Investigation of Meta-Linguistic and Meta-Cognitive Intervention to Improve Comprehension of Coordinating Conjunctions

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Abstract

**Background:** There is a limited evidence base available in the area of oral language comprehension for children with primary language comprehension difficulties, with existing research which demonstrates treatment effectiveness largely focusing on preschool or older school age children.

**Objectives:** This pilot study aims to investigate the efficacy of individually-tailored intervention and strategies to improve the oral comprehension skills of a child with primary language impairment aged 7 years 11 months.

**Methodology:** This intervention centred on a meta-linguistic approach with strategies tailored to match deficits of the individual participating in the study. A single case study design was chosen due to the heterogeneity of the population under investigation, allowing specific grammatical targets to be identified and treated using shapes and colours (Shape Coding, Ebbels 2007) to make the grammatical rules of English explicit. Rehearsal and visualisation strategies were employed to help the participant with working memory challenges. Comprehension monitoring strategies were explicitly taught to facilitate the participant to recognise when and how to ask for help.

**Results:** Non-parametric analysis comparing the child’s performance on pre and post assessment of treated and untreated measures demonstrated a statistically significant improvement ($p=.008^*$ 2-tailed) in comprehension of treated coordinating conjunction ‘neither/nor’ with no significant change in untreated structures. Spontaneous use of comprehension monitoring, and rehearsal and visualisation strategies were evident toward the end of therapy.

**Comprehension:** These findings provide preliminary evidence to support the use of a two-pronged approach in treating oral comprehension of younger school-aged children with primary language impairment.
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1. Introduction

Comprehension deficits are attributed to two factors: a deficit in underlying linguistic knowledge, or processing deficits of a specific or general nature. While errors in morphology and syntax may be due to an underlying deficit in linguistic representations, these deficits cannot explain more generalised processing difficulties (Boyle et al 2010). Processing deficit theories such as specific auditory processing difficulties or deficits of general processing capacity may offer a solution which can explain difficulties in the use of morphosyntax by children with language impairments (Leonard et al 2009). Features of language, such as morphemes, may be more difficult to acquire, particularly if they are presented and processed rapidly in the context of running speech (Bishop 1997). Children with comprehension difficulties may have problems understanding both written and spoken language (Boyle et al 2010). Difficulty comprehending spoken language may be exacerbated by slower cognitive processing speeds and deficits in phonological working memory capacity (Montgomery et al 2008).

Characteristics of children with comprehension deficits include difficulty with comprehension of morphology such as 3rd person singular and regular past tense markers (Rice et al 2000), the omission of auxiliary verbs (Conti-Ramsden 2003; Gathercole et al 2008), and incorrect verb argument structure (Paul 2007). Comprehension deficits may be characterised by difficulty understanding complex syntactic structures such as passive sentences, wh-questions or reversible sentences (Van Der Lely 1996), struggle in understanding lexical items, reduced ability to deduce meaning from conversation (Boyle et al 2010), issues with working memory capacity (Montgomery 2003), and have implications for processing ability (Schwartz 2010). A systematic review of language interventions (Law et al 2010) reports limited studies on the effectiveness of intervention for children with receptive language impairments (RLI). Those available in the area of oral language comprehension largely focus on pre-school or older school age children (Cirrin & Gillam 2008). Deficits in comprehension of language are more resistant to intervention than expressive language or phonological delay (Boyle et al 2010); therefore children with a comprehension deficit have greater
risk for unfavourable long term outcomes (IASLT 2007). This highlights the need for early intervention in the treatment of comprehension. The current study aims to investigate the efficacy of individually-tailored intervention and strategies to improve the oral comprehension skills of a child with a language impairment (LI) aged 7 years 11 months.

1.1 Intervention Approaches Addressing Language Comprehension

Current intervention approaches utilize strategies such as meta-linguistic awareness; that is, teaching specific grammatical targets by making the rules of English explicit (Ebbels 2007; Levy et al 2009; Bolderson et al 2011). Others emphasise meta-cognitive awareness focusing on strategies such as visualization and rehearsal (Gill & Klecan-Aker 2003), direct instruction, and comprehension monitoring (Bianco et al 2010). These interventions do not seek to eliminate the underlying problem but to change the disorder by teaching the parts of language the child does not know or has not yet acquired (meta-linguistic approach), or, teach strategies to help the child learn language by explicitly teaching them how to learn words or break down a word so they understand it (meta-cognitive approach).

The impact of expressive language intervention on generalized receptive skills has also been investigated, where expressive grammar was treated using verbal modelling of grammatical targets by the clinician (Camarata et al 2009). This type of approach addresses underlying processing difficulties and aims to make input more salient.

1.2 Meta-Linguistic Intervention

The evidence for the effectiveness of therapy for comprehension difficulties is limited (Law et al 2003). However, there has been some treatment effectiveness demonstrated for pre-school and older school-aged children.

Colourful semantics is a meta-linguistic approach which uses visual coding to aid the identification of syntactic parts of sentences. The difference between this and other visual coding interventions is that colourful semantics identifies the semantic roles of sentence constituents; it targets the predicate argument structure of sentences
(Bolderson et al 2011). Bolderson et al carried out a study examining the effects of colourful semantics with a focus on expressive language (2011). A within-participant design was used where the children were monitored over a 9 week baseline period and then over 8 weeks of therapy. It is acknowledged in the study that this design is weaker than the between-participant design used in larger studies; however, the limited sample size was justified, as the study aimed to replicate and extend results obtained by Bryan (1997), and was carried out as part of ongoing clinical work (Bolderson et al 2011). The 5-6 year old children in this study received therapy for 30-45 minutes, twice weekly for eight weeks. Though the focus of this study was on expressive language, a potential for improved comprehension was highlighted with a significant overall improvement on the Test of Receptive Grammar (TROG). However, Bolderson et al state that this improvement was not clearly related to therapy (2011).

Similarly, Camarata et al (2009) found significant gains in receptive language when children with specific language impairment (SLI) were exposed to expressive language intervention. This randomised control trial (RCT) consisted of 27 participants: 21 participants immediately enrolled in treatment, with the remaining 6 randomly assigned to a waitlist control condition. The participants received individual intervention designed to improve expressive language. Twenty-four one hour treatment sessions took place twice weekly over 12 weeks. Intervention techniques used to teach these targets included: imitation, modelling, conversational recasting, and milieu teaching (Camarata et al 2009). Significant comprehension effect ($p=<.001$) was measured using the auditory comprehension subtest of the Preschool Language Scale, third edition (PLS-3) (Zimmerman, Steiner & Pond, 1992). There was no significant change in the waitlist control group. The results of this study imply that recast, modelling, and imitation may be more facilitative of receptive gains, even for a child with SLI with relatively poor receptive language ability. Receptive language gains in this study may be a result of ‘cross-over effect’ in which training in one modality, such as expressive language, yields gains in an untreated modality, such as receptive language (Camarata et al 2009). Though this intervention has obvious benefits of improving expression and comprehension simultaneously, it is not suitable for all client profiles. Camarata et al state that grammatical progress is dependent on a variety of
factors such as: complex interactions of attention, long-term memory access to the child’s current repertoire of language structures, working memory and emotional-social processes (2009).

Ebbels (2007) has combined colour coding with shapes to teach grammar to school-aged children with SLI. Ebbels Shape Coding has been used to work on various structures including: wh-questions, passives, aspect and noun-verb agreement, conjunctions, and tense, with research studies to date including school-aged children 11-14 years old. The approach uses colours to illustrate parts of speech and shapes to code phrases according to their role and position in the sentence. This system allows for complex language to be visually explicit as the shapes can be placed inside each other, demonstrating the hierarchical structure of language (Ebbels 2007). This is a key advantage over systems which only use colours (Bryan 1997, Bolderson et al 2011). The movement of shapes also allows us to ‘show’ children how to form passive sentences and questions. Ebbels (2007) discusses intervention studies using shape coding. One study focused on comprehension of the dative form with three participants aged 11-12 at initial testing and 12-14 at the time of intervention. A subsequent study addressed the comprehension of comparative questions with the two participants from the first study. The results of these studies indicate that shape coding can be useful in teaching older children with SLI about verb argument structure, the dative form, wh-questions (including comparative questions), and passives. Nonetheless, analyses of individual cases highlight that this approach is not effective for all children for all these structures. For example, in study 1, one out of three participants did not significantly improve on dative or prepositional form. This participant was noted to have poor auditory memory skills; his poor understanding of dative and prepositional forms was likely due to his inability to remember the order of the three nouns present in sentences. Ebbels concluded that Shape Coding did not aid ability to remember the sequence of nouns in target sentences (2007). Another interesting outcome came from study 3, involving the past tense. It showed that not all children benefited from the system when taught in a group, but when provided with additional therapy in a pair, two children were able to improve. Therefore, some children may require particular methods of delivery in order to benefit from therapy.
Therapy provision must be flexible enough to accommodate the individual differences of children.

Ebbels, Mairč et al carried out a RCT of shape coding therapy to improve grammar in 14 secondary-aged students with LI, focusing on coordinating conjunctions (Ebbels et al 2012). Students were randomly assigned to two groups: therapy versus waiting controls. Therapy group received eight individual half-hour sessions with the SLT. The preliminary findings indicate significant improvements in comprehension of coordinating conjunctions ‘neither/nor’ and ‘not only but also’. The results are impressive; further research could investigate whether similar methods of therapy can be effective with younger children who have language impairment.

1.3 Meta-Cognitive and Other Strategic Approaches

The range of strategies targeting language comprehension includes scaffolding (Paul 2007), comprehension monitoring (Bianco et al 2010), rehearsal/rehearsal & visualisation strategies (Gill et al 2003), mental imagery (Center et al 1999), and visualising and verbalising strategies (Dixon et al 2001).

1.3.1 Comprehension Monitoring

There are two main aims in comprehension monitoring with children: firstly, the child must learn to recognise when they have not understood something; secondly, the child must learn to act upon this recognition by indicating to the speaker that they have not understood, and seek clarification. Bianco et al (2010) implemented a three year longitudinal study which found that comprehension-skill training can improve oral comprehension. This training, carried out with 4-5 year olds, was administered to independent groups of children with two of the programmes revolving around comprehension. The first group focused specifically on the components of comprehension: detection of inconsistencies, necessary and logical inferences, situational model and story structure. This aimed to raise children’s awareness of comprehension and develop their ability to monitor comprehension. The programme consisted of 30 minute sessions for 14-16 consecutive weeks per year, with each lesson targeting one of these components. The second comprehension-skill
programme involved the repeated reading of a storybook with small groups of children. This training, although language focused, was implicit both in its teaching format and in the way it drew the children’s attention to comprehension skills (Bianco et al 2010). The study applies a quasi-experimental design and its limitations are noted; the assignment of teachers and children to experimental groups was not randomized and no measures of the fidelity of programme implementation were obtained (Bianco et al 2010). The design was justified in the study by ensuring a natural setting for intervention. The positive results for comprehension cannot be ignored. Only the first group, provided with intervention focusing on the specific components of comprehension, showed long-term positive training effects in oral comprehension scores. These results were sustained for nine months post-therapy (Bianco et al 2010). These results would support promoting further use of comprehension-skill training to improve oral comprehension of children, where there is a focus on the specific components of comprehension.

1.3.2 **Visualisation and Rehearsal Strategies**

Dixon, Joffe & Bench investigated the efficacy of the ‘Visualising and Verbalising’ strategy, (originally developed by Bell (1987)), to enhance language comprehension in 9 to 15 year old children with LI (Dixon et al 2001). This approach was targeted at children whose language comprehension difficulties were hypothesised to be the result of ‘weak imagery’. This randomised study found that children’s language comprehension did not benefit more from ‘Visualising and Verbalising’ over ‘traditional’ therapy. Dixon et al concluded that the ‘Visualising and Verbalising’ intervention may place too high a demand on the working memory of a child with LI (2001).

In contrast to this, when treating deficits in following verbal directions, Gill et al (2003) found that both rehearsal strategy groups and rehearsal & visualisation strategy groups made significantly greater gains on formal testing than those who received the ‘traditional’ treatment. Their study included 30 children with SLI ranging in age from 6-11 years. The 30 children were placed into one of three therapy groups: traditional therapy, rehearsal strategy training, or rehearsal & visualization strategy training. The
allocation of participants to groups was matched to balance gender and grade and to reflect roughly equal mean pre-test scores. Statistical procedures compensated for minor differences in the groups. Participants received twice weekly language therapy sessions in a small group (2–3 children) for five weeks. The intervention comprised of 15 minutes dedicated to following directions, with the remaining 15 minutes directed toward expressive language activities. This study sought to determine if strategy training would create any residual enhancement of memory management systems. Results revealed that immediately following intervention, elementary students taught to use a rehearsal strategy and those taught to use a rehearsal & visualization strategy made significant gains over a traditional language therapy. Only the rehearsal & visualization group retained its gains over the traditional group eight months after the intervention (Gill et al 2003).

These findings support the long-term efficacy of systematic training via rehearsal & visualization to increase the ability of children with SLI to follow verbal directions. The effectiveness of rehearsal & visualisation strategies allows a useful explanation of language comprehension difficulties: it seems the activation of information must be retained sufficiently before it can be moved into working memory. For this to happen, the listener must actively seek to maintain it with a strategy such as visualisation & rehearsal (Cowan 1996). These findings warrant further investigation of the effect of rehearsal and visualisation strategies to improve the oral comprehension of children with language impairments.

Joffe et al also reported a positive effect of imagery training in children with SLI (2007). This study has a limited sample size of 9 children with SLI with a mean age of 9.6 years. The imagery training intervention consisted of five 30 minute sessions and took place over a three week period. The intervention improved question-answering performance of the children with SLI for literal questions. The study concluded that a relatively short intervention in the use of mental imagery is an effective way to boost the story comprehension of children with SLI.
1.4 **Current Research Study**

Underlying deficits relevant to comprehension impairments are believed to include insufficiency in underlying linguistic knowledge, or processing inabilities of a specific or general nature. It has been established that current research investigating the efficacy of comprehension intervention in the area of oral language comprehension is limited. This amounts to limited investigation of the efficacy of various interventions, and a lack of application of interventions to younger school-aged children (Cirrin & Gillam 2008, Law et al 2010). Effective approaches for pre-school and older school-aged children (11-14 years) include: shape coding therapy (Ebbels 2007, Ebbels et al 2012), comprehension monitoring (Bianco et al 2010), and rehearsal & visualisation strategies (Gill et al 2003; Joffe et al 2007). The effectiveness of these approaches warrant further study to identify whether similar methods of intervention would be successful with a younger school-aged population. This will enhance our knowledge about the nature and treatment of oral language comprehension. The current research is a pilot study that aims to investigate the efficacy of individually-tailored intervention and strategies to improve the oral comprehension skills of a child with primary language impairment aged between six and nine years old. This intervention centres on a meta-linguistic approach, with strategies then tailored to match deficits of the individual participating in the study.
2. Methods

2.1 Study Design

Single case studies have been demonstrated to be more appropriate than randomized control trials for studying the effects of a particular treatment with a heterogeneous population (Franklin 1997), such as children with receptive language impairment. Pring (2004) contends that it is premature to rely on evidence from RCTs for best practice in SLT. There is a need to build efficacy-based research from detailed descriptions of individual profiles and the variables that have a bearing on treatment outcomes. Single case study research is of vital importance, and is considered to be the best design for gaining evidence evaluating practice in SLT (Dodd 2008). Case studies allow for more in-depth testing and provide better information about the course of intervention and clinical decisions made.

The benefits of single case study designs include precise information about the outcomes in terms of acquisition, generalisation, and maintenance. Case studies provide a perspective on individual differences in symptomatology and varying responses to therapy. The development of evidence based practice consists of a hierarchal series of 5 phases (Robey & Schulz 1998). Each phase must be successfully completed before researchers can move to the next step of the process. Therefore, the role of this single case study design is appropriate in initial stages (1 & 2) during the testing and refining of therapy under optimal conditions (Joffe 2008).

With this in mind, a single subject research study with the subject acting as his own control was implemented. The results reported in this study are results from a single case study that was carried out as part of a case series with children aged 6-9 years. Baseline measures over two sessions were taken, with follow up post-intervention. Untreated items were used as a control for treated items; the student researcher hypothesised that a significant difference would be evident in the treated structures but no difference or a non-significant difference in the untreated targets. A further control measure was introduced in the form of an expressive language task (MLUw). It was expected that this may change slightly but not significantly without treatment.
2.2 Recruitment of Participant

One child, B, aged 7;11 at initial assessment, was recruited from the local area with the assistance of the local HSE Speech and Language Therapy community clinic. Participant selection was based on specific inclusionary and exclusionary criteria as outlined below:

2.2.1 Inclusionary Criteria:
- English as first language
- Be aged 6-9 years at time of recruitment
- Have a diagnosis of primary language difficulties that includes 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:
  o the receptive language index (RLI) of the Clinical Evaluation of Language Fundamentals 4 (CELF-4)
  o Test of Receptive Grammar (TROG)
  o The receptive portions of either the Reynell Developmental Language Scales (RDLS) or the Preschool Language Survey 4 (PLS-4)

2.2.2 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.

2.3 Participant

B is one of five children from a monolingual English-speaking home: he has two older brothers, one older sister, and one younger sister. He was originally referred to speech and language therapy services by his teacher. Previous language assessment via the Clinical Evaluation of Language Fundamentals, fourth edition (CELF 4) (Semel, Wiig & Secord 2006), (CA 5;11) indicated a severe language impairment, characterised by an expressive language SS of 55, and receptive language subtests scale scores as follows:
B, though quiet and shy, was observed to have good attention and willingly participated in assessments. B was attending counselling after witnessing a traumatic incident. A sibling was diagnosed with Attention Deficit Hyperactive Disorder. B’s mother noted similar traits in B. B’s parent reported that B has poor overall academic performance, needing a lot of help to complete homework. B’s mother described him as a ‘worrier’ who would show frustration when not understood: “you don’t understand me. Listen to me”. B’s parent’s main concern was his lack of expressive vocabulary, and limited understanding of words. B had attended two out of ten sessions of a block of group therapy targeting expressive language skills; B’s parent reported that he did not like a group dynamic: “he got very distracted by the other children”.

At the beginning of this study, B’s linguistic and processing skills were assessed via The Test for Reception of Grammar, version 2 (TROG-2) (Bishop 2003), British Picture Vocabulary Scale: third edition (BPVS-III) (Dunn & Dunn 2009), and Working Memory Test Battery for Children (WMTB-C) (Pickering & Gathercole 2001). These were for the purpose of profiling B’s language skills and elucidating the nature of his receptive language profile prior to developing intervention targets.

Mean length of utterance word score (MLUw) on the Expression, Reception and Recall of Narrative Instrument (ERRNI) (Bishop 2004) was derived as an expressive language control measure. A second assessment session was carried out, using probes developed specifically for the study, encompassing structures consistent with failed items on the TROG to obtain detailed baseline information on structures to be treated.

During assessment sessions B showed good attention and willingly participated in all assessments. Although able to participate in conversation, B displayed working memory issues and processing difficulties. This was evidenced by frequent hesitations; B needing considerable time to process questions and to formulate answers to these questions. B often appeared to ‘trail off’, leaving sentences unfinished.
2.4 Ethical Considerations

This research received ethical approval from the HSE Mid-Western Regional Hospital Research Ethics Committee. B’s parents were provided with an information letter explaining the details of the study prior to consent (Appendix A). B was also provided with a child information letter prior to his participation in the research study (Appendix B). Informed consent was attained from B’s parents prior to initial assessment (Appendix C).

2.5 Initial Assessment

Results of the TROG revealed that B had difficulty understanding complex syntactic structures (blocks passed: 7; SS: 69). His score on the BPVS III suggested delayed vocabulary development (raw score: 78; SS: 77). His MLUw on the ERRNI (11.04) is equivalent to a SS of 128.

The WMTB–C revealed B’s Visio sketchpad (Block Recall subtest SS: 114) & phonological loop (Digit Recall subtest SS: 89) as relative strengths, central executive (Backward Digit Recall subtest SS: 72) subtest scored -2SD from the mean suggesting a processing deficit.

Nine probes were developed to further examine blocks failed on the TROG. These probes were modelled on the layout of the TROG. B had to select one picture from a choice of four (containing lexical and grammatical distracters) to match the target sentence. Ten picture to sentence matching tasks were developed for each construction being assessed: three elements, relative clause in subject, not only X but also Y, reversible above and below, zero anaphor, pronoun gender/number, pronoun binding, neither/nor, X but not Y.
### 2.6 Procedure

Research illustrates stronger learning when stimuli are presented in a distributed fashion, rather than all at once. For example, Ambridge et al (2006) found that preschoolers were more successful learning grammatical constructs in a distributed condition (two exposures over 5 days) versus a massed practice condition (ten trials in a single day). Alt et al (2012) state that more examples spread over several sessions are better than fewer examples in a single session.

With this in mind, B was seen in the University of Limerick Speech and Language Therapy Clinic for 8 sessions twice weekly, from a planned ten sessions. The number of sessions was chosen to be consistent with the number of sessions provided in previous research studies demonstrating efficacy of the chosen interventions, bearing in mind the younger age range of the children in the current study and the constraints of the university term.

Sessions alternated from morning to afternoon and were not planned to occur on consecutive days. This was to ensure a distributed condition and allow for sleep-dependent consolidation. Specifically related to language, sleep has proven to enhance declarative memory for school-aged children (Wilhelm et al 2008). Each session lasted approximately 45 minutes; 30 minutes were dedicated to meta-linguistic intervention with the remaining 15 minutes targeting comprehension monitoring and visualisation/visualisation & rehearsal strategies. Meta-cognitive and comprehension monitoring intervention were alternated to occur at the start/end of each session.

<table>
<thead>
<tr>
<th>Probe Structure</th>
<th>Score at Initial Assessment</th>
</tr>
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<tbody>
<tr>
<td>Three elements</td>
<td>10/10</td>
</tr>
<tr>
<td>Relative clause in subject</td>
<td>9/10</td>
</tr>
<tr>
<td>‘Not only X but also Y’</td>
<td>3/10</td>
</tr>
<tr>
<td>Reversible above and below</td>
<td>10/10</td>
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<tr>
<td>Zero anaphor</td>
<td>6/10</td>
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<tr>
<td>Pronoun gender/number</td>
<td>9/10</td>
</tr>
<tr>
<td>Pronoun binding</td>
<td>9/10</td>
</tr>
<tr>
<td>‘Neither/nor’</td>
<td>0/10</td>
</tr>
<tr>
<td>‘X but not Y’</td>
<td>6/10</td>
</tr>
</tbody>
</table>

*Table 1: B’s results on probes at initial assessment*
was to observe a priming effect, if any, of spontaneous use of the strategies during the shape coding activities. It also provided variability of language input which is key for learning of grammatical structures (Alt et al. 2012).

Treatment targets of coordinating conjunctions were chosen based on B’s assessment results. Rehearsal and visualisation & rehearsal strategies were employed to help B cope with working memory limitations. Comprehension monitoring strategies were explicitly taught to facilitate B to recognise when and how to ask for help.

2.6.1 Meta-Linguistic Intervention:
Recommended steps of Shape Coding CD ‘Shape Coding Materials’ (Susan Ebbels ©) were followed (Appendix D). Therapy block consisted of a sequence of 9 suggested steps:

- 1 intro to SC: introduction of shapes for subject NP, auxiliary, verb and adjective phrases.
- Steps 2, 3, 4, and 5 focused on coordinating conjunction “and” vs ‘but not’.
- Steps 6, 7, 8 and 9 focused on coordinating conjunction “neither/nor”.

B’s progress determined the timing of steps; a score of 80% correct was obtained before moving to the next step. Coordinating conjunctions were introduced by explaining their meanings and use, linked to the colours and shapes of Shape Coding. They were then practised in 4 different constructions:

1. Coordinated NP + VP: The cat and the dog are jumping
2. NP + Coordinated VP: The cow is jumping but not running
3. Coordinated NP + AP: Neither the ball nor the box is blue
4. NP + Coordinated AP: The ball is neither green nor spotty

These constructions were presented using SC templates from the SC CD (Susan Ebbels ©) (further detail in Appendix D).

The student SLT administering therapy provided examples for B. The student SLT would then produce sentences, while B ‘acted out’/drew pictures/coloured in pictures to ‘make’ the sentence. Materials used included wooden dolls, plastic animals, action
pictures, and a laptop. When accurate, templates were removed but brought back to check responses.

2.6.2 Meta-Cognitive and Other Strategies:

The student SLT introduced the rehearsal strategy during B’s second therapy session. The student SLT provided specific instructions on following directions using the rehearsal strategy on its own initially; these were adapted from Gill et al (2003). B was instructed to repeat the directions aloud after they were stated by the student SLT.

Directives included manipulation of objects, for example: “put the smallest yellow block in the bucket and put the toy cow under mom’s chair”. B grasped this concept very quickly and was able to rehearse with minimal cueing in session two and three. ‘Visualisation’ was introduced in conjunction with the rehearsal strategy during therapy session four (Gill et al 2003; Joffe 2007). B was asked to ‘visualize’ the application of the instructions as the student SLT stated them. Instructions such as “imagine it happen” were provided. A sample instructional script for rehearsal, and visualisation & rehearsal is recorded in Appendix E (Gill et al 2003; Joffe et al 2007). If B did not appear to be looking at the objects as the instructions were stated, he was prompted verbally and/or gesturally. The student SLT encouraged B to rehearse the instructions simultaneously as he visualized them, then to carry out the instructions. Directions were controlled for length and syntactic complexity and were increased gradually as B successfully carried out the tasks. Activities were varied throughout therapy to maintain interest and learning. Physical distance between B and the objects and temporal distance between the verbal instructions and compliance attempt were increased gradually as long as B remained successful. The increasing distances better reflected classroom conditions and helped B understand the need to use rehearsal to retain the information (Gill et al 2003). As B began to use the strategy spontaneously, prompts were faded and only used when necessary.

Comprehension monitoring strategies (Bianco et al 2010) were explicitly taught through picture matching and discussion, to facilitate B to recognise when and how to ask for help (Appendix F). Initial activities were designed to introduce various everyday situations where oral language comprehension may be compromised, for example:
noisy class rooms where you cannot hear the teacher speaking, or when your mother gives a very long instruction at home and you cannot remember all of it. Picture matching exercises were used to depict these situations and possible solutions. B was taught to reason about potential difficulties, and the importance of correctly interpreting environmental cues was emphasized. B was taught how to use logical procedures to solve these problems; for example, asking for repetitions or asking for shorter instructions. These preceding skills were then put to use in building a situation model (Bianco et al 2010). As therapy sessions progressed, various SC activities were manipulated by the student SLT to present situational opportunities for B to practice these strategies. For example, student SLT would present a long complicated sentence in a SC activity. B would then have to ask for a repetition or for the student SLT to break down the sentence. If B did not spontaneously ask for this help the student SLT would verbally prompt him to recognise the issue: “that was a very long sentence, it’s hard to remember”. B would then have the opportunity to use a strategy. If he did not ask for help after sufficient time the student SLT would then prompt; “what could you do to help you understand/remember that long sentence?” If B still didn’t ask for help the SLT would prompt; “maybe you could ask me to make the sentence shorter”. Prompts were faded as B’s spontaneous ability to recognise when and how to use these strategies increased.

2.7 Outcome Measurement

An expressive language control was recorded pre and post intervention using the ERRNI, and untreated comprehension targets were also measured to determine if there was a treatment-specific effect.

A student SLT carried out treatment while a second student SLT observed ensuring comprehensive recording and monitoring of the participant’s responses during assessments and therapy sessions. Student SLTs compared notes on B’s responses and scores to ensure inter-rater reliability.

With parental consent, audio recordings of assessment and therapy sessions were taken to monitor treatment fidelity and to allow for detailed analysis of in-session responses and to ensure reliability of results. The single case study approach affords an
opportunity for recording of in-session exposures and responses, monitoring the effects of session timing and order of intervention effects. Post-intervention treatment results can be interpreted in the light of such data.

Generalisation outside of the clinic was measured by B’s mother keeping a home work diary. B’s school teacher was invited to contribute to the study by reporting any observations of generalisation of strategy use to the classroom. This did not occur.

2.8 Data Analysis

A non-parametric analysis comparing B’s performance on pre and post assessment of treated and untreated measures was carried out using the Statistical Package for the Social Sciences (SPSS) (IBM 2011). The McNemar test was used to compare two categorical variables: time 1 (pre-therapy) and time 2 (post-therapy) assessment results (Pallant 2010) on: blocks passed on the TROG, treated probes, and untreated probes. The expressive language control ERRNI MLUw SS pre and post therapy was compared; the raw MLUw score could not be compared as the number of utterances produced by B increased post therapy. The critical alpha probability (p) value at which differences/relationships were considered to be statistically significant was p=.05.
3. Results

This section will first outline the response to intervention for comprehension of coordinating conjunctions. It then outlines B’s response to the different strategies. This section also presents results of an analysis of in-session exposures and consideration of timing of sessions and order of introduction.

3.1 Response to Intervention for Comprehension of Conjunctions

B was an enthusiastic participant in therapy; he enjoyed the shape coding activities and materials, particularly using plastic animals and the ‘Paint’ program on the laptop.

Figure 1 presents pre-therapy and post-therapy assessment results on the TROG, treated: ‘and’ vs. ‘but not’, ‘neither/nor’, untreated ‘not only but also’, and control probe ‘zero anaphor’.

![Figure 1: Pre and post therapy assessment results](image-url)
The Y axis in Figure 1 represents the raw score. Raw scores have been converted to percentages for visual display. Each probe had a set of ten items and hence matched items were comparable pre and post intervention on the McNemar test for statistical significance.

Figure 1 illustrates that results from assessment carried out one week after intervention indicate a statistically significant improvement in the treated coordinating conjunction ‘neither/nor’ (McNemar p = .008* (2-tailed)). Increases in scores on the TROG (p = .625* 2-tailed) and coordinating conjunction ‘and’ vs. ‘but not’ (p = .687* 2-tailed) were not statistically significant. No change was evident for untreated coordinating conjunction ‘not only but also’ (p = 1.00* 2-tailed) or control probe zero anaphor (p = 1.000* 2-tailed) after intervention. These results show no generalisation to untreated targets.

The lack of change in untreated target ‘not only but also’ and control structure ‘zero anaphor’ are suggestive of a treatment specific effect on targeted items ‘and’ vs. ‘but not’ and ‘neither/nor’.

A decrease in B’s MLUw on the ERRNI (11.04 pre-therapy) to 10.09 post intervention was not significant (p value of .2775 * (2-tailed)). Although the mean number of words per utterance decreased, there was an increase in amount of utterances B produced to tell the ‘fish story’.

### 3.2 Rehearsal / Rehearsal & Visualisation

At initial assessment the WMTB-C was carried out, which involved a digit recall activity. During this subtest B displayed a good understanding of how to rehearse orally presented information and only needed one session to learn how to use the rehearsal strategy. Visualisation was introduced in treatment session four and used in conjunction with the rehearsal strategy. Table 2 illustrates B’s performance on rehearsal/ visualisation & rehearsal in clinical activities. B attained 100% correct on structured activities during every other session. The sessions in which B remembered to rehearse all targets took place early in the day. The therapy sessions in which B forgot to use rehearsal & visualisation strategies, or did not do so accurately, took
place at 2pm or later. Lower performance levels in the afternoon may be due to fatigue after school and/or poor attention when attending therapy at this time. This may present an inaccurate representation of B’s true ability.

Spontaneous use of the strategy in SC activities does not appear to be primed by targeting rehearsal & visualisation prior to SC activities in the same session. For example, in session 7 rehearsal & visualisation strategies were targeted at the start of session. B was observed to spontaneously use strategy only three times during the rest of the session. In session 9, B used strategy spontaneously 9 times though it was not targeted until the end of the session, and so spontaneous use before this was not primed (Table 2).
<table>
<thead>
<tr>
<th>Therapy Session</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Reassessment session</th>
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</thead>
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<tr>
<td>% Correct responses during introduction to rehearsal</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>% Correct in rehearsal activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>83%</td>
</tr>
<tr>
<td>% Correct on introduction to visualisation and rehearsal</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>% Correct in visualisation and rehearsal activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80% 100% 66% 100% 80%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session time</th>
<th>Morning</th>
<th>Afternoon</th>
<th>Morning</th>
<th>Afternoon</th>
<th>Morning</th>
<th>Afternoon</th>
<th>Morning</th>
<th>Morning</th>
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</thead>
<tbody>
<tr>
<td>Number of spontaneous use of strategies over sessions</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>19</td>
<td>8</td>
<td>3</td>
<td>9</td>
<td>27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time during session when visualisation and rehearsal were targeted</th>
<th>End</th>
<th>Start</th>
<th>End</th>
<th>Start</th>
<th>End</th>
<th>Start</th>
<th>End</th>
<th>End</th>
</tr>
</thead>
</table>

*Table 2: In session data; visualisation & rehearsal activities*
3.3 Comprehension Monitoring

As B’s therapy block progressed, he became more aware of environmental barriers affecting oral language comprehension. Figure 2 illustrates the increase of B’s spontaneous use of comprehension monitoring strategies throughout the therapy block. B’s mother also reported generalisation of this strategy outside of the clinical setting: “he asked me to repeat long sentences in the car on the way to school. He told his brothers to be quiet when we were doing homework because he couldn’t hear what I was saying”.

Figure 2: In session data; spontaneous use of comprehension monitoring during block
B was introduced to the SC method over two therapy sessions. Each shape was recapped in the third session before targeting coordinating conjunctions. The amount of exposure to each structure in a session varied depending on: what items were being recapped from the previous session, and B’s knowledge of each structure (he needed more examples of some constructions before comprehension was evident). Figure 3 demonstrates the exposures per structure across B’s block of therapy:

*Figure 3: Exposure to structure across sessions*
4. Discussion

The aim of this study was to investigate the efficacy of individually-tailored intervention and strategies to improve the oral language comprehension skills of a child with language impairment aged 7 years 11 months. Results illustrate successful intervention using a two pronged approach of meta-linguistic and meta-cognitive intervention, in the treatment of coordinating conjunctions.

4.1 Meta-Linguistic Intervention

B did very well in SC activities; the nature of SC therapy seemed to reduce the processing demand of orally-presented information for B. The shapes and colours made the sentence components and structures more salient and provided visual cues for B. This is in contrast to approaches, such as Camarata et al (2009) that are implicit: modelling structures, recasting, without making the child aware of the sentence parts.

B responded very well to positive feedback throughout therapy; he was able to ‘act out’ sentences with ease and his confidence grew with every session. He looked forward to homework activities often asking for “more, harder homework this week”. B had not learned language implicitly in the normal way; however, he quickly illustrated ability to learn language using explicit strategies. B’s limited understanding of words and delayed vocabulary development, as evidenced by BPVS III scores and parental report, had the potential to limit progress using shape coding intervention in a restricted time frame.

Despite this, B presented a good knowledge of the vocabulary necessary for SC therapy, needing only a total of two sessions to introduce the technique (Figure 3).

The current study, similarly to Ebbels et al (2012), showed significant improvement in the coordinating conjunction ‘neither/nor’ (p=.008* 2-tailed). While improvement was evident with treated target ‘and’ vs. ‘but not’, it was not significant (p=.687* 2-tailed).

This difference between improvements on the target structures may be related to impact of ‘dosage’. During initial assessment, B showed some understanding of ‘and’ vs. ‘but not’ (raw score 6/10 on probe), but no knowledge of ‘neither/nor’ (raw score 0/10 on the probe). Yet, ‘and’ vs. ‘but not’ required intervention over three and a half sessions before
B demonstrated adequate comprehension of the target in clinical activities. ‘Neither/nor’ required only two sessions to achieve a similar level of understanding (Figure 3). It is evident from these raw scores at initial assessment that ‘neither nor’ had much more scope for improvement; therefore the treatment effect is magnified.

It is possible that ‘neither/nor’ achieved a greater improvement in a lesser time as a result of a structural priming affect (Leonard 2011); B’s knowledge of the sentence constructions (Coordinated NP + VP, NP + Coordinated VP, Coordinated NP + AP, NP + Coordinated AP within which the target conjunctions were presented) and their associated shapes may have been established and reinforced during the sessions targeting ‘and’ vs. ‘but not’. Leonard (2011) states that syntactic structures can be primed simply by listening to prime sentences; this is noteworthy as the student SLT orally presented B with target sentences.

The limited improvement on ‘and’ vs. ‘but not’ may illustrate a necessity for sleep-dependent consolidation and distributed condition in language intervention (Alt et all 2012). To facilitate a distributed condition and sleep-dependent consolidation during this study, sessions were not planned to be occur on successive days. Despite this, due to cancellations and public holidays, four sessions (two bi weekly) targeting ‘and but not’ took place on consecutive days. This may have increased the amount of exposure to the structure necessary for B to fully comprehend the construction.

Similar to Ebbels et al (2012), current study results illustrated improvement on the TROG raw and standard scores. During initial assessment, B achieved a SS of 69 on the TROG (blocks passed: 7), this increased to SS: 72 (blocks passed: 9) post-treatment. The blocks which showed improvement were ‘three elements’ ‘relative clause in subject’ and ‘reversible above and below’.

Treated targets of ‘and’ vs. ‘but not’ & ‘neither/nor’ showed no change on the TROG post intervention, that is to say both blocks were failed pre and post therapy. Despite this, B did illustrate improvement on the ‘neither/nor’ block. At initial assessment, B failed the ‘neither/nor’ block of the TROG by selecting three incorrect pictures (out of a possible four). This decreased post-intervention to one incorrect picture. B failed the ‘and’ vs. ‘but not’ block by selecting one incorrect picture pre and post therapy.
During all assessment sessions, B illustrated an awareness of failure: “I don’t know this one”. In both pre-therapy and post-intervention assessments B failed the three blocks preceding ‘neither / nor’ & ‘and’ vs. ‘but not’ (zero anaphor, pronoun gender/number, pronoun binding). His awareness of failing these blocks may have impacted his performance on blocks examining ‘and’ vs. ‘but not’ & ‘neither/nor’. It is perhaps noteworthy that ‘neither/nor’ & ‘and’ vs. ‘but not’ blocks were the final blocks assessed on the TROG (as per discontinuation criteria), it is possible that B’s attention had decreased nearing the end of the assessment.

4.2 Meta-Cognitive Intervention and Other Strategies

From clinical observation, improvement on untreated blocks (were ‘three elements’ ‘relative clause in subject’ and ‘reversible above and below’) may be a product of meta-cognitive intervention. It is important to note that even though B failed these blocks on the TROG at initial assessment, he scored well on the probes targeting these structures during initial assessment (Table 1). B was observed to spontaneously use both comprehension monitoring (Figure 2) and visualisation & rehearsal strategies (Table 2) throughout reassessment. The use of these strategies may have lessened the demands on B’s central executive, allowing him to process orally-presented sentences for longer and to identify the correlating pictures. These results can be likened to Gill et al (2003), who found residual enhancement of memory management systems immediately following intervention for rehearsal/rehearsal & visualisation strategies. These results also concur with Bianco et al (2010), where intervention focusing on the specific components of comprehension illustrated positive effects in oral comprehension scores. A follow up session several months post-treatment would be useful to identify if these gains will be maintained.

Meta-cognitive and comprehension monitoring intervention were alternated to occur at the start/end of each session. This facilitated variability in language input (Alt et al 2012) and also provided the opportunity to observe a possible priming effect of spontaneous use of strategies during SC activities. It was hypothesised that providing intervention on rehearsal and visualisation strategies before SC activities might prime spontaneous use of the strategy during SC therapy; however, this was not the case. B’s spontaneous use of
these strategies appears to be random: for example, B used the strategy spontaneously nine times when targeted at the end of session (session 9), and only 3 times when targeted at the start of session (session 7) (Table 2).

A further pattern was noted regarding the time of day at which B attended therapy. Intervention targeting rehearsal/rehearsal & visualisation strategies were more effective in morning sessions than afternoon sessions (Table 2). B’s afternoon results may have been influenced by fatigue following school attendance and a swimming lesson. B was observed to have poor maintenance of attention during these sessions, evidenced by excessive movement, distractibility, and lower activity scores (Table 2). There was one morning session where B did not attain 100% correct on rehearsal & visualisation. This session was the final assessment. B used the strategy spontaneously throughout the assessment (Table 2). The strategy itself was assessed at the end of this session; B was observed to lose attention at this point. This may have been due to effects of demands on cognitive processes from the previous 40 minutes of assessment.

4.3 Limitations

Single case study designs are used to assess whether a potential treatment has an effect that justifies further intervention (Pring 2005). This study justifies further investigation of meta-linguistic and meta-cognitive intervention for targeting oral language comprehension of younger school-age children with language impairment, aged between six and nine years. Though the results of this study are promising, there are limitations with its design.

Firstly, these results cannot be generalised to other clients, however similar they may be. A single client is not representative of the population and therefore cannot be viewed as a test of the efficacy of this treatment with other children who have language impairment (Pring, 2005). Secondly, the use of untreated items as a control is not considered the most appropriate approach as there is a possibility of generalisation to untreated items. This did not occur in the current study. The inclusion of an expressive language control was recorded to illustrate treatment effect and potentially strengthens the study design (Franklin 1997).
Finally, a follow up assessment several months post-intervention would provide valuable information highlighting long-term treatment effects of oral language comprehension. Unfortunately, time constraints did not allow for a follow up session in the current study.

4.4 Clinical Implications

The findings of this pilot study cohere with previous success in the use of Shape Coding therapy (Ebbels 2007; Ebbels et al 2012) when targeting comprehension of children with language impairment. Meta-cognitive strategy results in this study reiterate previous positive results for oral language comprehension (Gill et al 2003; Bolderson et al 2010). These meta-linguistic and meta-cognitive approaches were applied simultaneously to significantly improve the oral language comprehension of child with language impairment aged 7:11. Considering the limited studies demonstrating effectiveness for intervention for children with receptive language impairment (Law et al 2010), and the gap in research for intervention with younger school-aged children (Cirrin & Gillam 2008), these results have clinical implications.

The IASLT (2007) highlight the need for early intervention in the treatment of comprehension deficits. This study provides new evidence for the use of Shape Coding (Ebbels 2007) therapy with a younger school-aged child, as B is more than three years younger than the youngest child from Ebbels study (2012). Not only was the treatment successful, the Shape Coding method was straightforward to teach and the participant thoroughly enjoyed intervention methods. The steps are well laid out (Appendix D) and easy to grasp for a child of B’s profile.

These results encourage future research incorporating Shape Coding therapy to target oral language comprehension with children who have language impairment, aged between 6-9 years. It also warrants further investigation of potential working memory benefits, such as a reduction on processing demands and residual enhancement of memory management systems, for meta-cognitive intervention with children who have a profile similar to B. A RCT may be appropriate to further test the efficacy of these outcomes with children who have language impairment, aged between 6-9 years (Robey & Schulz 1998; Joffe et al 2008).
4.5 Conclusion

Eight sessions of Shape Coding therapy significantly improved comprehension of coordinating conjunction ‘neither / nor’. Meta-cognitive intervention generalised to spontaneous use of strategies in sessions and outside of the clinical setting. Meta-cognitive intervention was more effective at morning than afternoon. Meta-linguistic intervention appears to be less effective when administered on successive days. This study proves Shape Coding intervention to be successful for a child with a profile such as B’s.
5. References:


Appendix A
Parent Information Sheet

Study title: A pilot study on the use of Shape Coding 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 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 is 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 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 Shape Coding) 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 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 and contact details:

For further information please contact the researcher, Carol-Anne Murphy (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 your 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

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 Shape Coding 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 and Language Therapist, B.Sc, M.Sc. MIASLT, Clinical Therapies Department, University of Limerick

- I confirm that I have read and understand the information sheet dated.................... ............) 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

Shape Coding Steps "Shape Coding Materials" CD, word version. Susan Ebbels/Moor House School (Susan Ebbels©)

1. Intro to Shape Coding

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.

2. ‘And’ vs ‘but not’ (Subject NP + Verb)

- a) Introduce the templates showing coordination of NPs in subject position, e.g.,
  
  ![Template: 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’
  
  ![Template: 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
3. ‘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.,

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’

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 e.g.,
   - 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.

4. ‘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’

\[
\text{The ball} \quad \text{but not} \quad \text{the hat} \quad \text{is} \quad \text{red}
\]

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

5. ‘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.,

\[
\text{The cow} \quad \text{is} \quad \text{big} \quad \text{and} \quad \text{black}
\]

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’

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

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

6. 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)

Neither the cow nor the cat is jumping (around)

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

7. Neither nor (VP)

a) Introduce template with ‘neither nor’

The cow is neither jumping nor running

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

8. Neither nor (Subject NP + Adjective)

a) Introduce template with ‘neither nor’

\[ \text{Neither the cow nor the cat is black} \]

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

9. Neither nor (Adjective Phrase)

a) Introduce template with ‘neither nor’

\[ \text{The cow is neither big nor black} \]

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

**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
Appendix E

Teaching of Rehearsal

The rehearsal and visualization protocol followed 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 subvocally 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/drawing different amount of items.

**Teaching of Visualisation**

Depending on the child’s progress, once the child is spontaneously rehearsing with minimal cues, we will introduce visualization strategy. Once again, this is derived Gill et al (2003) and the introductory section of Joffe et al (2007):

1. Introduce the concept of visualization/’paint a picture of it in your mind’ as described by Joffe et al (2007) and Freeman, Robertson and Outhred (1999).

   Initially visual prompts in the form of drawings will be used to encourage visualization of images for each sentence and/or part of the sentence. In the first session, children will be shown a picture of a common item (umbrella) and asked to visualize it in their mind. This was used to introduce the idea of visualization. The use of picture cues was reduced over time according to the client’s progress.

2. **Sample instructional scripts for the rehearsal=visualization strategy training**
   *Children were instructed in rehearsal strategy as above. When they were able to rehearse with minimal cueing, visualization was added as follows:*

   **SLT:** “OK, this time I want you to do two things. I will give you a direction. Still say it, just like we’ve been doing. But this time, I want you to look at the things I name. When I say them, look at them to help you remember them. Try to see the direction all...”
your mind. Look at the objects and imagine their ending place. Let’s try one. Remember – say it and see it. Put the pencil in the cup.”

**Child:** (Looks at the SLT as the direction is given.)

**SLT:** “Wait – this time you don’t have to look at me. Instead, look at whatever I say. If I say cup, you look at the cup. If I say ‘put the pencil in the cup’, try to imagine the pencil being in the cup. OK. Try it. Put the pencil on the plate.”

**Child:** (Appears to be looking at the pencil and plate.) “Put the pencil on the plate.” (Then does it.)

**SLT:** “GREAT!! You said it and you saw it. Try another one. Remember, when I talk, look at the things. Say what I said. Then do it. Let’s try another one. Get a yellow block from the box and put it under the little box.”

**Child:** (Appears to be looking at the objects and points to the objects as he rehearses the directions.) “Put a yellow block out that box and into that box.” (Then does it.)

**SLT:** “Wonderful. Let’s try a tough one. What are you going to do when I give the directions?”

**Child:** “I look at the stuff and make a picture in my head of it done and I say it . . .what you did.”

**SLT:** “Good. Ready for a hard, hard, hard one? OK. Bring both erasers from the front blackboard and set them on the fourth desk on the window side and then sharpen your blue map pencil.”

**Child:** (Appears to view the objects and jumps up to begin carrying out the directive.)

**SLT:** “Wait!! We’re gonna do two things. Do you know what they are?”

**Child:** “Yea! See it AND say it. I can do em both.”

**SLT:** “OK. Lets try it again. I’m listening for you to say it and watching for you to look at it. Bring both erasers from the front blackboard and set them on then fourth desk on the window side and then sharpen your blue map pencil.”

**Child:** (Looks at objects as he repeats the instructions, then carries them out.)
SLT: “Now I won’t remind you very often – but you remind yourself what to do every time, before I give you the direction.”
Appendix F

Comprehension Monitoring

These steps were introduced/taught in sessions 1-2, and 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 to do to be a good listener. Brainstorm, getting the child’s ideas followed by discussion. Try to elicit the following points from the child, ideally using the child’s 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 backed up by showing the appropriate Boardmaker/visual prompt card and use adult modeling of ‘good’ and ‘bad’ listening using examples of all the rules.

   We could introduce playing a guessing game where the child and adult take turns 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/visuals on the wall as a chart to remind the child of the ‘rules’.

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 or dad or their friends.