared to enjoy the 1 on 1 attention of therapy, and performed well on tasks in the supported environment of therapy sessions. She responded very well to praise, and liked colouring activities and bubbles as rewards. Despite this, heightened awareness of her language difficulties meant that she also sometimes responded negatively if she knew she was getting something incorrect.

### 3.6 Procedure

Ethical approval for the study was obtained from UL EHS REC.

Informed consent was obtained from the participant and her parents via the local HSE SLT manager who acted as gatekeeper. (Parent and child information letters and consent forms are in appendix a, b and c.) Parental consent was also obtained to record each session via Dictaphone. Recordings remained strictly confidential and were deleted after research analysis was completed.

All sessions were held in the Speech and Language clinic in the University of Limerick. K attended twice a week, for 45min, after school, every Monday and Wednesday. Non-consecutive days were planned in line with the principles of learning outlined in Alt, (2012) which specified the importance of sleep dependent consolidation when treating language impairment. Principles of variability of input and distributed practice (Alt, 2012), were also incorporated into the scheduling of therapy sessions. Baseline Assessment took place over 2 sessions a week apart. Therapy began in week 2 and continued twice a week, for 7 sessions. Originally, 10 therapy sessions were planned, but due to logistical issues of late recruitment, a missed session and school holidays, 7 were completed. Following the treatment phase, there was a one week break before re-assessment to allow for further consolidation. Re-assessment took place in a single session, after school. Table 6 outlines the procedure for the assessment, treatment and re-assessment phases:
Table 6: Procedure for Assessment and Treatment Phases

<table>
<thead>
<tr>
<th>Baseline Assessment Phase</th>
<th>Treatment Phase</th>
<th>Re-Assessment Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>TROG-2</td>
<td>Metacognitive Strategies: K was taught Rehearsal Strategies; instructions were based on ‘3-element’ sentence structure.</td>
<td>TROG-2</td>
</tr>
<tr>
<td>BPVS-III</td>
<td>5 Comprehension Monitoring strategies were taught.</td>
<td></td>
</tr>
<tr>
<td>WMB-C</td>
<td>Criterion Referenced Assessments probed all blocks failed on the TROG-2. They identified: • Treated items • Untreated control item • Generalisation item</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metalinguistic Intervention: SC was used to teach treated items: (coordinating conjunctions) ‘And/but not’ ‘neither/nor’</td>
<td>Criterion Referenced Assessment probes re-administered for treated items, untreated control item and generalization item</td>
</tr>
<tr>
<td></td>
<td>Expressive Language Control: ERRNI-MLUw standard score recorded pre therapy</td>
<td>Expressive Language Control: ERRNI-MLUw standard score recorded post therapy</td>
</tr>
<tr>
<td></td>
<td>Untreated control item ‘pronoun binding’ and generalization item ‘reversible passives’ were not treated.</td>
<td></td>
</tr>
</tbody>
</table>

The criterion referenced assessment probes were specifically developed for this study. Each assessment probe contained 10 test items, following the same format as the TROG. The participant heard a sentence and had to point to a matching picture from 4
presented pictures. The 4 pictures included the target along with lexical and grammatical foils presented in a 4 picture multiple choice format.

Each therapy session was divided into the teaching of metalinguistic strategies (SC) and metacognitive strategies (Rehearsal & Comprehension Monitoring). Materials consisted of the SC CD-ROM (©Ebbels), laminated SC sentence templates, verb/noun/adjective pictures, instruction-based activities, toy animals/dolls and pen and paper. Protocols were also devised for teaching of rehearsal and comprehension monitoring (appendix d).

SC was introduced following the teaching order outlined in Ebbels (2012). This consisted of firstly introducing the SC system and secondly, using this system to teach comprehension of co-ordinating conjunctions: ‘and/but not’ and ‘neither/nor’.

3.6.1 Introduction to Shape Coding
This stage followed the steps outlined in Ebbels (2012), whereby the participant was taught the shapes used to identify different parts of sentences. These were the oval (who/what) shape, the hexagon (what doing?) shape and the cloud (how feel/what like) shape. Sorting activities were used using pictures of verbs, nouns and adjectives. Pen and paper was used to allow the participant to draw the correct shape around the different parts of the sentence. After parts were identified, the different parts were reinforced by asking specific questions about them, as per the outline in Ebbels (2007; 2012), e.g. ‘who is eating?’ ‘What is the boy doing?’ and ‘what is the ball like?’ or ‘what is the girl feeling?’.

3.6.2 Teaching of Co-ordinating Conjunctions using Shape Coding
Teaching of co-ordinating conjunctions followed the teaching order of steps outlined in Ebbels, (2012) (Appendix e). Each of the conjunctions, ‘and’, ‘but not’ and ‘neither/nor’ was taught in different positions in a sentence. These were: the subject noun phrase + verb, the verb phrase, the subject noun phrase + adjective, and the adjective phrase. E.g.,

K but not Mum is jumping (‘but not’ in subject noun phrase + verb)
K is running but not talking (‘but not’ in verb phrase)

K but not Mum is happy (‘but not’ in subject noun phrase + adjective)

The ball is big but not red (‘but not’ in adjective phrase)

Of the 14 steps in the teaching order 9 were completed during the treatment phase of 7 sessions. Because of the participant’s age, it was not possible to use SC to code sentences in their written form alone. Sentences were presented orally and pictures, toys and the STs and parent were used to act out each sentence. Once K had correctly acted out the sentence, the ST asked her specific questions to reinforce learning, e.g.

1. K acted out the following sentence:
   - K is running but not singing
2. The ST asked questions such as: Who is running? Who is singing? Who is not singing/running? What is K doing? What is K not doing?
3. Finally, K and the ST used laminated sentences templates to write out the sentence and place the correct parts in the corresponding shapes. E.g., (Fig 1)

   ‘but not’ in the verb phrase:

   ![Diagram](image)

   Figure 1: ‘but not’ in the verb phrase outlined in the SC template

At the end of a teaching period, comprehension of the treated item was tested and responses were recorded as an outcome measure.

After each session, SC homework was provided to specifically reinforce the learning of treated items.
3.6.3 Comprehension Monitoring

A protocol was devised (appendix d), based on Bianco et al, (2010), to teach comprehension monitoring strategies. First K learned the ‘rules of good listening’; these were subsequently reinforced at the beginning of each session. 5 different scenarios where comprehension difficulties may arise were then identified and strategies to combat these breakdowns were introduced. The 5 strategies were taught explicitly in each session. As well as this, the ST manipulated situations during the rest of the session, in order to give K opportunities to use the strategies spontaneously during other activities. If she did not use them spontaneously, the ST gave her a cue to remind her to use a specific strategy. The 5 taught strategies were:

1. **Telling someone to ‘shhhhh!’ if they were being too noisy and she couldn’t hear the speaker.**
2. **Telling the speaker to ‘speak up’, if they were talking too low.**
3. **In school, putting her hand up and asking for help, if she didn’t understand a word the teacher had said, or what they had asked her to do.**
4. **Asking a speaker to ‘say it again’, if they gave a long instruction.**
5. **Asking a speaker to ‘slow down’, if they spoke too fast.**

Picture cue cards, matching games, sorting tasks and role-plays were used to teach each strategy. Once they had been taught, K’s parents and teacher was asked to keep a record of K’s use of the comprehension monitoring strategies at home and in the classroom.

3.6.4 Rehearsal Strategies

A teaching protocol was devised to teach rehearsal strategies. This protocol was based on steps adapted from Gill & Klecan-Acker (2003) – (appendix d). Instruction based activities were used to teach rehearsal strategies. First K was asked to listen to the instruction, second, to say the instruction out loud and third, do the action outlined in the instruction. In every session, the rehearsal activity consisted of 10 instructions, which were based on a 3 element sentence structure (as this was identified at baseline as a sentence structure K had difficulty comprehending). Accuracy was recorded by both the ST and the Observer. Responses were categorised as follows: K rehearsed with/without cueing, K accurately repeated the instruction, and whether K accurately
carried out the action. Homework activities were also given to reinforce the use of rehearsal. The ST explained to K that repeating an instruction out loud was a good ‘trick’ to help her remember what she had to do.

3.7 Outcome Measures and Treatment Fidelity

As well as assessments pre/post therapy, responses within sessions were also recorded for accuracy. Treated items were tested after a period of teaching (within the session) and accuracy was recorded. Treatment fidelity was ensured, by the presence of an observer, who was another student speech and language therapist (sSLT) and by the PI who observed some sessions. The second sSLT observed every session, recording clinical observations, in-session testing and level of cueing and accuracy of responses. Sessions were also recorded on a Dictaphone. Notes and results from each session were compared to ensure accurate recording of responses and to monitor treatment fidelity.
4 Results

4.1 Comparison of results pre and post therapy

Results for the treated items or ‘and/but not’ and ‘neither/nor’; the generalization item ‘reversible passives’; and the control item ‘pronoun binding’, were compared pre and post therapy. Raw scores for each of the items are outlined in Table 7 below.

Table 7: Results of Assessment Probes pre/post Therapy

<table>
<thead>
<tr>
<th>Treated Items</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>And/but not</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Reversible passives</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Pronoun Binding</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Generalization probe</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Untreated probe</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>And/but not</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Reversible passives</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Pronoun Binding</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neither/nor</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

The TROG was also re-administered post therapy, and results were compared (Table 8). The number of blocks passed pre therapy equalled 6. Post therapy this had decreased to 4 blocks passed. This decrease in raw score negatively impacted her standard score, which decreased from 72 to 62.

Table 8: Results of TROG-2 pre and post Therapy

<table>
<thead>
<tr>
<th>Pre Therapy</th>
<th>Post Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Blocks Passed</td>
<td>6</td>
</tr>
<tr>
<td>Standard Score</td>
<td>72</td>
</tr>
<tr>
<td>Percentile</td>
<td>3</td>
</tr>
</tbody>
</table>

Both assessment probe results and the TROG results are further outlined in figure 2. Data was entered into a statistical software package (IBM Corp., 2011), for further analysis. While treated item ‘and/but not’ showed some improvement, treated item
‘neither/nor’ did not change. The improvement in comprehension of ‘and/but not’ post therapy (from 2/10 pre-test to 4/10 post-test) was not statistically significant (McNemar test: p<0.625). Neither was the change in score on the control untreated item of ‘pronoun binding’ (from 2/10 to 3/10), statistically significant (McNemar test: p<1.0). While generalization to passives was not evident, and in fact score for comprehension of reversible passives appeared to have worsened, (from 5/10 to 2/10) this change was not significant (McNemar test: p<0.375). The MLUw standard score on the ERRNI decreased from 82 pre therapy to 72 post therapy; a related t-test showed this change was not significant (p=0.1618, 1 tailed/ p=0.3235, 2-tailed). This lack of change in the untreated area of expressive language may indicate that that any improvement on treated item ‘and/but not’, was a therapy specific effect.

Figure 2: Results of Assessments Pre and Post Therapy
4.2 In-Session Data

While it is clear that assessments post therapy did not show significant changes for treatment items or for overall standard scores on the TROG, in-session data and shows that learning did take place during the therapy session:

4.2.1 Shape Coding

In the first 3 therapy sessions (figure 3), K’s understanding of the shapes increased from 60% accuracy to 100%. The treated item ‘and/but not’ was introduced in session 3. By session 5, comprehension of ‘and/but not’ was recorded at between 80-100% in all positions, except in the adjective phrase (55%), which was introduced for the first time in that session.

![Understanding of Shape Coding and Treated Items across Sessions](image)

Figure 3: Understanding of SC and Comprehension of Treated Items
Due to a missed session and school holidays, the treated item of ‘neither/nor’ was taught indirectly using a home programme, carried out by K’s parents. Accuracy for ‘neither/nor’ in all positions was reported to be 71% after the home programme was completed (fig 3).

Outcome measures were recorded for all treated items and SC components in the final session. The Results are outlined in figure 4 below. This figure illustrates that K’s understanding of ‘and/but not’ was considerably higher on testing than her understanding of ‘neither/nor’. While accuracy for understanding of ‘and/but not’ in all positions fell consistently between 80-100%, accuracy for ‘neither/nor’ fell between ’67-80% (fig 4).

Figure 4: Comprehension of treated items ‘and/but not’ and ‘neither/nor’ in last therapy session
4.2.2 Exposure to Treated Items within Sessions

While figure 4 above shows the percentage of targets correct in the final SC session, figure 5 illustrates the level of exposure to those targets across all sessions. This was calculated by recording how many times the ST referred to each structure and modelled it within a session. The line graphs (fig 5) highlights the difference in levels of exposure for ‘and/but not’ and ‘neither/nor’. K received considerably more exposure to ‘and/but not’ than to ‘neither/nor’, which was introduced in session 6 (via a home programme) and in session 7, the last session.

![Exposure to 'and/but not' and 'neither/nor' across treatment phase](image)

Figure 5: Exposure to ‘and/but not’ and ‘neither/nor’ across treatment phase
4.2.3 Rehearsal strategies and Comprehension Monitoring

In-session data on the use of rehearsal strategies without cues indicate an increase across sessions (fig 6). Despite this, spontaneous use of rehearsal strategies outside of the rehearsal activity was not observed.

![Figure 6: Percentage of Instructions Rehearsed in Rehearsal Activity, across Therapy Session](image)

Table 9 below, illustrates the results of the final rehearsal activity. As well as measuring use of rehearsal, instructions were manipulated to measure the spontaneous use of comprehension monitoring during the activity. Of the 10 instructions given, 5 were manipulated so as to elicit a specific strategy (manipulation type in the key below Table 9).
### Table 9: Final Rehearsal Activity and Test of Comprehension Monitoring

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Nature of Manipulation of Instruction</th>
<th>Rehearsed without Cue</th>
<th>Used Comprehension Monitoring Strategy Spontaneously</th>
<th>Correct Strategy used after Cue</th>
<th>Instruction carried correctly Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence 1</td>
<td>none</td>
<td>yes</td>
<td>n/a</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Sentence 2</td>
<td>none</td>
<td>yes</td>
<td>n/a</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Sentence 3</td>
<td>- CL</td>
<td>yes</td>
<td>Cue was given</td>
<td>Yes, K asked for help</td>
<td>yes</td>
</tr>
<tr>
<td>Sentence 4</td>
<td>- RI</td>
<td>Yes after instruction was repeated</td>
<td>Yes-said ‘slow down’</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Sentence 5</td>
<td>none</td>
<td>yes</td>
<td>n/a</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Sentence 6</td>
<td>- LI</td>
<td>No (too long)</td>
<td>Cue was given</td>
<td>Yes, ‘say it again’</td>
<td>yes</td>
</tr>
<tr>
<td>Sentence 7</td>
<td>none</td>
<td>yes</td>
<td>n/a</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Sentence 8</td>
<td>-VL</td>
<td>yes</td>
<td>n/a – K heard the instruction anyway (Cue Given After)</td>
<td>Yes, ‘Speak Up’</td>
<td>yes</td>
</tr>
<tr>
<td>Sentence 9</td>
<td>none</td>
<td>yes</td>
<td>Cue was given</td>
<td>Yes, ‘Shhh’</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Key to comp monitoring manipulation**
- **Volume lowered**: VL
- **Background noise**: BN
- **Rate increased**: RI
- **Complex Language used**: CL
- **Long Instruction given**: LI
Of the 5 situations manipulated, K used a comprehension monitoring strategy once spontaneously. Of the other 4 occasions, she gave the correct strategy 3 times, after a cue was presented. On 1 occasion she did not respond to a cue. When directly asked to list the 5 strategies, she could with 100% accuracy. This is a positive increase on early sessions, when K could not name all 5 strategies, and did not respond when given cues to use a strategy. She used rehearsal spontaneously on 9 of the instructions given and on all 10 when a cue was presented. After rehearsing, she carried out the instruction correctly, 100% of the time (Table 9).

4.3 Qualitative data on Generalization of Metacognitive Strategies

K’s Teacher was asked to note the number of times K used metacognitive strategies in the classroom. Her teacher reported that K did not use either rehearsal strategies or comprehension monitoring strategies spontaneously in class. She reported that when she asked K to tell her about the different ways that could help her understand, K was able to list the 5 different situations and their matching strategies. Her parents reported similar findings.
5 Discussion

5.1 Treatment of Coordinating Conjunctions

Following intervention, comprehension of ‘and/but not’ had improved, while comprehension of neither/nor remained unchanged. While improvement of ‘and/but not’ was not statistically significant, outcome measures revealed that K made gains in the therapy sessions. K’s comprehension of ‘and/but not’ in all areas was consistently between 80%-100% at the end of each teaching period. In contrast, the improvement did not generalize to post therapy assessments of treated items or to overall language scores on the TROG-2. This discrepancy will be discussed in later paragraphs. With regard to previous findings, these post therapy results do not support previous research by Ebbels (2012), in which older school-age children significantly improved their comprehension of coordinating conjunctions when taught using SC. Obvious differences between the 2 studies exist and may have influenced the results here. In the current study, the client was considerably younger (6:6) than those of the Ebbels study (2012) (mean age: 13.1). There have been no studies to date using SC on this younger age-group. At 6:6, K may have been too young for this type of metalinguistic approach to be successful. On the other hand, she did respond to the approach within sessions. Perhaps, she may have benefitted from more implicit priming therapy, such as those outlined in Camarrata et al (2009) and Fey et al (2003), before embarking on this explicit metalinguistic approach. Nonetheless given the severity of her difficulties, the introduction of SC and other strategies can underpin further intervention she will likely need.

This study’s treatment phase was also of a shorter duration than outlined in Ebbels, 2012, which took place over an entire school semester (Ebbels, 2012). According to Alt (2012), children with language impairment may need more exposure, repetition and reinforcement of treated items for therapy to have an effect. This theory is illustrated in the current study, where it can be seen that ‘and/but not’ received higher levels of exposure and repetition and longer duration of direct input than ‘neither/nor’. Due to
logistical issues of missed sessions and school holidays, ‘neither/nor’ was targeted indirectly using a home programme, hence less direct therapy, and a reduced amount of exposure and reinforcement. This difference in levels of exposure may explain the differences between scores in the post therapy assessments of treated items. Considering Alt’s recommendations on exposure, the current findings, and the duration of the Ebbels study with an older age group, it may be assumed that if the therapy had continued for longer, and had K received more exposure to SC and the treated items, results of post therapy assessments may have been different.

5.2 Rehearsal and Comprehension Monitoring

While a positive trend was observed for the successful use of rehearsal strategies within therapy, this did not generalize to other situations. These findings do not fully support the findings of Gill & Klecan-Acker (2003), where generalization was evident, although in their study, follow-up assessment had taken place 6mths post treatment. The children in Gill & Klecan-Acker (2003) were of a similar age-group to K, and their study was of a similar duration, so it is not clear why this strategy was not as successful in K’s case. The literature has shown sub-vocal rehearsal is a cognitive skill that has been shown to emerge from age 7 and above. In the study by Gill & Klecan-Aker, another element called visualization was taught, which was not introduced here. Sessions were also longer at 30 min, whereas in this study, the ST spent 10-15 min of each session reinforcing rehearsal strategies. Findings at odds with Gill & Klecan-Aker, may point to the need for K to have had more exposure to the concept of rehearsal for it to have generalized. For instance, if more implicit teaching approaches had been used, via the use of imitation and modelling of rehearsal strategies (Camaratta et al, 2009); or if the strategies had been introduced in the context where they would be most useful, i.e. in the classroom, where K could rehearse ‘real instructions’ and see these strategies being modelled, the outcomes may have generalized more.

Similarly, K effectively learned the meaning of Comprehension Monitoring strategies, but she did not make use of them spontaneously. While the data shows positive trends for the use of these metacognitive strategies over the duration of the study, their lack of generalization, coupled with the lack of significant results for the items
treated via SC, leads the author to suggest that in this case, and at this time, K may have been too young to fully benefit from the meta approach.

5.3 Issues of Testing

While K’s response to therapy may be mediated by her age and the suitability of approach, the discrepancy between the in-session data and the post therapy results cannot rule out the issue of “testing” and whether it garners a true reflection of her abilities. It is hard to clarify whether therapy worked due to confounding variables of fluctuating performance across assessments.

5.3.1 Issues of Fatigue on Testing Performance

The baseline administration of the TROG-2 took place in a morning session; while re-assessment took place in an evening session, after school. Clinical observation and parental report showed K to be extremely tired during this re-assessment session. The implications of fatigue on outcomes of standardized assessments cannot be understated, as K failed 2 extra blocks on reassessment and went from a standard score of 72 to 62. Attention fluctuated throughout the assessment. These findings have implications for timing of assessments in general. They also highlight the problem of testing itself, and whether it is a reliable measure of consistent language performance; as performance on assessments can fluctuate from day to day (Evans, 2001).

5.3.2 Clinical Observations during Assessment

The ST noted heightened levels of anxiety during the assessment phase. This anxiety may have further negatively affected K’s processing abilities; such that differences were observed between performance in more supportive therapy environments and performance on assessment of treated items. Her awareness of her difficulties meant that she was sensitive to whether she was doing well on an assessment. If not doing well, her attention tended to fluctuate and ultimately this influenced her ability to do better on the assessment.

In therapy, K had the visual support of the shapes, and the SC templates to cue her, as well as the reinforcement of questions from the ST. In contrast, during assessments, K
heard only the sentence in isolation. This lack of visual supports may have been a step too high for K’s comprehension of treated items, given the low level of exposure some of the structures had received. Perhaps if visual supports had been left out in plain sight during assessments, they may have helped to focus K’s memory and processing and visually cue her to the meaning of sentences she was hearing. Unfortunately, this would place the validity of the assessment under scrutiny, as any changes would affect its reliability.

5.4 An Argument for Dynamic Assessment?

Issues outlined above, such as awareness and anxiety, fluctuating attention, age, fatigue and consistency across language assessment scores, have implications for clinic and future study and lead the researchers to question the validity of standardized testing in general. Indeed an indirect and not measured benefit of the study is that it reinforces the importance of dynamic assessment when considering responsiveness to intervention. According to Hasson & Joffe (2007), standardized assessments fail to uncover how children approach tasks or what difficulties they may encounter. They provide little information on which interventions may work and do little to predict a child’s responsiveness to a treatment. They recommend the use of dynamic assessment which allows for more detailed knowledge of the child’s learning strategies and their strengths and weaknesses which in turn inform their responsiveness to intervention (Hasson & Joffe, 2007).
6 Conclusion

6.1 Findings and Further Research

Findings suggest children with language impairment may need more exposure, repetition and reinforcement of treated items for therapy to have an effect (Alt, 2012). While elements of SC (previously used on 11-16 years; Ebbels, 2012), were successful here, it did not generalize to performance on probes post-therapy. This participant may have been too young to benefit from this metalinguistic approach. Rehearsal and comprehension monitoring did not generalize outside of clinic. The cognitive skills that allow for sub-vocal rehearsal may not be fully developed at 6:6. While gains were made within sessions, further research is needed as to why these gains did not generalize post therapy. The author recommends an alternative therapy approach, using implicit priming therapy outlined in Camarata et al, (2009); and Fey et al, (2003). Further research is required to compare implicit v explicit approaches to therapy for RLI. This could compare SC with repetition and modelling of structures without the overlay of codes and the explicit focus on components of the sentence.
7 References


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Bibliography:


• *SC CD-ROM Microsoft Word version*. ©Dr. S. Ebbels in Assoc. with Moor House School, Surrey.

8 Appendices

APPENDIX A

Parent Information Sheet

Parent Information Sheet

Study title: A pilot study on the use of SC and memory strategies to improve understanding of language in school-age children (aged 6-9 years) with language impairment.

We would like to invite your child to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for your child, please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?
Children with language impairment can have comprehension (understanding) difficulties. This can occur where a child doesn’t understand certain concepts/grammar and/or where memory and/or attention skills are poor. Some recent therapies using coding as clues have been shown to work with older school aged children and adolescents (11-16 years). The aim of this study is to find out whether these approaches work with younger school-age children.

Why has my child been invited to take part?
Six children will take part in this study. Your child has been chosen because:

- He/she has difficulty understanding sentences
- He/she is in the age range of the study: 6 to 9 years.

Do I have to let my child take part?
It’s up to you to decide. We will describe the study in this information sheet. We will then ask you to sign a consent form to show you have agreed to take part. You are free to withdraw at any time, without giving a reason. This would not affect any services you or your child receives.

What will happen to my child if we take part?
Your child will be given some tests by the researchers, who are final year student SLTs under the supervision of a qualified Speech & Language Therapist. These tests will include activities such as asking your child to listen to words and sentences, point to pictures from a choice of pictures that match the words and sentences, and repeat a short story. Your child will also participate in a short memory test, where he/she will be asked to repeat lists of words and numbers. This will take about one and a half hours. We will split the testing over two sessions.
Treatment sessions will then take place twice a week for five weeks. The therapy will involve teaching your child codes or clues (using SC) to help them understand types of words and sentences, for example colour codes for verbs (doing words) and nouns (names of things) and shapes. We will also introduce your child to strategies to help their memory. Two weeks after the therapy ends we will repeat the tests to see if your child’s understanding of language is better.

**Are there any disadvantages or risks in taking part?**
There are no risks to your child. A disadvantage is that your child may miss other activities while participating in the language activities. The activities used in the programme are meant to be fun for the child.

**Are there any benefits in taking part?**
Your child will receive a very thorough language assessment and participate in a program that should help improve his/her language. This is a small-scale pilot study and from the results we can develop a larger group study. The information we get from this study should help improve the treatment of children with language difficulties in the future.

**What happens when the research study finishes?**
After all the results have been collected, the researchers will write the study up. The results will be analysed and shared with other Speech & Language Therapists to help them decide the best way to treat children with language difficulties. We will give you a summary report of the findings regarding your own child. You may request a copy of the report of all the findings at the end of the study. Your child will not be identified in any research report or publication.

**Will my child’s taking part in the study be kept confidential?**
Yes. All information which is collected about your child during the course of the research will be kept strictly confidential, and any information about him/her which leaves the clinic will have the name and address removed so that he/she cannot be recognised. You have the right to check any data held about your child for accuracy and correct any errors.

**What will happen if I don’t want my child to carry on with the study?**
You can take your child out of the study at any time, without giving a reason. This will not affect any services you or your child would normally receive.

**What if there is a problem?**
If you have a concern about any aspect of this study, you should ask to speak to the principal investigator who will do her best to answer your questions (Carol-Anne Murphy; 061 213076). If you remain unhappy and wish to complain formally, you can do this through:

- **Who is organising and funding the research?**
The research is being carried out as part of final year Speech & Language Therapy students’ Master’s thesis under the supervision of a lecturer and qualified SLT at the University of Limerick, Castletroy, Limerick.

- **Who has reviewed the study?**
All research in the University is looked at by an independent group of people, called a Research Ethics Committee, to protect the safety, rights, wellbeing and dignity of those taking part. This study has been reviewed and given favourable opinion by the HSE Mid-Western Regional Hospital Research Ethics Committee.
If you have concerns regarding this study, please contact: **Chairman, Mid-Western Regional Hospital Research Ethics Committee Risk Management Dept, 3rd Floor Nurses Home, Mid-Western Regional Hospital, Dooradoyle, Limerick. Tel. (061) 234101**  
**Email:** joanne.oconnor@hse.ie

**Further information & contact details:**  
For further information please contact the researcher, Carol-Anne Murphy on 061-213076 or carol-anne.murphy@ul.ie.

Thank you very much for taking the time to read this information sheet. We will be grateful if you decide to let you child take part in the study. Your local speech and language therapist will go through the study information with you and your child. We have attached an information sheet for your child also, that he/she may read or that you can be used to explain the study to him/her.

If you decide to let your child take part in the study, please sign the attached consent form and return it to Catherine O’Farrell, Speech & Language Therapy Manager, Roxtown Health Centre, Old Clare Street, Limerick. You will then be contacted by phone to arrange an appointment.
APPENDIX B

Participant Information Sheet

Children’s Information Sheet

Title of Project: Helping Children to understand Words and Sentences

What is this about?

We are doing a project on helping children to understand different words and sentences. We would like help from children your age.

How will you be helping us?

We will see you in the clinic. We will do tests and activities to find out about your words and sentences. We will also teach you some new clues to help you with understanding words and sentences you find difficult. The tests and activities are like those you do with your speech and language therapist. We will write down what is said and we will record you telling a story on a digital recorder.

Do I have to help you?

This is up to you. You can talk to a grown up about it if you are worried or not sure.

This research has received ethical approval from the HSE Mid-Western Regional Hospital Research Ethics Committee. If you have concerns regarding this study, please contact: Chairman, Mid-Western Regional Hospital Research Ethics Committee Risk Management Dept, 3rd Floor Nurses Home, Mid Western Regional Hospital, Dooradoyle, Limerick. Tel. (061) 234101. Email: joanne.oconnor@hse.ie
APPENDIX C

Parent Consent Form

Study title: A pilot study on the use of SC and memory strategies to improve understanding of language in school-age children (aged 6-9 years) with language impairment

Name of Principal Researcher: Carol-Anne Murphy, Lecturer/Speech & Language Therapist, BSc., MSc., MIASLT, Clinical Therapies Department, University of Limerick.

- I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

- I understand that my child’s participation is voluntary and that I am free to withdraw him/her at any time without giving any reason and without his/her healthcare or legal rights being affected.

- I understand that my child’s identity will be kept confidential and it will not be possible to identify him or her in any reported findings.

- I agree to let my child take part in the above study.

Name of Child: ___________________ DOB: _______________

Name of Parent: ___________________ Date: _______________

Signature: ___________________________________________

Address: ________________________________

Telephone: ________________ Email address: _____________________________

This study has been reviewed and given favourable opinion by the HSE Mid-Western Regional Hospital Research Ethics Committee. If you have concerns regarding this study, please contact: Chairman, Mid-Western Regional Hospital Research Ethics Committee Risk Management Dept., 3rd Floor Nurses Home, Mid-Western Regional Hospital, Dooradoyle, Limerick. Tel. (061) 234101. Email: joanne.oconnor@hse.ie
APPENDIX D

Protocols for Introducing Comprehension Monitoring & Rehearsal Strategies

Protocol for Teaching Comprehension Monitoring Strategies

These steps will be introduced and taught in sessions 1-2. They will be incorporated into the introductory session rules at the beginning of each subsequent session.

The aims of the first session are to:

1. Introduce and discuss why we are here

Ask child why they think you both are here, and if they have had speech and language therapy before. Explain using this script:

‘You are going to be coming to therapy two times a week. We are going to think about listening and helping our memories and play lots of games to help to become even better at doing these things.’

2. Establish rapport

3. Discuss becoming a good listener

Discuss what it is to be a good listener. Brainstorm with the child. Allow them to suggest some ideas. Discuss the ideas with the child. Try to elicit the following points from the child, ideally using their suggestions.

• We need to do good sitting
• We need to do good looking
• We need to stop talking
• We need to be sitting still
• We need to do good listening
As each idea is introduced, back it up by showing the appropriate Boardmaker visual-prompt card and use adult modelling of ‘good’ and ‘bad’ listening. Use examples of all the rules.

Introduce a guessing game to reinforce the above ideas. Take turns with the child to choose a card with either a ‘good’ or ‘bad’ listening behaviour on it, to model for the other person who has to guess what it is. Once all the points on the list above have been discussed, put ‘good’ Boardmaker visual-prompt cards on the wall as a chart to remind the child of the ‘rules of therapy’.

4. **Introduce the idea of communication breakdown**

Introduce the idea of communication breakdown, saying ‘*You might be doing all the things we have talked about to help you to listen, but sometimes the person who is talking to you – it might be your friend or the teacher or another grown up – might do something that makes it hard to understand what they have said. So it might not be your fault when you don’t understand. Let’s think about some of the things that can go wrong that make it hard to understand.*’

Explain about rate, volume and noise. List some speaker factors that might affect comprehension.

- **Rate** - say ‘*I might talk really really fast so you don’t know what I’m saying.*’ Model speaking too quickly.

- **Volume** - say: ‘*I might talk so quietly that you can’t hear me, or there might be lots of noise in the room so you can’t hear me.*’ Model speaking too quietly.

5. **Summarise**

At the end of the session explain to the child that they have done a lot of work on things that help us to be good at listening. They should try to remember to do some of these things when they are listening in the session/classroom or to their mum, dad or their friends.
Protocol for Teaching Rehearsal Strategies

The rehearsal protocol will follow the Gill et al. (2003) therapy sequence:

1. **Introduce what rehearsal is**

*Sample instructional scripts for the rehearsal strategy training (taken from Gill et al. 2003)*

**SLT:** “I will give you a direction. Before you do it, tell me what I said to do. Listen. Then say what I said. Then do it. Remember — say it first, then do it. Let’s try one. Pick up the pencil.”

**Child:** “Pick up a pencil.” (Then picks up the pencil)

**SLT:** “Great! I said it, then you said it before you did it. Let’s do that again. Remember, say it before you do it. You can keep saying it to help you remember. Ready? Put the blue pencil on the brown desk.”

**Child:** “Put that pencil on the desk”. (Then does it.)

**SLT:** “Great! Tell me — what you are going to do every time I give you a direction?”

**Child:** “I’m gonna say it first like you did and then I do it.”

**SLT:** “OK. We’ll try a harder one. Ready? Put the little cup on the desk and then bring me an eraser.”

**Child:** (starts to get the cup)

**SLT:** “Whoa — tell me first.”
**Child:** “Oh yea, get that cup and put it on the desk and give you an eraser. You don’t have to remind me. I know... Say it first, then do it. OK, make the next one really hard.”

**SLT:** “OK. Now I won’t remind you very often. When I give you a direction, you tell yourself to say it. Keep on saying it to help you remember. See if you can do that every time.”

Directions continued to increase in complexity and in temporal and spatial distance. Children were cued to rehearse as needed until they did it spontaneously. (Eventually, most children did this sub vocally as evidenced by their lip movements.)

2. **Incorporate this strategy into a game to apply it to a practical situation**
   - Restaurant game
   - Shopping game
   - Simon Says
   - Building a story

Suggested homework activities:

- Completing tasks in the home with increasing length of instructions.
- Worksheets that involve colouring and drawing different amount of items.
APPENDIX E

Shape Coding Teaching Order for Coordinating Conjunctions (©Ebbels)

**Therapy**

- The sequence of activities below is the suggested order. However, the timing of the steps is at the discretion of the therapist, to suit each individual child, depending on their pre-therapy profile and how they respond to the therapy.
- Aim for 8 sessions once per week for 30mins per session (if SLTs feedback by week 5 that students already comprehend everything, we could bring re-testing forward for everyone!)
- Include brief introduction to SC if necessary
- Don’t bother with colours unless pupils particularly want to use them
- No need to focus on singular vs. plural aux, unless it is helpful for the individual (i.e. they have worked on it before). If not, then you could either mention in passing, or just gloss over (as the focus is on comprehension not production)
- Use signing for the coordinators to backup the SC, at the end of each section, gradually reduce use of signing too, so that final stage is following instructions with no support (signing or templates)
- In therapy notes, if you make reference to this sheet, you could just note down which steps you did (e.g., “steps 2c to 3j”)
- PLEASE ENSURE THAT THESE COORDINATORS ARE NOT TARGETED IN ENGLISH LESSONS FOR ANY PUPILS (THERAPY OR CONTROL) - THANKS

**Intro to SC**

Need to introduce the following (but only for those pupils who do not already know them)

a) ‘Who’ subject
b) aux ‘is’ and ‘are’ (but gloss over the plural/ singular distinction)
c) Verb phrase (only use single verbs here)
d) Adjective phrase

See Susan E if need instructions on how to do this

The last shape (Adj P) could be introduced just before step 4 or here (before step 2), at the discretion of the SLT.

‘And’ vs ‘but not’ (Subject NP + Verb)
a) Introduce the templates showing coordination of NPs in subject position, e.g.,

\[ \text{The cow and the dog are jumping} \]

b) Relate the coordinated subject to the question word “Who” – discuss how ‘and’ means both NPs are carrying out the action.

c) Take turns to produce sentences using ‘and’ while the other one acts out the sentence

d) Introduce template with ‘but not’

\[ \text{The cow but not the dog is jumping} \]

e) Relate the coordinated subject to the question word “Who” – discuss how ‘but not’ means only the first, not the second NP (shown by the cross) is carrying out the action.

f) Take turns to produce sentences using ‘but not’ while the other one acts out the sentence

g) Take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other acts out, using template as a guide

h) when accurate, remove templates, bring back to check responses

‘And’ vs ‘but not’ (Verb Phrase)

a) Revise the templates showing coordination of NPs in subject position with verb. Show similarity with template showing coordination of VPs, e.g.,

\[ \text{The cow is jumping (over the fence) and running (round the field)} \]

b) Relate the coordinated VP to the question word “What doing” – discuss how ‘and’ means the subject is doing both verbs (or Verb Phrases).

c) Take turns to produce sentences using ‘and’ while the other one acts out the sentence

d) Introduce template with ‘but not’

\[ \text{The cow is jumping (over the fence) but not running (round the field)} \]
e) Relate coordinated VP to the question word “What doing” – discuss how ‘but not’ means subject does only the first, not the second verb phrases (shown by the cross).

f) Take turns to produce sentences using ‘but not’ while the other one acts out the sentence.

g) Take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other one acts out the sentence.

h) When accurate, remove templates, bring back to check responses.

i) Take turns to create sentences matching one of four templates from sections 2 and 3, other acts out sentence.

j) When accurate, remove templates, bring back to check responses.

k) Make combinations of the templates using coordinated subjects and/or verbs.

- the cow and the cat are jumping but not running
- the cow but not the cat is lying down and sliding
- the cow and the cat are standing and jumping
- the cow but not the cat is lying down but not sliding

l) Take turns to create sentences matching these combined templates, other one acts out sentence.

m) When accurate, remove templates, bring back to check responses.

‘And’ vs ‘but not’ (Subject NP + Adjective)

a) Revise the templates showing coordination of NPs in subject position with verb. Show similarity with template showing coordination of NPs in subject position with adjectives, e.g.,

The ball and the hat are red

b) Relate the coordinated subject to the question word “Who” – discuss how ‘and’ means both NPs have the feature of the adjective.

c) Take turns to produce sentences using ‘and’ while the other one draws / colours in the sentence.

d) Introduce template with ‘but not’

The ball but not the hat is red

e) Relate the coordinated subject to the question word “Who” – discuss how ‘but not’ means only the first, not the second NP (shown by the cross) has the feature of the adjective.

f) Take turns to produce sentences using ‘but not’ while the other one draws / colours in the sentence.
g) take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other draws / colours in, using template as a guide

h) when accurate, remove templates, bring back to check responses

‘And’ vs ‘but not’ (Adjective Phrase)

a) Revise the templates showing coordination of NPs in subject position with adjective. Show similarity with template showing coordination of APs, e.g.,

The cow is big and black

b) Relate the coordinated AP to the question word “What like” – discuss how ‘and’ means the subject has the feature of both adjectives.

c) Take turns to produce sentences using ‘and’ while the other one draws / colours in the sentence

d) Introduce template with ‘but not’

The cow is big but not black

e) Relate coordinated AP to the question word “What like” – discuss how ‘but not’ means subject only has features of the first, not the second adjective (shown by the cross).

f) Take turns to produce sentences using ‘but not’ while the other one one acts out the sentence

g) take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other one draws / colours in

h) when accurate, remove templates, bring back to check responses

i) take turns to create sentences matching one of four templates from sections 4 and 5, other draws / colours in

j) when accurate, remove templates, bring back to check responses

k) Make combinations of the templates using coordinated subjects and/or adjectives e.g.,

   a. the hat and the ball are big but not blue
   b. the hat but not the ball is yellow and stripy
   c. the hat and the ball are small and black
   d. the hat but not the ball is red but not spotty

l) take turns to create sentences matching these combine templates, other one draws / colours in

m) when accurate, remove templates, bring back to check responses
**Neither nor (Subject NP)**

a) Revise the templates showing coordination of NPs in subject position with VP. Use ‘neither nor’ as coordinator and discuss how ‘neither nor’ means that not the first and not the second NP are doing the action (shown by crosses)

![Diagram](image)

b) Take turns to produce sentences using ‘neither nor’ while the other one acts out the sentence
c) take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other acts out, using template as a guide
d) when accurate, remove templates, bring back to check responses

**Neither nor (VP)**

a) Introduce template with ‘neither nor’

![Diagram](image)

b) Relate coordinated VP to the question word “What doing” – discuss how ‘neither nor’ means subject does not do the first, and not the second verb (shown by the crosses).
c) Take turns to produce sentences using ‘neither nor’ while the other one acts out the sentence
d) take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other one acts out the sentence
e) when accurate, remove templates, bring back to check responses
f) take turns to create sentences matching one of six templates from sections 2,3,6 and 7 other acts out sentence
g) when accurate, remove templates, bring back to check responses
h) Make combinations of the templates using coordinated subjects and/or verbs e.g.,

- Neither the cow nor the cat is jumping and running
- the cow and the cat are neither standing nor jumping
- the cow but not the cat is neither lying down nor sliding
i) take turns to create sentences matching these combined templates, other one acts out sentence
j) when accurate, remove templates, bring back to check responses
Neither nor (Subject NP + Adjective)

a) Introduce template with ‘neither nor’

b) Take turns to produce sentences using ‘neither nor’ while the other one colours in / draws

c) Take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other one colours in / draws

d) When accurate, remove templates, bring back to check responses

Neither nor (Adjective Phrase)

a) Introduce template with ‘neither nor’

b) Take turns to produce sentences using ‘neither nor’ while the other one acts out the sentence

c) Take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other one draws / colours in

d) When accurate, remove templates, bring back to check responses

e) Take turns to create sentences matching one of six templates from sections 4, 5, and 8, other draws / colours in

f) When accurate, remove templates, bring back to check responses

g) Make combinations of the templates using coordinated subjects and/or adjectives e.g.,
   a. Neither the hat nor the ball is big and blue
   b. The hat but not the ball is neither yellow nor stripy
   c. The hat and the ball are neither small nor black

h) Take turns to create sentences matching these combine templates, other one draws / colours in

i) When accurate, remove templates, bring back to check responses

Not only, but also (Subject NP)
a) Revise the templates showing coordination of NPs in subject position with VP. Use ‘not only, but also’ as coordinator and discuss how ‘not only, but also’ means that both the first and the second NP are doing the action (no crosses, like and)

Not only the cow but also the cat is jumping

b) Take turns to produce sentences using ‘not only, but also’ while the other one acts out the sentence
c) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, or ‘neither nor’) and the other acts out, using template as a guide
d) When accurate, remove templates, bring back to check responses

e) Take turns to create sentences matching one of eight templates from sections 2, 3, 6, 7, 10 & 11, other acts out sentence
f) When accurate, remove templates, bring back to check responses
g) Make combinations of the templates using coordinated subjects and/or verbs e.g.,

- Not only the cow but also the cat is jumping and running
- The cow and the cat are not only standing but also jumping
- The cow but not the cat is not only lying down but also sliding

h) Take turns to create sentences matching these combine templates, other one acts out sentence
i) When accurate, remove templates, bring back to check responses

Not only, but also (VP)

a) Introduce template with ‘not only, but also’

The cow is not only jumping but also running

b) Relate coordinated VP to the question word “What doing” – discuss how ‘not only, but also’ means subject does both the first and the second verb (shown by no crosses).
c) Take turns to produce sentences using ‘not only, but also’ while the other one acts out the sentence
d) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, or ‘neither nor’) and the other acts out, using template as a guide
e) When accurate, remove templates, bring back to check responses
f) Take turns to create sentences matching one of eight templates from sections 2, 3, 6, 7, 10 & 11, other acts out sentence
g) When accurate, remove templates, bring back to check responses
h) Make combinations of the templates using coordinated subjects and/or verbs e.g.,

- Not only the cow but also the cat is jumping and running
- The cow and the cat are not only standing but also jumping
- The cow but not the cat is not only lying down but also sliding

i) Take turns to create sentences matching these combine templates, other one acts out sentence
j) When accurate, remove templates, bring back to check responses
Not only, but also (Subject NP + Adjective)

a) Introduce template with ‘not only, but also’

\[
\text{Not only (the cow) but also (the cat) is black}
\]

b) Take turns to produce sentences using ‘not only, but also’ while the other one colours in / draws
c) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, ‘neither nor’) and the other one colours in / draws
d) When accurate, remove templates, bring back to check responses

Not only, but also (Adjective Phrase)

a) Introduce template with ‘not only, but also’

\[
\text{The cow is not only big but also black}
\]

b) Take turns to produce sentences using ‘not only, but also’ while the other one draws / colours in
c) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, ‘neither nor’) and the other one acts out the sentence
d) When accurate, remove templates, bring back to check responses
e) Take turns to create sentences matching one of six templates from sections 4, 5, and 8, 9, 12 & 13 other draws / colours in
f) When accurate, remove templates, bring back to check responses
g) Make combinations of the templates using coordinated subjects and/or adjectives e.g.,
   - Not only the hat but also the ball is neither big nor blue
   - The hat but not the ball is not only yellow but also stripy
   - The hat and the ball are not only small but also black
h) Take turns to create sentences matching these combine templates, other one draws / colours in
i) When accurate, remove templates, bring back to check responses

Everything together

a) Take turns to create sentences using any of the coordinators in any of the positions introduced in any combination, other one act out
b) Use templates to check any disagreements