Child Language Teaching and Therapy

Teaching grammar to school-aged children with specific language impairment using Shape Coding

Susan Ebbels

The online version of this article can be found at:
http://clt.sagepub.com/cgi/content/abstract/23/1/67

Additional services and information for *Child Language Teaching and Therapy* can be found at:

Email Alerts: http://clt.sagepub.com/cgi/alerts

Subscriptions: http://clt.sagepub.com/subscriptions

Reprints: http://www.sagepub.com/journalsReprints.nav

Permissions: http://www.sagepub.com/journalsPermissions.nav

Citations (this article cites 31 articles hosted on the
SAGE Journals Online and HighWire Press platforms):
http://clt.sagepub.com/cgi/content/abstract/23/1/67#BIBL

Teaching grammar to school-aged children with specific language impairment using Shape Coding

Susan Ebbels
Moor House School, Oxted, Surrey, UK

Abstract

This paper describes an approach to teaching grammar which has been designed for school-aged children with specific language impairment (SLI). The approach uses shapes, colours and arrows to make the grammatical rules of English explicit. Evidence is presented which supports the use of this approach with older children in the areas of past tense morphology, comprehension of dative structures and comparative questions. I conclude that there is sufficient evidence that this kind of intervention can be effective with these older children. This challenges the current move to reduce direct intervention for school-aged children.

Introduction

Specific language impairment (SLI) has been estimated to affect approximately 7 percent of children (Leonard, 1998; Tomblin *et al.*, 1997) and to persist into adolescence (Aram *et al.*, 1984; Beitchman *et al.*, 1996; Stothard *et al.*, 1998; Johnson *et al.*, 1999). However, studies of intervention for school-aged children are very rare, especially for children in Key Stage 2 or above (over seven years). Only a few published intervention studies exist which involve children with SLI of this age, but also provide evidence of improving language abilities and include experimental control which allows us to determine whether any change is likely to be due to the intervention, rather than general maturation or other events in the child's life.

Address for correspondence: Susan Ebbels, Moor House School, Mill Lane, Hurst Green, Oxted, Surrey, RH6 8QR, UK. E-mail: ebbelss@moorhouseschool.co.uk

10.1191/0265659007072143

Children described as having SLI have difficulties with many areas of language. However, as a group they show disproportionate difficulty with some areas, performing worse than typically developing children matched on vocabulary level or mean length of utterance. Several authors (eg, Leonard *et al.*, 1992; Rice *et al.*, 1995; Rice and Wexler, 1996; Oetting and Horohov, 1997; van der Lely and Ullman, 2001) observe that this is particularly the case in the area of verb morphology and it has also been reported in some areas of syntax, including the comprehension of passive sentences (Bishop, 1979; van der Lely and Harris, 1990; van der Lely, 1996) and formation of wh-questions (Leonard 1995; van der Lely and Battell, 2003).

However, there are few intervention studies focussing on these areas with school-aged children. In the area of verb morphology, two studies focus on decreasing omissions of the auxiliary 'is' (Leonard, 1975; Ellis Weismer and Murray Branch, 1989), while two others include a range of verb morphology targets amongst an array of other targets (Camarata and Nelson, 1992; Nelson *et al.*, 1996) but do not evaluate the change in scores on these in particular. In the area of syntax, a few studies have targeted question formation or comprehension (Wilcox and Leonard, 1978; Ellis Weismer and Murray Branch, 1989; Ebbels and van der Lely, 2001; Spooner, 2002) and one targeted comprehension of passives (Ebbels and van der Lely, 2001). No other studies with school-aged children were found which focus specifically on verb morphology or syntax.

Background and rationale for using visual coding to teach grammar

Intervention studies with younger pre-school children with SLI have frequently used methods that teach language implicitly (see for example, Ellis Weismer and Murray Branch, 1989; Camarata and Nelson, 1992; Camarata *et al.*, 1994; Nelson *et al.*, 1996; Fey *et al.*, 1993, 1997), assuming that the children will be able to learn the rules of language in the normal way if the frequency and salience of target forms are increased. However, the persisting language difficulties of older school-aged children with SLI may reflect a difficulty with learning language implicitly, suggesting they may require a different approach. Indeed a recent study involving older children with SLI (Bishop *et al.*, 2006) found that repeated responding to spoken sentences (whether acoustically modified or not) did not lead to improved comprehension of reversible sentences such as actives and passives. The current study teaches language explicitly.

Explicit approaches for teaching syntax to children with SLI often use visual coding. These approaches assume that children with SLI have visual strengths and can be taught language through these. The first reports of such an approach with children with SLI were by Lea (1965, 1970) *The Colour Pattern Scheme*, although such methods had been used with other children at the beginning of the 20th century (Montessori, 1918). Several other approaches to teaching children with SLI incorporate the idea of colour coding (eg, *Language Through Reading*, Conn, 1973; Zwitman and Sonderman, 1979; *Colourful Semantics*, Bryan, 1997; *Spotlights on Language Communication System*, Kaldor, 1999, 2001; *Language Through Colour*, Gap House School, 2005). Shapes have also been used to teach language to typically developing children (Montessori, described in Polk Lillard, 1972) and those with SLI (Kaldor, 1999, 2001; Redmayne, 2006).

Despite the number of approaches using visual coding which exist, very few studies have been carried out investigating their efficacy. Zwitman and Sonderman (1979) found that using picture cards with coloured dots to show sentence order was effective at improving the use of two- to four-word combinations by children with SLI aged 3;4 to 4;4. Three reports describe case studies using the Colourful Semantics method (Bryan, 1997; Spooner, 2002; Guendouzi, 2003). Bryan's (1997) original study showed a child's age equivalent score on a simple test of expressive language improved by 12–18 months after only three months of intervention. Spooner (2002) showed progress on formal language tests in two children while Guendouzi (2003) studied two children with SLI and found that one made some progress in expressive language while the other did not. However, none of these case studies include experimental control and it is therefore difficult to know how much of the progress was directly related to the specific intervention method.

The approaches described above are all limited to basic sentence structures. While this may be adequate for younger children with SLI, some older children need work on structures such as wh-questions, passives, conjunctions, tense, aspect and noun-verb agreement. None of the above systems are able to illustrate all of these structures. For this reason, I developed the 'Shape Coding' system, which takes features of some of the approaches discussed above and extends them, in order that more complex structures and verb morphology can be shown using one visual coding system. The 'Shape Coding' system is most closely related to the Colour Pattern Scheme (Lea, 1970) and Colourful Semantics (Bryan, 1997). The Colour Pattern Scheme focuses on the surface structure of a sentence and colour codes the parts of speech (eg, noun, verb, adjective), whereas Colourful Semantics focuses on thematic roles (eg, agent, theme, location). However, both systems underline words or

groups of words with colours and thus could not be combined in a straightforward manner. Therefore, in the Shape Coding system, colours were kept for parts of speech and shapes were used for coding phrases according to their role and position in sentences.

The main advantage of 'Shape Coding' over systems which only use colours is that shapes can be placed inside each other, thus showing the hierarchical structure of language. Also, shapes can easily be moved around, making it possible to show the children how to form questions and passive sentences. This enables complex language (as well as simple structures) to be made visually explicit.

Overview of Shape Coding system

The Shape Coding system aims to represent visually the major linguistic features of English. Thus, different aspects of the system can be used to teach children a range of grammatical rules of English. When teaching the children, only those aspects of the system which are essential to explain each rule are used.

Syntactic structure

The Shape Coding system underlines individual parts of speech (eg, noun, verb, adjective) with the basic colours of the Colour Pattern Scheme, with a few alterations and the addition of new colours for determiners and conjunctions (see Table 1).

Each of these parts of speech can head a phrase which is grouped with a shape (eg, noun phrase – 'the BOY' = oval, verb phrase – 'THROWS the ball' = hexagon, prepositional phrase – 'IN the box' = semicircle, adjective phrase – 'BIGGER than a cat' = cloud). The different shapes correspond to different kinds of phrases and each is linked with 1) a question such as

Table 1 Parts of speech and their colours in the Shape Coding system

Colour	Part of speech	Examples
Red	Noun/pronouns	boy, table, I
Pink	Det/possessive pronouns	the, a, my
Yellow	Verb	push, melt
Green	Adjective	hard, sad
Blue	Preposition	in, through
Purple	Coordinating conjunction	and, but, or
Orange	Subordinating conjunction	because, if

Who/What, What doing, Where and What like/How feel, 2) a symbol (Writing with Symbols 2000, Widget Software, Cambridge) to represent these questions, and 3) a colour according to the part of speech which heads the phrase; examples are shown in the Appendix. For example, a prepositional phrase is surrounded by a semi-circle and is linked with the question 'Where' and contains a 'blue word' (preposition). Verb phrases consist of a main verb (or 'yellow word') and any noun and prepositional phrases which follow it (eg, 'pushing the box', 'rolling down the slope', 'putting the ball in the box', 'giving the girl the ball'). The whole verb phrase is surrounded by a hexagon and is linked with the question 'What doing'. Noun phrases have different shapes according to whether they are 'internal' or 'external' arguments, ie, whether they are inside another phrase (eg, push THE BOX, where THE BOX is internal to the verb phrase) or whether they stand alone (eg, THE GIRL pushed the box, where THE GIRL is external to the verb phrase).

The distinction between external and internal arguments is important, as it allows the system to distinguish between passive versus active sentences and subject versus object questions. Both external and internal arguments can answer the questions of 'Who' or 'What'; their shape does not depend on animacy, but on their position in the sentence. Therefore all of the following sentences have the same shape 'template' as that shown in Figure 1a:

I) John hit the car
II) The car hit John
III) John hit Fred
IV) The car hit the wall

An internal argument can also appear inside prepositional phrases as in the examples in Figure 1b. Auxiliaries and modals are coded with a diamond. It is important to keep these separate from the main verb, as they do not appear together in questions; only the auxiliary/modal (diamond) is moved to the front of the sentence (see Figure 1c).

Verb morphology
Verb morphology is indicated in the Shape Coding system using a series of arrows. Tensed verbs have vertical arrows going down from the yellow line which underlines the verb. Present tense verbs have an arrow in the middle of the line and past tense verbs an arrow at the left hand end of the line (see Figure 2a for examples).

The coding system for participles aims to represent their basic meaning. The present participle (eg, 'eating') has a zig-zag line under the '–ing', representing the continuous nature of the action. The past participle (eg, 'eaten') has an
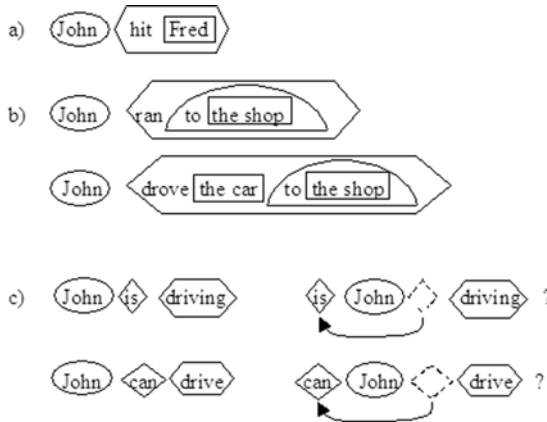
Figure 1 (a) Basic sentence template: external argument + verb phrase (including internal argument); (b) sentence templates including prepositional phrases (with an internal argument); (c) coding of auxiliaries and modals
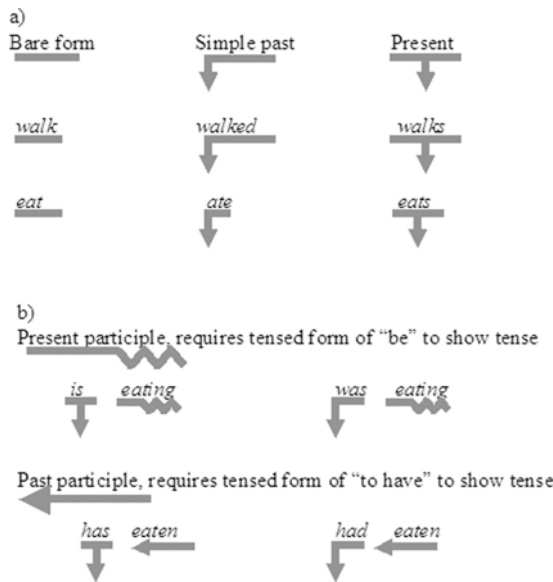

Figure 2 Verb morphology: (a) coding for finite verb tenses (all lines would be in yellow); (b) coding for present and past participles

arrow pointing left to represent its past meaning, but the arrow is horizontal, not vertical, indicating that it does not carry tense. For examples of the coding of participles see Figure 2b.

Using the Shape Coding system, it is possible to teach grammatical rules to children with SLI. For example, they learn that 'every sentence must have a down arrow' (a tensed verb). Therefore sentences such as 'he going home'

and 'he eaten it' are ungrammatical. By coding such erroneous sentences, therapists and teachers can show the children that they do not contain a 'down arrow' and that therefore one needs to be added by inserting an auxiliary verb ('diamond') which does.

Noun-verb agreement

The Shape Coding system shows noun-verb agreement by using double coloured lines under plural nouns and verbs. Therapists or teachers can therefore teach the children that the number of red lines in the oval (external argument) must match the number of yellow lines in the diamond (auxiliary). This is particularly useful for helping the children see that a plural auxiliary is needed where two coordinated nouns are in the subject position, eg, 'the man and the lady are talking'. I have noted in the course of my clinical work that many children with SLI use the singular auxiliary with coordinated noun subjects, presumably because they are only making the auxiliary agree with the noun immediately before the auxiliary 'the man and **the lady is** talking'. In order to explain agreement with coordinated noun phrases, it is necessary to use both the oval and diamond shapes and the red and yellow lines, because although 'man' and 'lady' are both singular, in total there are two red lines inside the oval and therefore the plural auxiliary 'are' should be used (see Figure 3).

The system can also be used to teach children about the third person singular –s by explaining that when a *he, she* or *it* is followed by a 'yellow word' with a 'down arrow' 'in the middle', they have to add an 's'.
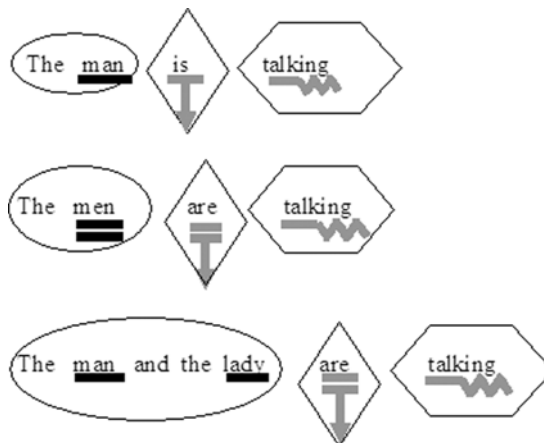

Figure 3 Noun–verb agreement (black = red, grey = yellow)

Introducing Shape Coding to children with SLI

The full Shape Coding system is complex in order to be flexible enough to capture the complexity of the English language. Therefore, introducing it to children with SLI may seem daunting. However, it is important to bear in mind that children are only introduced to those parts of the system which are necessary for explaining the particular rule which is being targeted at any one time.

If I have decided that a child may benefit from Shape Coding, I first identify which areas of grammar he/she needs to work on, then work out an order in which to teach them. This is based on criteria such as typical age of acquisition, relatedness to other structures which need to be taught, possible effect on the child's functioning in the classroom and whether the child can be paired or grouped with other children who need work on similar structures. Then, if the child is unfamiliar with the system, the basic system is introduced in the way described below (often with groups of children). After they understand the basics, they are ready to start on those structures where they have particular needs.

When introducing Shape Coding to children with SLI, the first aim is to establish the link between the shape and the question word; the colour is secondary at this stage. I begin by using laminated 'Who/What' and 'What doing' shapes (oval and hexagon) and ask the children to give me a name to go in the 'Who' shape and an action to go in the 'What doing' shape. I then either write these in or draw a picture with erasable white board pens on the back of the shape (for examples of the shapes see the Appendix). The children can then 'read' their sentence. To reinforce the link between questions and shapes, the shape is turned over to reveal the question word and ask the relevant question (eg, WHO is running?) and then the child is asked to turn over the relevant shape to find the answer on the back (eg, Sam). In the first session, I introduce the idea that a shape can contain more than one word, by encouraging the children to put noun phrases in the 'Who/What' shape (eg, 'the boy', or 'my mum') and verb phrases in the 'What doing' shape (eg, 'riding a bike'). I always stress that the shape goes around all the words in an answer, therefore if the answer to 'What is he doing?' is 'riding the bike', then the hexagon goes all around all three words 'riding the bike'. If the children know from the beginning that more than one word can go in a shape, the system immediately becomes more flexible. Indeed, this is the main advantage of the system. For this reason, colour is backgrounded to start with, as the coloured lines belong under individual words. Early exercises include drawing shapes around written sentences, identifying shape templates for spoken sentences and creating sentences for shape templates, either orally or written. To reinforce the

meaning of the shapes, I give exercises where the shape changes according to the meaning, for example, 'John is sleeping' versus 'John is tired', where 'sleeping' goes in a hexagon as it tells you 'What doing', while 'tired' goes in a cloud as it tells you how someone feels.

As the next step, I introduce the fact that an oval answers questions of both 'Who' and 'What', eg, 'the boy is small' and 'the house is small' use the same shape template (oval, diamond, cloud). Similarly, a rectangle also answers questions of 'Who' and 'What', but belongs inside other shapes, as in the examples in Figure 1a and 1b.

The next steps would depend on the focus of the therapy which the individual child requires, whether they need work on, for example, verb argument structure, question formation, sentence comprehension, verb morphology. Having chosen the area of focus, only those features of the Shape Coding system which are necessary for explaining and teaching that area are used. All other features are ignored until they are needed for teaching another area of language.

Applications of Shape Coding and evidence for its effectiveness

The Shape Coding system can be used to teach children with SLI a wide range of grammatical rules in the areas of argument structure, syntax and morphology. In this section, I will discuss some of the ways the system can be used and any evidence for its effectiveness in each area.

Vocabulary and argument structure

In order to be able to use a new item of vocabulary productively, children need to know its phonology, morphology (eg, whether it is a plural noun or particular verb form), semantics and syntax (both its part of speech and its argument structure). The Shape Coding system cannot be used for phonology, but it can be used to aid teaching in the other three areas. In terms of morphology, plural nouns or verbs can be indicated using double lines, and verb tenses and participles can be indicated using the arrow coding systems shown in Figure 2. The Shape Coding system is of limited use in teaching semantics, but it can be used to aid the comprehension of multiple meanings where they represent different parts of speech. For example, the word 'light' could be a noun (red), adjective (green) or verb (yellow). Once the children know the 'colour' of a new word, if they have learned the connection between colour and shape in the system, they should be able to begin to use shape templates to make sentences with the new words.

However, if the word is a verb, they also need to know its argument structure in order to use it correctly in a sentence. Indeed sentences are built around verbs and their argument structures (Chiat, 2000) and thus difficulties with verbs and their argument structures will lead to sentence production difficulties. Verbs have a range of argument structures and some verbs can have more than one argument structure, for example:

He is sleeping	Verb
He is eating (an apple)	Verb + optional Noun Phrase (NP)
He is lighting the fire	Verb + NP
He is pouring water on the fire	Verb + NP + Prepositional Phrase (PP)
He is filling the bucket (with water)	Verb + NP + optional PP
He is giving the girl the ball	Verb + NP (recipient) + NP
He is giving the ball to the girl	Verb + NP + PP (recipient)

The Shape Coding system can show each of these argument structures using different shape templates and when children learn a new verb, if they also learn its corresponding template(s), they will then be able to use it accurately in a sentence. This is important, as some studies have found that children with SLI omit more obligatory arguments than age controls (Thordardottir and Weismer, 2002), MLU controls (Watkins and Rice, 1991) and vocabulary controls (Ebbels, 2005). They also use the incorrect argument structure for verbs such as 'fill', where the object (eg, 'the bucket') changes state, not location (Ebbels, 2005), saying for example: *the lady is filling the sweets into the jar, the girl is building the bricks* and *the lady is covering the scarf on her head*. In a randomized control trial Ebbels *et al.* (2006, submitted) showed Shape Coding can improve the performance of children with SLI in their use of argument structure, improving their use of the correct argument structure with verbs like 'fill'.

Study 1: comprehension of dative form

Children with SLI have been found to have difficulties understanding the two constructions (dative versus prepositional) involved in verbs such as 'give' (van der Lely and Harris, 1990). I have used the Shape Coding system to help three children understand these constructions. These children were all involved in the study by Ebbels and van der Lely (2001) and showed significant progress with passives and wh-questions (see below). They were 11- to 12-years old at initial testing and 12 to 14 at the time when they received therapy targeted at the dative construction. All had severe receptive and expressive difficulties (see Table 2) but normal visual perceptual skills as measured on the Test of Visual Perceptual Skills (Gardner, 1988).

Table 2 Standard scores on standardized tests

Test	Participants		
	RU	JD	DG
CELF-R: Receptive Language	54	50	59
CELF-R: Expressive Language	54	59	59
TROG	65	<65	65
BPVS	50	50	68
Test of visual-perceptual skills	109	111	112

The children's comprehension of the dative and prepositional form was tested using an acting out task with a variety of animals using the verb *give*, initially once a week for four weeks and then once every school term. They were given six sentences in the prepositional form (eg, 'the cow is giving the pig to the sheep') and six sentences in the dative form (eg, 'the cow is giving the pig the sheep'). The most common error was that when they were asked to act out sentences in the dative form such as 'the cow is giving the pig the sheep', they tended to make the cow give the pig to the sheep, ie, they seemed to understand the dative form as if it were the prepositional form 'the cow is giving the pig to the sheep'. During the first year of the study, the children received therapy on passives and 'wh' questions (see Ebbels and van der Lely, 2001). Two children (RU and DG) then received one school-term of intervention (autumn term of year 2) targeting dative comprehension, while the other (JD) received intervention targeting comprehension of comparative questions (see below). JD then received intervention targeting comprehension of datives in the following spring term of year 2.

Method. The Shape Coding system was used to show the children the meaning of the two forms of the dative. They were taught the two sentence templates associated with the prepositional and dative forms (see Figure 4). The Recipient had the same shape in each of the templates, so that they could learn that the noun in the semi-circle receives the noun in the rectangle. Initially, the focus was on the prepositional form as the children had relatively good comprehension of this form. I taught them that the animal in the oval does the action, the one in the rectangle moves and the one in the semi-circle receives the one in the rectangle. A selection of toy animals was placed on the table and the shape template drawn on a piece of paper. Then, when the children heard a sentence, they had to place the correct animal in the correct shape to match the sentence they heard and repeat back the sentence. Then, after they had placed the animals in the shapes, they carried out the action described by the sentence. The child and I took turns to take on the different roles of
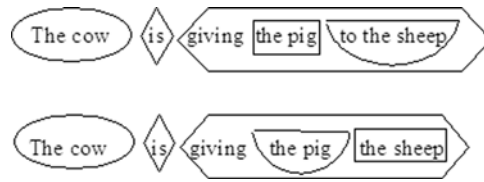
Figure 4   Shape coding templates for the dative and prepositional forms

creating and acting out the sentences. In this way, I could model for the child how to use the shape template to correctly act out the sentence and the child could take on the role of 'teacher', correcting me for any 'mistakes'.

When the child had grasped the principles of the shape template for the prepositional form, the template for the dative form was introduced. I told the child that this sentence type means the same thing, but when no 'to' is present (eg, in 'give the pig the cow') the order of the semi-circle and rectangle swap, so they have to listen very carefully for the 'to'. For the next few sessions, the child was given a choice of the two sentence templates in Figure 4. I would say a sentence which matched one of the templates and the child had to choose which template was used. Then, they placed the animals in the correct shapes on the correct template and only then acted out the sentence, remembering that the animal in the rectangle moves and the one in the semi-circle receives. Again, therapist and child frequently swapped roles. Later sessions consisted of turning over the piece of paper so that the child could not see the templates, but they were asked to picture them in their mind before acting out the sentence. Then, before the therapist gave feedback on whether they had acted out the sentence correctly or not, they had to turn over the piece of paper containing the templates and decide for themselves whether they had carried out the correct action.

The number of sessions at each stage depended on the response of the child; they did not progress to the next stage until they were accurate with the previous stage, thus some children progressed through the therapy quicker than others.

Results and discussion.   Table 3 shows the results for the three participants RU, JD, DG. RU and DG received therapy targeting this area in the autumn term of Year 2, while JD received it in the spring term. The post-therapy score for each child is highlighted in the table.

It is clear from Table 3 that prior to therapy, RU and JD had good comprehension of the prepositional form and no real understanding of the dative form. Two-tailed Wilcoxon matched samples tests for both children

Table 3   Percentage correct for comprehension of prepositional and dative forms

Participant:		RU		JD		DG	
Year	School-term test carried out	Prep. form	Dative form	Prep. form	Dative form	Prep. form	Dative form
1	Autumn (week 1)	100	0	100	33	33	17
1	Autumn (week 2)	67	17	100	0	83	50
1	Autumn (week 3)	100	0	100	0	100	17
1	Autumn (week 4)	100	0	100	0	67	17
1	End of autumn	67	0	100	0	33	33
1	End of spring	83	0	100	0	100	33
1	End of summer	100	0	100	0	100	67
2	Start of autumn	100	0	100	0	83	33
2	End of autumn	**100**	**100**	100	0	**83**	**33**
2	End of spring			**100**	**100**		
	Mean pre-therapy	90	2	100	4	75	33
	Post-therapy	100	100	100	100	83	33

showed that this difference between the two forms was significant both for RU ($T = 0$, $n = 8$, $p = 0.009$) and JD ($T = 0$, $n = 9$, $p = 0.004$). Because their pre-therapy scores are not normally distributed, it is not possible to carry out a t-test, but it is clear that they made excellent progress with intervention as their post-therapy scores on both forms were 100%, while before therapy, they both scored 0% correct on the dative form on all but one occasion. Their progress in this area is likely to be due to the intervention rather than any external factors as for both children their progress was related to the time they received the intervention, which for JD was one term later than for RU. They were both in the same class and thus any effect on performance of classroom activities would be expected to affect both children at the same time, which was not the case.

DG differed from JD and RU in that he showed unreliable comprehension of both the dative and prepositional forms both prior to and after therapy. However, in line with the other two children, his comprehension of the prepositional form pre-therapy was still significantly better than his comprehension of the dative form ($T = 0$, $n = 7$, $p = 0.016$). His post-therapy scores

did not differ significantly from his pre-therapy scores on either the dative form ($t(7) = 0.06$, $p = 0.95$, $d = 0.002$) or prepositional form ($t(7) = -0.81$ $p = 0.44$, $d = 0.29$), showing that he did not benefit from the intervention in this area. A likely reason for the different pattern of performance for DG is likely to be auditory memory. Although robust data was not collected in this area for all three children, DG had noticeably poor auditory memory and on informal tests was unable to remember three items reliably in sequence. Hence, the reason for his poor understanding of both the dative and preposi-tional forms is likely to be his inability to remember the order of the three nouns present in these sentences. Indeed, during the testing, he frequently repeated the sentence incorrectly before attempting to act it out. It seems that Shape Coding did not aid his ability to remember the sequence of the nouns in the sentence.

Study 2: syntax (comprehension of comparative questions)

As discussed in the introduction, several studies have found that children with SLI have difficulties understanding passive sentences and forming wh-questions, but therapy studies targeting these areas of syntax are virtually non-existent. Shape Coding has been used to remediate both these areas. Ebbels and van der Lely (2001) report on its use to teach comprehension and use of wh-questions and passive sentences to four children. The method of coding such sentences is shown in Figure 5. Three of the children (RU, JD and DG) showed good progress in these areas. However, one child (FT, with good comprehension but poor production of these structures pre-therapy) showed little improvement with Shape Coding therapy, indicating that her difficulties may be different from the others.

A follow-up study showed that Shape Coding could also be used to help the children understand comparative questions (eg, 'what is bigger than a cat?' or 'what is a cat bigger than?'). These questions occur frequently in maths and while therapists and teachers often focus on children's understanding of the concept of comparison (eg, bigger than, smaller than), we rarely focus on the syntax of the questions. If children with SLI have difficulties understand-ing structures involving 'movement' (as has been argued by van der Lely, 1998), the structure of the question may affect whether the children can answer it correctly or not, regardless of their understanding of the concept of comparison.

This study involved two of the three children who benefited from the therapy focused on passives and wh-questions (JD and DG). Their understand-ing of comparative questions was measured once a week for four weeks and then once per term during the first year of the study (during the passive and
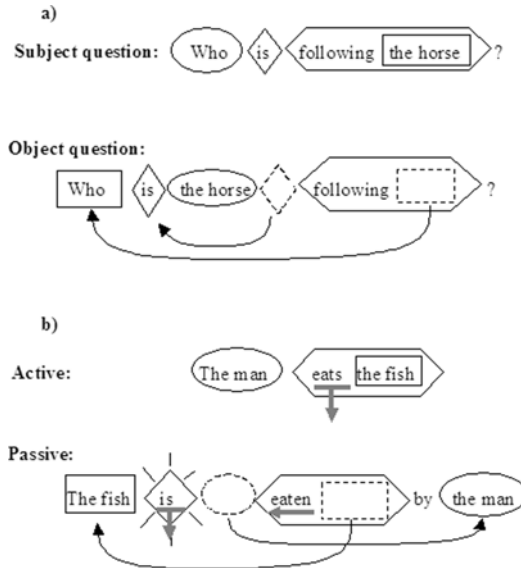
Figure 5   (a) Coding for wh-questions; (b) coding for active and passive sentences

wh-question therapy reported in Ebbels and van der Lely, 2001), directly prior to receiving therapy on comparative questions and then again after a term of therapy. The test consisted of twelve questions involving the concepts of 'bigger than' and 'smaller than'. Six questions were without movement, three using 'bigger than' and three using 'smaller than' (eg, 'what is bigger/smaller than a cat?') and six questions with movement (eg, 'what is a cat bigger/ smaller than?').

In order to control for other factors in their school experience, as they were in the same class, the two children received intervention on this target at different times: JD during the autumn term of year 2 and DG in the spring term.

Method.   The method used was very similar to that used in our earlier study (Ebbels and van der Lely, 2001): movement of the wh-phrase was shown with a trace (shape with dotted line) and an arrow joining the new location of the question word and its original location (see Figure 6).

The children were first introduced to the shape template for the sentence they could understand better (ie, the form without movement). Initially they were introduced to comparative statements rather than questions which fitted the template (eg, 'a cow is bigger than a cat'). They were then shown that the question word 'What' can be used to replace the word in the oval. This was usually done by writing the words (or drawing a picture for children with poor literacy) on the
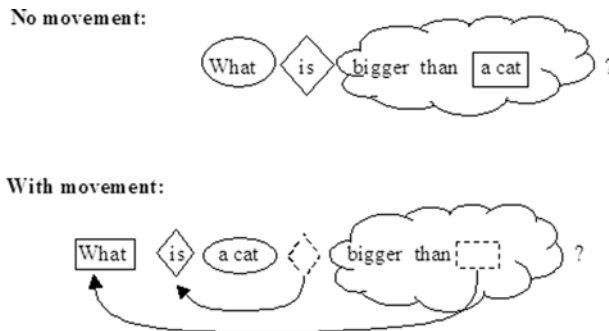
Figure 6   Coding for 'wh' question comparatives

back of the laminated shapes. Thus, the shape could be turned over to reveal the question word and turned back to reveal the 'answer'. I discussed with the children that many words could go in the oval shape as many objects are bigger than a cat. One exercise therefore involved writing (or drawing) many words on the back of the oval shape, all of which completed a true statement. By changing the words in the rest of the sentence (eg, changing 'bigger' to 'smaller' or 'cat' to 'house') the children learned to change the objects in the oval, by rubbing out those which no longer applied and adding new ones.

When the children had a good comprehension of how the shape template worked for the question with no movement, I then introduced the template with movement. To introduce movement, I started again with a statement (eg, 'a cow is bigger than a cat') and then showed them that the question on the back of the rectangle was also 'What' and that sometimes we may want to ask about the rectangle. When the rectangle was turned over to reveal the question word, the sentence now read 'a cow is bigger than what?'). I then showed them that question words have to move to the front of the sentence leaving a trace behind, shown as a dotted rectangle (producing 'what a cow is bigger than ____?') and then the rule that if a rectangle is at the beginning of a sentence, a diamond (ie, auxiliary) has to come second. Because a diamond is already present in the sentence (containing 'is'), that can move from its original position to second place, resulting in 'what is a cow ____ bigger than ____?'). The concept of moving question words to the beginning of a sentence and diamonds to the second position was already familiar to the children from the 'wh' question therapy they had already carried out as part of our earlier study (Ebbels and van der Lely, 2001).

In the next stage the children were given the two possible shape templates to choose from (as shown in Figure 6) and then asked comparative questions which

matched one of the templates. They had to listen carefully to the question and choose which template it matched (for literate children this task can also be given in a written form). Having chosen the correct template they then had to answer the question. As a check and before they were given feedback on their answer, they had to turn the question back into a statement by turning the 'What' shape over and replacing it with their answer and, if it was a rectangle, returning it to its original position in the sentence and reading the resulting statement. In this way, they could see if they had given the correct answer. In the final stages of therapy, this process was carried out without looking at the templates at first, but afterwards using them as a check in a similar way to that used in the dative therapy. Thus, the children learned to use the shapes to correct their own answers rather than relying on the adult to tell them if they had made an error or not.

Results and discussion. The children's scores on the comparative questions test are shown in Table 4, the post-therapy scores for each child are highlighted. This shows that prior to receiving therapy, both children had good understanding of comparative questions without movement (eg, 'what is bigger/smaller than a cat?') showing that they understood the concepts of 'bigger than' and 'smaller than'. However, their comprehension of those questions involving movement (eg, 'what is a cat bigger/smaller than?') was significantly worse (JD: $T = 0$, $n = 8$, $p = 0.008$ and DG: $T = 0$, $n = 9$, $p = 0.004$).

Their scores during the period before they received intervention targeting this structure are of interest. DG showed consistently poor scores on questions

Table 4 Percentage correct for comprehension of comparative questions

Year	School-term test carried out	JD No movement	JD With movement	DG No movement	DG With movement
1	Autumn (week 1)	100	17	100	17
1	Autumn (week 2)	100	17	100	0
1	Autumn (week 3)	100	67	83	0
1	Autumn (week 4)	100	33	83	0
1	End of autumn	100	50	100	0
1	End of spring	100	0	100	0
1	End of summer	100	67	100	0
2	Start of autumn	100	33	100	0
2	End of autumn	**100**	**83**	100	0
2	End of spring			**100**	**100**
	Mean pre-therapy	100	35	96	2
	Post-therapy	100	83	100	100

involving movement. However, JD showed some improvement during the autumn and summer terms of the first year. This is during the time when he was receiving intervention focused on non-comparative wh-questions, indicating that for him, there was some generalization from this therapy to the comprehension of comparative questions. However, during the periods when he was not receiving intervention focused on wh-questions, his scores on comparative questions decreased, although he maintained progress with standard object wh-questions which were the direct focus of the intervention (see Ebbels and van der Lely, 2001).

A one-sample *t*-test showed JD's comprehension of the questions involving movement was significantly better after this specific intervention than before ($t(7) = -5.52$, $p = 0.001$, $d = 1.98$). Because DG's pre-therapy scores were not normally distributed, it was not possible to carry out a *t*-test, but it is clear that he made excellent progress with therapy, scoring 100% after therapy, whereas on all but one previous occasion, he had scored 0%. Thus, the Shape Coding therapy was effective at teaching comprehension of comparative questions for both children in this study.

Study 3: verb morphology (past tense)

The most common finding in studies with children with SLI is that they have difficulties with verb morphology. These difficulties include omission of the past tense and tensed auxiliaries (eg, is, are, was, were) and errors of subject-verb agreement (eg, omitting third person –s in the present tense or using 'was' or 'is' instead of 'were' and 'are'). The Shape Coding system can be used to teach children the concepts of tense and agreement and grammatical rules governing their use. Once they have learned these rules, the system can be used to correct the errors they have made in their work. If the teacher or therapist marks the child's work using the Shape Coding symbols, the children can 'see' their own mistakes; this increases their independence as they can correct their own mistakes and also understand why they are wrong.

In the next section, I report on a study focusing on teaching the past tense in written work with the Shape Coding system. This was carried out with one class of nine children with SLI aged 11–13 years.

Method.   The children were taught to associate tense with a 'time line', where the present is in the middle of the line and the past at the left hand end. A vertical arrow appeared at the left of the horizontal line under past tense verbs and in the middle under present tense verbs (see Figure 2a). The children were taught to identify verbs in written sentences and then identify

whether they were tensed or not and which tense they were in. They were taught rules such as: all main clauses 'must have one (and only one) down arrow' (ie, one tensed verb) and throughout a piece of text 'the arrows have to stay the same' (ie, you have to maintain consistency of tense), unless you are quoting direct speech. They were encouraged to write sentences which matched particular patterns, check written sentences for tense errors and eventually to check their own and others' written work by drawing the symbols under the verbs and make corrections if the work did not conform to the rules they had learned.

Before the intervention began, the children were asked to write about their Summer holiday and the proportion of verbs written in the past tense (where required) was recorded. The intervention lasted throughout the Autumn term and was taught to the whole class of nine children in an English lesson (one hour per week). In January they were asked to write about their Christmas holidays and the same measure was taken. Two of the children showed a decrease in performance and were therefore given extra sessions in a pair and re-tested again after the February half-term.

Results and discussion. The results for the individual participants (A–I) are shown in Table 5. This shows that six of the nine participants used the past tense more consistently when retested in January when compared with their performance in September. One child showed little change (participant F) and two showed a decrease in performance (A and B). For participant B this was partly due to a very restricted use of verbs in her first sample, where she used only five high frequency verbs in total. However, after six additional half-hour sessions in a pair focusing on the same area, participants A and B showed better performance than their original performance in September.

A one-tailed paired *t*-test comparing performance in September and January for the whole group was not significant, despite a large effect

Table 5 Percentage of past tense use in spontaneous written work

	A	B	C	D	E	F	G	H	I	Mean	SD
Sept	54	80	38	43	64	71	78	82	87	66	*18*
Jan	50	36	55	75	91	70	85	100	100	74	*23*
Feb	73	92									
Difference: Sep–Jan	−4	−44	17	32	27	−1	7	18	13	7	*23*
Difference: Sep–final	19	12	17	32	27	−1	7	18	13	16	*10*

size ($t(8) = -0.96$, $p = 0.18$, $d = 1.72$). However, the group difference is significant with a very large effect size if the child who used a very restricted number of verbs in her pre-therapy sample (participant B) is removed ($t(7) = -4.46$, $p = 0.001$, $d = 3.70$) or if all children are included but for the two children who received additional paired therapy (participants A and B), their February scores are used instead ($t(8) = -4.46$, $p = 0.001$, $d = 5.88$).

The results of this study show that for most children in the class, intervention in a group targeting the past tense was effective. However, two children showed no progress when taught with the whole class but made good progress with additional sessions of paired work. Thus, it seems that while group work may work well for some pupils, it is not equally effective for all. Thus, if a child does not appear to benefit from intervention it may be worth changing the method of delivery of intervention rather than the method of intervention itself.

Summary and general discussion

The Shape Coding system is flexible enough to be used to teach a range of grammatical rules. Studies reported in this paper and elsewhere indicate that it can be useful in teaching older children with SLI about verb argument structure, the dative form, wh-questions (including comparative questions), passives and the past tense. However, analyses of individual cases indicate that it is not effective for all children for all these structures. The study involving the past tense 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. The child in the study by Ebbels and van der Lely (2001) with good comprehension of the passive and wh-questions, showed no change in her production of these structures. Another child in that study (DG) is also discussed in this paper. He made good progress with passives and wh-questions (including comparative questions), but not with comprehension of the dative form. I hypothesized that this was due to his difficulties remembering the three noun phrases involved in the dative structures; all the other structures involved only two noun phrases and thus it is possible that he was able to remember the sentences and then use the Shape Coding system to improve his understanding of the syntax. These studies therefore indicate that individual differences between children can lead to different outcomes of therapy. Some children may have additional difficulties which affect their response to therapy on particular structures (as hypothesized

for DG). Other children may require particular methods of delivery in order to benefit from therapy as seems to be the case with the two children in the past tense study. Therapy provision must be flexible enough to accommodate the individual differences of children.

These mixed results point to many further avenues of research. We need to establish which children can benefit from the Shape Coding method, in which setting (group versus paired versus individual therapy) and for which structures. In addition, we need to investigate whether similar methods of therapy can be effective with younger children with SLI. I have received reports that therapists and teachers have found it to be useful with younger age groups (Key Stages 1 and 2), but controlled studies are now needed. With younger children, it would be even more important to use only those parts of the system which are essential at any one time, thus avoiding unnecessary complexity. However, the advantage of the Shape Coding method is that for those children who are likely to have long-term language difficulties, it can be extended to more complex structures later.

The studies reported in this paper and others (eg, Ebbels and van der Lely, 2001; Ebbels *et al.*, 2006, submitted) show that intervention can be effective for secondary-aged children with SLI. This is in contrast to a recent study (Bishop *et al.*, 2006) which found that a computer programme which provided repeated examples of structures similar to those investigated with the Shape Coding system and reinforcement for correct answers did not improve the children's comprehension of these structures. The participants in that study were very similar to those who have benefited from use of the Shape Coding system. Therefore, either the intervention method or its delivery are likely to account for the very different results of that study from those reported in this paper. The studies differed in the method of teaching (computer versus therapist) as well as the content of the therapy. In Bishop *et al.*'s study, although the children were informed whether their responses were correct or incorrect, they were not given any explicit explanation as to why. This is in contrast to the Shape Coding method, where the therapist or teacher uses the shapes to explain to the child why they have made an error and how to improve their performance. Given these two differences, future studies could aim to establish which ingredients of the Shape Coding therapy are crucial to success: the interaction with a person rather than a computer, the explicit rather than implicit behavioural approach, or both.

The positive results reported in this paper provide evidence in favour of continuing to provide intervention for the persisting difficulties of older children with SLI. Unfortunately, many services (in the UK at least) provide very little and often no therapy to children over 11 years of age (Lindsay *et al.*,

2005; Dockrell *et al.*, 2006). This is perhaps unsurprising given the limited evidence that intervention for this age group is effective. However, the positive results discussed above might encourage others to investigate intervention for other areas of language in school-aged children.

The predominant philosophy within speech and language therapy services in the UK is to provide intervention when the children are as young as possible, to prevent future difficulties. While I applaud this principle, I would also argue that at present we have no 'cure' for SLI and many children continue to have difficulties throughout childhood and into their adult lives. Therefore, as long as therapy can be shown to be effective, it should continue throughout a child's school life and possibly beyond. The challenge however, given limited therapy resources, is to establish the most effective methods and approach to therapy for each area of language, for each age group and for every profile of difficulties.

Acknowledgements

References

Aram, D. M., Ekelman, B. L. and Nation, J. E. 1984 'Pre-schoolers with language disorders: 10 years later', *Journal of Speech and Hearing Research* **27**, 232–44.

Beitchman, J. H., Wilson, B., Brownlie, E. B., Walters, H. and Lancee, W. 1996 'Long-term consistency in speech/language profiles: 1. Developmental and academic outcomes', *Journal of the American Academy of Child and Adolescent Psychiatry* **35**, 804–14.

Bishop, D. V. M. 1979 'Comprehension in developmental language disorders', *Developmental Medicine and Child Neurology* **21**, 225–38.

Bishop, D. V. M., Adams, C. V. and Rosen, S. 2006 'Resistance of grammatical impairment to computerized comprehension training in children specific and non-specific language impairments', *International Journal of Language & Communication Disorders* **41**, 19–40.

Bryan, A. 1997 'Colourful Semantics', in S. Chiat, J. Law and J. Marshall (eds), *Language disorders in children and adults: psycholinguistic approaches to therapy.* London: Whurr.

Camarata, S. M. and Nelson, K. E. 1992 'Treatment efficiency as a function of target selection in the remediation of child language disorders', *Clinical Linguistics & Phonetics* **6**, 167–78.

Camarata, S. M., Nelson, K. E. and Camarata, M. N. 1994 'Comparison of conversational-recasting and imitative procedures for training grammatical structures in children with specific language impairment', *Journal of Speech and Hearing Research* **37**, 1414–23.

Chiat, S. 2000 *Understanding children with language problems*. Cambridge University Press.

Conn, P. 1973 *Language therapy*. Invalid Children's Aid Association.

Dockrell, J. E., Lindsay, G., Letchford, B. and Mackie, C. 2006 'Educational provision for children with specific speech and language difficulties: Perspectives of speech and language therapist managers', *International Journal of Language and Communication Disorders* **41**: 423–40.

Ebbels, S. H. 2005 'Argument structure in specific language impairment: from theory to therapy', unpublished PhD thesis, University College London.

Ebbels, S. and van der Lely, H. 2001 'Meta-syntactic therapy using visual coding for children with severe persistent SLI', *International Journal of Language & Communication Disorders* **36**(Suppl), 345–50.

Ebbels, S. H., van der Lely, H. K. J. and Dockrell, J. E. 2006 'Intervention for verb argument structure in children with persistent SLI: a randomized control trial', *Journal of Speech Language and Hearing Research* (Submitted).

Ellis Weismer, S. and Murray Branch, J. 1989 'Modeling versus modeling plus evoked production training – a comparison of 2 language intervention methods', *Journal of Speech and Hearing Disorders* **54**, 269–81.

Fey, M. E., Cleave, P., Long, S. H. and Hughes, D. L. 1993 'Two approaches to the facilitation of grammar in children with language impairment: an experimental evaluation', *Journal of Speech and Hearing Research* **36**, 141–57.

Fey, M. E., Cleave, P. L. and Long, S. H. 1997 'Two models of grammar facilitation in children with language impairments: phase 2', *Journal of Speech Language and Hearing Research* **40**, 5–19.

Gap House School. 2005 'Language through colour', Developed at Gap House School, Broadstairs, Kent. Contact 01843 866672 for further information.

Gardner, M. F. 1988 'Test of visual-perceptual skills (non-motor)', Available from Ann Arbor Publishers Ltd, PO Box 1, Belford, Northumberland, NE70 7JX.

Guendouzi, J. 2003 ' "SLI", a generic category of language impairment that emerges from specific differences: a case study of two individual linguistic profiles', *Clinical Linguistics & Phonetics* **17**, 135–52.

Johnson, C. J., Beitchman, J. H., Young, A. *et al.* 1999 'Fourteen-year follow-up of children with and without speech/language impairments: speech/language stability and outcomes', *Journal of Speech Language and Hearing Research* **42**, 744–60.

Kaldor, C. 1999 'From visual image to verbal and syntactic symbols: The spotlights on language communication system (SPOTS-ON)', Paper presentation at the AFASIC Conference, York, 1999 (Available from the author: pkaldor@yahoo.com).

Kaldor, C., Robinson, P. and Tanner, J. 2001 'Turning on the spotlight', *Speech and Language Therapy in Practice*, Summer 2001.

Lea, J. 1965 'A language system for children suffering from receptive aphasia', *Speech Pathology and Therapy* **8**, 58–68.

Lea, J. 1970 *The colour pattern scheme: a method of remedial language teaching*. Moor House School, Hurst Green, Surrey, UK.

Leonard, L. B. 1975 'Developmental considerations in the management of language disabled children', *Journal of Learning Disabilities* **8**, 44–49.

Leonard, L. B. 1995 'Functional categories in the grammars of children with specific language impairment', *Journal of Speech and Hearing Research* **38**, 1270–83.

Leonard, L. B. 1998 *Children with specific language impairment*. Cambridge, MA, USA: MIT Press.

Leonard, L. B., McGregor, K. K. and Allen, G. D. 1992 'Grammatical morphology and speech-perception in children with specific language impairment', *Journal of Speech and Hearing Research* **35**, 1076–85.

Lindsay, G., Dockrell, J. E., Mackie, C. and Letchford, B. 2005 'Local educational authorities' approaches to provision for children with specific speech and language difficulties in England and Wales', *European Journal of Special Needs Education* **20**, 329–45.

Montessori, M. 1918 *The advanced Montessori method II. The Montessori elementary material*. London: Heineman, UK.

Nelson, K. E., Camarata, S. M., Welsh, J., Butkovsky, L. and Camarata, M. 1996 'Effects of imitative and conversational recasting treatment on the acquisition of grammar in children with specific language impairment and younger language-normal children', *Journal of Speech and Hearing Research* **39**, 850–59.

Oetting, J. B. and Horohov, J. E. 1997 'Past-tense marking by children with and without specific language impairment', *Journal of Speech Language and Hearing Research* **40**, 62–74.

Polk Lillard, P. 1972 *Montessori: a modern approach*. New York, USA: Schocken Books.

Redmayne, C. 2006 *Pack 10 (Shape Up) of ten Language Packs*. Cambridge: Widget Software Limited.

Rice, M. L. and Wexler, K. 1996 'Toward tense as a clinical marker of specific language impairment in English-speaking children', *Journal of Speech and Hearing Research* **39**, 1239–57.

Rice, M. L., Wexler, K. and Cleave, P. L. 1995 'Specific language impairment as a period of extended optional infinitive', *Journal of Speech and Hearing Research* **38**, 850–63.

Spooner, L. 2002 'Addressing expressive language disorder in children who also have severe receptive language disorder: a psycholinguistic approach', *Child Language Teaching and Therapy* **18**, 289–313.

Stothard, S. E., Snowling, M., Bishop, D. V. M., Chipchase, B. B. and Kaplan, C. A. 1998 'Language-impaired preschoolers: a follow-up into adolescence', *Journal of Speech Language and Hearing Research* **41**, 407–18.

Thordardottir, E. T. and Weismer, E. 2002 'Verb argument structure weakness in specific language impairment in relation to age and utterance length', *Clinical Linguistics & Phonetics* **16**, 233–50.

Tomblin, J. B., Records, N. L., Buckwalter, P., Zhang, X., Smith, E. and O'Brien, M. 1997 'Prevalence of specific language impairment in kindergarten children', *Journal of Speech Language and Hearing Research* **40**, 1245–60.

van der Lely, H. K. J. 1996 'Specifically language impaired and normally developing children: Verbal passive vs adjectival passive sentence interpretation', *Lingua* **98**, 243–72.

van der Lely, H. K. J. 1998 'SLI in children: movement, economy, and deficits in the computational-syntactic system', *Language Acquisition* **7**, 161–92.

van der Lely, H. K. J. and Battell, J. 2003 'Wh-movement in children with grammatical SLI: a test of the RDDR hypothesis', *Language* **79**, 153–81.

van der Lely, H. K. J. and Harris, M. 1990 'Comprehension of reversible sentences in specifically language-impaired children', *Journal of Speech and Hearing Disorders* **55**, 101–17.

van der Lely, H. K. J. and Ullman, M. T. 2001 'Past tense morphology in specifically language impaired and normally developing children', *Language and Cognitive Processes* **16**, 177–217.

Watkins, R. V. and Rice, M. L. 1991 'Verb particle and preposition acquisition in language-impaired preschoolers', *Journal of Speech and Hearing Research*, **34**, 1130–41.

Wilcox, J. M. and Leonard, L. B. 1978 'Experimental acquisition of *Wh*-Questions in language-disordered children', *Journal of Speech and Hearing Research* **21**, 220–39.

Zwitman, D. H. and Sonderman, J. C. 1979 'A syntax program designed to present base linguistic structures to language-disordered children', *Journal of Communication Disorders* **12**, 323–35.

Appendix
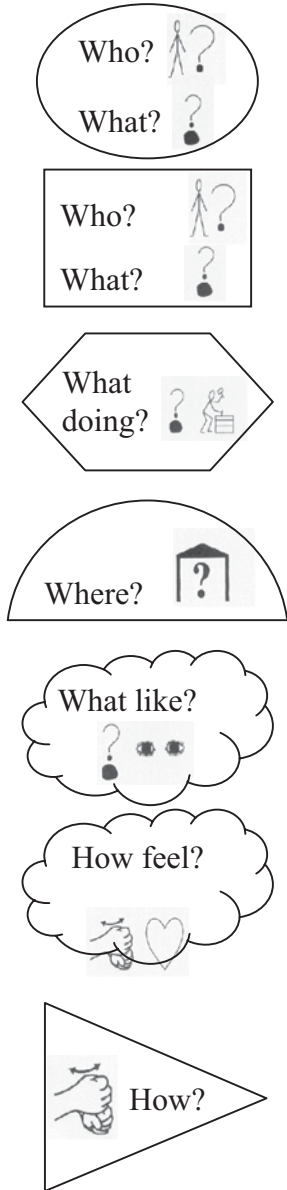
	Colour	Shape
Who? What? (oval)	*Red = noun*	*Oval=Noun Phrase (external argument)*
Who? What? (rectangle)	*Red = noun*	*Rectangle=Noun Phrase (internal argument)*
What doing? (hexagon)	*Yellow = verb*	*Hexagon=Verb Phrase*
Where? (semi-circle)	*Blue = Preposition*	*Semi-circle= Prepositional Phrase*
What like? How feel? (clouds)	*Green = Adjective*	*Cloud=Adjective Phrase*
How? (triangle)	*No colour*	*Variety of phrases:* *1. with+NP* *2. by plus progressive verb* *3. adverbial phrase*