META-SYNTACTIC THERAPY USING VISUAL CODING FOR CHILDREN WITH SEVERE PERSISTENT SLI

Susan Ebbels[1,2] and Heather van der Lely[2]

**Moor House School, Mill Lane, Hurst Green,
Oxted, Surrey, RH8 9AQ[1] and Department of Psychology, Birkbeck College,
University of London, Malet Street, London WC1E 7HX[2]
email: susan.ebbels@care4free.net**

The results of a pilot study into meta-syntactic therapy using visual coding for four children (age 11-13 years) with severe receptive and expressive specific language impairment (SLI) are presented. The coding system uses shapes, colours and a system of arrows to teach grammatical rules. A time-series design established baseline pre-therapy measures of comprehension and production of both passives and 'wh' questions. All participants made progress with passives and this was significant in three cases of the four. Comprehension and production of 'wh' questions also improved in all participants, although this did not always reach statistical significance. The results indicate that meta-syntactic therapy of grammatical rules, capitalising on visual strengths, can improve both comprehension and production in secondary age children with severe persistent SLI.

Introduction

Recent work investigating both the expression and comprehension of grammar indicates that a core deficit in some children (with 'grammatical-SLI') can be characterised by a deficit in syntactic 'movement', i.e. forming dependent relations between lexical items which are needed for grammatical interpretation or production of sentences (van der Lely 1998). In this study we evaluate a remedial programme which focuses on making explicit grammatical relations between words. The therapy procedure uses a visual coding scheme which amalgamates and extends the approaches of Bryan's (1997) 'Colourful Semantics' and Lea's (1965, 1970) 'Colour Pattern Scheme'. It codes thematic roles (agent, theme), syntactic dependant relations (subject-verb), grammatical categories (nouns, verbs) and morphological inflections (-ing, -ed). Unlike Bryan's and Lea's schemes, it is able to represent the hierarchical nature of language by showing embedding and can be used for teaching both comprehension and expression. This pilot study is an initial step in the evaluation of this procedure. The structures targeted were both the production and comprehension of passive sentences and 'wh' questions, which have been found to present particular difficulties for children with SLI (van der Lely 1996, van der Lely and Battell 1998).

Participants

Four children with severe persistent SLI participated (three boys and one girl, aged 11;08-12;09 years at initial testing). Their language scores as assessed on the Clinical Evaluation of Language Fundamentals (CELF-R UK) (Semel *et al*. 1994) fell at least three standard deviations below the mean (group mean z = -3.1, SS = 53.5). Their

vocabulary as assessed on the British Picture Vocabulary Scales (BPVS-II) (Dunn *et al.* 1997) ranged from -2 to -3.3 standard deviations (group mean z = -2.67, SS = 59.5). On the Test of Reception of Grammar (TROG) (Bishop 1983) a test of sentence comprehension, their scores ranged between −1.65 and more than -2.3 standard deviations below the mean. Their visual perceptual skills as tested on the Test of Visual-Perceptual Skills (Gardener 1988) fell within the normal range (group mean z = 0.16, SS = 102.5) (with three of them above average).

Initial Testing

Design and method

The participants' ability to correctly assign thematic roles was assessed by investigating their comprehension and production of active and passive sentences and 'wh' questions. Two procedures were used for testing comprehension: a) baseline testing using an acting out procedure and b) a picture selection task. Active and passive sentences were elicited using the same materials with specific prompts. Baseline testing was repeated once per week for four weeks. 'Wh' questions were elicited using a 'whodunnit' game.

The passive baseline tests used twelve semantically reversible active and passive sentences. The children acted these out (comprehension) or responded to a prompt, 'tell me about the ___', which focused on the either the actor or patient (expression). The picture selection task used the Test of Active and Passive Sentences (TAPS) (van der Lely 1996). The target sentence types were active (the man eats the fish), long passive (the fish is eaten by the man) and short verbal passive (the fish is being eaten). An adjectival picture (of an eaten fish) is also provided. This test was modified to test expression, using prompts as before.

Baseline comprehension of subject and object questions focused on semantically reversible 'who' and 'which' questions. For example, 'who is following the cow?' (subject) or 'which pig is the cow following?' (object). Production of subject and object questions used a modified game of Cluedo (van der Lely and Battell 1998). The child asks questions to get clues as to 'whodunnit'. There are six subject and six object questions for each target 'wh' word, 'who', 'what' and 'which'.

Results

The percentages correct for these initial tests are shown in the first line for each participant of Tables 1 and 2. For the baseline tests, the mean of the four scores is shown. Although the participants had similar scores on the standardised tests, their responses to these targeted tests varied greatly. Considering passive comprehension first: RU and JD interpreted virtually all passive forms as active. DG improved on the acting out task during baseline testing, from 67% to 100% by the last test. He had particular difficulty with short passives on the TAPS, choosing the adjectival picture. FT made very few errors on all sentence types. Passive expression was difficult for all the participants. None achieved a mean of more than 33% correct. DG and FT failed to convert the verb into the past participle. RU and JD made few attempts to use the passive and used active sentences to try to express the content, e.g. 'the horse doesn't like it', 'the horse is cross cos the cow's hitting him'.

When comprehending 'wh' questions, 'who' subject and object questions were correctly comprehended by all but RU, who improved during baseline testing to 100% correct by the third test. All participants made errors comprehending 'which' object questions, although DG improved during the baseline from 50% to 100% by the third test.

Expression of subject and object questions in the past tense was difficult for all the participants, particularly object questions. The highest total score was 16/36 (JD) the other three scored only 3 or 8. The most common errors were: maintenance of past tense; 'do support' (both addition of 'do/did' in subject questions and more frequently omission in object questions); tense agreement, e.g. 'who did she saw?' and missing argument or verb, e.g. 'who did someone in the lounge?'. RU and DG also made many errors of 'gap-filling', e.g. 'who did Mrs Peacock see *someone* in the library?' RU additionally made errors by not moving the whole of the 'which' phrase, e.g. 'which did the telephone rang?' All the children exhibited difficulties producing simple object questions that are generally mastered by 3 to 4 years of age, e.g. in response to the clue 'Mrs Peacock saw someone in the lounge, ask me who', they asked: 'who saw in the lounge' (JD), 'who it was in the lounge' (FT), 'who did Mrs Peacock saw someone in the lounge' (DG) and 'who did someone in the lounge' (RU).

These children were still struggling with these basic areas of grammar at the age of 11-13 years despite years of special education and intensive therapy input. We therefore hypothesised that they were unable to learn these rules subconsciously by extracting them from the language they heard around them and that they might benefit from learning these consciously as a second language learner might learn a language. Building on their strong visual skills, a visual coding system was used to facilitate understanding and retention of the rules underlying passive sentences and 'wh' question formation.

Therapeutic intervention

Design and method

A brief description of some features of the visual coding system follows. The system uses shapes to group words in phrases, each shape indicating a particular thematic role. The shapes can be embedded inside each other and moved leaving behind traces; black arrows show the chain between a moved constituent and its trace. Colours represent the grammatical categories of individual words. The basic colours (with a few minor modifications) are those used by Lea (1970) in his 'Colour Pattern Scheme'. A system of arrows indicates inflections of tense and aspect.

The comprehension therapy taught the children to recognise and use syntactic cues necessary for correct interpretation of 'wh' questions and passives. They were taught to identify gaps in object questions and passives, to link these with the moved constituent (or 'wh' word) and assign the correct thematic roles. Expressive therapy taught rules about, for example, 'do' support and movement of tense and aspect inflections in 'wh' questions or passives. An example of an active and its related passive sentence follows:
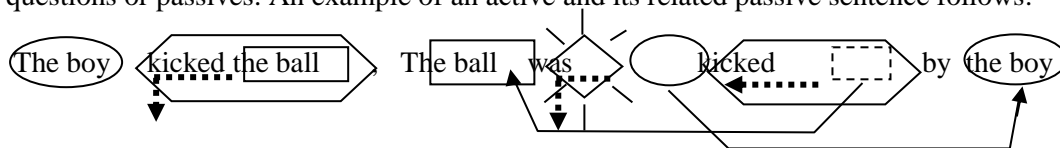
The dotted lines and arrows would be yellow, as they are verbs. The other words are also associated with colours which may or may not be included according to the needs of the child and the structure being taught. The oval and rectangle code the actor and patient respectively. The hexagon identifies the verb phrase. The child learns to identify the number of verb arguments required for each particular verb e.g., 'kicked' requires an agent and a patient. There is no suitable noun phrase after 'kicked' in our example so it must have moved to the front and left a gap. They code this first and then identify the agent, which has also moved from its active position. For production, they learn that the tense inflection (here past tense, marked by a downwards arrow on the left of the yellow

line) moves from the main verb to a new (marked by radiating lines) auxiliary (diamond) that is inserted to carry the tense because the main verb converts to a past participle (marked by a horizontal arrow on the left of the yellow line). The application of this method involved several other aspects not described here.

Each participant received 13 half-hour sessions introduction to the coding system. Then two received 'wh' and two passive therapy for a ten week block (approximately 7-8 hours therapy), before swapping for a second block. All participants received a further block of 'wh' therapy, as it had become clear this required more teaching. A period of no therapy followed. Re-testing took place after each block of therapy and at follow-up (after ten weeks without therapy) to establish maintenance of new skills.

Results

Tables 1 and 2 show the participants' scores on the tests at various stages of therapy. The significance levels of changes in score since pre-therapy were computed using the chi-square test.

Table 1. Percentage correct for passives pre- and post-therapy

		COMPREHENSION				EXPRESSION			
		Acting out		TAPS		Acting out		TAPS	
				Long	Short				
	Time of testing	Act	Pass	Act	Pass	Pass	Act	Pass	Act	Pass
RU	Pre-therapy	92	8	100	0	8	100	0	75	8
	Post passive thrpy	100	**100****	**67**	**100****	**92****	100	**100****	100	**100****
	Post wh Q thrpy 1	100	**100****	100	**75****	**92****	100	**100****	100	**100****
	Post wh Q thrpy 2	100	**100****	100	**100****	**100****	100	**100****	92	**92****
	Follow-up	100	**100****	100	**100****	**100****	100	**100****	100	**83***
JD	Pre-therapy	100	4	92	17	17	92	29	92	0
	Post wh Q thrpy 1	100	**33**	92	17	8	100	50	92	**67***
	Post passive thrpy	100	**100****	92	**75**	17	100	**100***	92	**100****
	Post wh Q thrpy 2	100	**66****	100	**100****	17	100	**100***	100	**100****
	Follow-up	100	**100****	100	**83***	25	100	**83**	100	**100****
DG	Pre-therapy	88	79	83	58	17	100	33	75	33
	Post passive thrpy	100	100	92	75	42	100	**83**	75	67
	Post wh Q thrpy 1	100	100	100	83	**75**	100	67	92	**75**
	Post wh Q thrpy 2	100	100	100	**100**	75	100	**83**	83	**75**
	Follow-up	100	83	100	**100**	**83***	100	67	100	67
FT	Pre-therapy	100	100	92	100	92	63	21	83	17
	Post wh Q thrpy 1	100	100	92	100	92	100	50	75	17
	Post passive thrpy	100	100	92	100	100	100	33	75	33
	Post wh Q thrpy 2	100	100	100	92	83	100	33	75	50
	Follow-up	100	100	92	100	83	83	**67**	75	33

Bold: $\chi^2_1 > 3.84$, $p < 0.05$, *: $\chi^2_1 > 7.88$, $p < 0.005$, **: $\chi^2_1 > 12.12$, $p < 0.0005$

RU made significant progress in comprehension and expression of passives with targeted therapy. JD made some progress during 'wh' therapy when passives were not targeted, but his results on the two tests were not consistent until he received targeted therapy. DG made gradual progress with comprehension, his scores continuing to rise after targeted therapy. His progress with expression was less dramatic and was not maintained at follow-up. FT only made significant progress with expression of passives on the acting out baseline task.

RU and JD improved significantly on 'which' comprehension after targeted therapy. Progress on expression of 'wh' questions was limited for all the participants. RU, JD and FT made significant progress on subject questions with therapy, which was not maintained, whereas DG maintained the progress he made. RU and DG improved on object questions, but this was not maintained.

Table 2. Percentage correct for 'wh' questions pre- and post-therapy

	Comprehension				Expression							
	"Who"		"Which"		Subject				Object			
Time of testing	Subj	Obj	Subj	Obj	Who	What	Which	TOT	Who	What	Which	TOT
RU Mean	88	88	88	38	50	0	0	17	0	0	0	0
Post pass thrpy	100	83	100	50	67	0	0	22	0	0	17	6
Post wh thrpy1	100	100	100	**100***	100	0	**67**	**56**	0	33	0	11
Post wh thrpy2	100	100	100	**100***	83	33	**67**	**61**	17	33	50	**33**
Follow-up	100	100	100	**83**	83	0	50	44	0	33	17	17
JD Mean	100	100	92	38	100	50	33	61	17	33	33	28
Post wh thrpy1	100	100	100	67	83	67	50	67	33	33	83	50
Post pass thrpy	100	100	100	50	100	100	67	89	33	33	50	39
Post wh thrpy2	100	100	100	**100***	100	100	**100**	**100***	33	17	33	28
Follow-up	83	100	100	**100***	100	83	83	89	17	33	67	39
DG Mean	100	100	100	71	33	33	50	39	0	0	17	6
Post pass thrpy	100	100	100	83	67	50	33	50	17	17	50	28
Post wh thrpy1	100	67	100	67	**100**	83	83	**89***	33	50	67	**50***
Post wh thrpy2	100	100	100	83	**100**	67	67	**78**	0	50	**83**	44
Follow-up	100	100	100	83	**100**	83	50	**78**	17	33	33	28
FT Mean	100	100	100	83	50	0	67	39	0	0	17	6
Post wh thrpy1	100	100	100	100	83	**83**	33	67	0	17	17	11
Post pass thrpy	100	100	100	83	83	**67**	67	72	0	0	0	0
Post wh thrpy2	100	100	100	100	100	**67**	67	**78**	0	0	0	0
Follow-up	100	100	100	100	83	50	67	67	0	33	0	11

Bold: $\chi^2_1 > 3.84$, $p < 0.05$,   *: $\chi^2_1 > 7.88$, $p < 0.005$

Discussion

The participants all showed progress although the significance and maintenance of their progress varied between individuals. Considering first the timing of progress, the greatest progress was made by all participants during targeted therapy. However, note DG showed some progress during baseline testing for comprehension of 'which' questions and expression of passives, and JD made some inconsistent progress with passives prior to targeted therapy.

The reasons contributing to the variable nature of the children's response to this kind of therapy need to be considered. FT responded least well. However, she had the lowest standard score on the Test of Visual-Perceptual Skills and therefore may not have benefited from the visual method of presentation. She also had good comprehension but great difficulties producing the targeted structures pre-therapy. The source of her difficulties therefore, may have been different to that of the other participants and perhaps was not best addressed by this type of therapy.

JD was similar to RU in his comprehension of the target structures and response to therapy but had superior expressive skills pre- and post-therapy. DG made a similar level of progress to RU and JD but the manner in which he improved showed a different

pattern. He made no progress until receiving targeted therapy; progress was then gradual and continued after therapy, indicating that he needed a period of consolidation. Pre-therapy he made fewer errors on passives and his comprehension of 'which' questions was unreliable but improved with testing. He may have been aware of differences between passives versus actives and subject versus object questions and developed his own inaccurate strategies to respond to these. With therapy he learnt more reliable strategies and may have needed time to reject his old strategies in favour of the new, thus showing more gradual progress. RU and JD on the other hand appeared to have no awareness of the differences between these structures and no strategies of their own prior to therapy. These did not therefore have to be rejected and they could begin to use the strategies taught, leading to a dramatic increase in scores.

The method of therapy used in this study was effective in improving the performance of at least three out of four participants. It was particularly effective in teaching the participants to comprehend grammatical structures which involve 'movement' involving dependent structural knowledge between sentence constituents. We aim to extend this method to a wider range of structures and refine the coding system further to maximise the potential benefits to the children. Further work is needed on a larger group of subjects in order to establish which children may benefit from this kind of approach and which factors may render children less likely to benefit. It is hoped that this will provide further insights in the future into the possible existence of subgroups of SLI and their differing responses to different types of therapy.

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