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Research Report

Improving comprehension in adolescents with severe receptive language impairments: a randomized control trial of intervention for coordinating conjunctions

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Abstract

Background: Little evidence exists for the effectiveness of therapy for children with receptive language difficulties, particularly those whose difficulties are severe and persistent.
Aims: To establish the effectiveness of explicit speech and language therapy with visual support for secondary school-aged children with language impairments focusing on comprehension of coordinating conjunctions in a randomized control trial with an assessor blind to group status.
Methods & Procedures: Fourteen participants (aged 11;3–16;1) with severe RELI (mean standard scores: CELF4 ELS = 48, CELF4 RLS = 53 and TROG-2 = 57), but higher non-verbal (Matrices = 83) and visual perceptual skills (Test of Visual Perceptual Skills (TVPS) = 86) were randomly assigned to two groups: therapy versus waiting controls. In Phase 1, the therapy group received eight 30-min individual sessions of explicit teaching with visual support (Shape Coding) with their usual SLT. In Phase 2, the waiting controls received the same therapy. The participants' comprehension was tested pre-, post-Phase 1 and post-Phase 2 therapy on (1) a specific test of the targeted conjunctions, (2) the TROG-2 and (3) a test of passives.
Outcomes & Results: After Phase 1, the therapy group showed significantly more progress than the waiting controls on the targeted conjunctions ($d = 1.6$) and overall TROG-2 standard score ($d = 1.4$). The two groups did not differ on the passives test. After Phase 2, the waiting controls made similar progress to those in the original therapy group, who maintained their previous progress. Neither group showed progress on passives. When the two groups were combined, significant progress was found on the specific conjunctions ($d = 1.3$) and TROG-2 raw ($d = 1.1$) and standard scores ($d = 0.9$). Correlations showed no measures taken (including Matrices and TVPS) correlated significantly with progress on the targeted conjunctions or the TROG-2.
Conclusions & Implications: Four hours of Shape Coding therapy led to significant gains on comprehension of coordinating conjunctions which were maintained after 4 months. Given the significant progress at a group level and the lack of reliable predictors of progress, this approach could be offered to other children with similar difficulties to the participants. However, the intervention was delivered one-to-one by speech and language therapists, thus the effectiveness of this therapy method with other methods of delivery remains to be evaluated.

Keywords: intervention, randomized control trial, language impairment, language disorder, receptive language, Shape Coding, adolescents.

What this paper adds?
What is already known on this subject?
Many children supported by speech and language therapy services have receptive language impairments. However, there is little evidence of the effectiveness of speech and language therapy for receptive language difficulties, particularly in older children and those with severe receptive language difficulties.

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What this study adds?
This randomized control trial with blind assessment shows that explicit speech and language therapy with visual support can lead to significant gains on a specific test of the targeted structures and can also generalize to a standardized test. Progress was maintained for 4 months. Therefore, a small amount of speech and language therapy can lead to significant gains in comprehension, even for adolescents with severe receptive language difficulties.

Introduction

Language impairments affect approximately 7% of children (Tomblin *et al.* 1997) and for some their language impairment persists into adolescence, affecting their educational achievements (Conti-Ramsden 2008), and into adulthood, affecting their employment prospects (e.g. Law *et al.* 2009). Language impairments persist more in children with both receptive and expressive language impairments (RELI). Indeed, Clark *et al.* (2007) found that of 58 children with severe RELI at school entry, only two had language scores in the normal range 6 years later. They concluded that 'receptive SLI [specific language impairment] rarely resolves and trials of therapy are urgently needed' (p. 614).

Despite the long-term, severe difficulties of children with RELI, receptive language impairments have received relatively little research attention. This is particularly the case for adolescents, who also receive limited professional services (Dockrell *et al.* 2006).

Theories of SLI and implications for intervention

Several theories of SLI have been proposed. Linguistic theories claim that grammatical difficulties are the primary deficits. Processing theories, in contrast, propose that processing problems cause language difficulties, either directly or because certain aspects of language are particularly vulnerable.

Ullman and Pierpont (2005) put forward a different proposal: the Procedural Deficit Hypothesis (PDH), which hypothesizes that many children with SLI have a deficit in *procedural memory.* This is involved in implicit acquisition, storage and use of knowledge and is hypothesized to be used in implicitly learning the rule-governed aspects of grammar. However, they proposed that another memory system, *declarative memory* (which learns explicit information), is spared in SLI and can be used partially to compensate for the procedural memory deficits, by learning rules explicitly.

The PDH is supported by several studies, but most recently by Lum *et al.* (2012) who found that while children with SLI were impaired at procedural memory, visuo-spatial working memory was intact, as was declarative memory once working memory and language deficits were controlled for. They found grammatical abilities were correlated with procedural memory in typically developing children, but with declarative memory in children with SLI, indicating that children with SLI may be using their largely intact declarative memory system to learn grammar instead of their impaired procedural memory system.

Linguistic theories of SLI predict that providing enhanced but essentially normal language stimulation should have little effect on grammatical abilities and intervention should teach compensatory strategies using the children's relative strengths to help them learn language. The PDH implies that intervention should use their largely intact declarative memory system and teach grammar explicitly to children with SLI. Also, if working and declarative memory are normal for visuo-spatial information, then intervention could capitalize on their relative visual strengths. Thus, the PDH predicts the most effective interventions should explicitly teach the rules of language using visual support. In contrast, processing theories would predict that any intervention which focuses on explicit teaching of linguistic rules should exacerbate their difficulties, as this would involve additional processing.

Intervention studies including a focus on improving receptive language in school-aged children with receptive language difficulties

Reviews of the effectiveness of speech and language therapy for children with language impairments (e.g. Law *et al.* 1998, 2003) have found little reliable evidence that speech and language therapy for receptive language difficulties can be effective and have concluded that 'the most substantial single gap in the literature [. . .] is the lack of good-quality literature about intervention for children with severe receptive language difficulties' (Law *et al.* 2004: 935) and that there is 'an overall lack of evidence for approaches to effective treatment for children with RELI' (Boyle *et al.* 2010: 997). Of the few studies that have investigated receptive language intervention in school-aged children, several have failed to find any significant effects (Bishop *et al.* 2006, Boyle *et al.* 2009, Gillam *et al.* 2008, McCartney *et al.* 2011). Others, however, have found significant improvements in receptive vocabulary (Parsons *et al.* 2005, Throneburg *et al.* 2000), specific grammatical structures (Ebbels and van der Lely 2001, Ebbels 2007), and general text and

sentence comprehension (Joffe *et al.* 2007, Tallal *et al.* 1996). The studies investigating receptive language intervention at sentence level are discussed in more detail below.

Intervention for general sentence-level comprehension

Several studies of the Fast ForWord (FFW) programme (Scientific Learning Corporation 1998) (which consists of highly intensive listening exercises recorded with acoustically modified speech) have focused on improving receptive language. Early studies reported significant improvement in children's language comprehension (Tallal *et al.* 1996). However, recent independent large-scale randomized control trials (RCTs) (Cohen *et al.* 2005, Fey *et al.* 2010, Gillam *et al.* 2008) found control groups showed equal progress to those receiving FFW.

Studies by Boyle and McCartney and colleagues of commonly used interventions delivered in mainstream schools (Boyle *et al.* 2009, McCartney *et al.* 2011) found that on the Clinical Evaluation of Language Fundamentals—3rd Edition (CELF-3) Receptive Language Scale, children receiving speech and language therapy showed no greater progress than controls. However, this could be due to the fact that very few of the therapy activities, as described by McCartney *et al.* (2004), appear to include work on receptive language (with the exception of vocabulary, which is unlikely to have much impact on the CELF Receptive Language Scale). More concerning is the finding that the children with RELI made no progress with expressive language either. This was in contrast to those with Expressive Language Impairment (ELI) who made progress with expressive language when they received therapy from a speech and language therapist (SLT) or SLT assistant employed by the research project (Boyle *et al.* 2009), but not when it was delivered using the 'consultative model' (McCartney *et al.* 2011). Nevertheless, another study (Ebbels *et al.* 2007) showed explicit therapy improved the production of verb argument structure in children with RELI. Thus, it seems that school-aged children with RELI can make progress in expressive language with therapy when the intervention is explicit and targeted and the outcome measures are closely linked to the intervention.

Intervention for comprehension of specific grammatical structures

Ebbels and colleagues showed that explicit speech and language therapy using 'Shape Coding' (which uses visual templates and patterns to explicitly teach the rules of grammar) improved comprehension of 'wh' questions and passives (Ebbels and van der Lely 2001) and dative sentences (Ebbels 2007). In contrast, a study using implicit computerized training aiming to improve comprehension of specific grammatical structures (Bishop *et al.* 2006) found no difference between children trained either with or without modified speech and untrained children who received only their 'standard' speech and language therapy package. These conflicting results may be due to different approaches (explicit versus implicit) or method of delivery (SLT versus computer).

Intervention for adolescents with language impairments

Of the studies discussed above, very few have included adolescents with language impairments. The exceptions are the studies by Ebbels and colleagues, where all the children were over 11 years and Bishop *et al.*'s (2006) study, which included children aged 8–13 years. In addition, we know of two published studies of speech and language therapy for word finding difficulties which included adolescents (Ebbels *et al.* 2012, Wright *et al.* 1993) and one on production of verb argument structure (Ebbels *et al.* 2007).

Summary

Receptive language impairments, particularly in adolescents, are neglected in the literature, despite receptive language difficulties affecting young people's long-term life chances. Studies have shown that intervention aimed at improving the basic auditory processing of language and hence receptive language is probably not effective. Generalized language intervention also does not seem to improve receptive language (or expressive language in children with RELI). However, specific intervention that explicitly teaches the rules of grammar and uses visual support appears to be effective.

Aims of the current study

This study aims to investigate the effectiveness of a speech and language therapy method (Shape Coding; Ebbels 2007) which explicitly teaches the rules of English using visual patterns of shapes as a support (thus fitting well with the PDH) using an RCT design. It focuses on a specific area of comprehension and uses measures which are closely related to the target and also investigates generalization. For our specific targets, we chose comprehension of coordinating conjunctions, as these occur frequently in classroom instructions and general conversation. Indeed, use of *and* and *but* is usually introduced in Year 2 in English schools (albeit with a focus on written English) and use of connectives including *and* and *but* is needed to achieve the National

Curriculum Level 2 in writing (the level expected of 7 year olds). Written use of connectives is unlikely to be accurate unless the children can understand them and use them in speech. We targeted those coordinating conjunctions which appear in the Test of Reception of Grammar (TROG-2) (Bishop 2003): *but not, neither nor, not only but also*, as we could then use responses to this test as part of our outcome measures.

Thus, the primary research question was: For young people with RELI of secondary school age, will 4 h of one-to-one explicit teaching of coordinating conjunctions with visual support (Shape Coding) with their usual SLT improve their comprehension of targeted coordinating conjunctions? The secondary research questions were: Will this have any effect on scores on a standardized test of comprehension of grammar (TROG-2) or generalize to other grammatical structures (passives)?

Method

Participants

This study was carried out at a specialist residential school for pupils with language impairments in the UK. All pupils are tested at specific time points (at 11, 14 and 16 years) on the Clinical Evaluation of Language Fundamentals—4th Edition (CELF-4) (Semel 2006) and British Picture Vocabulary Scale—2nd Edition (BPVS-2) (Dunn *et al.* 1997) to measure general language progress during their time in the school. They are also assessed on the Test of Visual Perceptual Skills (TVPS) (Gardner 1988) as part of their pre-admission assessment and at the same intervals as the language tests if they are on the occupational therapy caseload. For this study, all pupils in years 6–9 (aged 10–14 years) in the academic year before the study intervention started were tested on the TROG-2. Those with a standard score < 85, who also made at least three errors on the blocks of the TROG-2 testing comprehension of *but not* (Block P), *neither nor* (Block O), and *not only but also* (Block H) were included in the study. An additional pupil in the year above was added, as receptive grammar was felt to be a priority area for her and she matched the participant criteria. A flow diagram of progress through the study is shown in figure 1.

Fourteen participants were identified; a summary of their most recent scores on the standardized tests at the beginning of the study is shown in table 1 and their individual data in appendices A and B. Table 1 shows all the participants had severe RELI, including severe difficulties with comprehension of grammar, as measured by TROG-2. In addition to their RELI, some participants had difficulties or diagnoses which mean they would not meet the strict exclusionary criteria for SLI (listed in appendices A and B).

Selecting participants on the basis of comprehension difficulties, regardless of their other characteristics, allowed us to see which (if any) participant characteristics affected response to intervention. Given the nature of the therapy, visual processing skills and general non-verbal reasoning were of particular interest. We therefore collected information on their most recent scores on the TVPS (unavailable for two participants). Unfortunately, we had not carried out a non-verbal test at the beginning of the study, but many participants had been assessed on non-verbal tests previously. Among these non-verbal tests, Matrices tests were most commonly included, although using a variety of tests (Kaufman Brief Intelligence Test (KBIT), Kaufman and Kaufman 2004; Wechsler Abbreviated Scale of Intelligence (WASI), Wechsler 1999; Wechsler Intelligence Scale for Children (WISC-IV), Wechsler 2004). We recorded these scores and for participants with no score or scores more than a year old, we administered the Matrices test of the Wide Range Intelligence Test (WRIT) (Glutting *et al.* 2000) after completion of the therapy. To enable easy comparison across tests, we converted all Matrices scores to standard scores (mean of 100 and standard deviation (SD) of 15). The actual test used for each participant is listed in appendices A and B.

While several participants had standard scores on Matrices < 85, most of them showed a discrepancy between their Matrices and CELF scores. Indeed an analysis of variance (ANOVA) (with a Greenhouse–Geisser correction) comparing CELF Receptive and Expressive Language, Matrices and TVPS found a significant difference, $F(1.3) = 45.2$, $p < 0.001$, $\eta p^2 = 0.80$. Post-hoc Bonferroni corrected t-tests showed that the Matrices and TVPS standard scores did not differ significantly from each other, $p = 0.08$ and the CELF Receptive and Expressive Language did not differ from each other, $p = 0.57$, but both CELF measures differed significantly from both the Matrices and TVPS, $p < 0.001$. Therefore, as a group their language scores were significantly lower than their non-verbal and visual processing scores.

The therapy method (Shape Coding) was already being used in the school, but the participants' knowledge of the system varied. Because this could affect response to the intervention, we asked each participant's SLT to rate the participant's prior knowledge of Shape Coding on a scale of 0–4.

Study design

This study is a single-blind cross-over trial with random allocation to groups with an assessor blind to group status. The 14 participants were randomly assigned to

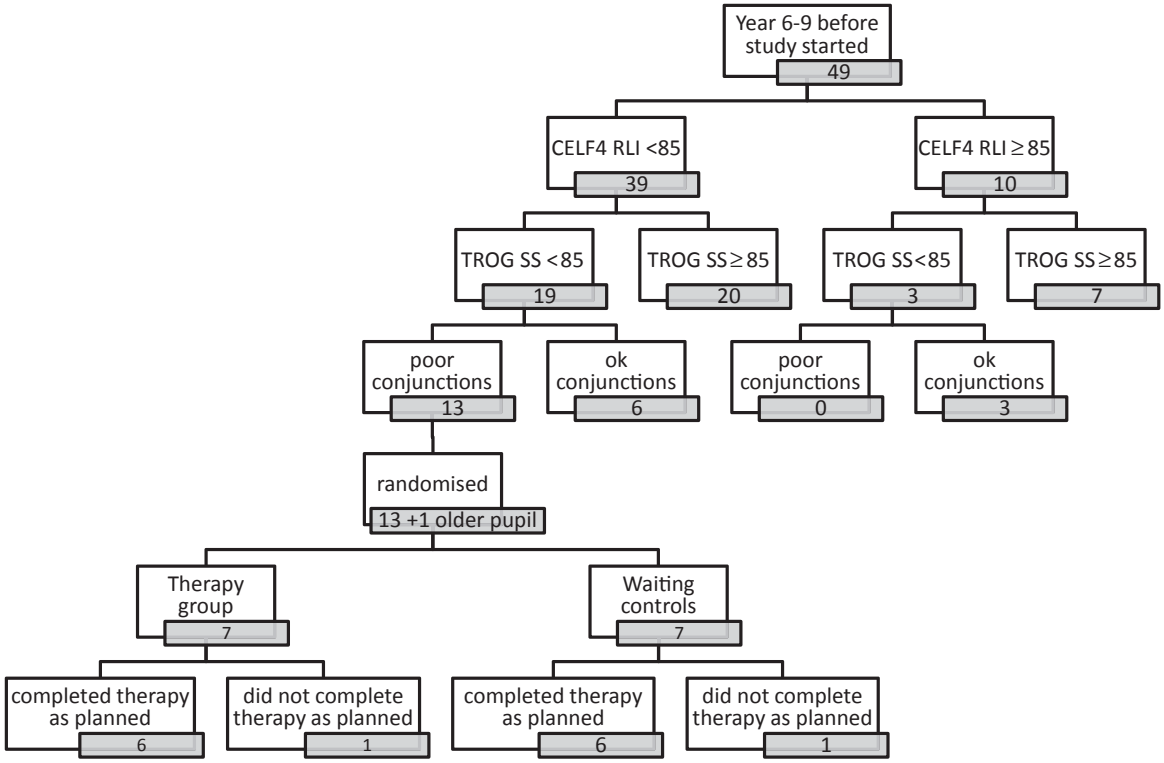

Figure 1. Flow of participants through the trial.

Table 1. Pre-therapy standard scores on standardized tests

Boys:girls	Therapy group 4:3		Waiting controls 6:1		Overall 10:4
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)
Age	13;4 (1;6)	11;3–15;8	13;8 (1;7)	11;5–16;1	13;6 (1;6)
Test of visual perceptual skills	86 (12)	64–97	86 (21)	63–114	86 (16)
Matrices[a]	81 (9)	68–94	81 (18)	57–102	81 (14)
BPVS–II	66 (10)	47–78	64 (14)	47–85	65 (24)
TROG-2	57 (5)	55–69	61 (9)	55–78	59 (7)
CELF-4 Receptive language	53 (5)	45–58	53 (6)	45–61	53 (5)
CELF-4 Expressive language	48 (3)	45–53	53 (6)	45–59	50 (5)

Note: [a]The standard score was computed from the *z*-score to aid in the comparison with other tests.

two groups (Therapy versus Waiting Control) by the first author using the random number function in Excel to sort the participants into a random sequence which was then split into two groups. The therapy group received the study therapy in the Spring Term (Phase 1) and the waiting controls in the Summer Term (Phase 2). All participants were assessed pre-therapy (in January), immediately after Phase 1 (in April) and immediately after Phase 2 (in July). All testing was carried out by an SLT assistant blind to group status, but trained in using the tests.

When the participants were not receiving the study therapy (Phase 1 for waiting controls (WC) and Phase 2 for the original therapy group (T)), they continued with their normal speech and language therapy package, but grammatical comprehension was not targeted. Therefore both groups received their normal amount of speech and language therapy at all times, thus avoiding a potential Hawthorne effect. The study was approved by the Moor House School Ethics Forum.

Analyses of the pre-therapy scores for the two groups showed no differences between the two groups in gender distribution, $\chi^2(1) = 1.4$, $p = 0.24$, age, $t(12) = 0.4$, $p = 0.67$, $d = 0.19$, TROG-2 raw score, $t(12) = 0.36$, $p = 0.28$, $d = 0.73$, standard scores on the CELF-4 Expressive Language,[1] $U = 14.5$, $n_1 = 7$, $n_2 = 7$, $p = 0.21$, CELF-4 Receptive Language, $t(12) < 0.001$, $p = 1.0$, $d = 0.0$, TROG-2, $U = 15.0$, $n_1 = 7$, $n_2 = 7$, $p = 0.30$, Matrices, $t(12) = 0.02$, $p = 0.99$, $d = 0.01$, or TVPS, $t(10) < 0.001$, $p = 1.0$, $d = 0.0$ or prior

knowledge of Shape Coding, $U = 12.5$, $n_1 = 7$, $n_2 = 7$, $p = 0.10$.

Measurements

Test of Reception of Grammar—2 (TROG-2) (Bishop 2003)

All participants were tested on the TROG-2 (a picture-pointing comprehension test) at all testing points (pre-therapy, post-Phase 1 therapy and post-Phase 2 therapy). The stimuli are presented in blocks of four targeting the same construction. Three blocks target the conjunctions receiving intervention in this study. The number of correct answers in each of these blocks was recorded separately and combined with the specific test described below. We also recorded the raw score (in terms of number of blocks passed; where all answers in the block were correct) and standard score.

Specific test of comprehension of conjunctions

We constructed a specific picture-pointing test to assess the participants' comprehension of the targeted coordinating conjunctions further. The items were presented in a random order, mixed in with the control items (passives; discussed below). The position on the page of the correct picture was also randomized. Each targeted conjunction (*but not*, *neither nor* and *not only but also*) had four items, with different grammatical constructions (four items using *and* were also included but not analysed as they were at ceiling pre-therapy):

- Noun phrase + conjunction + noun phrase + adjective (e.g. *the ladder and the snake are long*).
- Noun phrase + conjunction + noun phrase + verb (e.g. *the horse but not the sheep is eating*).
- Noun phrase + adjective + conjunction + adjective (e.g. *the pencil is neither long nor blue*).
- Noun phrase + verb + conjunction + verb (e.g. *the lady is not only standing, but also waving*).

Specific test of control construction (passives)

We tested the participants' understanding of passive sentences to act as a within-subject control and to ascertain whether any improvement in the comprehension of conjunctions generalized to another area of grammar. We selected items from the Test of Active and Passive Sentences (van der Lely 1996b), which tests three different forms of the passive and active constructions using a picture pointing task. We tested four items for each construction to ensure similarity with the specific conjunctions test. The four constructions were (for a full description of these, see van der Lely 1996a):

- Active (e.g. *the car hits the lorry*).
- Adjectival passive (e.g. *the teddy is mended*).
- Long passive (e.g. *the girl is washed by the boy*).
- Short passive (e.g. *the fish is being eaten*).

We analysed only the proportion of passives correct (adjectival, long and short combined) as the active sentences were at ceiling pre-therapy.

Therapy method

This study used the Shape Coding therapy approach (Ebbels 2007) to teach the participants in an explicit way the targeted coordinating conjunctions and their meaning in a variety of sentence structures, using visual templates and cues.

We aimed for the participants' usual SLT to deliver the therapy for 30 min, once a week for 8 weeks (4 h in total), on an individual basis in their usual therapy setting. Six different SLTs were involved, each seeing between one and five participants. The SLT who worked with each participant is shown in appendices A and B. The therapy programme was devised by the first author and consisted of a sequence of 14 steps, which were provided to the SLTs (reproduced in appendix C). The SLTs also received a pack of materials (blank Shape Coding templates, target conjunctions with visual cues underneath, black and white line drawings for colouring activities and small animal objects). The first author was available to answer queries throughout the study. The SLTs worked through the therapy sequence at the participants' own pace, and stopped after eight sessions, regardless of the step reached.

In the first session, the participants were introduced to the approach. The conjunctions were then introduced, one at a time, in a variety of sentence constructions. Each step built on the previous steps and contrasted new conjunctions with those previously introduced. The SLTs did not move onto the next step until they judged the participant had understood the current step, to ensure good comprehension of each taught conjunction and a solid foundation for the next step.

Each conjunction was introduced with a spoken explanation of its meaning and a corresponding visual cue (see appendix C). Some SLTs also reinforced each question word with its Makaton sign and head nodding/shaking, but this was reduced during the therapy. *But not* was introduced first, then *neither nor*, then *not only but also*. Therapy activities consisted of the SLTs taking turns with the participants to generate and act out sentences using the shape templates as an aid (these sentences did not match exactly those used in the specific test or the TROG-2). When the SLT judged that a participant's understanding of a conjunction was

accurate, the templates were removed and the activities repeated.

Attendance and treatment fidelity

Attendance and treatment fidelity were assessed indirectly by the first author after each phase by sending questionnaires to the SLTs and checking their case notes. Two participants did not receive the full 4 h of therapy. One (WC4) withdrew from the study during Phase 2 (his therapy phase). The other (T2) attended eight therapy sessions, but due to listening and attention difficulties had shorter sessions than the others, so in total received 2 h and 40 min of therapy. His results were excluded from all analyses, but the results of WC4 were included during Phase 1, when he was acting as a control, but excluded from Phase 2 (his therapy phases). Thus, the results analyse whether those who received the full amount of therapy made progress.

The therapy was usually provided by the participants' own SLT as part of their normal therapy package (see appendices A and B for which SLTs saw which participants). The exceptions to this were three participants (WC2, WC3 and WC7) whose SLT was absent at the end of Phase 2, so their final two or three sessions were carried out by one or two of the study authors (see appendix B).

Because the therapy programme was delivered at the participants' own pace, not all participants completed the programme and some were not introduced to all the targeted conjunctions. Six participants completed the whole therapy programme (T1, T6, T7, WC1, WC5, WC7), four completed *but not* and *neither nor* (T4, WC2, WC3, WC6), one only completed *but not* (T3), and two did not complete any conjunction (T2, T5), but T2 was excluded from the analyses (see above).

The study therapy was provided as part of the participants' normal speech and language therapy package, which includes joint planning and teaching of English lessons, at least two speech and language therapy groups per week and individual speech and language therapy sessions. The focus of the groups attended by the participants during the study period included: vocabulary, narrative, reading comprehension, use of signing, social skills and life skills. Individual therapy while in the control phase of the study focused on: articulation, vocabulary, past tense, phonological awareness, conversation ability, signing, narrative and voice, but not comprehension of grammar. Some participants also received other individual speech and language therapy during their study therapy phase in addition to the study therapy; this focused on articulation, vocabulary, inferencing, narrative, idioms and use of signing.

To test whether the amount of speech and language therapy differed between the two groups in either of the two phases of the study, we carried out *t*-tests comparing the amount of individual, group and total speech and language therapy received by the two groups in each phase. None of these analyses showed any significant differences between the groups (Phase 1: individual therapy, $t(11) = 0.5$, $p = 0.60$, $d = 0.34$; group therapy, $t(11) = 0.7$, $p = 0.52$, $d = 0.42$; total therapy $t(11) = 0.8$, $p = 0.43$, $d = 0.53$; Phase 2: individual therapy, $t(11) = 2.1$, $p = 0.06$, $d = 1.42$; group therapy, $t(11) = 0.5$, $p = 0.65$, $d = 0.30$; total therapy $t(11) = 1.7$, $p = 0.12$, $d = 1.12$). The difference between the two groups almost reached significance and showed a large effect size during Phase 2 for individual therapy. This is because three of the study authors completed the study therapy with the absent SLT's caseload, but the other children on her caseload from the original therapy group did not receive cover for their individual therapy. The group therapy they received was unaffected.

Results

We analysed the study in two phases. Phase 1, which takes the form of a typical RCT with a therapy group and a control group, was analysed separately from Phase 2 to enable comparison with other RCTs. In Phase 2, we then provided the same therapy to the waiting controls. The Phase 2 analyses consider whether the waiting controls made a similar amount of progress to the original therapy group with therapy and whether the original therapy group maintained their progress. Complete data were available for 12 participants, six in each group.

Phase 1 results

Targeted coordinating conjunctions

To increase power, we combined the results from the specific test with the responses to those blocks on the TROG-2 which test the targeted conjunctions. This gave a score out of eight for each targeted conjunction (four items from the relevant TROG-2 block and four items from the specific test) and an overall score of 24. Table 2 shows mean scores on the targeted conjunctions at each time point for the two groups (individual scores are shown in appendices A and B). Table 2 shows that overall, from pre-therapy to post-Phase 1 therapy, the therapy group improved, while the waiting controls got worse. A comparison of the change in targeted conjunctions over Phase 1 (post-Phase 1 therapy minus pre-therapy) between the two groups using a two-tailed *t*-test revealed a significant difference between the two groups, $t(11) = 2.7$, $p = 0.02$, $d = 1.64$, where the therapy group showed more progress than the waiting controls.

Table 2. Means (standard deviations) at each testing point

	Scores at each testing point						Change in scores			
	Pre-therapy[a]		Post-Phase 1 therapy[a]		Post-Phase 2 therapy[b]		Over Phase 1[a]		Over Phase 2[b]	
Therapy group							Therapy period		Maintenance	
Conjunctions (/24)	10.3	(3.6)	13.7	(2.1)	14.2	(3.7)	3.3	(3.8)	0.5	(3.8)
TROG-2 Raw Score	6.3	(2.3)	8.5	(2.1)	9.2	(2.9)	2.2	(1.7)	0.7	(1.0)
TROG-2 Standard Score	57.3	(5.7)	62.2	(7.8)	65.2	(9.0)	4.8	(7.5)	3.0	(3.7)
Passives (/12)	7.8	(2.5)	8.7	(2.0)	8.0	(1.3)	0.8	(1.7)	–0.7	(0.8)
Waiting controls							Baseline		Therapy period	
Conjunctions (/24)	10.1	(4.1)	8.4	(4.9)	15.5	(6.7)	−1.7	(2.9)	6.7	(3.1)
TROG-2 Raw Score	7.7	(3.0)	7.3	(2.3)	10.3	(4.2)	−0.4	(2.6)	2.5	(2.6)
TROG-2 Standard Score	61.4	(9.0)	58.0	(5.5)	70.5	(14.3)	−3.4	(4.5)	12.0	(10.7)
Passives (/12)	7.0	(3.7)	6.3	(2.9)	5.3	(3.3)	−0.7	(1.6)	−1.3	(0.8)

Notes: [a]Includes WC4.
[b]Excludes WC4.

Table 3. Pearson's *r*-values for correlations between progress and all other measures taken

	Overall conjunctions progress	TROG-2 SS progress	Overall conjunctions pre-therapy	TROG-2 SS pre-therapy	Matrices	TVPS	Prior knowledge of Shape Coding
TROG-2 SS progress	0.51						
Overall conjunctions pre-therapy	−0.29	0.27					
TROG-2 SS pre-therapy	0.34	0.17	0.35				
Matrices	0.35	−0.36	−0.53	0.23			
TVPS	0.20	−0.14	−0.11	0.47	0.89**		
Prior knowledge of Shape Coding[a]	0.48	0.24	−0.32	−0.12	−0.36	−0.32	
Step reached with therapy[a]	0.39	0.79**	0.07	0.11	0.07	0.09	0.13

Note: [a]Spearman's *r*.
p-values (two-tailed): $p < 0.05^{*}$, $p < 0.01^{**}$ and $p < 0.001^{***}$.

To test whether progress made by either group was significantly better than zero, we analysed their change in score over Phase 1. One-tailed,[2] one-sample *t*-tests showed that overall the therapy group made progress which was significantly greater than zero, $t(5) = 2.1$, $p = 0.04$, $d = 0.86$. We did not analyse the change for the waiting controls as this was negative.

Generalization of progress (TROG)

Table 2 also shows the mean scores at each testing point on the TROG-2 (Raw and Standard Scores). This shows that over Phase 1, the therapy group improved on the TROG-2, while the waiting control group did not. A two-tailed *t*-test showed the progress of the two groups over Phase 1 differed significantly on standard scores, $t(11) = 2.5$, $p = 0.03$, $d = 1.48$. The difference on raw score just failed to reach significance despite a large effect size, $t(11) = 2.1$, $p = 0.06$, $d = 1.24$.

One-tailed, one-sample *t*-tests on the change in raw and standard scores showed that the therapy group made progress which was significantly greater than zero on the raw, $t(5) = 3.1$, $p = 0.01$, $d = 1.26$, but not the standard score, $t(5) = 1.6$, $p = 0.09$, $d = 0.64$. We did not analyse the progress of the waiting controls as their scores decreased.

Control structure (passives)

Table 2 also shows the scores out of 12 on the specific passives test. This shows a small positive change in the therapy group and a small negative change in the waiting controls over Phase 1. A two-tailed *t*-test revealed no significant difference between the progress of the two groups over Phase 1, $t(11) = 1.68$, $p = 0.12$, $d = 1.01$, despite a large effect size. One-tailed, one-sample *t*-tests showed that the progress made by the therapy group was not significantly greater than zero, $t(5) = 1.2$, $p = 0.14$, $d = 0.49$. The waiting controls' scores decreased.

Summary of Phase 1 results

The therapy group made significantly more progress than the waiting controls on the targeted conjunctions and TROG-2 standard score. The therapy group also made progress which was significantly greater than zero on the targeted conjunctions and TROG-2 raw score. We found no obvious generalization to passives.

Phase 2 results

Targeted coordinating conjunctions

Table 2 also shows the post-Phase 2 therapy scores and the change in scores over Phase 2. To analyse whether the waiting controls made similar progress with therapy to the original therapy group, we compared the changes during the specific period when each group received therapy (over Phase 1 for the original therapy group and over Phase 2 for the waiting controls) and found no significant difference, $t(10) = 1.6$, $p = 0.13$, $d = 1.04$. A one-tailed *t*-test confirmed that the waiting controls also made progress with therapy which was significantly greater than zero overall, $t(5) = 5.2$, $p = 0.002$, $d = 2.1$.

To get an overall effect size for progress made by all participants for just the period when enrolled in the therapy (progress over Phase 1 for the original therapy group and over Phase 2 for the original waiting controls), we combined the two groups and compared their progress to zero and found a significant effect, $t(11) = 4.6$, $p < 0.001$, $d = 1.33$.

To analyse whether the original therapy group maintained the progress they had made in Phase 1 during Phase 2, we compared their change in score over Phase 2 to zero using a two-tailed *t*-test.[3] This showed that their scores remained stable, $t(5) = 0.3$, $p = 0.76$, $d = 0.13$.

Generalization of progress (TROG)

Table 2 also shows the post-Phase 2 therapy scores and changes on the TROG-2 during Phase 2. To analyse whether the waiting controls made similar progress with therapy to the original therapy group, we compared change during the specific period when each group received therapy and found no significant difference on either raw, $t(10) = 0.3$, $p = 0.80$, $d = 0.17$, or standard scores, $t(10) = 1.3$, $p = 0.21$, $d = 0.85$. One-tailed *t*-tests confirmed that the waiting controls made progress with therapy (over Phase 2) which was significantly greater than zero on both the raw, $t(5) = 2.4$, $p = 0.03$, $d = 0.97$, and standard scores, $t(5) = 2.8$, $p = 0.02$, $d = 1.13$. When we combined the two groups (thus increasing power) and compared their progress over the period when enrolled in the therapy to zero, we found a significant effect for both the raw, $t(11) = 3.8$, $p = 0.001$, $d = 1.11$ and standard scores, $t(11) = 3.1$, $p = 0.005$, $d = 0.88$.

A two-tailed *t*-test showed that the change in score over Phase 2 for the original therapy group was not significant for either the raw, $t(5) = 1.6$, $p = 0.18$, $d = 0.65$, or standard scores, $t(5) = 2.0$, $p = 0.10$, $d = 0.82$, i.e. they maintained their progress.

Control structure (passives)

Table 2 shows change in scores on passives over Phase 2. This shows that the scores declined for both groups during Phase 2. Therefore, no statistical analyses of progress were carried out.

Summary of Phase 2 results

The waiting controls also made progress on the targeted conjunctions when they received therapy. The scores for the original therapy group remained stable; thus progress was maintained. When the two groups were combined, they showed significant progress over their therapy period.

On the TROG-2, the waiting controls made similar progress to the original therapy group, who maintained their previous progress. When the groups were combined, both the raw and standard score of the TROG-2 showed significant progress with therapy.

On the passives, the scores for both groups declined. Thus, the waiting controls did not replicate the small, non-significant progress made by the original therapy group in Phase 1 and the original therapy group did not appear to maintain their original progress.

Possible factors influencing progress

To investigate the factors which could have influenced progress, we carried out two-tailed correlations between the progress scores with therapy (on overall conjunctions and TROG-2 standard scores) and the other measures taken. The correlations are shown in table 4. Progress was not significantly correlated with any test measure.

We also considered variables more directly related to the therapy itself: the SLT's rating of the participants' prior knowledge of Shape Coding and step of the programme reached by the end of therapy, using Spearman's *r*. We found a significant correlation between progress on the TROG-2 SS and the step of therapy reached, but not between either measure of progress and the SLTs' ratings of the participants' prior knowledge of Shape Coding. The two non-language tests (Matrices and TVPS) were significantly correlated with each other, but not with any other measure.

We included participants with a wide range of difficulties in addition to their RELI. Thus, the majority do not fit the strict exclusionary criteria for SLI. Taking the strict criteria for SLI of non-verbal IQ needing to be equal to or greater than 85 and excluding participants with any other diagnosis, only two participants met these strict criteria (one of whom also has a diagnosis of dyslexia). A statistical comparison of the overall progress on the conjunctions made by these participants and the others was not possible due to small numbers, however their progress on targeted conjunctions with therapy (7 and 5) was very similar to the rest of the participants (mean = 5). If the non-verbal exclusionary criterion is relaxed to 70, five participants meet the criteria for SLI. The progress of this group was not significantly different from those not meeting criteria, $t(10) = 0.45$,

$p = 0.66$, $d = 0.31$. Four participants had diagnosed medical syndromes, but did not differ from the others in their progress, $t(10) = 0.31$, $p = 0.76$, $d = 0.22$ and neither did the three with hearing impairments, $t(10) = 0.88$, $p = 0.40$, $d = 0.64$, although the numbers are too small to draw any strong conclusions.

Discussion

Four hours of explicit therapy with visual support, focused on comprehension of coordinating conjunctions, one-to-one with an SLT significantly improved comprehension of the targets among adolescents with severe RELI. The waiting controls made little progress during their baseline period, even getting slightly worse (Phase 1) but made progress when they too received the therapy (after Phase 2). At the end of Phase 1, after only one group had received the study therapy, the progress of the two groups differed significantly ($d = 1.64$). Progress could not have been due to a placebo or Hawthorne effect as both groups received their normal therapy package with their usual SLT at all times, but during their study therapy phase, this included therapy targeted at comprehension of coordinating conjunctions for 30 min per week. Given this and the fact that the participants were randomly assigned to the two groups, it is most likely that the content of the therapy was responsible for progress, rather than any other factors. The effect size for progress with therapy of the two groups combined (relative to zero change) was $d = 1.33$.

The original therapy group maintained their progress for 4 months after their therapy had ceased. Progress generalized to the TROG-2 raw and standard scores such that on average, over the whole study, the participants closed the gap with their typically developing peers by eight standard score points. This could be partly due to progress on the blocks containing the targeted conjunctions, however, the progress on these blocks was often insufficient for a block to be passed (e.g. progress from one to three out of four in a block would not be registered in the TROG-2 raw score). Also, several participants made progress on blocks other than those containing the targeted conjunctions. However, the data do not indicate that the effects of therapy generalized to comprehension of passives.

Factors influencing progress

The analyses showed that progress was not significantly correlated with any of the standardized tests, although several of the effects were medium ($r > 0.3$) or large ($r > 0.5$). Performance on a Matrices test and the TVPS, while significantly correlated with each other, were not significantly related to any other measure, including progress measures. Thus, it seems that visual perceptual skills and performance on a non-verbal test (Matrices) are not key indicators of the ability to make progress with this kind of therapy, even though the therapy involves meta-linguistic explanations and uses visual cues.

Analyses of whether participants meeting certain diagnostic criteria (e.g. those meeting strict criteria for SLI) differed from the others in their response to intervention revealed no significant differences. Therefore we cannot, from our data, make any predictions regarding which children make the most progress with this therapy.

The significant correlation between progress on the TROG-2 and the step of therapy reached indicates that if the participants who did not complete the therapy in the eight weeks had been able to continue and finish the programme, they might have made more progress. Thus, a future project could measure the effectiveness of completion of the therapy programme, regardless of the time taken, rather than the model used here of a restricted amount of time dictating when the therapy should stop.

Implications for theories of SLI

The therapy approach in this study used explicit teaching with visual cues. This could be argued to increase the processing demands on the participants. If the main reason for failing comprehension tasks was processing limitations, then it is unlikely that this therapy approach would improve their performance on these tests. The success of the therapy approach therefore makes it less likely that impaired processing was the cause of their difficulties.

More likely, however, is that the therapy worked by allowing the participants to use their relative strengths to compensate for their weaknesses. Within the framework of the PDH, it could be that the explicit therapy enabled them to use their better declarative memory system to compensate for their more impaired procedural memory system. The visual support could also have enabled them to enlist their better visuo-spatial skills to compensate for their weaker verbal working memory. However, this study was not specifically designed to examine the underlying processes, thus these hypotheses remain speculative.

Implications for clinical practice

Clinicians are under increasing pressure to base their intervention on evidence. Unfortunately, we have little or weak evidence for many of the approaches which we commonly use (particularly for receptive language). The publication of recent UK government-funded research (Law *et al.* 2012) investigating the current evidence base is very welcome, as are initiatives to make the evidence more easily accessible to clinicians, such as the What

Works website being set up by the Communication Trust.[4]

This study provides evidence of effectiveness of speech and language therapy for older children with RELI, as, on average, our participants made progress with targeted therapy which was maintained. Combined with the findings of other studies, it seems that the Shape Coding therapy approach can be effective for improving a range of areas of grammatical comprehension and production in older children with RELI. Its effectiveness for younger children or children with other profiles of difficulties remains to be established.

We were not able to find factors which predicted which participants would make the most progress, as diagnostic criteria seemed to make no reliable difference and pre-therapy language levels (within the small range in our study), visual perceptual skills and non-verbal reasoning abilities as measured on Matrices also seemed to have little effect. It is difficult to draw strong conclusions given the small size of this study, but it seems that based on our evidence, this approach could be tried with any adolescent with a severe receptive language impairment affecting comprehension of grammar. However, we do not know whether young people, like participant T2, with listening and attention difficulties will benefit when given the full amount of therapy (albeit in smaller chunks) or whether such children would be able to complete the full therapy programme and make progress given sufficient time.

Limitations and future directions

The RCT presented here was small in scale and based in one school. This may have affected the results in several ways and we need to be careful not to either under- or over-interpret the data. The small sample size means that we had limited power in our analyses. Some of our non-significant results showed large effect sizes. Thus, at times the data appear to indicate a difference between groups, or that progress differed from zero, or that progress correlated with possible predictors, but the sample size was too small to evaluate whether these were statistically significant. Thus, larger scale trials with more power are required to investigate these results further as we may be under-interpreting our findings.

However, our small sample size and the fact that the participants all came from the same school means that it cannot be assumed that our results will generalize to other groups of young people with language impairments. Future work could aim to establish whether similar results to our study are obtained for the same therapy method but with different age groups. Different methods of delivery could also be investigated, including whether this therapy method can be delivered by non-SLTs or to pairs or groups of children.

The precise aspects of the therapy which are responsible for progress could also be investigated, as could the amount of therapy which is needed to make significant or optimal gains. Future work could investigate the effects of completing the whole therapy protocol regardless of the length of time taken to do so and also take other measures of pre-therapy abilities (e.g. executive functions) to try to find reliable predictors of progress.

This study focused on a small area of comprehension. While other less rigorous studies indicate the effectiveness of the Shape Coding approach for some other areas of comprehension (passives, 'wh' questions and datives, Ebbels and van der Lely 2001, Ebbels 2007), the effectiveness of this therapy approach for a wider range of areas of comprehension remains to be established. Indeed, studies of its effectiveness for expressive language are also limited. An RCT has shown it is effective for production of verb argument structure, but only smaller less robust studies have investigated its effectiveness for production of past tense (Ebbels 2007, Kulkarni *et al.* 2013), passives and 'wh' questions (Ebbels and van der Lely 2001). Thus, more studies are required to establish whether this approach can be effective for a wider range of targets, with a wider range of children (particularly in terms of age) and a wider range of adults delivering the therapy in a variety of settings.

Conclusions

Adolescents with severe RELI receiving 4 h of individual therapy with an SLT focused on the comprehension of specific coordinating conjunctions made significant progress. Waiting controls made no progress until they also received the therapy when they made similar gains. Progress was maintained for 4 months.

This study contributes further to existing evidence that speech and language therapy for adolescents with language impairments can be effective. Thus, this age group should not be neglected in the provision of therapy services. It also provides the first strong evidence, using a (small-scale) RCT, that speech and language therapy for school-aged children with receptive language impairments can improve their comprehension of targeted structures.

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Appendix A. Individual data for participants in the original therapy group (receiving therapy in Phase 1)

Participant code		T1	T2	T3	T4	T5	T6	T7
Gender		Male	Male	Male	Female	Female	Male	Female
Age at the start of the study		14;11	11;3	12;11	12;2	13;1	13;4	15;8
Medical diagnoses/exclusionary criteria[a]		NV < 85	ASD, NV < 70	none	synd, NV < 85	NV < 85	synd	NV < 85
Matrices test used		WRIT	WASI	WASI	KBIT	WISC	WISC	WRIT
SLT(s) delivering therapy		A	L	M	E	M	S	N
Pre-Phase 1 therapy	Test of Visual Perceptual Skills SS	95	86	97	n.a.	64	90	85
	Matrices SS	81	69	94	84	70	88	83
	CELF-4 UK receptive language SS	45	58	58	58	50	55	50
	CELF-4 UK expressive language SS	47	47	53	49	47	45	47
	BPVS SS	47	73	78	70	61	64	68
	TROG-2 RS	6	3	10	5	4	5	8
	TROG-2 SS	55	55	69	55	55	55	55
	Prior knowledge of Shape Coding	1	1	1	2	1	1	1
	Targeted conjunctions (/24)	4	10	11	11	14	13	9
	Passives (/12)	4	5	9	9	8	6	11
Post-Phase 1 therapy	TROG-2 RS	9	4	10	7	5	10	10
	TROG-2 SS	58	55	69	55	55	74	62
	Targeted conjunctions (/24)	14	9	16	14	13	15	10
	Passives (/12)	7	7	7	10	8	8	12
Post-Phase 2 therapy	TROG-2 RS	10	2	11	6	5	11	12
	TROG-2 SS	62	55	74	55	55	74	71
	Targeted conjunctions (/24)	8	8	16	17	18	14	12
	Passives (/12)	7	3	7	9	7	8	10
Step of the therapy programme reached		13	3	7	11	4	14	14

Note: [a]Exlusionary criteria: synd = diagnosed medical syndrome; and NV = non-verbal skills as measured on Matrices.

Appendix B. Individual data for participants in original waiting control group (receiving therapy in Phase 2)

Participant code		WC1	WC2	WC3	WC4	WC5	WC6	WC7
Gender		Male	Male	Male	Male	Female	Male	Male
Age at the start of the study		14;8	13;2	13;6	16;1	14;6	11;5	12;5
Medical diagnoses/exclusionary criteria[a]		HI	synd, HI, NV<70	epi, CI	epi, LKS, NV < 85	synd, NV < 70	ADHD, NV < 70	(dyslexia)
Matrices test used		WRIT	WRIT	WRIT	KBIT	WRIT	WASI	WRIT
SLT(s) delivering therapy		A	M + N + S	M + A	A	A	L	M + S
Pre-Phase 1 therapy	Test of Visual Perceptual Skills SS	n.a.	73	114	90	71	63	106
	Matrices SS	102	66	99	80	57	68.5	97
	CELF-4 UK receptive language SS	58	58	50	45	50	52	61
	CELF-4 UK expressive language SS	55	52	45	45	53	59	59
	BPVS SS	55	62	55	47	62	80	85
	TROG-2 RS	11	9	4	6	5	7	12
	TROG-2 SS	67	65	55	55	55	55	78
	Prior knowledge of Shape Coding	4	2	2	0	3	2	1
	Targeted conjunctions (/24)	7	7	11	6	11	11	18
	Passives (/12)	8	3	2	5	10	10	11
Post-Phase 1 therapy	TROG-2 RS	10	5	7	4	8	7	10
	TROG-2 SS	62	55	55	55	55	55	69
	Targeted conjunctions (/24)	7	2	5	6	13	10	16
	Passives (/12)	6	5	2	4	9	10	8
Post-Phase 2 therapy	TROG-2 RS	16	5	6	n.a.	12	10	13
	TROG-2 SS	90	55	55	n.a.	71	69	83
	Targeted conjunctions (/24)	19	7	8	n.a.	21	15	23
	Passives (/12)	5	2	1	0	8	9	7
Step of the therapy programme reached		14	12	9	7	14	10	14

Note: [a]Exlusionary criteria: synd = diagnosed medical syndrome; HI = hearing impairment; epi = epilepsy; CI = cochlear implant; LKS = Landau–Kleffner Syndrome; and NV = non-verbal skills as measured on Matrices.

Appendix C: Therapy programme

1. Introduction to Shape Coding

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 

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.,

(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'

(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.

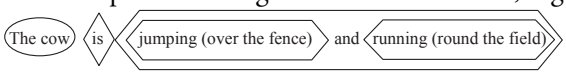
(f) Take turns to produce sentences using 'but not' while the other one acts out the sentence

(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)

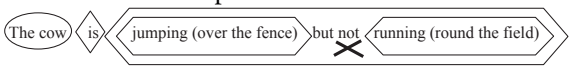
(a) Revise the templates showing coordination of NPs in subject position with verb. Show similarity with template showing coordination of VPs, e.g.,



(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'



(e) Relate coordinated VP to the question word "What doing" – discuss how 'but not' means subject does only the first, not the second verb phrase (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.,

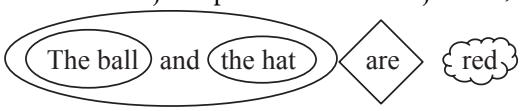
- the cow and the cat are jumping but not running
- the cow but not the cat is lying down and sliding
- the cow and the cat are standing and jumping
- the cow but not the cat is lying down but not sliding

(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)

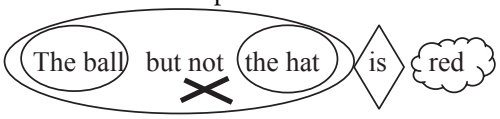
(a) Revise the templates showing coordination of NPs in subject position with verb. Show similarity with template showing coordination of NPs in subject position with adjectives, e.g.,



(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'



(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.

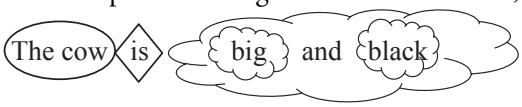
(f) Take turns to produce sentences using 'but not' while the other one draws/colours in the sentence

(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)

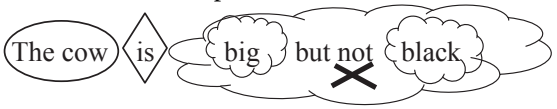
(a) Revise the templates showing coordination of NPs in subject position with adjective. Show similarity with template showing coordination of APs, e.g.,



(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'



(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.,

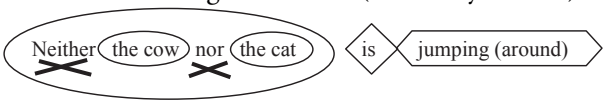
- the hat and the ball are big but not blue
- the hat but not the ball is yellow and stripy
- the hat and the ball are small and black
- the hat but not the ball is red but not spotty

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

(m) when accurate, remove templates, bring back to check responses

6. Neither nor (Subject NP + Verb)

(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)



(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'

(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.,

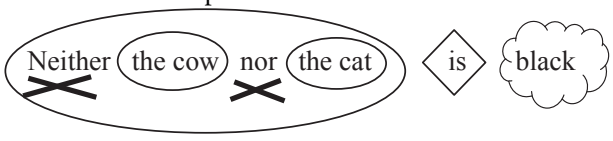
- Neither the cow nor the cat is jumping and running
- the cow and the cat are neither standing nor jumping
- the cow but not the cat is neither lying down nor sliding

(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'



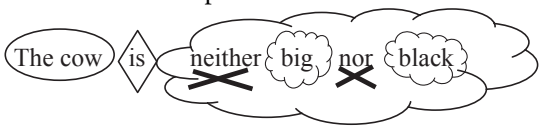
(b) Take turns to produce sentences using 'neither nor' while the other one colours in/draws

(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'



(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.,

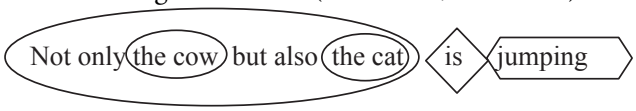
- Neither the hat nor the ball is big and blue
- the hat but not the ball is neither yellow nor stripy
- the hat and the ball are neither small nor black

(h) take turns to create sentences matching these combined templates, other one draws/colours in

(i) when accurate, remove templates, bring back to check responses

10. Not only, but also (Subject NP + Verb)

(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')



(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

11. Not only, but also (VP)

(a) Introduce template with 'not only, but also'

(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', 'neither nor') 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 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.,

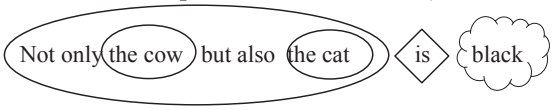
- Not only the cow but also the cat is jumping and running
- the cow and the cat are not only standing but also jumping
- the cow but not the cat is not only lying down but also sliding

(i) take turns to create sentences matching these combined templates, other one acts out sentence

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

12. Not only, but also (Subject NP + Adjective)

(a) Introduce template with 'not only, but also'



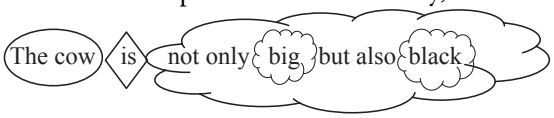
(b) Take turns to produce sentences using 'not only, but also' while the other one colours in/draws

(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

13. Not only, but also (Adjective Phrase)

(a) Introduce template with 'not only, but also'



(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 combined templates, other one draws/colours in

(i) when accurate, remove templates, bring back to check responses

14. 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

Notes

1. Mann–Whitney tests were used for non-normally distributed data: CELF Expressive Language Scale and TROG Standard Score were negatively skewed for the therapy group and prior knowledge of Shape Coding resulted in six of seven participants in the therapy group receiving the same rating.
2. A one-tailed test was used to analyse progress as we were only interested in change in one direction. Where change was negative, statistical tests were not carried out.
3. A two-tailed *t*-test was used as we had no particular prediction about the direction of any change during the maintenance period.
4. See http://www.thecommunicationtrust.org.uk/schools/what-works-database.aspx/.

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