WH-MOVEMENT IN CHILDREN WITH GRAMMATICAL SLI: A TEST OF THE RDDR HYPOTHESIS

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This article presents a test of the proposal that a subgroup of children with GRAMMATICAL-SPECIFIC LANGUAGE IMPAIRMENT (G-SLI) have optional movement (the REPRESENTATIONAL DEFICIT FOR DEPENDENT RELATIONS (RDDR) account, van der Lely 1998) by investigating WH-movement in fifteen G-SLI subjects and twenty-four younger children matched on language abilities (LA controls). The RDDR/optional movement account predicts that G-SLI subjects would have deficits with both WH-operator and Q-feature movement and therefore would have particular problems producing object questions. We elicited 36 questions balanced for subject and object questions and WH-words (*who*, *which*, *what*). The G-SLI subjects were significantly impaired in producing WH-questions, showing particular difficulties with object questions in relation to the control children. The majority of G-SLI subjects (80%) evinced both WH-operator and T/Q-feature movement errors whereas only one control child (4%) did so, yet on occasion all the G-SLI subjects used appropriate movement operations to satisfy the WH-criterion. We conclude that the RDDR account whereby movement is optional is consistent with the findings of correct and incorrect WH-question formation. Thus, this first test of the RDDR account of G-SLI is supported by the findings. We discuss the possible underlying nature of a grammar that could cause such optionality, the implications for normal and impaired language acquisition, and the generalizability of the findings to other groups of children with SLI. We propose that in the face of no movement, the WH-word and, on occasion, *do* are merged in situ in the CP, and function as an interrogative adjunct.*

1. PRELIMINARIES. Specific language impairment (SLI) is a heterogeneous disorder of language acquisition in children who have no other apparent cognitive, neurological, or environmental impairment that can account for their deficit (Menyuk 1964). SLI affects around 7% of children and can persist into adulthood (Leonard 1998). Evidence from diverse sources indicates that there is a significant genetic contribution to the disorder (Fisher et al. 1998, Bishop et al. 1995, Hurst et al. 1990, SLI Consortium 2002, van der Lely & Stollwerck 1996). Investigations of subjects with SLI not only inform us about the nature of their disorder but also provide theoretical insight into the innate basis of language and the development of specialized cognitive systems, like the grammatical system.

Towards this end, van der Lely and colleagues have investigated a subgroup of Grammatical (G)-SLI children, who exhibit a relatively pure, domain-specific grammatical impairment (van der Lely 1996b, 1998, van der Lely & Christian 2000, van der Lely et al. 1998). Previous investigations into G-SLI subjects' syntactic abilities show that they inconsistently manipulate core aspects of syntax, including tense and agreement marking, the assignment of thematic roles to noun phrases, and the assignment of coreference to pronouns and anaphors in sentences when only syntactic cues are

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available, as well as comprehension and production of embedded phrases and clauses (van der Lely 1996b, van der Lely & Dewart 1986, van der Lely & Hennessey 1999, van der Lely & Stollwerck 1997). The REPRESENTATIONAL DEFICIT FOR DEPENDENT RELATIONS (RDDR) hypothesis, developed to account for G-SLI grammar, identifies the source of the linguistic deficit in the computational syntactic system, that is, in the syntax proper (van der Lely 1994, 1998). The RDDR contends that the core deficit responsible for G-SLI children's grammar is in 'Movement' (Chomsky 1995), and more specifically, that whereas the basic operation/rule 'Move' in normal grammar is (by definition) obligatory, in G-SLI grammar it is optional (van der Lely 1998). This would account for the broad range of language deficits and a core feature of G-SLI grammar—the inconsistent use of certain grammatical rules (van der Lely 1998). Further characterization of the RDDR hypothesis is provided below. This study tests the RDDR proposal by investigating subject and object question formation in G-SLI subjects (aged 11:3–18:2 [years:months]), exploring their ability to compute WH-movement in sentences, and comparing their performance with that of younger, language-matched control children (aged 5:1–9:1). Surprisingly, there have been few systematic investigations of WH-movement in SLI subjects, despite the role such investigations have played in linguistic theory and language acquisition (Crain & Thornton 1998, de Villiers & Roeper 1995, Manzini 1992, Rizzi 1990, Stromswold 1995). The obligatoriness of movement makes the investigation of subject and object question formation a strong test of the RDDR account.

1.1. SPECIFIC LANGUAGE IMPAIRMENT AND THE G-SLI SUBGROUP. An ongoing controversy surrounds the heterogeneity of linguistic and cognitive characteristics found in children with SLI and the significance of this for any single account of the cause of the disorder (van der Lely 1999). Some children with SLI evince grammatical deficits without other primary impairments (van der Lely et al. 1998), while others evince cooccurring grammatical and nongrammatical language deficits or nonverbal deficits (Bishop 1979, Bishop et al. 2000, Bishop & Adams 1989, Vargha-Khadem et al. 1995). Moreover, SLI resolves in some individuals but persists in others (Bishop 1997, Bishop & Edmundson 1987). Are we looking at one or many disorders? And, what are the relations between these different deficits and their underlying causes? Although various attempts using, for example, cluster analysis (Aram & Nation 1975), processing criteria (expressive vs. receptive), or clinically based models (Bishop & Rosenbloom 1987) have tried to identify SLI subgroups, they have not resulted in any agreed-upon definitions for SLI subtypes. The children in this study have been selected for their relatively discrete deficit in grammatical abilities and then subjected to detailed testing of their grammatical, nongrammatical linguistic, and nonverbal cognitive abilities (van der Lely et al. 1998). To the extent that similar grammatical deficits are also found in children with SLI who may evince other deficits, such as phonological or pragmatic deficits (Bishop et al. 2000, O'Hara & Johnson 1997, Precious & Conti-Ramsden 1988), the findings from G-SLI children may generalize to a broader population. Such findings suggest that the grammatical deficits found in G-SLI are more widespread than the G-SLI subgroup.

1.2. CHARACTERISTICS OF CHILDREN WITH G-SLI. G-SLI children are selected for their persistent deficit in grammatical comprehension and expression and are aged 9:0 years or older. Lexical/vocabulary impairments, considered to be a secondary consequence of problems with using syntactic cues to learn new nouns and verbs, are a characteristic of this subgroup (Froud & van der Lely 2002a,b, van der Lely 1994, O'Hara & Johnston

1997). Concurring SEVERE articulatory/phonological deficit that causes frequent omissions of final consonant clusters or unintelligible speech is not a characteristic of G-SLI, although subtle deficits in phonological structure are evident (Marshall et al. 2002, Peiris 2000, Gallon et al. 2003). Only children with performance IQ above 85 on standardized tests (e.g. British Ability Scales, Elliott et al. 1978) are included in the subgroup.

The linguistic characteristics of this subgroup, as well as the nongrammatical language and nonverbal abilities revealed in previous investigations, are well documented, so they will not be repeated here (see, for example, van der Lely 1996b, 1997a,b, 1998, van der Lely & Christian 2000, van der Lely & Harris 1990, van der Lely et al. 1998, van der Lely & Stollwerck 1997, van der Lely & Ullman 1996, 2001). However, a central feature of G-SLI children, relevant to this study, is that they exhibit correct and incorrect use of, for example, tense marking or pronominal reference for the same lexical item in a similar syntactic context. This characteristic of language performance for G-SLI children concurs with previous research on SLI subjects generally, which indicates an 'optional' use of grammatical morphemes (Bishop 1994, Leonard et al. 1992, Rice & Wexler 1996).

1.3. THE REPRESENTATIONAL DEFICIT FOR DEPENDENT RELATIONS (RDDR) ACCOUNT OF G-SLI. The representational deficit for dependent relations (RDDR) hypothesis, developed over a number of years, aims to account for the broad range of deficits found in G-SLI subjects that are at the core of the syntactic system. The RDDR account identifies the underlying deficit in the computational syntactic system (van der Lely 1994, 1998, van der Lely & Stollwerck 1997). The RDDR hypothesis assumes that certain aspects of grammar have an autonomous psychological and neural basis (Chomsky 1986, Fodor 1983, Pinker 1994). The RDDR largely adopts the minimalist program (Chomsky 1998, 1999) to provide a precise definition of G-SLI grammar. Within the minimalist perspective (Chomsky 1998, 1999), long-distance dependencies necessitate movement, where movement is construed as attraction by a noninterpretable feature (e.g. tense, gender) for the purposes of feature checking. Specifically, Move takes place when neither Merge nor Agree are options for noninterpretable feature deletion; that is, it is the 'last resort chosen when nothing else is possible' (Chomsky 1998:14). Although Chomsky (1995, 1998, 1999) defines this syntactic dependency operation as 'Movement', the terminology to describe this operation may change with developing linguistic theories (cf. Lightfoot's 2002 'feature-copying').[1] The RDDR account contends that the core deficit responsible for G-SLI grammar involves movement (Chomsky 1995), and more specifically, that whereas the basic grammatical operation/rule Move in normal grammar is (by definition) obligatory, in G-SLI grammar it is optional. Thus, G-SLI children's grammar may be characterized by 'optional Movement' (van der Lely 1998).

The optionality—rather than the absence—of movement characterizing G-SLI grammar indicates that the operation or rule Move F (a feature) is available to them. Therefore, the underlying deficit is not in the operation Move itself, but the implementation of the operation (van der Lely 1998)—that is, Move per se is not missing. Manzini suggested to us that the locus of the deficit is with the ECONOMY principles (Chomsky 1998). Van der Lely (1998) explored this proposal and concluded that, of the various

[1] Indeed, completely different theoretical frameworks would handle all of the operations and constructs invoked here entirely differently; our adoption of minimalism is intended to show the consequences for that theory, and the assumptions it makes, of the experimental data presented here. Any theory, we claim, must be able to account for the particular facts from G-SLI considered here (cf. Joanisse & Seidenberg 1998).

principles or properties of economy (e.g. MINIMAL LINK CONDITION, LAST RESORT), a deficit within last resort provided a parsimonious explanation of the data. Formally, Chomsky (1995:280) defined last resort as 'Move F raises F (a feature) to target K only if F enters into a checking relation with a sub-label of K'. Last resort may be thought of as comprising two principles (Manzini, personal communication, 1998). The first principle, ECONOMY 1, ensures that the operation Move operates, if at all, only if it satisfies a feature-checking relation when Merge and Agree cannot satisfy this operation. Thus, economy 1 ensures that Move F occurs only if there are features to be checked but does not ensure the obligatory nature of Move for unchecked features. Further, without economy 1, the operation Move F would be totally missing, which is not the case in the G-SLI data. The second principle, ECONOMY 2, forces movement, and thereby obligatory checking of unchecked features, if the target has not had its features checked. Thus, the economy 2 principle of last resort ensures that movement operations are obligatory (van der Lely 1998). Van der Lely (1998) contends that the economy 2 ('the Must-Move') principle of last resort is missing in G-SLI grammar and that this accounts for the optionality of movement. From a computational, mechanistic viewpoint, this could be interpreted as an impaired (specialized) algorithm, underlying movement representations or operations in G-SLI, such that movement can occur but, in contrast to normal grammar, is not 'automatic' and compulsory—that is, a steady state has not been achieved. Thus, the split of last resort into economy 1 and 2 is necessary to account for the optionality of Move in G-SLI and the acceptance in grammaticality judgment tasks of sentences where movement has not taken place (Davies 2001, van der Lely et al. 2003).

Problems with head-to-head movement (e.g. V to I) can account for G-SLI subjects' deficit with tense and agreement marking (but see Wexler 1998 for an alternative view about a deficit in DP movement, which is more akin to the RDDR hypothesis and earlier versions of this proposal, van der Lely & Stollwerck 1997). Further, problems with A(Argument)-movement can account for G-SLI subjects' difficulties in assigning thematic roles to noun phrases, particularly in passive sentences (van der Lely 1994, 1996b, van der Lely & Dewart 1986, van der Lely & Harris 1990). We adopt Manzini and Roussou's (2000) and Hornstein's (1999) proposals of A-movement and control, which depart from standard transformational theory of A-movement and enable a parsimonious explanation of our data (see van der Lely 1998). The RDDR characterization of G-SLI, for instance, correctly predicts that problems with root sentences may occasionally surface if nongrammatical strategies cannot facilitate performance (see van der Lely 1994, van der Lely & Harris 1990). The RDDR hypothesis predicts that G-SLI subjects would also have problems with WH-movement and Q-feature movement. Although errors with question formation have been noted in the literature (Eyer & Leonard 1995, Hamann et al. 1998, Menyuk 1978), we are not aware of any systematic exploration of the production of WH-subject and WH-object questions in SLI children. This study investigates WH-movement of *who*, *what*, and *which* in subject and object questions in G-SLI children to test the predictions of the RDDR hypothesis and, in doing so, fills a gap in the SLI literature characterizing the linguistic deficits of children with SLI.

Before we discuss in detail the RDDR's predictions for WH-movement (question formation), we provide a brief outline of the relevant theoretical issues underlying question formation.

1.4. WH-MOVEMENT: SUBJECT AND OBJECT WH-QUESTION FORMATION. As a starting point in investigating WH-movement in G-SLI children, we focus on simple, matrix

subject and object questions and restrict our inquiry to movement operations. The syntactic differences between subject and object questions have been the topic of much debate (de Villiers 1996, Manzini 1992, 1995, Rizzi 1990, 1991, Roeper & de Villiers 1994, Stromswold 1995), but it is generally agreed that formation of object WH-questions involves two forms of movement. First, A(argument)-bar movement of the WH-operator to the specifier (spec) position of the complementizer phrase (CP) occurs, leaving a trace behind in the internal verb argument position, which is bound by the WH-operator, shown in 1a below (Rizzi 1991; hereafter WH-OPERATOR MOVEMENT). This precludes, in normal adult grammar, the empty internal verb argument position being filled by a determiner phrase (DP), as shown in 1b. Second, object questions necessitate movement of *do* bearing the Q-feature into the head of CP, that is, I to C movement—known as *do*-SUPPORT (see 1a)—and determines appropriate tense and Q-feature marking in object questions (hereafter T/Q-feature movement).

(1) a. $[_{CP}$ Who$_i$ $[_{C'}$ did$_j$ $[_{IP}$ Ralf $[_{I'}$ e$_j$ $[_{VP}$ $[_{V'}$ see $[_{NP}$ t$_i$?]]]]]]]
b. *$[_{CP}$ Who$_i$ $[_{C'}$ did$_j$ $[_{IP}$ Ralf $[_{I'}$ e$_j$ $[_{VP}$ $[_{V'}$ see $[_{NP}$ Sam$_i$?]]]]]]]

In contrast, subject questions do not incur *do*-support, and therefore no I to C movement occurs. Thus, in subject questions, tense is typically marked on the matrix verb following (the less costly) covert V to I movement.

One possibility in the case of subject questions is that the WH-word moves from an original position within the inflectional phrase (IP) to the CP, as shown in 2a (Rizzi 1991). Alternatively, the WH-word may be inserted directly into the spec of CP, or remain in an original position within the IP, as shown in 2b (Pesetsky 1987). In this latter position, it may function primarily as a pronoun. For consistency, we adopt Rizzi's (1991) analysis for subject and object questions. Note, however, that in production of subject questions, even if WH-movement has not taken place, the correct word order will surface. Therefore, we will attend to errors such as 'gap-filling' for evidence of failed WH-operator movement.

(2) a. $[_{CP}$ Who$_i$ $[_{C'}$ $[_{IP}$ t$_i$ $[_{I'}$ $[_{VP}$ $[_{V'}$ saw Liz?]]]]]]
b. $[_{CP}$ $[_{C'}$ $[_{IP}$ Who $[_{I'}$ $[_{VP}$ $[_{V'}$ saw Liz?]]]]]]

Despite the syntactic differences between subject and object questions, Stromswold (1995) found that normally developing children acquire object questions at the same time as, or earlier than, subject questions. Using data from CHILDES for twelve children, Stromswold found that the mean age of production of *who* subject questions was 2:6, and for object questions 2:5; for *what* questions, the mean age was 2:7 for subject questions and 2:3 for object questions; and for *which* questions production came at a slightly later mean age, with subject questions being acquired by the twelve children at a mean age of around 3:6 and object questions being acquired at around 2:11 (Stromswold 1995). The youngest age at which any of the children in Stromswold's study produced any of the WH words was 1:8.5, for *who*, and the latest age was 4:4.0, for *which*, although this is not to say that such young children did not make any grammatical errors on occasion in their question formation (see Thornton 1995).

The competence in comprehension and production of subject and object questions in young children is robust across languages (e.g. French, German, English) despite variations in vocabulary and features to be learned (Weissenborn et al. 1995). Thus, it is evident that normally developing children by the age of four and a half or earlier have the competence to produce matrix questions and, arguably, even more complex long-distance WH-questions like 3 (Thornton 1990).

(3) How did Big Bird ask to help?

1.5. PREDICTIONS. The characterization of subject and object questions given above leads to clear predictions with respect to the RDDR hypothesis for G-SLI grammar. First, if movement-feature checking is optional for G-SLI grammar, as claimed by the RDDR account, then G-SLI subjects would, on the one hand, be impaired in both WH-operator movement and T/Q-feature movement and, on the other hand, evince accurate WH-operator and Q-feature movement on occasion. Second, because 'no movement' of the WH-word in subject questions results in the correct word order and, further, the Q-feature is satisfied by the less costly, covert V to T movement that is needed independently of question formation, the RDDR/optional movement account predicts that G-SLI subjects should evince fewer errors with subject questions than object questions. Further, if syntactic movement is indeed an area at the core of G-SLI subjects' grammatical deficit, as the RDDR proposes, then their performance would be impaired in comparison to younger children developing normally who are matched on other aspects of language abilities, such as vocabulary development.

Alternatively, if G-SLI subjects are acquiring language in the same way as normally developing children, contra the RDDR's proposal, albeit extremely delayed, then we would expect them to show a similar level and pattern of performance on subject and object questions as younger children matched on language abilities.

2. METHOD. The experiment was based on the 'Who done it?' game and elicited subject and object questions balanced for *who*, *what*, and *which* WH-words in subjects with G-SLI and younger, normally developing children.

2.1. SUBJECTS. Three subject groups participated in the experiment: a group of G-SLI subjects and two groups of younger children who provided control groups for different tests of language abilities (LA controls).

GRAMMATICAL-SLI SUBJECTS

Fifteen children and teenagers (three girls and twelve boys) aged between 11:5 to 18:2 participated in the study. Six of the subjects had participated in a number of studies over the preceding six years, while the remaining nine subjects had been in the cohort for approximately two years. All the subjects met the criteria for G-SLI. That is, all the subjects showed persisting problems in grammatical comprehension and expression of language as revealed by standardized tests as well as procedures tailored to assess specific grammatical abilities which characterize G-SLI. For example, the additional tailored tests assessed tense and agreement marking in expressive language (van der Lely 2000), assignment of theta roles in reversible active and passive sentences (van der Lely 1996a), and the assignment of reference to pronouns and anaphors (van der Lely 1997c). Subjects were included in the subgroup only if they made 20% or more errors on each of these tests (whereas normally developing children rarely make errors after five years of age on these tests). The subjects' nonverbal IQ fell above 85 (range 86 to 119) as measured on the overall performance test of the British Ability Scales (BAS) (Elliott et al. 1978). Further details of the selection procedure for children with G-SLI are well documented so they will not be repeated here (see van der Lely 1996a, van der Lely & Stollwerck 1996, 1997). Any child with cooccurring nonverbal deficits, emotional or social abnormalities, or any obvious speech deficits or dyspraxia was excluded from the subgroup. Thus, the subjects' speech for known words in sentences was clear and intelligible. However, subtle underlying phonological deficits, as revealed by repetition of prosodically complex nonwords, can be found in the subgroup (Peiris

	G-SLI (n = 15)		LA1 Control (n = 12)		LA2 Control (n = 12)	
	Mean	SD	**Mean**	SD	**Mean**	SD
Chronological age	**14:10**	27.63	**6:07**	8.02	**7:09**	6.02
Range	11:05–18:02		5:03–7:04		7:04–9:01	
GC-ITPA	**22.0**	3.97	**21.6**	4.98	**26.7**	3.44
SS	NA		**40.58**	6.50	**39.33**	4.92
Z-score	NA		**0.67**	0.43	**0.56**	0.33
Equivalent age	7:03		7:00		8:08	
TROG	**14.6**	1.80	**14**	2.89	**16.8**	1.33
SS	**75.13**	12.42	**101.92**	14.51	**106.00**	8.59
Z-score	**−1.66**	0.83	**0.13**	0.97	**0.39**	0.57
Equivalent age	7:06		7:00		10:00	
BPVS	**79.13**	17.83	**59.3**	12.88	**78.33**	16.0
SS	**70.47**	8.58	**98.92**	10.14	**102.75**	13.57
Z-score	**−1.97**	0.57	**−0.072**	0.67	**0.18**	0.90
Equivalent age	8:07		6:02		8:05	

TABLE 1. Summary of subject details for G-SLI subjects and LA control groups.

Key
GC-ITPA = Grammatical Closure subtest, Illinois Test of Psycholinguistic Abilities (Kirk et al. 1968)
TROG = Test of Reception of Grammar (Bishop 1983)
BPVS = British Picture Vocabulary Scale (Dunn et al. 1982)
SS = standard score
NA = SS and Z-scores not available for subjects' age

2000, Marshall et al. 2002, Gallon et al. 2003). Table 1 provides a summary of the subjects' details and their scores for three standardized language tests that were used for selecting language matched control children. It can be seen from Table 1 that on the grammatical closure subtest from the Illinois Test of Psycholinguistic abilities (GC-ITPA; Kirk et al. 1968)—a test of expressive morphology—the G-SLI subjects had a mean equivalent age of 7:3. On the test for reception of grammar (TROG; Bishop 1983)—a test of sentence understanding—the children's mean z-score was −1.66, with an equivalent age of 7:6.[2] Their scores on the British Picture Vocabulary Scale (BPVS; Dunn et al. 1982)—a test of single-word comprehension—produced a mean z-score of −1.97, and an equivalent age of 8:7.

LANGUAGE ABILITY CONTROL GROUPS

Two groups of twelve normally developing children provided language ability (LA) control groups. The children were randomly selected from a state school in central London. Three standardized tests were administered. Only children who fell within the normal range of abilities as assessed by these tests were included in the study. The younger LA1 control group had a mean age of 6:7 (range 5:3–7:4) and provided a grammar-matched control group. Their raw scores did not differ from those of the G-SLI subjects' scores on the GC-ITPA ($t(22) = 0.25$, $p < 0.81$) or the TROG ($t(25) = .66$, $p = 0.52$). However, the LA1 controls' raw vocabulary scores on the BPVS were significantly lower than those of the G-SLI subjects ($t(25) = 3.40$, $p < 0.005$).

The older LA2 controls had a mean age of 7:9 (range 7:4–9:1) and provided a vocabulary comprehension matched control group. Analysis revealed that the LA2 controls did not differ from the G-SLI subjects on the BPVS ($t(25) = 0.13$, $p < 0.90$),

[2] Scores on the GC-ITPA and TROG tests should be taken as a general guide to the SLI subjects' grammatical knowledge, since these test assess a range of abilities, not only those that are problematic for G-SLI subjects. The tests are always supplemented with nonstandardized assessments that target specific morphosyntactic knowledge, which we see as crucial to the linguistic characterization of G-SLI.

but their raw scores on the grammatical tests were significantly higher than those of the G-SLI subjects (TROG ($t(25) = -3.57, p < 0.001$) and GC-ITPA ($t(25) = -3.33$, $p < 0.005$)). Table 1 provides a summary of the subject details for the LA control groups.

2.2. DESIGN AND MATERIALS. A 3 (Group: G-SLI, LA1, LA2) × 2 (Question type: subject, object) × 3 (WH-word: *who*, *what*, *which*) design was used to explore the subjects' production of subject and object questions. The game of 'Cluedo' was adapted to provide two 'Who done it?' games in which the subjects' task was to find out who did what, where (e.g. Mr. Plum stole the necklace in the library). The games comprised the Cluedo game board showing a plan of a house and garden, people cards (e.g. a picture of Mr. Plum), object cards, three sets of WH-question elicitation cards corresponding to *who*, *what*, and *which* words, and thirty-six color coded WH-word (*who*, *what*, *which*) disks (e.g. *who* = blue disk with *who* written on it), which were placed in a cloth bag for random selection during the game.

Thirty-six statements were designed to elicit 18 subject and 18 object questions, balanced for the WH-words *who*, *what*, and *which*. A further 18 questions designed to elicit adjunct and embedded WH-questions were also formulated to elicit a broader range of WH-words and to prevent the subjects from using strategies when formulating the target WH-questions. The elicitation statements employed a variety of verbs. Only the 36 subject and object questions out of the overall total of 54 questions will be reported in this article. A full list of the elicitation test statements and the corresponding target answers is provided in Appendix A.

The pragmatic context was manipulated in order to enhance the participants' involvement and task understanding, which are crucial in successful question elicitation techniques (Crain & Thornton 1998). Thus, an answer was given to each target question which provided a clue (some of which were helpful and some which were not) to enable the participants to solve the 'Who did what where?' problem, which was the explicit aim of the game.

2.3. PROCEDURE. Subjects were tested either at home or in a quiet room at school. The game board and people and object cards were laid out in front of the subject while the question elicitation cards and color coded WH-word disks in the cloth bag were placed in front of the investigator. The order of presentation of game A or B was randomized—decided by a flip of a coin. The investigator explained the instructions for the first game, emphasizing either more or less the role-playing nature of the game depending on the age of the subject. For game A the child was told the following: 'Mrs. Brown is having a barbecue in her garden for friends. In the evening she finds out that SOMEONE has stolen a piece of jewelry from her house. She phones the police and they send round their best detective—you! You have to find out what happened. The police have also sent round your sergeant—me! I have found out SOME information already, but I am being difficult. I am going to make you ask me questions to find out what I know. SOME of the answers I will give you will help you, but SOME won't be helpful at all. At the end of the game you must guess what was stolen, who stole it, and where they stole it from'.

The experimenter named or pointed out the various parts of the game: Mrs. Brown's house, her garden, and the people and object cards, which, it was explained, could be moved onto the house board to help remember what happened. The child was told he or she must choose one of the color-coded WH-words from the bag. The experimenter

explained that she had to choose the answer card that was the same color as the subject's WH-word disk and read the card to the subject. The exact instructions given by the experimenter for games A and B are provided in Appendix B.

The experimenter then presented three practice trials—one for each of the three WH-words. The child shook the bag with the WH-words, while the experimenter shuffled the answers. The child then chose a word and told the experimenter which WH-word it was (*who*, *what*, or *which*). The experimenter (the Sergeant) then chose an answer card and read it (see 4a). The child was then encouraged to ask the question, using the same WH-word that he or she had chosen from the bag (see 4b).

(4) a. Sergeant (experimenter)
Someone climbed the stairs. Ask me who.
b. Inspector (subject)
Who climbed the stairs? (Target question response)

If the subject was reluctant to respond, then the experimenter provided a model target question for the child and the second practice trial was given. At the end of the practice trials, the child was asked if he or she understood the game; if the answer was no or the experimenter was not sure, then a further three practice trials were administered prior to starting the game. If during the game the subject hesitated, seemed confused, or did not respond, the experimenter asked if the subject would like the statement repeated. The statements were also repeated if the subject requested this.

The subjects' responses were recorded on a high-quality Sony DAT tape recorder using a stereo ECT microphone to ensure a good quality recording for later transcription. Administration took approximately thirty minutes.

2.4. CODING. Each subject's responses were coded first for correctness; incorrect responses were further categorized into error types.

CORRECT

Responses were scored as correct when they matched the target question. Responses containing word substitutions reflecting pragmatically appropriate minor variation of the target question or memory failure were scored as correct. These substitutions included the following:

(1) Pronoun substitution: e.g. *Who frightened her?* Target: *Who frightened Mrs. Brown?*

(2) Article change: e.g. *What lay under the table in the lounge?* Target: *What lay under a table in the lounge?*

(3) Name change: e.g. *Which chair did Mr. Plum sit on?* Target: *Which chair did Rev. Green sit on?*

(4) Embedded question: e.g. *What do you think that Mrs. Scarlett stole?* Target: *What did Miss Scarlett steal?*

(5) Overregularized past tense verb form: Overregularization of an irregular past tense form of a verb was not counted as an error, e.g. *Who hidded some money?*

ERRORS

Responses were categorized as nongrammatical or grammatical errors. The grammatical errors were categorized according to whether T/Q-feature and/or WH-operator errors were made.[3]

[3] We are grateful to Celia Jakubowicz for her very helpful suggestions and discussions about the coding scheme.

Nongrammatical errors or changes

Two types of response were considered nongrammatical errors or changes to the target response.

Semantic and pragmatic change: this 'error' is an acceptable semantic or pragmatic change or variation in the target question. It is not a grammatical error and, therefore, does not indicate any impairment in grammatical knowledge. Example: *What was on Mrs. Brown's clothing?* Target: *What crawled onto Mrs. Brown's dress?* However, such variations from the target responses were categorized so that we could contrast these responses with true grammatical errors.

Subject-for-object question: that is, a target object question is turned into a subject question. This response was considered ambiguous as to whether it reflects a pragmatically motivated change, an avoidance of a problematic structure, or a response strategy following failure to produce an object question. Thus, erring on the side of caution, we coded this response as a nongrammatical error. Example: *Who was in the lounge?* Target: *Who did Mrs. Peacock see in the lounge?* Example: *Who was in the library?* Target: *Who did Miss Scarlett notice in the library?*

Grammatical errors

Assuming Rizzi's (1991) WH-criterion (5), grammatical errors fall into one of three categories.

(5) a. A WH-operator must be in a spec-head relation with a head carrying the WH-feature.
b. A head carrying the WH-feature must be in a spec-head relation with a WH-operator.

Category A: T/Q-feature errors (+WH, −T/Q)

These are sentences where the WH-word has overtly moved (there is no lexical DP in the position of the gap) but the WH-criterion is not satisfied.

For object questions, there are four possible subcategories of target inconsistent sentences.

A. (i) Obj: Aux-less questions with an inflected main verb (6a)
(ii) Obj: Aux-less questions including a nonfinite verb (6b,c)
(iii) Obj: Questions with Aux and an inflected main verb (6d,e)
(iv) Obj: Omission of copular or lexical verb (6f)

(6) a. What cat Mrs. White stroked?
b. What Mrs. Brown place in the library?
c. Who Mrs. Brown see?
d. What did they drank?
e. What did she spotted in the library?
f. Which one?

For subject questions a further four subcategories of target inconsistent sentences fall into category A.

A. (v) Subj: Questions with a nonfinite main verb (7a,b)
(vi) Subj: Questions with pleonastic *do* and an inflected verb (7c)
(vii) Subj: Questions with pleonastic, unstressed *do* and a nonfinite verb (7d)
(viii) Subj: Omission of copular or lexical verb (7e,f) (Note there were very few such errors (total 4) and analysis with or without such errors did not alter the results.)

(7) a. Who carry her bag?
b. What lie under the lounge?
c. Which telephone did rang?

d. Which telephone did ring?
e. What under the table?
f. What Mrs. Peacock's hands?

Category B: −WH, +T/Q

These target inconsistent sentences contain questions with a lexical DP in the position of the gap (gap-filling) and overt T movement to C (8a,b).

(8) a. Which one did he wear the coat?
b. What did Mrs. Peacock like jewelry?

Category C: −WH, −T/Q

This category contains target inconsistent questions with neither WH-word movement (as indicated by the presence of a lexical DP in the position of the gap) nor T/Q-feature movement (overt movement of *do* for object question and covert movement of the inflected verb to T for subject questions).

For object and subject questions there were ten subcategories that fall into category C.

C. (i) Obj: Aux-less gap-filling with an inflected main verb (9a,b)
(ii) Obj: Aux-less gap-filling with a nonfinite verb (9c)
(iii) Obj: Gap-filling with pleonastic *do* and an inflected verb (9d,e)
(iv) Obj: Gap-filling with omitted verb (9f)
(v) Obj: WH-referential phrase omission with pleonastic *do* and an inflected verb (9g)
(vi) Subj: Gap-filling with an inflected main verb (9h)
(vii) Subj: Gap-filling with a nonfinite verb (9i)
(viii) Subj: Gap-filling with pleonastic *do* and an inflected verb (9j)
(ix) Subj: Gap-filling with omitted verb (9k)
(x) Subj: WH-referential phrase omission (There were no examples of this error type.)

(9) a. Who Mrs. Scarlett saw somebody?
b. Who Mrs. Peacock saw somebody?
c. Which Rev. Green open a door?
d. What did Colonel Mustard had something in his pocket?
e. Which one did Mrs. White wore a hat?
f. Which one the vase in the study?
g. Which did Mr. Black had in the study?
h. Which one door creaked?
i. Which one table fall over?
j. Which door did it creaked?
k. What something in Mrs. Brown's desk?

3. Results.

3.1. Correct scores. The three groups' mean correct scores for the subject and object questions for the three different WH-words can be found in Table 2. Although the control children generally performed at over approximately 70% correct for both subject and object questions for all the WH-words, the G-SLI subjects' responses were generally less than 51% correct, with the exception of *who* subject questions, for which they produced over 80% correct responses.

A 3 (Group: G-SLI, LA1, LA2) × 2 (Question type: subject, object) × 3 (WH-word: *who*, *what*, *which*) analysis revealed a significant main effect of group ($F(2,36) = 15.15$, $p < 0.001$). Further analysis revealed that the G-SLI subjects produced fewer correct responses overall than the grammatical LA1 controls ($t(25) = 2.52$, $p < 0.05$),

	G-SLI			LA1			LA2		
	Mean (n = 6)	%	SD	Mean (n = 6)	%	SD	Mean (n = 6)	%	SD
WORD TYPE				SUBJECT					
who	**5.08**	85	1.00	**5.33**	89	1.30	**6.00**	100	0.00
what	**3.17**	51	1.75	**4.92**	82	1.38	**5.42**	90	0.67
which	**3.08**	51	1.31	**4.75**	79	1.71	**5.92**	98	0.29
SUBTOTAL (n = 18)	**11.33**	63	3.31	**15.00**	83	3.81	**17.33**	96	0.78
WORD TYPE				OBJECT					
who	**1.33**	22	1.23	**3.25**	54	2.34	**5.50**	92	0.67
what	**2.67**	45	1.72	**4.25**	71	1.82	**5.83**	97	0.39
which	**2.00**	33	2.17	**5.00**	83	1.76	**5.75**	95	0.62
SUBTOTAL (n = 18)	**6.25**	35	4.29	**12.50**	69	5.13	**17.08**	95	1.00
TOTAL (n = 36)	**17.75**	49	5.83	**27.50**	76	8.69	**34.42**	96	1.51

TABLE 2. Correct scores for the three subject groups.

and the vocabulary LA2 controls ($t(25) = 6.25$, $p < 0.001$). In addition, the younger LA1 controls performed significantly lower than the LA2 controls ($t(22) = 2.64$, $p < 0.05$). A significant main effect of question type ($F(1,36) = 36.15$, $p < 0.001$) reflected more overall correct responses for subject questions than for object questions. However, a significant Group × Question type interaction was found ($F(2,36) = 11.74$, $p < 0.001$. Further analyses revealed that the G-SLI subjects responses on the subject questions did not differ from those of the LA1 controls ($t(25) = 1.78$, $p = 0.086$) but were significantly worse than those of the LA2 controls ($t(25) = 4.32$, $p < 0.001$). Furthermore, the G-SLI subjects' performance was consistently worse than both control groups for the object questions (LA1 controls: $t(25) = 2.63$, $p < 0.005$; LA2 controls: $t(25) = 6.46$, $p < 0.001$). Thus, the G-SLI subjects were having greater overall difficulties with producing object questions than subject questions in comparison to the control children.

The triple interaction was also significant ($F(2,36) = 6.31$, $p < 0.01$), indicating that the subject groups were performing differently across subject and object questions as a function of the different WH-words. To unpack this interaction, we first conducted a 2 (Question type) × 3 (WH-word) ANOVA for each subject group. This first analysis revealed a similar pattern of results for the G-SLI subjects and the LA1 controls. A significant main effect of question type was found for the G-SLI and LA1 control groups (G-SLI: $F(1,14) = 37.72$, $p < 0.0001$; LA1: $F(1,11) = 8.10$, $p < 0.05$), reflecting the overall lower scores on object questions than subject questions. In addition, a significant question-type × word interaction was found for the two groups (G-SLI: $F(2,28) = 18.9$, $p < 0.001$; LA1: $F(2,22) = 10.65$, $p < 0.005$). However, differences were revealed in the follow-up t-tests. While the G-SLI subjects were clearly better at subject than object questions for each WH-word (*who*: $t(14) = 6.37$, $p < 0.001$; *what*: $t(14) = 4.56$, $p < 0.001$; *which*: $t(14) = 3.28$, $p < 0.005$), this difference was less marked for the LA1 controls, who showed significant differences between subject and object *who* ($t(11) = 3.44$, $p < 0.005$) and *what* ($t(11) = 2.24$, $p = 0.048$) but not *which* ($t(11) = .233$). For the LA2 controls, in contrast, there were no significant main effects or interaction. This can be largely attributed to their near-ceiling level of performance. Finally, planned comparisons of the simple effects for each WH-word revealed that the G-SLI subjects' production of *who* subject questions was not significantly different from that of the LA1 controls ($F(1,36) = .87$), and only marginally significantly different from that of the LA2 controls ($F(1,36) = 4.03$, $p = 0.052$). For *who* object questions, the G-SLI subjects performed marginally significantly lower than

the LA1 controls ($F(1,36) = 4.07$, $p = 0.051$) and clearly significantly worse than the LA2 controls ($F(1,36) = 25.13$, $p < 0.0001$). For all the other analyses, the G-SLI subjects performed significantly lower than both the control groups, although generally the differences were greater for the object questions than the subject questions (*what* subject: LA1, $F(1,36) = 5.94$, $p = 0.020$; LA2, $F(1,36) = 12.1$, $p < 0.005$; *what* object: LA1, $F(1,36) = 5.82$, $p = 0.021$; LA2, $F(1,36) = 23.53$, $p < 0.0001$; *which* subject: LA1, $F(1,36) = 4.17$, $p = 0.048$; LA2, $F(1,36) = 15.47$, $p < 0.0001$; *which* object: LA1, $F(1,36) = 10.10$, $p = 0.003$; LA2, $F(1,36) = 19.36$, $p < 0.0001$).

Thus, the analysis of correct responses revealed that the G-SLI subjects generally have more difficulties in producing questions, and particularly object questions, than both younger children matched on vocabulary abilities and those matched on two tests tapping morphosyntactic abilities. We will now consider whether the types of errors made by the groups differed and whether the G-SLI subjects' difficulties were indeed due to impairments with WH-movement.

3.2. ERROR ANALYSIS. The mean number of errors for the three WH-words for each group for the subject and object questions, categorized into the various error types, is shown in Table 3. The table reveals that the LA2 controls made a few nongrammatical errors but no grammatical errors in this task, whereas the LA1 and G-SLI subjects made errors across the various error categories. Because there were generally so few grammatical errors for the control children, the three WH-words were not considered separately.

We first conducted group analyses on the two nongrammatical error types: semantic/pragmatic change and subject-for-object responses. For the semantic/pragmatic change errors, a 3 (Group) $\times$ 2 (Question type) one-way ANOVA revealed no significant

	G-SLI		LA1		LA2	
	Mean	SD	Mean	SD	Mean	SD
ERROR TYPE			SUBJECT			
GRAMMATICAL						
A [+WH, −T/Q]	**1.53**	1.25	**0.17**	0.58	0.00	0.00
B [−WH, +T/Q]	**0.07**	0.26	**0.08**	0.29	0.00	0.00
C [−WH, −T/Q]	**1.60**	2.29	**0.08**	2.90	0.00	0.00
TOTAL	**3.20**	3.10	**0.33**	0.78	0.00	0.00
NONGRAMMATICAL						
Semantic/pragmatic	**0.60**	1.12	**2.58**	3.65	**0.25**	0.25
			OBJECT			
GRAMMATICAL						
A [+WH, −T/Q]	**2.93**	2.19	**0.83**	1.53	0.00	0.00
B [−WH, +T/Q]	**0.40**	0.63	**0.50**	1.45	0.00	0.00
C [−WH, −T/Q]	**1.67**	2.77	**0.25**	0.87	0.00	0.00
TOTAL	**5.00**	3.89	**1.58**	3.26	0.00	0.00
NONGRAMMATICAL						
Semantic/pragmatic	**0.33**	0.72	**1.17**	1.95	**0.33**	0.65
Subject-for-object	**3.33**	3.54	**2.33**	2.81	**3.33**	0.39

TABLE 3. Error scores for the three subject groups.

Key

A = questions where the WH-word has overtly moved (there is no lexical DP in the position of the gap) but the WH-criterion is not satisfied.

B = target inconsistent questions with a lexical DP in the position of the gap and overt T movement to C.

C = target inconsistent questions with neither WH-word movement nor overt movement of *do* for object questions and covert movement of the inflected verb to T for subject questions.

effect of group or question type. Thus, G-SLI subjects' semantic/pragmatic changes did not differ from those of the younger LA1 controls or the LA2 controls. Table 3 shows that the youngest children (LA1 controls) produced more of these errors than the other groups. This can be attributed to their age, when factors such as memory failure or pragmatic immaturity could play a greater role in determining their responses in this task than for the older children. In contrast, for the subject-for-object errors for the object questions, the one-way ANOVA revealed a significant effect of group ($F(2,36) = 4.66$, $p < 0.05$). Planned comparisons revealed that the G-SLI subjects made significantly more subject-for-object errors than the vocabulary LA2 controls ($t(25) = 3.07$, $p < 0.005$) but not significantly more than the grammatical LA1 control subjects ($t(25) = 0.798$).

To consider WH-movement errors—the central focus of the study—the grammatical errors for each response were analyzed according to the three categories outlined above: A (+WH, −T/Q); B (−WH, +T/Q); C (−WH, −T/Q). Because the LA2 controls did not make any grammatical errors they were not included in the analysis. A 2 (Group) × 2 (Question type: subject, object) × 3 (Grammatical error type: A, B, C) ANOVA revealed a significant main effect of group ($F(1,25) = 8.56$, $p < 0.001$) and question type ($F(1,25) = 9.08$, $p = 0.006$), reflecting the greater number of grammatical errors made by the G-SLI subjects, and more errors for object than subject question, respectively. None of the interactions with group were significant. However, there was a significant interaction between question type and error type ($F(1,25) = 4.65$, $p = 0.041$), indicating that the proportion of errors in the three categories differed for subject and object questions. Further analysis revealed that for categories A (+WH, −T/Q) and B (−WH, +T/Q) significantly more errors were made for object than subject questions (A: $t(26) = 3.17$, $p = 0.004$; B: $t(26) = 2.08$, $p = 0.048$), but there was no difference between subject and object questions for the numbers of C category errors (−WH, −T/Q).

In sum, the G-SLI subjects as a group made significantly more grammatical errors overall in each category than the younger grammatical or vocabulary matched control children, but the overall pattern of errors across subject and object questions was not qualitatively different.

3.3. INDIVIDUAL SUBJECT ANALYSIS. In order to assess whether in the G-SLI subject group the individual children's grammatical errors were like those of the control children or qualitatively different, the children were categorized according to whether they made no errors, either, or both types of errors that violated the WH-criterion. To account for all possible response patterns, there were four categories: no errors (+WH, +T/Q), only A type errors (−T/Q errors), only B errors (−WH, +T/Q), or A + B, or C, type errors (i.e. −WH, −T/Q in the same or in different questions) (see Table 4). It is clear from Table 4 that there is a different pattern of error types made by the majority of the G-SLI subjects in comparison to the controls. First, all of the G-SLI children made some grammatical errors, whereas this was not so for 50% of the LA1

	G-SLI		LA1		LA2	
	NUMBER	%	NUMBER	%	NUMBER	%
No errors (+WH, +T/Q)	0	0	6	50	12	100
A only (+WH, −T/Q)	3	20	4	33	0	0
B only (−WH, +T/Q)	0	0	1	8	0	0
A + B/C, C (−WH, −T/Q)	12	80	1	8	0	0

TABLE 4. Categorization of the G-SLI and LA control children (according to error type).

controls and all of the LA2 controls. Chi-squared analysis revealed that these differences between the numbers of subjects in the G-SLI group and the LA control groups were significant (LA1: $\chi^2(1) = 9.643, p = 0.02$; LA2: $\chi^2(1) = 27.000, p < 0.0001$). Further, 12/15 (80%) of the G-SLI subjects made both −WH and −T/Q errors, whereas only one of the LA1 control subjects and none of the LA2 controls made both −WH and −T/Q errors. These differences were significant (G-SLI/LA1: $\chi^2(1) = 13.715, p < 0.001$; G-SLI/LA2: $\chi^2(1) = 17.280, p < 0.001$). Interestingly the subject LA1-03 (age 5:9) was the only child in the LA control groups who made frequent grammatical errors in all categories. Further, her pattern of errors looked very similar to those made by the G-SLI subjects. Observation of her scores on the TROG—the standardized test of sentence understanding—fell only just within the normal range (−.87 sd.). Thus, it is possible that she has an undiagnosed language deficit, although further assessment is required to verify this. The occurrence of only B type errors (−WH, +T/Q) was very rare for all the groups, with only one LA1 control subject producing one sentence with such an error but no −T/Q errors (see 10), whereas the G-SLI children who made these errors also made −T/Q errors. Analysis revealed no differences between the groups for the B-only type errors.

(10) LA1-12: What did Mrs. Brown place something in the library?

The number of children making only A type errors (+WH, −T/Q) shows a surprising similarity between the LA1 controls and the G-SLI subjects at first glance—and there were no significant differences between the groups (G-SLI/LA1: $\chi^2(1) = 0.617, p = 0.43$; G-SLI/LA2: $\chi^2(1) = 2.700, p = 0.100$). But inspection of the individual error types in each category (shown in Table 5) revealed some differences: for the four LA1 controls who made only A type errors, 6 of the 8 errors were incorrect nonfinite or past-tense irregular forms when the target required a present or past tense form, with the remaining two errors being *do*-support omissions. Thus, some of these errors could be due to immaturity in lexical knowledge rather than grammatical errors. In contrast, the three G-SLI children (SM, AZ, and MP) who made only A type grammatical errors produced many more errors (total 18). The majority of these were A(iii) errors, that is, double tense marking (see 6d,e), whereby the inflected verb has covertly checked the T/Q feature, and so *do* cannot have its features checked. In addition, these G-SLI subjects also made *do*-support omissions in object questions. Interestingly, SM and AZ produced frequent subject-for-object errors (13 (72%) and 5 (28%), respectively) for the object questions. These subject-for-object responses were often made after several attempts to produce an object question, as shown in (11). This suggests that at least some of the subject-for-object responses were strategic, following failure to produce an object question. It remains an open question whether, if forced to produce an object question, these subjects would have produced a WH-operator movement error.

(11) AZ: Who . . . Where did Mrs. Peacock . . . Who was in the library?
(Target: Who did Mrs. Peacock notice in the library?)

Finally, for full interpretation of the data, it is important to consider both correct scores and errors on the subject and object questions. All fifteen G-SLI subjects produced 8 (44%) or more correct subject questions, and eleven (73%) of the G-SLI subjects produced 4 (22%) or more correct object questions. Only one G-SLI subject (CG) did not produce any correct object questions, although he produced 12 (67%) correct subject questions. CG made 7 type A (−T/Q errors) and 3 type C (−WH, −T/Q) errors on the 18 object questions (with a further 7 subject-for-object errors).

	G-SLI		LA1		LA2	
	Mean	SD	Mean	SD	Mean	SD
ERROR TYPE			SUBJECT			
A [+WH, −T/Q]						
(v)	**0.27**	1.25	**0.17**	1.25	0.00	0.00
(vi)	**0.40**	0.26	**0.00**	0.26	0.00	0.00
(vii)	**0.60**	2.29	**0.00**	2.29	0.00	0.00
(viii)	**0.27**	3.10	**0.00**	3.10	0.00	0.00
B [−WH, +T/Q]	**0.07**	0.26	**0.08**	0.29	0.00	0.00
C [−WH, −T/Q]						
(vi)	**0.40**	0.74	**0.00**	0.00	0.00	0.00
(vii)	**0.33**	0.90	**0.00**	0.00	0.00	0.00
(viii)	**0.73**	1.53	**0.08**	0.29	0.00	0.00
(ix)	**0.27**	0.70	**0.00**	0.00	0.00	0.00
(x)	**0.00**	0.00	**0.00**	0.00	0.00	0.00
ERROR TYPE			OBJECT			
A [+WH, −T/Q]						
(i)	**0.67**	1.25	**0.17**	0.39	0.00	0.00
(ii)	**0.73**	0.26	**0.00**	0.00	0.00	0.00
(iii)	**1.47**	2.29	**0.67**	1.23	0.00	0.00
(iv)	**0.07**	0.26	**0.00**	0.00	0.00	0.00
B [−WH, +T/Q]	**0.40**	0.63	**0.50**	1.45	0.00	0.00
C [−WH, −T/Q]						
(i)	**0.53**	1.25	**0.00**	0.00	0.00	0.00
(ii)	**0.27**	0.80	**0.00**	0.00	0.00	0.00
(iii)	**0.67**	1.80	**0.17**	0.58	0.00	0.00
(iv)	**0.13**	0.35	**0.00**	0.00	0.00	0.00
(v)	**0.00**	0.00	**0.08**	0.29	0.00	0.00

TABLE 5. Grammatical error analysis.

Key

SUBJECT

A(v) = Questions with nonfinite main verb
A(vi) = Questions with pleonastic *do* and inflected verb
A(vii) = Questions with pleonastic *do* and nonfinite verb
A(viii) = Omission of copular or lexical verb

B = Target inconsistent questions with a lexical DP in the position of the gap

C(vi) = Gap-filling with inflected main verb
C(vii) = Gap-filling with nonfinite verb
C(viii) = Gap-filling with pleonastic *do* and inflected verb
C(ix) = Gap-filling omitting verb
C(x) = WH-phrase omission

OBJECT

A(i) = Aux-less questions with inflected main verb
A(ii) = Aux-less questions including a nonfinite verb
A(iii) = Questions with Aux and inflected main verb
A(iv) = Omission of copular or lexical verb

B = Target inconsistent questions with a lexical DP in the position of the gap

C(i) = Aux-less gap-filling with inflected main verb
C(ii) = Aux-less gap-filling with nonfinite verb
C(iii) = Gap-filling with pleonastic *do* and inflected verb
C(iv) = Gap-filling omitting verb
C(v) = WH-phrase omission

Therefore, some of his responses showed appropriate WH-operator movement but not T/Q-feature movement for object questions.

4. GENERAL DISCUSSION. This study tested core predictions of the RDDR hypothesis, which claims that G-SLI subjects' grammatical (syntactic) deficit is in the computational syntactic system whereby syntactic movement is optional. The RDDR account predicted that WH-movement, that is, WH-operator movement and T/Q-feature movement, would cause G-SLI subjects to be impaired in producing subject and object questions in comparison to younger children matched on other language abilities. Further, they would be more impaired in object than subject questions because of the additional (and more costly) overt I to C movement demands for object questions.

The results revealed, first, that the G-SLI subjects generally performed significantly worse than both the grammar-matched LA1 control group and the vocabulary-matched LA2 control group. Second, a qualitatively different pattern of correct subject and object questions for the three groups as a function of the three WH-words (*who*, *what*, *which*) was found. The G-SLI subjects were consistently worse at object questions than subject questions, while this difference was less marked for the control children. Further, in relation to the control children's correct responses, for subject questions the G-SLI subjects performed significantly worse than the LA1 and LA2 controls for *which* and *what* questions, but they were not significantly different for *who* subject questions from the LA1 controls and only marginally significantly worse than the LA2 controls. These findings, showing that the G-SLI subjects evince particularly impaired performance on object questions both in relation to their own performance on subject questions and also in relation to the LA controls' performance, confirm the RDDR hypothesis's prediction.

The G-SLI subjects' good performance on *who* subject questions stands apart from the rest of their question formation. One explanation for the good performance on subject *who* questions but particularly poor performance on object *who* questions—a pattern also evinced in the LA controls, albeit to a lesser extent (see Table 2)—is that the children are treating *who* as an interrogative subject pronoun, with a lexical-semantic representation of AGENT theta role. The majority of G-SLI subjects simply never used *who* when syntactically linked to an object with a THEME theta role. A reliance on semantic and pragmatic knowledge rather than syntactic knowledge of lexical items is consistent with the data and has been observed over a number of years (Froud & van der Lely 2002a,b, van der Lely 1994, van der Lely & Dewart 1986) and thus warrants further investigation.

The error analysis, in which nongrammatical changes to the target questions and grammatical errors were considered, revealed that differences between the groups' incorrect responses were due to grammatical errors rather than nongrammatical changes or errors. The G-SLI subjects and LA1 controls did not differ in either the number of semantic/pragmatic changes to the target question or the number of subject-for-object question responses. Thus, pragmatic immaturity, or deficits related to more general task demands, cannot easily explain the data.

In contrast, group and detailed individual analysis of the grammatical errors revealed quantitative and qualitative differences between the impaired and normally developing groups. The group analysis revealed that the G-SLI subjects made significantly more grammatical errors than the LA1 controls and the LA2 controls, who did not make any grammatical errors. However, the individual analysis, considering the three possible error combinations of the two movement operations required for satisfaction of the WH-criterion, that is, either only −T/Q or only −WH, or both −T/Q and −WH errors,

revealed differences in the frequency and type of errors produced by the children in the G-SLI and LA1 control groups. Whereas the occurrence of only −T/Q errors (category A errors) did not differentiate the groups, the occurrence of both −T/Q and −WH errors did. The presence or absence of both movement errors correctly categorized 90% of the children into the impaired or normally developing groups. If the total number of errors is also taken into account alongside error types, with children making more/less than four −T/Q errors being categorized as impaired/normal respectively, then all but one LA1 control child (93% of the total sample) are correctly categorized. Thus, on this basis, impaired question formation appears to be a good phenotypic marker, distinguishing impaired from normally developing children over five years of age.

Note, however, that all of the G-SLI subjects correctly produced some subject questions, and all but one child some object questions, thereby evincing appropriate WH-operator and T/Q-feature movement on occasions. Thus, the Move operation or 'rule' required to satisfy the WH-criterion is not missing per se. In sum, the findings of this study confirm the predictions of the RDDR hypothesis and thus support this account of G-SLI. Before discussing the theoretical implications of the findings for G-SLI subjects' underlying grammar and the generalizability to other children with SLI, we consider whether alternative accounts of SLI can explain the results.

4.1. ALTERNATIVE ACCOUNTS OF SLI. A main opponent of the 'grammar-specific deficit' view of SLI, of which the RDDR is one account, is the input-processing deficit view of SLI (Bishop 1997, Kail 1994, Karmiloff-Smith 1998, Leonard 1998). Accounts within this framework do not distinguish different forms of SLI, and thus contend that input processes that particularly affect 'nonsalient' morphemes are impaired and processing capacity is limited in all SLI children (Bishop 1997, Kail 1994, Leonard 1998). But the findings of this study go against the prediction of that framework. First, the majority of errors do not involve perception and processing of nonsalient morphemes, as example 12 shows.

(12) a. Which one did he wear **the coat?**
b. Which did Mr. Green open **the door?**
c. Who Mrs. Scarlett saw **someone** in the lounge?
d. What **did** glittered on Mrs. Peacock's hands?

Such commission errors as gap-filling (12c), failing to pied-pipe the referential WH-phrase (12a,b), and double tense marking (12d), rather than omitting constituents as predicted by the input-processing account (Bishop 1997, Leonard 1998), militate against a processing deficit account of the findings.

The frequency of grammatical errors also differentiates the groups: all but one of the control children produced few (4 or less) if any grammatical errors, and those that were made were generally restricted to −T/Q rather than −WH errors involving highly salient lexical DPs, whereas the G-SLI subjects made a substantial number of −WH as well as −T/Q errors. More relevant, however, are the particular difficulties shown by the G-SLI subjects, but not the control groups, with object questions, as revealed by their correct scores and the large number of WH-operator errors they made for these responses. Table 2, for example, demonstrates that movement of the referential WH-phrase (e.g. *Which hat did Mrs. White wear?*) caused few if any problems for the LA1 or LA2 control children, whereas the G-SLI subjects were particularly impaired in *which* object-question formation, where the DP that forms part of the WH-phrase remained in situ on a substantial number of occasions. Finally, based on the G-SLI subjects' vocabulary scores, virtually no grammatical errors would be expected, as the vocabulary-

matched LA2 controls performed close to ceiling. Thus, this finding goes against the view that grammatical performance is strongly correlated with or even 'inseparable' from vocabulary development (Bates & Goodman 1997, Tomasello 2000). These data further indicate that impaired grammatical operations, rather than processing limitations causing a more general language delay, are affecting G-SLI subjects' language. The findings from this experiment thus indicate that, minimally, the scope of the input-processing deficit account should be restricted to some children but not others with SLI, specifically not those with G-SLI.

Another consideration is whether the findings could be accounted for by alternative SLI accounts, which fall within the grammar-specific-deficit framework. Many of these alternative accounts argue for lexical deficits with sublexical grammatical features. Gopnik and colleagues suggested that all syntactic-semantic features, such as person, number, or gender, are missing from SLI grammar (Gopnik 1990, Gopnik & Crago 1991), while Tsimpli and Stavrakaki (1999) argue for missing noninterpretable features. Therefore, rules that operate on these features are not able to function, although the operations themselves are potentially normal. Alternatively, Clahsen and colleagues' (1997) agreement deficit proposal—a narrower version of these accounts—argues that only noninterpretable phi-features of verbs are affected. Another account, which identifies the source of the deficit in feature specification, is offered by Rice, Wexler, and Cleave (1995) and Rice and Wexler (1996) who postulate that the Tense feature, or projection, is missing or underspecified, which results in an EXTENDED OPTIONAL INFINITIVE (EOI) grammar in children with SLI. There are several problems with these feature-based accounts as an explanation for a G-SLI grammar evincing impaired subject and object question formation. First, it is difficult to see how, with an absence of all syntactic features (Gopnik 1990, Tsimpli & Stavrakaki 1999), G-SLI subjects would have been able to produce any correct questions—which clearly they were able to do. But while the broad characterization appears too wide, Clahsen's phi-feature (agreement) deficit account and Rice and Wexler's EOI account appear too narrow. Although the EOI hypothesis, in contrast to Clahsen and colleagues' agreement-deficit account (Clahsen et al. 1997), could explain G-SLI subjects' problems with T/Q-feature movement, as indicated by double tense marking and *do*-support omissions and commissions, neither of these accounts would predict problems with WH-operator movement. Further, there is no explicit definition of 'underspecified' features that could account for the optionality attested in the data and which, moreover, makes testing these proposals problematic. The data from this study clearly indicate that the deficit underlying G-SLI extends further than Tense- or Verb-related features or dependencies. Thus, the agreement deficit (Clahsen et al. 1997) and the EOI (Rice & Wexler 1996, Wexler et al. 1998) hypotheses do not provide parsimonious explanations of the data for G-SLI subjects.

4.2. THE RDDR ACCOUNT. Bearing in mind the correct formation of some subject and object questions made by most of the G-SLI subjects, we now consider the implications of the findings for the nature of G-SLI grammar and conclude that not only were the types of deficits with T/Q-feature and WH-operator movement predicted by the RDDR account, but also that the RDDR provides a parsimonious explanation of the correct scores and error types found in the data. We argue that first, evidence of satisfaction of the WH-criterion by most children is consistent with the operation Move being appropriately available to the children at least some of the time (due to normal functioning of economy 1 of last resort). But for G-SLI children, when Move fails (due to missing economy 2 of last resort) for the T/Q feature, different options are applied: direct Merge

of pleonastic *do* in C (6d,e, 7d), covert movement from V to T (inflected main verb: 6e, 7c), or no verb movement at all (nonfinite verb: 6c, 7a,b). When Move fails for the WH-element, they use only one option: direct Merge of the WH-word in CP (8a,b, 9a–g). We now provide details of the various error types with respect to our characterization of G-SLI grammar.

First, consider omission errors causing unchecked T/Q features: category A Obj (A(i), A(ii)) and Subj (A(v)), and corresponding category C errors. For object questions such as 6b,c and subject questions such as 7a,b, the T/Q feature is not checked by either *do* (which is omitted in object questions) or by the main verb through covert V to T movement whereby the WH-criterion is satisfied on a representational chain containing the T/Q features (Rizzi 1991). For object aux-less questions with an inflected main verb (6a), we presume that the inflected verb checks T in the covert component, but the WH-criterion is not satisfied as the T/Q feature is not carried to C so that it is in a spec-head relation with the WH-word.

Commission errors where an auxiliary occurs with finite verb in object questions (Categories A(iii), C(iii), e.g. 6d,e) or subject questions (A(vi), C(viii), e.g. 7c) rarely occurred in young normally developing children in this study (see Table 5) or previous studies (Guasti 2000). For the object questions, assuming that covert movement is 'cheaper' than overt movement, one possibility is that the inflected verb covertly moves to T and checks the noninterpretable features of this head. Consequently, no features are left in T to be checked by the auxiliary. Hence the auxiliary in the head of C must have been directly merged in C and thus does not carry the T/Q feature. For the subject questions, once the inflected verb has covertly checked the T/Q feature, *do* cannot have its features checked. Alternatively, if *do* is merged directly into C, thereby not properly governing its trace, it leaves open the possibility of covert V to I movement. Furthermore, since in subject questions there is no I to C movement, pleonastic *do* must have been directly merged in C, where it intervenes between the WH-word and T. Thereby the WH-criterion is not satisfied. Such a representation thus shows a deviation from adult grammar. Interestingly, for the LA controls, but not the G-SLI subjects, all tense-doubling errors involved irregular verbs where the participle or past-tense form of the verb was produced rather than the nonfinite form (13a,b). Thus, it remains a possibility that for these children such errors were lexically driven and do not reflect a nonadult syntactic representation.

(13) a. Who did she saw in the lounge?
b. Which hat did she wore?

If we now consider the −WH errors (Category B, e.g. 8, and C, e.g. 9a–g), the occurrence of a lexical DP in the position of the gap indicates that the WH-word or WH-phrase has been directly merged either in spec-C or spec-RefP (see Hollebrandse & Roeper 1996) or in a topic position adjoined to the IP (de Villiers 1991) and functions as an adjunct, somewhat similar to an interrogative marker placed at the beginning of the sentence, conjoined to the utterance. Further, under the conditions of base insertion described above, the occurrence of a lexical item in the trace position may be a means of satisfying the theta-criterion. Although Labelle (1990) reports a similar gap-filling strategy in relative clause constructions in French children of three to six years, we are not aware of reports of DP gap-filling in normally developing children in the simple matrix questions that were the focus of this study. Thus, such a pattern could indicate an atypical grammar when it occurs, rather than an earlier stage of development of normal language acquisition.

It is noteworthy that the G-SLI subjects had particular problems with extraction of a referential WH-phrase and its movement to either spec CP or, it has been argued, following Stowell and Beghelli (1994), to a higher projection through spec CP to spec RefP—a referential phrase (Rizzi 1990, Thornton 1995). Although this operation does not appear to be problematic for the normally developing children in this study or previous studies (Thornton 1995), it clearly is problematic for the G-SLI subjects. Based on young children's (age 3:5 to 5:2) chance level of performance in question comprehension requiring extraction of the referential DP, but good performance on questions that did not require pied piping, such as *who* questions, Avrutin (2000) suggests that the problem resides in processing limitations since such sentences require discourse operations as well as syntactic ones. Specifically, these 'D(discourse)-linked questions' require the speaker to introduce a set of presupposed objects to which *which* could refer. Although a possibility, Table 1 reveals that the G-SLI subjects did not differ substantially on *what* and *which* questions, and, further, for object questions, the non-D-linked *who* questions were worse than the D-linked *which* questions. Thus, it does not appear that a particular impairment at the syntax-discourse interface, or in processing requirements for these operations, is at the root of the G-SLI subjects' problems with question formation.

Finally, we compare the findings from this study with previous investigations of young children to see whether alternative explanations for early language would provide a parsimonious explanation for these data. Consistent with previous observations of young children (Stromswold 1990, Guasti 2000), in this study the WH-in-situ was not attested in either the normal or G-SLI data. It thus appears that for our older G-SLI subjects, like very young children, WH-in-situ is never an option. However, omissions of the WH-word are reported in the SLI literature for children younger than those in this study (Eyer & Leonard 1995, Hamann et al. 1998). Such errors represent deviation from both normal adult grammar and early language acquisition. There are two reasons why such errors might not have occurred in this study. First, when movement failed, the pragmatic/contextual components of the task, whereby the child held a WH-word disk and knew that he or she should start the question with this word, could have facilitated Merge of the WH-word in the utterance. Second, the effects of therapy on these older children, whereby question formation is explicitly taught, could have enabled the child to use nongrammatical, cognitive reasoning to facilitate question formation, whereby a WH-word is used in initial position. However, neither the task demands nor therapy can account for Merge of pleonastic *do* or the use of a lexical DP in the WH-gap. Thus, such explanations are not parsimonious with the overall data set.

It is noteworthy that auxiliary omission errors are attested in our normally developing children and have been previously reported in both English and Italian early language (Guasti 2000, Stromswold 1990). Guasti (2000) contends that children satisfy the WH-criterion by projecting a null auxiliary in C. Moreover, Guasti (2000) argues that such omission errors are compatible with the view that the child and adult grammar are the same, and such errors result from performance limitations or the unavailability in the child lexicon of a particular lexical item. In contrast, commission errors could provide evidence that the child and adult grammar are different in some respects (Guasti 2000, Stromswold 1995).

Commission errors are occasionally attested in normal child language and second language learning, occurring for tense (double tense marking), WH-words, and resumptive pronouns (de Villiers et al. 1990, Hollebrandse & Roeper 1996, Labelle 1990, Thornton 1991, 1995). The gap-filling errors whereby the trace position is filled by a

nonspecific DP (*something*), a specific DP (*the door*), or a resumptive pronoun (*it*) (9a–g) found in our study can also be thought of as a doubling phenomenon and, as far as we can ascertain, such gap-filling is reported only in nonmatrix complex structures such as relative clauses in early child language. Further, the occurrence of gap-filling errors in subject questions (9f,g) indicates that the WH-word is in the spec of C rather than in spec of I, as presumably the gap-filling DP is located in the spec of I. An alternative explanation is that these doubling errors represent a spell-out of the chain formation without the need for relabeling (Hollebrandse & Roeper 1996, Thornton 1995). Hollebrandse and Roeper (1996) argue that this is a 'first resort' phenomenon, where the acquisition stage is incomplete, and reflects a more economical representation. Although such an underlying grammar can account for these doubling errors, it cannot account for the omission errors. Thus, for reasons of parsimony, we favor the explanation of Merge of the WH-word and/or *do* in the CP, which functions as an adjunct phrase since no checking relation is established with its trace (cf. de Villiers 1991).

In conclusion, the occurrence of both correct and incorrect subject and object questions in children with G-SLI indicates that appropriate WH-operator movement and Q-feature movement is optionally implemented in G-SLI grammar. We have argued that the operation Move operates, at least some of the time, due to normal functioning of economy 1 of last resort. But missing economy 2 of last resort (van der Lely 1998) operationally results in Move not functioning on a substantial number of occasions, and thus being optional. In WH-question formation, when WH-movement fails, the G-SLI children appear to use Merge of the WH-word as well as Merge of *do*, covert movement of V to T, or no verb-movement at all. Consequently they fail to form the crucial structural dependent relation within the computational syntactic system to check features on a substantial number of occasions. The data provide further support for the RDDR, optional movement, characterization of G-SLI subjects' grammar.

4.3. GENERALIZATION. It is evident that WH-question formation needs to be systematically explored in other populations of children with SLI and crosslinguistically to substantiate the finding from this study. Similar findings, showing problematic, but not missing, movement and thus feature-checking in other subgroups of children with SLI would have several implications. First, such findings would indicate that the RDDR explanation of grammatical deficits in G-SLI subjects can be extended to a broader population of children with SLI, and not just to those with G-SLI or English-speaking children. Second, the crosslinguistic data could provide further information with respect to a deficit in the mechanisms/representations underlying the grammatical system, that is, UG, rather than a characterization of the surface properties of SLI in one language. Initial crosslinguistic investigations of passive and question formation in Greek-speaking G-SLI children (Stavrakaki 2001, 2002) and question formation and relative-clause comprehension in Hebrew G-SLI subjects (Novogrodsky & Friedmann 2002, Friedmann & Novogrodsky 2002) reveal significant deficits in just those structures requiring movement, but not those where other operations are implemented. Moreover, Leonard (2002) reported problems with complex DP constructions in Swedish, where Move was required for feature checking, which could not be satisfied by Merge or Agree. Thus, so far, these crosslinguistic data provide tentative support for the RDDR hypothesis and indicate that further inquiries into structures in different languages where feature checking requires Move, in contrast to Merge and Agree, deserves fuller exploration.

4.4. CONCLUSION. This initial investigation into WH-movement (WH-operator and T/Q-feature movement) in G-SLI subjects and normally developing children tested

predictions central to the RDDR hypothesis. The findings support the RDDR hypothesis and provide further evidence for a pervasive deficit in the computational syntactic system that, nonetheless, is highly constrained and predictable in children with G-SLI. The G-SLI subjects, in contrast to the younger control children, showed particular difficulties with object questions and evinced both WH-operator movement and T/Q-feature movement errors, yet on occasion evinced appropriate movement operations to satisfy the WH-criterion. We conclude that the RDDR account whereby movement is optional is consistent with the (predicted) findings of grammatically correct and incorrect WH-question formation. We propose that, in the face of no movement, the WH-word and, on occasion, *do* are merged in situ in the CP and function as an interrogative adjunct. The normal functioning of Merge, in contrast to Move, is further illustrated by comparing the findings from this study with those of Davies (2001, 2002), who investigated negative particles in G-SLI subjects. In contrast to the findings in this study, when feature checking can be appropriately satisfied via Merge, as in negation, these same subjects with G-SLI in a production task never omitted the noncontracted (*not*) or contracted negative particle (*isn't*/*didn't*) in 288 occasions, although they had problems with *do*-support as predicted by the RDDR hypothesis (Davies 2001, 2002).

The discovery of significant (and predictable) WH-movement errors in G-SLI children is a contribution to the literature characterizing SLI that needs to be accounted for in any theory of SLI, whether or not one adopts the split into economy 1 and 2 within the RDDR hypothesis. Thus, these data provide a challenge to alternative hypotheses of SLI.

Finally, the data from this study, which cannot be explained by a general deficit in processing limitations, provide further evidence for a constrained and predictable domain-specific deficit within the grammatical system as characterized by Chomsky (1986). The findings are thus consistent with a modular, specialized system underlying the human language faculty (Chomsky 1986, Pinker 1994), which can be differentially impaired.

APPENDIX A: QUESTION-ELICITATION STATEMENTS WITH THEIR TARGET RESPONSES (*in italics*)

Subject questions

Who

1. Someone went into the house. Ask me who. *Who went into the house?*
2. Someone carried a bag. Ask me who. *Who carried a bag?*
3. Someone went in the kitchen. Ask me who. *Who went into the kitchen?*
4. Someone frightened Mrs. Brown. Ask me who. *Who frightened Mrs. Brown?*
5. Someone hid their money. Ask me who. *Who hid their money?*
6. Someone liked reading. Ask me who. *Who liked reading?*

What

1. Something was in Colonel Mustard's pocket. Ask me what. *What was in Colonel Mustard's pocket?*
2. Something lay under a table in the lounge. Ask me what. *What lay under a table in the lounge?*
3. Something fell off a table. Ask me what. *What fell off a table?*
4. Something was in Mrs. Brown's desk. Ask me what. *What was in Mrs. Brown's desk?*
5. Something crawled onto Mrs. Brown's dress. Ask me what. *What crawled onto Mrs. Brown's dress?*
6. Something glittered on Mrs. Peacock's hands. Ask me what. *What glittered on Mrs. Peacock's hands?*

Which

1. A table fell over. Ask me which one. *Which table fell over?*
2. A window slammed shut. Ask me which one. *Which window slammed shut?*
3. A lamp stood in the library. Ask me which one. *Which lamp stood in the library?*
4. A door creaked. Ask me which one. *Which door creaked?*
5. A telephone rang. Ask me which one. *Which telephone rang?*
6. One guest looked unhappy. Ask me which one. *Which guest looked unhappy?*

Object questions

Who

1. Mrs. Peacock saw someone in the lounge. Ask me who. *Who did Mrs. Peacock see in the lounge?*
2. Mrs. Brown saw someone in the kitchen. Ask me who. *Who did Mrs. Brown see in the kitchen?*
3. Colonel Mustard walked past someone in the hall. Ask me who. *Who did Colonel Mustard walk past in the hall?*
4. Miss Scarlett saw someone in the lounge. Ask me who. *Who did Miss Scarlett see in the lounge?*
5. Miss Scarlett noticed someone in the library. Ask me who. *Who did Miss Scarlett notice in the library?*
6. Mrs. Peacock heard someone in the library. Ask me who. *Who did Mrs. Peacock hear in the library?*

What

1. Mrs. Brown placed something in the library. Ask me what. *What did Mrs. Brown place in the library?*
2. Mrs. Peacock liked some jewelry. Ask me what. *What jewelry did Mrs. Peacock like?*
3. Miss Scarlett left something in the library. Ask me what. *What did Miss Scarlett leave in the library?*
4. Colonel Mustard borrowed something. Ask me what. *What did Colonel Mustard borrow?*
5. Mrs. Peacock and Mrs. Brown drank something. Ask me what. *What did Mrs. Peacock and Mr. Brown drink?*
6. Colonel Mustard dropped something. Ask me what. *What did Colonel Mustard drop?*

Which

1. Mr. Black had a vase in the study. Ask me which one. *Which vase did Mr. Black have in the study?*
2. Professor Plum wore a coat. Ask me which one. *Which coat did Professor Plum wear?*
3. Mrs. White wore a hat. Ask me which one. *Which hat did Mrs. White wear?*
4. Mrs. White wanted a sandwich. Ask me which one. *Which sandwich did Mrs. White want?*
5. Mrs. White stroked a cat. Ask me which one. *Which cat did Mrs. White stroke?*
6. Rev. Green opened a door. Ask me which one. *Which door did Rev. Green open?*

Appendix B: Explanation and instructions for the games in the study

Explanation

'We're going to spend the next half hour or so playing a couple of games. It's a bit like Cluedo except I've changed how to play. If you don't understand anything while we're playing, just ask and I'll try to explain. I hope you enjoy it. Let's toss a coin to see which game we'll play first.'

Instructions

Game A: 'In this game Mrs. Brown is having a barbecue in her garden for her friends. In the evening, she finds out that someone has stolen a piece of jewelry from her house. She phones the police and they send round their best detective—you! You have to find out what happened. The police have also sent round your sergeant—me! I have found out some information already, but I'm being difficult. I am going to make you ask me questions to find out what I know. Some of the answers I will give you will help you but some won't be helpful at all. At the end of the game you must guess what was stolen, who stole it and where they stole it from. If you think you know before the end of the game, you can say. You must still ask all the questions.'

How to play

'1. Here is Mrs. Brown's house. Here is her garden.

2. These are people and object cards. You can move them on the house board if you want, to help you remember what happened.

3. These are question words. You must choose one from the bag.

4. These are answer cards. I must choose a card from the same color pile as your question word. I read the card to you.

5. You ask me a question. Make sure your question starts with your question word.

We are ready to start. Let's have a few practice questions first.

Shake the bag. Shuffle the answers.

Choose a question word. What does it say?

I choose an answer card and read it.

Now you ask me a question using your question word.

O.K. Let's play the game now.'

Game B: 'Mr. Black is having a birthday party in his house. In the evening he finds out that someone has broken one of his things. He asks his best friends (you and me) to help him work out what happened. I have some information but I'm being difficult. I'm going to make you ask me questions to find out what

I know. Some of the answers I will give you will help but some won't be helpful at all. At the end of the game you must guess what was broken, who broke it and where it was broken. If you think you know before the end of the game you can say. But, you must still answer all the questions.'

How to play

'1. Here is Mr. Black's house.

2. These are people and object cards. You can move them on the house board if you want to, to help you remember what happened.

3. These are the question words. You must choose one from the bag.

4. These are the answer cards. I must choose a card from the same color pile as your question word. I read the card to you.

5. You ask me a question. Make sure your question starts with your question word.

We are ready to start. Let's have a few practice questions first.

Shake the bag. Shuffle the answers.

Choose a question word. What does it say?

I choose an answer card and read it.

Now you ask me a question using your question word.

O.K. Let's play the game now.'

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