# Narrative discourse in Grammatical specific language impaired children: a modular language deficit?*

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ABSTRACT

This paper provides a further investigation into the linguistic abilities of a subgroup of 12 Grammatical specific language impaired (SLI) children (aged 10;2 to 13;11). The study investigates the use of referential expressions (e.g. pronouns) in a narrative discourse, and provides insight into the underlying nature of Grammatical SLI, thereby contributing to the modularity debate. Previous investigations indicate that Grammatical SLI children have a deficit with dependent structural relationships, i.e. a Representational Deficit for Dependent Relationships (RDDR). Grammatical SLI children's RDDR appears to be a modular language deficit. To test this claim, linguistic representations of dependent structural relationships which are not part of the modular language system are investigated using a narrative discourse based on the picture book *Frog where are you?* The SLI children's pattern of referential expressions was compared with 36 language ability controls (aged 6;4 to 9;8). The findings indicated that the Grammatical SLI children have relatively mature linguistic development in the use of referential expressions to produce a cohesive, structured narrative discourse. The view of the organisation of the mind in which a modular language system can be differentially impaired from aspects of language which rely on the central system can most easily account for the data. Thus, the data support the hypothesized modular nature of Grammatical

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SLI children's underlying linguistic deficit. The implications of the findings for language acquisition are discussed.

INTRODUCTION

The issue of the modularity of the mind (Fodor, 1983) is at the centre of many theoretical debates amongst researchers. The focus of one line of this debate is whether language provides evidence for or against the modularity of mind, and what aspects of language, if any, are modular.

This paper provides a further investigation into the linguistic abilities of a subgroup of 12 so-called 'Grammatical specific language impaired' (SLI) children (van der Lely & Stollwerck, 1993; van der Lely, 1994, 1996a, 1996b). The study investigates the use of referential expressions (e.g. pronouns) in a narrative discourse, and provides insight into the underlying nature of Grammatical SLI, thereby contributing to the modularity debate. In addition, the methodology used in this study, in which the performance of SLI children and normally developing children are compared may elucidate the relationship between linguistic abilities and provide insight into language acquisition in a way which is not possible from only the investigations of normally developing children. In particular, such studies may reveal relative autonomy in the acquisition of aspects of syntax, inflectional morphology, and phonology from semantic-lexical and pragmatic development. This cognitive neuropsychological approach has been fruitfully exploited in investigations of language processing in adults (e.g. Ellis & Young, 1988) but has not been implemented to the same extent in developmental studies.

*Specific language impairment in children*

SLI children are characterized by severe problems in the development of language comprehension and/or expression. In other respects of their cognition these children do not show any obvious impairments. For example, they perform within normal limits on standardized tests of non-linguistic cognitive and motor abilities, hearing and emotional development.

Specific language impairment in children is a heterogeneous disorder. However, relatively homogeneous subgroups of SLI children can be identified: for example, semantic-pragmatic SLI children (Adams and Bishop, 1989); Familial SLI (i.e. a family of 30 members of whom half are language impaired) (Hurst, Baraitser, Auger, Graham & Norell, 1990; Gopnik & Crago, 1991); Grammatical SLI (van der Lely, 1994, 1996b; van der Lely & Stollwerck, 1996). At this stage of our knowledge, it would seem that the investigation of subgroups of SLI children provides a stronger basis from which to investigate their underlying disorder and draw theoretical inferences (see Aram, Morris & Hall, 1993).

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Grammatical SLI children are characterized by a persistent SLI with a disproportionate impairment in the grammatical comprehension and expression of language. That is, their grammatical abilities appear to be impaired over and above any general (secondary) language impairment they may have in, for example, lexical development. Concurring SEVERE articulatory/phonological deficits, articulatory dyspraxia or a phonological disorder of the severity to cause frequent omissions of final consonants or unintelligible speech are not a characteristic of this group of children. I am not claiming that Grammatical SLI children do not have ANY phonological impairment but if it exists it is subtle and, as yet, it has not been investigated in these children.

A summary of the findings so far from the group of 12 Grammatical SLI children (aged 9;3 to 12;10) participating in this study will initially be provided. This will be followed by consideration of a possible hypothesis about the underlying nature of their disorder and how this relates to the modularity debate.

### Background characteristics of the Grammatical SLI children

Previous investigations have revealed that the Grammatical SLI children are impaired in their production of aspects of inflectional morphology. In their expressive language, investigations have revealed a large number (approximately 50%) of omissions of obligatory third person agreement *s* on the verb (e.g. 'My Dad make_breakfast') (Kubli, 1995; van der Lely, 1996a). Errors with both regular (*jump-jumped*) and irregular (*swim-swam*) past tense marking have also been found. Grammatical SLI children may use infinitival or stem verb forms in past tense contexts; e.g. 'Yesterday I swim a mile' (van der Lely, 1996a; van der Lely & Ullman, 1996). In addition, they make approximately 10% overgeneralization errors (e.g. *swimmed*, *falled*) at an age (9;3 to 12;10) when overregularisations would rarely be expected (Marcus, Pinker, Ullman, Hollander, Rosen & Xu, 1992). This pattern of morphological impairment found for Grammatical SLI children concurs with data from previous investigations into the expressive language of younger SLI children (Clahsen, 1989, 1991; Gopnik & Crago, 1991; Leonard, McGregor & Allan, 1992; Bishop, 1994; Rice, Wexler & Cleave, 1995).

However, Grammatical SLI children's problem with inflectional morphology is not merely a production problem. In a grammatical judgement task they judge stem forms (*walk*) and overregularisations of verbs (*falled*) in past tense contexts to be acceptable (van der Lely & Ullman, 1996). Although the SLI children's proportion of tense marking errors are more marked with regular verbs, an occurrence of both regular and irregular verb errors indicates that their problem extends to syntactic tense and is not confined to morphology. Furthermore, the similar findings in the production and

judgement task illustrates that the underlying deficit causing Grammatical SLI is not to be found in differences between expressive vs. receptive language processes, or with the cognitive demands of a particular task.

Grammatical SLI children's problems with syntax have been frequently found when they have to assign thematic roles (*agent*, *theme*) to NPs (*subject-NP*, *Object-NP*) in reversible sentences (e.g. *The boy is hit by the girl*); that is, when semantic or pragmatic cues are not available to guide them (Bishop, 1983; van der Lely & Harris, 1990; van der Lely, 1994, 1996*b*).

In addition to the linguistic investigations of Grammatical SLI children, a preliminary study was carried out to investigate whether this group of SLI children have a familial aggregation of language impairment. The results revealed that the SLI children have a significantly higher incidence of a positive family language impairment history than a large group of control children matched on chronological age (van der Lely & Stollwerck, 1996). The pattern of impairment in their first degree family members is consistent with an autosomal dominant genetic inheritance of Grammatical SLI.

### The underlying nature of Grammatical SLI

A hypothesis is required to account for the particular deficits in morphology and syntax found in the comprehension and expression of Grammatical SLI children. There have been various hypotheses put forward to account for the deficits in subgroups or mixed groups of SLI children. For example, Leonard (1989), and Leonard *et al.* (1992) have argued for an auditory perceptual deficit underlying SLI which causes particular problems for the perception of morphemes with 'low-phonetic substance'. The missing agreement deficit was put forward by Clahsen (1989) to account for the findings from German SLI children and the missing feature deficit was put forward to account for Familial SLI (Gopnik & Crago, 1991). Whilst these hypotheses may account for the linguistic impairments found in some populations of SLI children and/or some aspects of the language investigated in the respective studies, the hypotheses cannot account for the range of linguistic impairments found in Grammatical SLI children (see van der Lely (1996*a*) for further discussion). Rather, the expressive and receptive language abilities of Grammatical SLI children can be accounted for in terms of a deficit with structure-dependent relationships, i.e. A Representational Deficit for Dependent Relationships (RDDR) (van der Lely, 1994, 1996*a*, 1996*b*; van der Lely & Stollwerck, 1993). Note that what appears to cause Grammatical SLI children to fail in a task is not whether the tasks are tapping either comprehension or production, but that structure-dependent relationships between constituents are required (see reports on inflectional morphology above).

Clahsen (1989, 1991) first identified an underlying impairment with structure-dependent representations in inflectional morphology which he

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characterized as the missing agreement deficit. Subject–verb agreement illustrates this deficit: the inflectional form of the verb (e.g. *jump/jumps*) is dependent on the syntactic relationship between a noun phrase and the verb (i.e. they are in a subject–verb relationship) and the grammatical number and person of the noun. A different type of structure-dependent relationship is required for thematic (theta) role assignment. In sentence comprehension the thematic role of a noun phrase is dependent on a combination of the verb's lexical properties and the noun's syntactic relationship to the verb (i.e. whether it is the subject NP or object NP). It is only when knowledge of the relationship between structures is required for the assignment of thematic roles that SLI children's impaired comprehension is apparent (van der Lely, 1994, 1996*b*). In other sentences, such as *The ball is kicked by the boy*, lexical, pragmatic or general world knowledge is sufficient to guide correct assignment of thematic roles, and SLI children do not show a deficit (van der Lely & Dewart, 1986).

A further investigation was carried out to see if Grammatical SLI children's problems with structure-dependent representations extended to other syntactic relationships. The assignment of intrasentential reference to pronouns (*him*, *her*) and reflexives (*himself*, *herself*) within the linguistic framework of Binding Theory (Chomsky, 1986) was investigated to explore this. An example in (1) below illustrates the importance of the syntactic structural knowledge in assigning intrasentential reference.

(1)   *Mowgli$_i$ says Baloo Bear$_j$ is tickling him$_{i/*j}$/himself$_{*i/j}$.*

In a sentence-picture judgement task, the Grammatical SLI children were found to be unable to rule out inappropriate coreference when this depended crucially on the structural syntactic knowledge (van der Lely & Stollwerck, 1993). For example, when presented with the reflexive version of the sentence in (1) and a picture of Mowgli tickling himself the Grammatical SLI children performed at chance in accepting or rejecting the picture-sentence pair. However, they ruled out inappropriate coreference if semantic-lexical properties of the depicted referent (e.g. semantic gender) did not match those of the anaphor or pronoun.

The linguistic investigation so far suggest that Grammatical SLI children's deficit with structural-dependent relationships between constituents is restricted to arguably 'modular' aspects of language, such as inflectional morphology, thematic (theta) role assignment and Binding Theory. However, to substantiate this, further investigations are required with tasks requiring representations for dependent relations in areas of language which do not fall within the hypothesized language module. This study addresses this by investigating the use of pronominal reference in a narrative discourse. The following section will briefly outline the modularity of language issue and how this study may provide evidence for or against language modularity.

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*Language modularity*

One theoretical perspective about how the human mind is organized makes a distinction between a CENTRAL SYSTEM, responsible for rational thought and the fixation of beliefs, and a number of MODULAR INPUT SYSTEMS, one for each of the senses which feed the central system (Fodor, 1983). Fodor (1983) argues that the language faculty is an input system on a par with the senses, such as vision, and that it meets the criteria for a module. Modules are domain specific, informationally encapsulated, fast, mandatory, and have shallow outputs; they are subserved by specific neural architecture and are subject to idiosyncratic pathological breakdown (Fodor, 1983). Domain specificity refers to the requirement that modules deal exclusively with a single input type. It is also claimed that the neural specificity of the architecture of the modules is genetically determined ('innate') and therefore largely invariant across the species (Chomsky, 1965; Fodor, 1983; Pinker & Bloom, 1990; Pinker, 1994).

Many of the modular criteria are not specific to only modules. The exception is informational encapsulation, which refers to the fact that modular processes appear to be impervious to encyclopedic information (Smith, 1994). Furthermore, not all aspects of language fit into the definition of the language module. Pragmatic inference and the storage of lexical representations may be viewed as part of the central system, whereas syntax, inflectional morphology, and phonology may be viewed as part of the language module (Chomsky, 1981, 1986; Sperber & Wilson, 1986; Smith & Tsimpli, 1995).

An alternative view of the organisation of the brain is based on a non-modular perspective. This view does not assume that there is neural specificity of the architecture of the brain leading to informational encapsulation of aspects of language. However, parts of the brain may be DOMAIN SPECIFIC and consequently SPECIALIZE in processing certain types of information (see, e.g., Karmiloff-Smith, 1992; Bates, 1993; Marchman, 1993). A variant of this view suggests that the brain may BECOME modularized through reorganisation and representational change during development (Karmiloff-Smith, 1985, 1992). The functional-processing approach to language development is associated with this perspective (Bamberg, 1987; Karmiloff-Smith, 1992; Bates, 1993) The processing demands of tasks and consequent differences between comprehension and expression are seen as some of the relevant distinctions within this approach rather than syntax *versus* pragmatic or lexical knowledge (Bates, Dale & Thal, 1995).

It would appear, on the surface, that Grammatical SLI children provide a potentially strong case supporting the modularity of language and the associated autonomy of aspects of syntax in language acquisition. Thus, further investigations of their linguistic abilities are warranted to exploit the

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potentially significant theoretical implications arising from studies of Grammatical SLI.

### Narrative story-telling discourse

In a story-telling context the linguistic form of a referent (full NP, pronoun or zero anaphora) will be determined by an interaction between the overall global and local narrative structure and the linguistic function of the referent. The linguistic function of the referent may be to introduce or establish a main or subsidiary protagonist in the story. Alternatively, the function may be to reintroduce (switch) reference or maintain the reference to a protagonist (Karmiloff-Smith, 1985, 1987; Bamberg, 1987; Wigglesworth, 1990; Kail & Hickman, 1992; Slobin & Berman, 1994). Factors such as the speakers' knowledge of the world, their understanding of the listeners 'need to know', as well as their knowledge of the global and local structure of the narrative, will influence the linguistic form of the referent used in a narrative. These linguistic factors relating to inferential communication are elegantly captured within the theory of Relevance (Sperber & Wilson, 1986). According to Sperber & Wilson the speaker attempts to create a cognitive representation for the listener, involving the maximum effect for the minimum of effort. Thus, the linguistic form of the referent is dependent on the speaker's representation of the previous and current narrative discourse alongside the balancing act between creating the maximum effect for the minimum effort for the listener.

There have been many investigations into how children learn to narrate stories and the development of their ability to introduce and track protagonists as the story proceeds (e.g. Karmiloff-Smith, 1985; Bamberg, 1987; Hickman, 1987; Kail & Hickman, 1992; Slobin & Berman, 1994). This study focuses on the introduction, reintroduction (switching) and maintenance of reference to a protagonist in a story.

The ability of normally developing children to use appropriate anaphoric referential expressions in a narrative discourse develops at a late stage of language acquisition. Changes have been documented between the ages of three and ten years which reflect qualitative differences in the use of pronouns in narrative discourse (Karmiloff-Smith, 1985; Bamberg, 1987; Hickman, 1987; Kail & Hickman, 1992). Karmiloff-Smith (1985) proposed a three-phase model of the development of anaphora. She claimed that young children's initial production of pronouns reflects deictic use and is motivated by the stimuli conveying information about the focused-upon event or referent. The following phase (Phase 2) is characterized by a THEMATIC SUBJECT CONSTRAINT whereby pronominal reference in subject position is largely restricted to a maintenance function for the main protagonist in the story. The final phase reflects an integrated system. In this phase children's

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use and non-use of pronouns and other referring expressions shows flexibility and serves to organize the ongoing discourse relations into a cohesive discourse (Karmiloff-Smith, 1985).

Bamberg (1987), Wigglesworth (1990) and Bamberg & Marchman (1991) differentiate the use of pronominal reference for different functions in the narrative, i.e. the introduction, reintroduction (referred to as 'switching' by Bamberg, 1987) and maintenance functions. Bamberg (1987) found that children of three to four preferred to use pronouns rather than nominals for reintroducing the main protagonist, whereas five- to six-year-olds used both pronouns and nominals equally. By nine to ten years the children preferentially used nominals rather than pronouns for this function which reflected an adult-like pattern. In contrast to the reintroduction function, for the maintenance function pronouns were predominantly, but not exclusively, used by all ages.

Previous research investigating SLI children's ability to produce a coherent discourse has found that they use significantly more full NPs than control subjects; provide the listener with too much or too little information in informal conversation; interpret messages literally; respond to one or two words in a sentence rather than the entire message; have an inability to take turns and maintain or switch a topic in discourse (Johnston, 1982; Liles, 1985; Rapin, 1987; Adams & Bishop, 1989; Bishop & Adams, 1989, 1991, 1992; Schelleter, 1990). As the appropriate use of a referential expression taps many of these areas previously investigated in other groups of SLI children we could expect that Grammatical SLI children would be impaired in using pronouns in a narrative discourse.

The specific questions addressed in this paper are: (1) Do Grammatical SLI children use a range of referential devices (nominals, pronouns, and zero anaphor) in a narrative discourse? (2) Do the Grammatical SLI children show a similar pattern of referential expressions for introducing, re-introducing and maintaining reference to a protagonist in a story as groups of younger children matched on different aspects of language development?

Support for the modularity of language hypothesis would be provided if it was found that the SLI children's deficit did not extend to pragmatic structurally dependent relationships.

METHOD

A narrative of a long picture book was employed. The performance of the Grammatical SLI children was compared with three groups of younger control children. The control groups were matched to the SLI children on different standardized tests of language which tapped a range of language abilities. All the children participating in this study had already participated in a number of experiments in the preceding year (e.g. van der Lely &

Stollwerck, 1993, 1996; van der Lely, 1996a, 1996b; van der Lely & Ullman, 1996).

### Subjects

*Grammatical SLI children.* There were 12 Grammatical SLI children in the subgroup. The children were relatively homogeneous and showed the required persistent and disproportionate impairment in morpho-grammatical abilities in comparison to their performance on tests of single word comprehension and expression, sentence length and information content in their expressive language. The selection criteria and procedure for the subgroup has already been well documented and therefore will not be repeated here (see van der Lely 1996a, 1996b; van der Lely & Stollwerck, 1996). However, for readers' convenience the raw scores and standard deviations for the six language tests which were used for selection and matching are reproduced in Appendix 1A and 2A. At the time of this investigation, which was undertaken approximately ten to twelve months after the original selection, the SLI children had a mean age of 12;2 (range 10;2 to 13;11). There were ten boys and two girls in the group.

*Language ability control groups.* Three groups of 12 children developing normally provided language ability (LA) control groups. Full details of the matching procedure can be found in van der Lely (1996a, 1996b) and van der Lely & Stollwerck (1993, 1996). Appendix 1B, 2B and 3B provides a summary of the LA controls' raw scores and s.d. for the standardized tests used for matching purposes.

The youngest control group (LA1 controls) were matched to the SLI children on two standardized tests tapping morpho-grammatical abilities. The older two control groups (the LA2 and LA3 controls) were matched to the SLI children on expression and comprehension of single words. The mean ages of the children were: LA1 controls 6;8 (range 6;4 to 7;3); LA2 controls, 7;10 (range 7;4, to 8;3); LA3 controls, 8;10 (8;4 to 9;8).

### Materials

A picture-book, with no written text, entitled *Frog, where are you?* (Mayer, 1969) was used to elicit the narratives. It contains 24 pictures that represent a story about a boy and his dog who lose a frog and their following search for it. The story involves two main protagonists, the boy and the dog, who for the most part perform different actions from each other. This makes the narrator switch back and forth from one protagonist to the other in order to represent the actions in a temporal sequence. Several other actors interact with the two protagonists' search for the frog, which calls for the narrator to introduce additional characters, maintain reference to them, and also to switch

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reference from one to another character. This particular picture book was selected since it has already been widely employed in previous studies with adults as well as children of different ages, and in many different languages, including English (Bamberg 1987, Kail & Hickmann 1992; Slobin & Berman 1994).

*Procedure*

The children were seen individually in a quiet room with the experimenter, who was already familiar to them from various experimental visits during the past year. Each child was shown five envelopes and told that they each contained a picture book that told a story. Unknown to the child each enveloped contained a copy of *Frog where are you?* The experimenter explained that 'the five stories were almost the same, but some things that happened were just a little bit different in each story'. The child was asked to choose one of the envelopes, go over to the corner of the room where the experimenter couldn't see him, and have a good look at all the pictures in the book so that he could come back and tell the story. The experimenter would then have to guess which of the five stories it was.

When the child was ready, he came and sat opposite the experimenter at a table with the picture book resting on a stand, so that he could turn over the pages while telling the story, but without the experimenter being able to see the pictures. The stand also inhibited the child from showing the experimenter the pictures, pointing or gesturing to the characters. Before the child began to tell the story, the experimenter reminded him about the aim of the activity, namely that the child should tell her about everything so that she would know exactly what happened in the story and who did what. During the child's narration the experimenter listened, signalling that she was attentively following the story. She did not intervene unless the child stopped narrating, in which case she would encourage the child to continue (e.g. 'go on', 'and then', with rising intonation).

This procedure differed from Bamberg's original study in that the child was not told the story by an adult prior to them telling the story and, as far as the child was concerned, the experimenter did not have knowledge of the story and nor did she look at the pictures during the story telling. However, the procedure is similar to Kail & Hickman's (1992) study in which the listener and narrator did not have mutual knowledge of the story. The procedure was chosen in order that the narratives of the children were not influenced by previous adult descriptions of the story and to enable an assessment of the children's sensitivity to the lack of shared knowledge in the referential expressions used in the narrative.

The child's story was audio-taped using a portable digital tape recorder (Sony DAT) and an electret condenser microphone (ECM-959) on a stand, positioned close to the child's mouth. The stories were transcribed

orthographically by the same experimenter. Hesitations and pauses were noted, and ambiguous utterances were transcribed phonetically.

*Coding*

This study focused on the ability to refer appropriately to the two main protagonists in a story. In particular, the type of reference used to (i) introduce characters when they were referred to for the first time, (ii) to reintroduce characters after a different character had been referred to, and (iii) to maintain reference to a character in subject or object position. For reintroduction the use of a nominal expression (proper name or determiner + N) was expected. In other cases the narrator needed to maintain reference to the character(s), sometimes for a long sequence of different actions carried out by a particular protagonist. The coding scheme was devised to track these referential expressions in sequence in order to establish whether the children were employing pronominal expressions (pronoun *he/it*, or zero anaphor) to refer back to a character once his existence had been established in the story. To do this, each narrative was first subdivided into separate episodes. An episode was defined as a sequence of actions or events concerning the same character, where the character remains in focus position. Two examples of the protagonist in focus position are given in (2) and (3) below:

(2) 'Then *he* ran off.'
(3) 'but it was *the dog* … '

An example of two consecutive episodes is shown in (4) below. The first episode illustrates the boy in focus position, and the next episode has a minor character (the mole) in focus position. An episode is enclosed within brackets and the occurrences of the protagonist (in this case, the boy) are highlighted.

(4) [*The boy*$_1$ looked down a hole and $o_2$[1] shouted for the frog.] [But a mole came out and bit *the boy*$_3$ on *his*$_4$ nose.]

The coding of the narratives into episodes is important as this determines whether a referring device is functioning as an introduction of the protagonist, a reintroduction or maintaining device. It can be seen in (4) above that reference 1 (subscript) to the boy marks a reintroduction to the boy, reference 2, the maintenance, and references 3 and 4 a consequent reintroduction following a reference to the mole, and maintenance of reference to the boy, respectively.

The coding was carried out separately for the two main protagonists, the boy and the dog. The following procedure was adopted: all occurrences of the protagonist in question (in the singular only) were identified in the text.

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[1] *o* represents 'zero anaphor'.

Included were nominal expressions, pronouns and zero anaphors (used in all analyses), also possessive expressions ('his', 'the boy's') and relative pronouns (used in total counts only). Occurrences as (part of) a plural NP were excluded in this analysis, e.g. *they/them*, *the boy and the dog*. The exception to this was the first occurrence in the story, e.g. 'There was once *a boy* and a dog and a frog.'

Any ungrammatical expressions were marked as such, but were still included in the analysis. Common errors were the omission of a determiner, or the ungrammatical use of a zero anaphor. An example of each is given in (5) and (6) below:

(5) Then *\*boy* fell down.
(6) Then *\*o* caught a frog.

Ambiguous references were noted. We judged an expression as ambiguous if pragmatic factors were not sufficient to disambiguate its referent. (NB The listener was not able to see the pictures, nor had she any knowledge of the story, as far as the narrator was concerned.)

Finally, it was noted whether the protagonist was introduced with or without the child presupposing knowledge of his existence on the part of the listener. The former is signalled with the use of a definite NP (e.g. the dog/this boy), the latter by using either an indefinite NP (e.g. a boy) or a NP with a possessive (e.g. his dog).

*Coding of other characters*. To gain an overall picture of the children's referencing behaviours all remaining references to characters in the stories were noted. These were those made to the boy and the dog as a plural expression (which were not included in the coding of the two main protagonists, see above), and those to other animate characters in the story (which included the pet frog, a swarm of bees, a rodent, an owl, a deer, a family of frogs). All references were identified and ambiguity and un-grammaticality marked. Division into episodes for this analysis, however, was not carried out. Further details of the procedure to code the narratives can be found in Appendix C.

This paper focuses on the referential devices used to refer to the boy and the dog. From the coded data the following percentages were calculated: (1) The percentage of nominal expressions (taken from the total number of nominal and pronominal expressions) used to refer to (a) the boy, (b) the dog and (c) all animate characters as a total. (2) The percentage of definite NPs used to maintain reference to a protagonist (taken from the total number of definite NPs and pronominal expressions used to maintain reference to the protagonist) was calculated for (a) the boy and (b) the dog. (3) The percentage of pronominal and zero expressions used to refer to (a) the boy and (b) the dog. (4) The percentage of ambiguous pronouns (taken from the total number of pronouns) used to refer to (a) the boy, (b) the dog (c) other

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animate characters. (5) The percentage of episodes where a nominal expression is used to initially introduce and then reintroduce the protagonist in an episode (calculated from the total number of nominal and pronominal expressions first occurring in an episode) for (a) the boy and (b) the dog.

To assess the reliability of the coding scheme, a linguist who was unfamiliar with the study coded a selection of the transcripts based on the coding scheme as outlined above. For the number and position of the boundaries of the Episodes there was over 94 % agreement. For the coding of the referential expressions for the boy and the dog and the ambiguous pronouns there was 96·5 % and 92·8 % agreement respectively.

RESULTS

An initial analysis was undertaken to check whether the SLI children and LA control groups were producing similar overall lengths of narratives and a similar number of references to the boy and the dog. It can be seen from Table 1, which shows the mean scores from the word count, that the groups

TABLE 1. *Types of expressions used in the narrative discourse by the SLI children and LA control groups*

|  | SLI children Mean S.D. | LA1 controls Mean S.D. | LA2 controls Mean S.D. | LA3 controls Mean S.D. |
|---|---|---|---|---|
| Word count: total | 393 (143) | 385 (79·3) | 327 (103) | 328 (102) |
| | | References to the boy | | |
| Episode: total | 16·25 (4·98) | 15·42 (4·94) | 13·33 (5·02) | 14·00 (3·08) |
| References: total | 26·16 (6·42) | 25·75 (11·73) | 25·75 (11·73) | 25·25 (6·78) |
| Nominals: % | 56·65 (14·47) | 38·29 (17·52) | 36·01 (26·01) | 36·85 (16·95) |
| Pronominals: % | 43·35 (14·47) | 61·71 (17·52) | 63·99 (26·01) | 63·15 (16·95) |
| | | References to the dog | | |
| Episode: total | 12·33 (4·76) | 8·92 (4·38) | 7·75 (4·41) | 8·92 (4·06) |
| References: total | 17·17 (7·28) | 12·75 (4·86) | 12·17 (6·87) | 12·08 (5·63) |
| Nominals: % | 78·13 (12·65) | 77·68 (14·09) | 74·20 (22·95) | 82·72 (10·04) |
| Pronominals: % | 21·87 (12·65) | 22·32 (14·09) | 25·80 (22·95) | 17·28 (10·04) |

produced very similar lengths of stories. The minimum and maximum story length for the SLI children was 192 and 754 respectively, and for the LA control groups it was 188 and 544. Table 1 also shows the mean total number of references made to the boy and the dog. The SLI and LA controls made a very similar number of references to the boy. The SLI children produced slightly more references to the dog than the control groups. However, analysis revealed that this difference was not significant.

It can be noted that the overall number of references to the boy and the dog found for the groups in this study is considerably less than in previous studies using the same picture book. For example, Bamberg (1987) found that his

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youngest group of age 3;6 to 4;0 made 184 references and the ten-year-olds made up to 434 references. This difference almost certainly reflects the different procedures used, i.e. the absence of the adult model of the story on which the children could base their narratives. However, the subject groups in this study show a similar proportion of references to the boy and the dog as the subject groups in Bamberg's (1987) study. An approximately 60:40 preference for the boy over the dog was made by each group (see Table 1). The similar performance found for the groups in this initial analysis indicates that any differences found between the groups cannot be attributed to merely different story lengths or numbers of references to the boy and dog in the narrative.

Following Bamberg (1987) and Hickman (1987), the use of the indefinite article + N was taken as the least presupposing device, the definite article + N the next least presupposing device, pronouns the next least and the zero anaphor the most presupposing device.

The proportion of nominal (indefinite or definite article + noun) (i.e. the least presupposing devices) and pronominal (pronouns and zero anaphors[2]) (i.e. the more presupposing devices) was calculated. One-way ANOVA, Proportion of nominals (1) × Group (4) (SLI, LA1, LA2, LA3 controls) revealed a significant difference between the groups for the percentage of nominal expressions employed when referring to the boy ($F(3, 44) = 3.144$, $p = 0.035$), but no significant difference when referring to the dog. It can be seen from Table 1 that the three LA control groups used a similar percentage of nominal expressions to each other. The SLI children, generally, used a higher percentage of nominal expressions than the three LA control groups. Further analysis, comparing the SLI children with each of the LA controls confirmed that this observed difference was significant ($t(22) > 2.80$, $p < 0.01$ in all analyses).

It is interesting that the proportions of nominal and pronominals for the LA controls (aged approximately 6 to 9 years) closely match the proportions of nominals and pronominals found by Bamberg for his five- to six-year-old German children (39 % nominal, 61 % pronominal). However, the proportions for the SLI children more closely match Bamberg's nine- to ten-year-olds and adult subjects (47 % nominal, 53 % pronominal).

Before analysing the functions and pattern of referential devices used by

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[2] The mean total number of zero anaphors used by each group was relatively low and significant differences between the groups were only found when referring to the boy but not to the dog. The mean total zero anaphors and (S.D.) for the boy were: SLI 2.41 (1.56); LA1 0.833 (1.19); LA2 2.33 (2.27); LA3 1.58 (1.44). Analysis revealed that the LA1 controls were using significantly fewer zero anaphors than the SLI children and the LA2 controls ($t(22) > 2.21$, $p < 0.038$, for the two analyses) but not the LA3 controls. The SLI children's use of zero anaphors did not differ from the LA2 and LA3 control groups. Because of the overall small numbers, the zero anaphors were counted with the pronouns and represent the 'more presupposing' referential expressions.

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the children it was important to establish whether the groups were using a similar number of episodes. It can be seen from the coding procedure above, that the episode determined whether a referring device was functioning as an introduction, reintroduction or maintaining linguistic form.

The mean number of episodes for each group for the boy and the dog can also be found in Table 1. A slightly higher number of episodes for the SLI children than the LA control groups for both the boy and the dog was evident. Analysis did not reveal a significant difference between the groups for the boy ($F(3, 44) = 1 \cdot 005$). Although the difference between the SLI children and LA control groups was larger for the dog, this difference was not significant ($F(3, 44) = 2 \cdot 42$).

The initial analyses above indicated that the SLI children were producing similar lengths of narratives which contained a similar number of episodes. However, the SLI children produced significantly more nominals, i.e. fewer presupposing devices than all three LA control groups. Further analysis enabled the functions of the referential devices to be assessed and the source of the more frequent use of nominals by the Grammatical SLI children to be identified.

*Analysis of introductory devices*

Initial observation of the data revealed that on no occasion did any of the children use a pronoun for the initial introduction of a protagonist. This differs from some previous studies (e.g. Bamberg, 1987) and reflects differences in the procedures used in the studies. In contrast to Bamberg's study, the children in this study were under the impression that the experimenter did not know which book had been selected and the experimenter did not see the book during the story telling.

The percentages of the children who used an indefinite article + N and definite article + N to introduce the protagonists were calculated. It can be seen from Table 2 that a very high percentage of the children (reflecting 10/12 SLI children and between 8 and 10/12 in the 3 LA control groups) used the least presupposing indefinite article + N to introduce the boy. The SLI children showed a more even distribution for the use of the indefinite

TABLE 2. *Types of expressions used for the introduction of the protagonists*

|  | SLI children | LA1 controls | LA2 controls | LA3 controls |
|---|---|---|---|---|
|  | References to the boy | | | |
| Indefinite NP: % | 83 | 67 | 83 | 75 |
| Definite NP: % | 17 | 33 | 17 | 25 |
|  | References to the dog | | | |
| Indefinite NP: % | 58 | 67 | 83 | 67 |
| Definite NP: % | 42 | 33 | 17 | 33 |

and definite article + N to introduce the dog. However, a general preference for using the indefinite article + N was found for all groups. An analysis revealed no significant differences between the groups for the type of device used to introduce either the boy or the dog.

*Analysis of reintroductory devices*

The percentages of NP (indefinite + definite NPs) and pronominals used to reintroduce the boy and the dog in a new episode were calculated (see Table 3).

TABLE 3. *Types of expressions used for the reintroduction of the protagonists*

|  | SLI children | LA1 controls | LA2 controls | LA3 controls |
|---|---|---|---|---|
|  | | References to the boy | | |
| Nominals: % | 77·03 (8·76) | 55·91 (25·48) | 52·32 (27·72) | 57·04 (15·17) |
| Pronominals: % | 22·97 (8·76) | 44·09 (25·48) | 47·68 (27·72) | 42·96 (15·17) |
|  | | References to the dog | | |
| Nominals: % | 90·46 (9·30) | 96·29 (5·89) | 94·70 (7·92) | 92·21 (10·59) |
| Pronominals: % | 9·54 (9·30) | 3·71 (5·89) | 5·30 (7·92) | 7·79 (10·59) |

The LA control groups showed a slight preference to use full NPs rather than pronouns to reintroduce the boy. This preference was more marked with the SLI children, A $1$ (% NPS) $\times 4$ (Group) ANOVA revealed a significant difference between the groups ($F(3, 44) = 3\cdot464$, $p = 0\cdot024$). Further analyses revealed that proportionally the SLI children used significantly more NPs (and thus, fewer pronouns) to reintroduce the boy than each of the three LA control groups ($t(22) > 2\cdot72$, $p < 0\cdot013$ for all analyses).

A clear difference was found in the type of linguistic form (nominal vs. pronominal) used to reintroduce the dog. All of the groups used NPs for this function on over 90% of occasions and there was no significant difference between the groups.

*Analysis of maintaining devices*

The percentages of types of referential expressions used to maintain reference to the two protagonists were calculated in two different ways. First, the number of nominals vs. pronominals (i.e. pronouns + zero anaphors) were calculated (see Table 4).

All the groups preferentially used pronominals to maintain reference, rather than nominals. This is the opposite pattern to that found when the referential expression is functioning to reintroduce a protagonist. The

TABLE 4. *Types of expressions used for maintaining reference to the protagonists*

| | SLI children | LA1 controls | LA2 controls | LA3 controls |
|---|---|---|---|---|
| | References to the boy | | | |
| Nominals: % maintaining devices | 26·37 (26·58) | 6·16 (9·95) | 6·89 (12·45) | 14·06 (28·18) |
| Pronouns: % maintaining devices | 73·63 (26·58) | 93·84 (9·95) | 93·12 (12·45) | 85·94 (28·18) |
| Nominals: % of total nominals | 20·57 (27·03) | 6·43 (9·65) | 6·27 (9·26) | 16·88 (40·04) |
| Pronominals: % total pronominals | 56·25 (22·53) | 58·49 (22·40) | 59·72 (13·58) | 55·41 (21·44) |
| | References to the dog | | | |
| Nominals: % maintaining devices | 31·06 (31·20) | 14·00 (25·03) | 15·83 (18·61) | 46·36 (36·07) |
| Pronominals: % maintaining devices | 68·94 (31·20) | 86·00 (25·03) | 84·17 (18·61) | 53·63 (36·07) |
| Nominals: % total nominals | 7·70 (7·69) | 6·76 (13·34) | 5·53 (8·13) | 11·35 (9·13) |
| Pronominals: % total pronominals | 57·77 (30·11) | 78·18 (32·50) | 75·29 (30·68) | 59·72 (41·71) |

TABLE 5. *Percentages of maintaining referents in the episodes*

| | SLI children | LA1 controls | LA2 controls | LA3 controls |
|---|---|---|---|---|
| | Reference to the boy | | | |
| Total episodes | 16·25 (4·98) | 15·42 (4·94) | 13·33 (5·02) | 14·00 (3·08) |
| % containing at least one ref-maintaining device | 36·55 (17·10) | 35·74 (14·20) | 34·41 (14·11) | 34·39 (14·73) |
| % containing at least one pronominal for maintenance | 29·85 (19·32) | 32·53 (16·14) | 32·77 (14·70) | 32·97 (14·97) |
| | Reference to the dog | | | |
| Total episodes | 12·33 (4·76) | 8·92 (4·38) | 7·75 (4·41) | 8·92 (4·06) |
| % containing at least one ref-maintaining device | 19·50 (11·74) | 23·39 (18·20) | 29·28 (26·82) | 19·88 (10·44) |
| % containing at least one pronominal for maintenance | 13·97 (9·00) | 19·64 (15·09) | 26·15 (26·59) | 12·02 (9·84) |

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preference for pronominals was most marked when referring to the boy, but was also evident when referring to the dog. Although the SLI children and LA controls showed a similar preference for using pronominals when maintaining reference to a protagonist some differences between their performance existed.

It can be seen from Table 4 that the SLI children used proportionally fewer pronouns than the three control groups. A $1 \times 4$ (Group) ANOVA on the percentages of pronominals used was carried out for references to the boy and to the dog. The main effect of Group just failed to reach the significance level for the boy ($F(3, 44) = 2\cdot402$, $p = 0\cdot08$) but a significant Group effect was found for references to the dog ($F(3, 44) = 2\cdot909$, $p = 0\cdot047$). Further analyses clarified the results. T-tests revealed that the SLI children used proportionately fewer pronominals when referring to the boy than both the LA1 controls ($t(22) = 2\cdot47$, $p = 0\cdot022$) and the LA2 controls ($t(22) = 2\cdot30$, $p = 0\cdot031$). However, the SLI children's performance did not differ from the older LA3 controls. Further analysis of the proportion of pronominals used to maintain reference to the dog did not reveal any differences between the SLI children and the three LA control groups. However, the LA1 and LA2 controls were found to use significantly more pronominals to maintain reference to the dog than the older LA3 controls ($t(22) > 2\cdot36$, $p < 0\cdot028$ for both analyses).

The overall results of the analysis of the referential expressions used to maintain reference indicate that the SLI children's pattern of referential use was more similar to the mature LA3 controls than to the younger LA1 or LA2 control groups.

The percentage of nominals and pronominals used for maintaining reference as a proportion of all nominals and pronominals used in the narrative to refer to the boy and to the dog was also calculated (see Table 4). Although analyses revealed no significant differences between the groups, it is interesting to note that the younger two control groups appear to use primarily pronominals for the maintenance function when referring to the dog. This pattern is not evident for the SLI children nor the LA3 controls.

Because it was of particular relevance to this study to be able to show whether or not the SLI children could refer anaphorically using pronouns, further investigations of the data were undertaken. The percentage of episodes containing at least one reference maintaining device (of any type) to the protagonists was calculated for each group. It can be seen from Table 5 that the SLI children and LA controls used a similar number of episodes in which at least one reference maintaining device was used. Analysis confirmed that there was no significant difference between the groups.

Having established that the groups maintained reference at least once to the protagonist a similar proportion of the time, the number of episodes containing at least one pronominal to maintain reference was calculated (see

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TABLE 6. *Ambiguous pronominal expressions*

|  | SLI children | LA1 controls | LA2 controls | LA3 controls |
|---|---|---|---|---|
| Boy: pronouns % | 11·97 (16·17) | 9·38 (14·23) | 8·70 (8·94) | 9·03 (12·10) |
| Dog: pronouns % | 8·33 (18·00) | 1·82 (6·03) | 0·00 (0·00) | 0·00 (0·00) |

Table 5). Again, the SLI children's performance did not differ from the LA control groups.

*Ambiguous pronominal reference*

The mean percentage of ambiguous pronominals for the boy and the dog was investigated and can be found in Table 6. This analysis provides an additional measure of the appropriateness of the use of pronouns.

Overall there were very few pronominals that were ambiguous for any of the groups. Analysis did not reveal any significant differences for either ambiguous pronominals referring to the boy or to the dog. Superficially, it appears from the mean percentage scores that the SLI children have made more ambiguous pronominal references. However, it can be recalled that overall the SLI children used fewer pronouns. When the individual children's raw scores are compared, the SLI children perform very favourably in comparison with the three control groups. For the boy, the following range of ambiguous pronouns were found: 0 to 4, SLI children; 0 to 7, LA1 controls; 0 to 5, LA2 controls; 0 to 3 LA3 controls. For the dog the range of ambiguous references for the children in each group was 0 to 1 for the SLI and LA1 controls, with no ambiguous references being made by any of the children in the LA2 and LA3 control groups.

*Individual analysis*

Because of the potential heterogeneity in groups of SLI children, the data from each SLI child were checked to see if they conformed to the general pattern revealed by the analysis above.

One child, SLI 10 (BS) stood out from the rest for the following reasons. First, BS primarily used indefinite articles throughout the narrative, rather than only for introducing the protagonist. He used 17 indefinite and four definite articles to refer to the boy in the narrative, and 10 indefinite and 6 definite articles to refer to the dog. He only used a total of six pronouns (four to refer to the boy and two to refer to the dog). Only one of these pronouns was classified as maintaining reference. However, he used three possessive determiners and four zero anaphors all of which maintained reference appropriately to the main protagonist (the boy).

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Thus, BS's narrative showed some differences from the other children in that he primarily used non-presupposing referential devices in a situation where less presupposing devices could have been used. However, he still demonstrated some ability to maintain reference correctly using pronominal or zero anaphoric forms. Further investigation of BS's use of determiners and pronouns is warranted.

DISCUSSION

*Narrative discourse*

The results indicated that the quantity of information provided in the narratives was similar for the SLI children and the three LA matched control groups, i.e. in the lengths of the narratives; the number of references to the boy, the dog and to other subsidiary protagonists; and the number of episodes in which reference to a protagonist was maintained in subject–focus position through a sequence of actions. Thus, any differences in the linguistic form–function pairs between the SLI children and LA control groups cannot be attributed to differences in their overall ability to produce a narrative.

The main analyses focused on the linguistic forms used to introduce, to reintroduce and to maintain reference to the two main protagonists, i.e. the boy and the dog. Generally, the SLI children and all three LA control groups introduced the boy using the least presupposing linguistic form, the indefinite article + N, rather than a definite article + N. Although less marked for the SLI children, a similar pattern was found for introducing the dog with the majority of the children using the indefinite article + N. None of the children used a pronoun to introduce the main protagonists.

The high use of an indefinite article + N to introduce the boy may be contrasted with previous studies using this story book. However, these differences were only found when the narrator and listener had shared knowledge either prior or during the story telling (Karmiloff-Smith, 1985; Bamberg, 1987; Wrigglesworth, 1990; Kail & Hickman, 1992). The strong preference for using an indefinite article + N found in this study concurs with Kail & Hickman's (1992) investigation in which, in one condition, the children and adults did not have mutual knowledge of the story.

The SLI children's use of the indefinite article + N is interesting for two reasons. First, it indicates that the SLI children are sensitive to the acoustic, semantic and pragmatic significance of the indefinite vs. definite articles. That is, the indefinite article + N signals the least presupposing device whereas the definite article + N may be used to refer to a specific referent once it has been introduced.

It is also interesting that, when the pragmatics of the situation demand the use of an article, (i.e. when introducing the boy for the first time) none of the

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SLI children omitted this form. However, it is frequently reported that SLI children omit articles (e.g. Leonard, 1989). One possible reason is that the SLI children are more likely to omit articles when their pragmatic function is not strongly highlighted. This explanation is supported by the omission of some determiners by some of the SLI children when reintroducing a protagonist within an episode, where the pragmatic motivation for the determiner may not be so evident. In such a context, whether the determiner is included or not, the listener is able to pragmatically infer the correct antecedent, whereas in the initial introduction the indefinite article has a clear pragmatic function – to mark that the referent is new. The finding of correct marking and omissions of the determiners in the same task goes against an explanation which appeals to differences in 'general processing load' in the narrative task, where the pictures may scaffold processing vs. conversations, where the child has to generate both the content and linguistic form.

To reintroduce the main protagonist (the boy), the SLI children were found to use significantly more nominals (rather than pronouns) than the three younger control groups. The LA controls showed only a slight preference for using a nominal rather than a pronoun for reintroductory purposes for the boy. The higher proportion of pronouns used by the LA controls when referring to the boy in contrast to references to the dog indicates that they identify the boy, being the human protagonist, as the main protagonist and the dog the secondary protagonist. This pattern of anaphoric reference, in which presupposing devices are used for the main protagonist, concurs with Karmiloff-Smith's (1985) phase 2 and is consistent with her 'Thematic Subject Constraint'. In contrast, the Grammatical SLI children used significantly more specific (i.e. less presupposing) terms of reference when reintroducing the boy than the LA control children. This is consistent with a more mature pattern of anaphoric reference. The interpretation above is supported by Bamberg's (1987) analysis of the pattern of referential forms used to reintroduce the two protagonists: the pattern for the LA controls concurs with the pattern found by Bamberg (1987) for five- to six- and nine- to ten-year-old children, whereas the SLI children's pattern concurs most closely with the pattern found for adult subjects (Bamberg, 1987).

The predominant use of nominals to reintroduce the protagonists is complemented by the use of pronominals to maintain reference to the protagonists. The SLI children used 73 % pronominal forms to maintain reference to the boy (in contrast to 77 % nominal forms to reintroduce the boy). Whilst all the LA control groups preferentially used pronominals to maintain reference, the two youngest LA control groups showed a very high proportion of pronominals (approximately, 93 %). The LA1 and LA2 controls were found to use pronominals significantly more than the SLI children and the LA3 controls to maintain reference to the boy. However, no significant difference was found between the SLI children and LA3 controls.

The younger two controls groups were also found to use significantly more pronominals (and therefore fewer nominals) than the LA3 controls to maintain reference to the dog.

The pattern of referential expressions used by the LA1 and LA2 controls to maintain reference again shows some similarities with Karmiloff-Smith's (1985) Phase 2, Thematic Subject Constraint, whereby pronominal reference is largely restricted to a maintenance function. However, the SLI children and LA3 controls appear to show a more mature pattern with greater flexibility in their use and non-use of pronouns for maintaining reference.

*Conclusion*

The SLI children used linguistic forms of reference differentially depending on the pragmatic-linguistic function the referent serves within a structured narrative discourse. The results showed that, generally, they differentiated between the linguistic forms of reference which presuppose the least knowledge of the listener from those which presuppose some knowledge. Thus, the SLI children primarily used the indefinite article + N to introduce a protagonist, the definite article + N to reintroduce the protagonist, and the more presupposing pronoun or zero anaphor to maintain reference to the protagonist.

There were few differences between the SLI children and the three groups of younger children who were matched on different aspects of language abilities. Overall, the SLI children had a tendency to use more nominals than pronominals than the three LA control groups. This difference, generally, was only found to be significant in comparison to the two younger LA control groups (aged, approximately, six to seven and seven to eight years). The difference may be accounted for by the SLI children's greater maturity in pragmatic development as shown by the older LA controls in this study and previous investigations of narrative discourse. It is possible that the SLI children's awareness of their linguistic problems and language therapy, which often focuses on the need to make messages unambiguous, has resulted in their higher use of nominals.

The findings for this group of Grammatical SLI children differ from some previous investigations of other subgroups or undifferentiated groups of SLI children. Thus, the study illustrates the need to investigate subgroups of SLI children, as very different patterns of language abilities may be found.

GENERAL DISCUSSION

This study investigated the extent of the domain of the proposed underlying deficit in Grammatical SLI children. This deficit was characterized as a RDDR (van der Lely & Stollwerck, 1993; van der Lely, 1996*b*). Previous

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investigations of Grammatical SLI children are consistent with the RDDR being restricted to modular aspects of language. This paper tested this claim by investigating an aspect of language function which requires a rep-resentation of structure-dependent relationships but which is not part of the modular language system; i.e. narrative discourse. The major issue addressed was whether the Grammatical SLI children could produce an appropriate pronominal form when this form depended on a complex interaction of the structural organization of the narrative and the pragmatic awareness of the listener's need to interpret the message, rather than on syntactic constraints.

The findings indicate that the Grammatical SLI children have relatively mature linguistic development in the use of referential expressions to produce a cohesive, structured narrative discourse. When the use of a pronominal form depends on a complex representation of pragmatic functions (i.e. introducing, reintroducing or maintaining reference to a protagonist, the structure of the narrative, and the need to make reference unambiguously) the SLI children appear to have adequate linguistic abilities. The implications of these findings for the nature of the underlying deficit in SLI children will be discussed in the next section before addressing the implications for the modularity of language and language acquisition.

### The underlying nature of Grammatical SLI

The implications for the underlying nature of Grammatical SLI arising from this study are related to the linguistic factors which contribute to appropriate anaphoric reference. The linguistic factors which strongly determine the appropriate use of pronominal reference and other referential expressions in a narrative discourse relate to pragmatic inferential communication. Based on Relevance theory, pragmatic inferential communication was defined as an aspect of language which does not fall within the hypothesized language module but may be viewed as part of the central system language function (Sperber & Wilson, 1986). It is interesting to note that the SLI children's ability to use appropriate anaphoric expressions in this narrative concurs with their ability, generally, to make appropriate pragmatic inference. In a test of conversational inference based on Smith & Tsimpli's (1991) study, the children's ability to make decisions which required implicated assumptions, implicated conclusions, *modus ponendo ponens* or *modus tollendo ponens* was assessed. The SLI children were able to make the required pragmatic inferences to complete the task correctly (van der Lely, unpublished data). However, the youngest LA1 controls, who showed some immaturities in anaphoric reference, were less proficient in the test of pragmatic inference. Further investigations of the development of the ability to make pragmatic inference and the appropriate use of anaphoric reference in narratives in a

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younger group than those investigated in this study are warranted to establish further the relationship between these two abilities.

Before discussing the modular vs. central system language functions dichotomy in more detail with respect to accounting for Grammatical SLI, the ability of alternative theories to account for the data will be considered. First, can a (non-modular) processing deficit account for these data? The view that a basically similar mechanism or process underlies the acquisition of different language abilities, albeit that these abilities may develop at different times (e.g. Bates, 1993; Marchman, 1993; Bates *et al.*, 1995) cannot easily account for the development of pronominalization by the Grammatical SLI children. These Grammatical SLI children when compared to the same LA control groups show a good ability to use pronominal reference appropriately in narratives but an impaired ability to rule out inappropriate intrasentential coreference based on syntactic knowledge (van der Lely & Stollwerck, 1993). The findings for the SLI children are particularly striking when compared with normally developing children's acquisition of pronominals. In normally developing children an opposite pattern of development is found: proficiency with the structural syntactic knowledge for pronominal reference is found in children of three to four years, whereas proficiency with the structural pragmatic knowledge needed for the use of pronouns in narratives is not found until around eight years or later. Clearly, these different patterns of development found in normally developing children and Grammatical SLI children are difficult to account for within a general processing theory of language acquisition and language disorder. However, this explanation assumes that the processing demands of the tasks are not causing the observed differences: i.e. the processing demands of the judgement task are causing particular difficulties for the SLI children. Data from previous investigations indicate that this is not so. The SLI children have been found to be both successful and unsuccessful in other tests of language abilities using the judgement paradigm. Their success or failure on the task appears to depend on the nature of the required linguistic knowledge, rather than the task itself. For example, the SLI children successfully completed the judgement task of pragmatic inference (van der Lely, unpublished data). Further evidence against the cause of failure being related to the processing demands of the particular task, has been revealed from using different paradigms to test the same aspect of linguistic knowledge: Kubli (1995) and van der Lely & Ullman (1996) found that this group of Grammatical SLI children used unmarked verb forms (*look*, *give*) in past tense contexts in spontaneous speech and in an elicitation task, and they judged these forms as acceptable. The limited data set available on the Grammatical SLI children's spontaneous use of pronominals and reflexives is also consistent with the judgement tasks of these forms. Tentatively, these data indicate that the use of reflexives may be problematical for Grammatical SLI children and they

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may use pronouns in syntactic contexts which violate Binding Principle B (van der Lely & Stollwerck, 1993). Thus, there appears to be no substantial evidence to indicate that the different processing demands of producing information versus detecting and judging coreference can adequately explain the data.

If we are to try to account for Grammatical SLI in terms of a processing deficit we need a theory of processing which can account for their linguistic characteristics – both impaired and non-impaired. The auditory perceptual hypothesis is one explanation which appeals to a processing deficit to account for younger SLI children's difficulties with the production of morphology (Tallal, Stark & Mellits, 1985; Leonard, 1989; Leonard *et al.*, 1992). Leonard *et al.* (1992) hypothesized that processing capacity limitations, in addition to perceptual limitations, can explain specific language impairment in children. Leonard argues that SLI children's deficit in auditory perception causes particular problems with the closed-class items with 'low-phonetic substance', such as the -*s* plural and third person singular agreement marker. This causes secondary problems for SLI children in building morphological paradigms. Because greater processing resources are required by the SLI child to perceive non-stressed morphemes, he does not have sufficient resources available for the additional operations of hypothesizing the grammatical function of the form and placing it in a morphological paradigm (Leonard *et al.*, 1992). Leonard's hypothesis may provide a plausible explanation of why SLI children produce the final segment in dan*ce* but not in keep*s*. However, when linguistic knowledge of the same, salient, surface form (pronouns) is found to differ depending on whether syntactic or pragmatic knowledge is required, rather than the perceptual saliency of the surface form, then it is difficult to see how an auditory impairment alongside a processing capacity limitation can be at the root of Grammatical specific language impairment.

In contrast, if one assumes that the acquisition of syntactic abilities is relatively independent from central system language functions the data are more easily explained. It appears that the most parsimonious explanation for Grammatical SLI children's pattern of linguistic abilities are to be found in the dissociation of abilities to form representations which depend on modular language representations such as syntax, vs. representations which depend on central system language representations such as those involving pragmatic inference. This is shown by the Grammatical SLI children's inability to rule out inappropriate intrasentential coreference (van der Lely & Stollwerck, 1993) in comparison with their appropriate use of pronominal reference in the narrative. It is also interesting that the Grammatical SLI children were able to rule out inappropriate intrasentential coreference based on a mismatch of lexical–semantic features (e.g. semantic gender) of the antecedent and the pronoun. This finding provides further evidence that it is not the task itself

that is causing the Grammatical SLI children to fail, but the type of linguistic information which is required for their judgements. By itself a finding of no difference between the SLI children and language matched controls is insufficient to make large claims (see Bishop, 1992). However, when the same groups of children show differential abilities for the same linguistic form, for ostensibly the same purpose, i.e. pronominal reference, depending on whether a structural syntactic or a structural pragmatic representation is required, a stronger basis is provided.

In conclusion, the findings from Grammatical SLI children indicate that their deficit characterized by a RDDR does not extend to central system pragmatic functions. When Grammatical SLI children's development in the acquisition of syntactic vs. pragmatic knowledge of pronouns is considered alongside their impaired acquisition of theta role assignment and inflectional morphology, there is mounting evidence that Grammatical SLI children have an impairment within the modular language system but have normally functioning central system language abilities.

### The modularity of language and language acquisition

The results from this study, which indicate that a modular language deficit underlies Grammatical SLI, provide support for the modularity of language hypothesis. The claim that Grammatical SLI results from a modular language deficit is not to imply that these children have no modular language abilities. They certainly do, but the findings are consistent with an under-specified representations with respect to structurally dependent relationships within the syntactic module. One possibility is that the intrasentential coindexation of a pronoun and its antecedent, characterized by Binding Principles (Chomsky, 1986) (i.e. the specification of a particular syntactic relationship between constituents; see (1) above) will not be specified in the syntactic representation (the logical form) derived from the syntactic module. In semantically or pragmatically ambiguous circumstances this syntactic specification is required for full interpretation. In many instances, but not all, the Grammatical SLI child will be able to pragmatically infer with the aid of general lexical and cognitive knowledge who is an inappropriate referent (see van der Lely & Stollwerck, 1993 for further details of the linguistic characteristics of this hypothesized deficit). This study has revealed that Grammatical SLI children are also able to select a pronoun appropriately for referential use when pragmatic inference and general knowledge are largely sufficient to determine its use or non-use. Interestingly, these two studies demonstrate that it is not differences between comprehension and production but whether a representation of a syntactic structural relationship is crucially required which determines Grammatical SLI children's success with a task.

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Further research into Grammatical SLI children may provide valuable clues as to representational similarities and differences within the modular language system and have particular relevance for language acquisition theories.

It is also of interest to consider the findings from this study within a developmental perspective. A developmental reorganization or representational change has been suggested to occur by, for example, Bowerman (1982), Bamberg (1987), Karmiloff-Smith (1987, 1992). Karmiloff-Smith (1992) proposes that in different areas of cognitive abilities, including different aspects of language, the child's representations undergo a change whereby previously unrelated representations become linked and a structural relationship develops. The different form–function pairs in discourse structure is one example where this representational change may occur. In narrative discourse the systematic organization means that the use of a particular device (e.g. a pronoun) conveys simultaneously information about the non-use of other devices represented in the same subsystem (Karmiloff-Smith, 1987, 1992). Furthermore Karmiloff-Smith claims that modularity is not innate but results from the OUTCOME of processing the input, and some forms of modularity from the reorganization of representations. Thus, implicit in Karmiloff-Smith's hypothesis is that any qualitative differences between pragmatic and syntactic representations of pronouns result from processing the input and are not inherent in the architecture of the brain. Karmiloff-Smith's theory may account for changes in pronominal use in narratives. However, it is not clear what 'reorganization' could account for the syntactic knowledge of pronominal coreference. Moreover, if Grammatical SLI children have the ability to reorganize pragmatic representations, why are they unable to reorganize syntactic representations? However, if the theoretical perspective is taken that the representational changes proposed by Karmiloff-Smith are independent and qualitatively different from language abilities, such as syntax, within a modular system then the problem does not arise. Therefore, it may be argued that the data from Grammatical SLI children showing a dissociation in the development of syntactic and pragmatic knowledge of pronominal reference provide evidence for qualitative cognitive differences within the developing linguistic system.

In conclusion, the view of the organisation of the mind in which a modular language system can be differentially impaired from aspects of language which rely on the central system as suggested by Fodor (1983) can most easily account for the data. Thus, Grammatical SLI children may provide a valuable source of evidence for the modularity of language. This study has illustrated how the investigations of Grammatical SLI children provide insight into language acquisition and language modularity which could not be provided from investigations into normally developing children. Further investigations are warranted to exploit the potential theoretical implications from such studies.

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# APPENDICES 1A AND 2A

Raw scores, z-scores or standard scores and equivalent age score for the language tests used for selection and matching purposes for the SLI children.

## APPENDIX 1A

| Subjects | Chronological age | BPVS[a] | | TROG[b] | | NV-BAS[c] | | GC-ITPA[d] | |
|---|---|---|---|---|---|---|---|---|---|
| | | Raw score (z-score) | Equivalent age | Raw score (z-score) | Equivalent age | Raw score (SS) | Equivalent age | Raw score (z-score) | Equivalent age |
| J.W. | 9;3 | 60 (−1·7) | 6;5 | 10 (−2·2) | 5;3 | 17* | 7;9 | 17 (−3·7) | 6;0 |
| W.L. | 9;5 | 72 (−0·9) | 7;9 | 12 (−1·7) | 5;9 | 17* | 7;9 | 18 (−3·8) | 6;3 |
| J.S. | 9;10 | 89 (0·0) | 9;9 | 13 (−1·5) | 6;0 | 19* | >7;11 | 17 (−4·6) | 6;0 |
| A.Z. | 10;3 | 72 (−1·3) | 7;9 | 12 (−1·9) | 5;9 | 19* | >7;11 | 16 (−5·5) | 5;10 |
| R.J. | 10;11 | 76 (−1·4) | 8;2 | 16 (−0·8)[e] | 9;0 | 19* | >7;11 | 16* | 5;10 |
| A.Z. | 11;0 | 72 (−1·7) | 7;9 | 12 (−2·1) | 5;9 | 18* | >7;11 | 24* | 7;11 |
| C.T. | 11;11 | 86 (−1·1) | 9;0 | 13 (−2·2) | 6;0 | 18* | >7;11 | 21* | 7;0 |
| S.B. | 12;0 | 90 (−0·7) | 9;5 | 15 (−1·6) | 8;0 | 17* | 7;9 | 24* | 7;11 |
| A.T. | 12;1 | 80 (−1·6) | 9;0 | 13 (−2·2) | 6;0 | 16* | 6;3 | 17* | 6;0 |
| B.S. | 12;2 | 78 (−1·8) | 8;5 | 12 (−2·5) | 5;9 | 20* | >7;11 | 22* | 7;3 |
| A.W. | 12;2 | 84 (−1·5) | 9;3 | 16 (−1·2)[f] | 9;0 | 17* | >7;11 | 22* | 7;3 |
| M.P. | 12;10 | 87 (−1·4) | 7;9 | 13 (−2·2) | 6;0 | 18* | >7;11 | 26* | 8;6 |

\* SS (standard score) or z-score not available.

[a] British Picture Vocabulary Score. [b] Test of Reception of Grammar. [c] Naming Vocabulary, British Ability Scales. [d] Grammatical Closure sub-test from Illinois Test of Psycholinguistic Abilities.

[e,f] On the basis of only these test scores for R.J. and A.W. they would not have been included in the group. However, previous scores on this test for both children showed a greater deficit in relation to their BPVS scores. It appeared that the TROG score obtained above represented a sudden improvement on this test. This may have resulted from the remedial help they were receiving at this time, which was directed at improving the performance on particular structures which were assessed in this test.

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APPENDIX 2A

| | | Language tests | | | | |
| | | Bus Story[a] | | | Action Picture Test[b] | |
| Subjects | Chronological age | Info (age) | Sent. length (age) | Subclause (age) | Info (age) | Grammar (age) |
|---|---|---|---|---|---|---|
| J.W. | 9;03 | 28 (6;1) | 14 (8;2) | 2 (4;8) | 34 (6;9) | 23 (5;3) |
| W.L. | 9;05 | 23 (5;1) | 10 (6;4) | 1 (4;2) | 26·5 (4;2) | 20 (4;3) |
| J.S. | 9;10 | 29 (6;4) | 11 (6;10) | 1 (4;2) | 33·5 (6;6) | 26 (6;3) |
| A.Z. | 10;03 | 42 (5;3) | 13 (7;10) | 2 (4;8) | 28 (4;8) | 20 (4;3) |
| R.J. | 10;10 | 27 (5;10) | 8 (4;7) | 1 (4;2) | 34·5 (7;0) | 22 (5;0) |
| A.Z. | 11;00 | 22 (4;11) | 11 (6;10) | 1 (4;2) | 34·5 (7;0) | 25 (6;0) |
| C.T. | 11;11 | 33 (7;4) | 12 (7;4) | 2 (4;8) | 38 (8;5) | 24 (5;9) |
| S.B. | 12;00 | 20 (4;7) | 12 (7;4) | 3 (5;10) | 35·5 (7;6) | 23 (5;3) |
| A.T. | 12;01 | 29 (6;4) | 11 (6;10) | 1 (4;2) | 34·5 (7;0) | 26 (6;3) |
| B.S. | 12;02 | 30 (6;7) | 11 (6;10) | 2 (4;8) | 35 (7;3) | 26 (6;3) |
| A.W. | 12;02 | 25 (5;5) | 9 (5;7) | 2 (4;8) | 35 (7;3) | 25 (6;0) |
| M.P. | 12;10 | 32 (7;1) | 9 (5;7) | 1 (4;2) | 35 (7;3) | 28 (6;9) |

[a, b] Action picture test/Bus story: Info = information score; sub-clause = number of subordinate clauses; (age) = equivalent age score.

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# APPENDICES 1B, 2B AND 3B

Raw scores, z-scores and standard scores and equivalent age score for the language tests used for matching purposes for the individual LA control children

## APPENDIX 1B: LA1 CONTROLS

| | | Language tests | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | BPVS[a] | | TROG[b] | | NV-BAS[c] | | GC-ITPA[d] |
| Subjects: LA1 controls | Chronological age | Mean (z-score) | Equivalent age | Mean (z-score) | Equivalent age | Mean (SS) | Equivalent age | Mean (z-score) | Equivalent age |
| 1 | 5;5 | 41 (−0·7) | 5;11 | 9 (−0·7) | 5;0 | 14 (−0·5) | 4;3 | 15 (0·3) | 5;8 |
| 2 | 5;5 | 67 (1·2) | 7;2 | 12 (0·0) | 5;9 | 15 (0·0) | 5;3 | 19 (1·5) | 6;5 |
| 3 | 5;5 | 52 (−0·1) | 5;7 | 12 (0·0) | 5;9 | 17 (1·0) | 7;9 | 22 (2·3) | 7;3 |
| 4 | 5;6 | 53 (0·1) | 5;9 | 14 (0·7) | 7;0 | 15 (−0·4) | 5;3 | 19 (1·5) | 6;5 |
| 5 | 5;8 | 55 (0·1) | 5;11 | 10 (−0·6) | 5;3 | 16 (0·2) | 6;5 | 20 (1·2) | 6;8 |
| 6 | 5;8 | 50 (−0·2) | 5;5 | 11 (−0·3) | 5;6 | 15 (−0·4) | 5;3 | 21 (1·3) | 7;0 |
| 7 | 5;9 | 46 (−0·5) | 5;0 | 10 (−0·6) | 5;3 | 16 (0·2) | 6;5 | 19 (1·0) | 6;5 |
| 8 | 5;11 | 61 (0·5) | 6;7 | 15 (1·1) | 8;0 | 18 (1·7) | > 7;11 | 26 (2·8) | 8;6 |
| 9 | 6;0 | 52 (−0·2) | 5;7 | 12 (−0·6) | 5;9 | 16 (0·1) | 6;5 | 25 (2·2) | 8;2 |
| 10 | 6;3 | 62 (0·4) | 6;8 | 15 (0·3) | 8;0 | 17 (0·8) | 7;9 | 25 (2·2) | 8;2 |
| 11 | 6;3 | 67 (0·8) | 7;2 | 16 (0·6) | 9;0 | 17 (0·8) | 7;9 | 23 (1·5) | 7;7 |
| 12 | 6;4 | 69 (0·9) | 7;5 | 15 (0·3) | 8;0 | 16 (0·1) | 6;5 | 21 (0·7) | 7;0 |

[a] British Picture Vocabulary Score. [b] Test of Reception of Grammar. [c] Naming Vocabulary, British Ability Scales. [d] Grammatical Closure sub-test from Illinois Test of Psycholinguistic Abilities.
SS = Standard score.

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APPENDIX 2B: LA2 CONTROLS

| Subjects: LA2 controls | Chronological age | Language tests | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | BPVS | | TROG | | NV-BAS | | GC-ITPA | |
| | | Mean (z-score) | Equivalent age | Mean (z-score) | Equivalent age | Mean (SS) | Equivalent age | Mean (z-score) | Equivalent age |
| 13 | 6;5 | 62 (0·3) | 6;8 | 15 (0·3) | 8;0 | 16 (0·1) | 6;5 | 26 (2·0) | 8;6 |
| 14 | 6;6 | 73 (1·1) | 7;10 | 16 (0·6) | 9;0 | 19 (> 1·9) | > 7;11 | 30 (3·0) | 10;4 |
| 15 | 6;7 | 78 (1·5) | 8;5 | 19 (2·6) | > 11;0 | 18 (1·2) | > 7;11 | 30 (3·0) | 10;4 |
| 16 | 6;8 | 54 (−0·5) | 5;10 | 16 (0·6) | 9;0 | 17 (0·5) | 7;9 | 22 (0·7) | 7;3 |
| 17 | 6;9 | 58 (−0·3) | 6;3 | 13 (−0·3) | 6;0 | 17 (0·5) | 7;9 | 19 (0·0) | 6;5 |
| 18 | 6;9 | 67 (0·4) | 7;2 | 16 (0·6) | 9;0 | 16 (−0·2) | > 7;11 | 21 (0·3) | 7;0 |
| 19 | 6;10 | 75 (1·0) | 8;1 | 16 (0·6) | 9;0 | 18 (1·2) | > 7;11 | 30 (2·7) | 10;4 |
| 20 | 7;2 | 76 (0·6) | 8;2 | 19 (2·2) | > 11;0 | 19 (> 1·6) | > 7;11 | 31 (2·5) | > 10;4 |
| 21 | 7;3 | 83 (1·1) | 9;0 | 15 (−0·1) | 8;0 | 16 (−0·4) | 6;5 | 24 (0·8) | 7;11 |
| 22 | 7;3 | 76 (0·6) | 8;2 | 17 (0·7) | 10;0 | 17 (0·2) | 7;9 | 29 (2·0) | 9;8 |
| 23 | 7;3 | 86 (1·3) | 9;5 | 16 (0·3) | 9;0 | 18 (0·9) | > 7;11 | 28 (1·8) | 9;2 |
| 24 | 7;4 | 72 (0·3) | 7;9 | 14 (−0·4) | 7;0 | 15 (−0·9) | 5;3 | 25 (0·7) | 8;2 |

SS = Standard score.

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APPENDIX 3B: LA3 CONTROLS

| | | Language tests | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | BPVS | | TROG | | NV-BAS | | GC-ITPA | |
| Subjects: LA3 controls | Chronological age | Mean (z-score) | Equivalent age | Mean (z-score) | Equivalent age | Mean (SS) | Equivalent age | Mean (z-score) | Equivalent age |
| 25 | 7;5 | 74 (0·1) | 8;0 | 18 (1·3) | 8;0 | 16 (−0·6) | 6;5 | 26 (0·7) | 8;6 |
| 26 | 7;8 | 75 (0·2) | 8;1 | 19 (2·2) | > 11;0 | 17 (0·0) | 7;9 | 29 (1·3) | 9;8 |
| 27 | 7;8 | 81 (0·6) | 8;9 | 18 (1·3) | 11;0 | 18 (0·7) | > 7;11 | 32 (2·2) | > 10;4 |
| 28 | 7;9 | 78 (0·4) | 8;5 | 16 (0·3) | 9;0 | 17 (0·0) | 7;9 | 30 (1·7) | 10;4 |
| 29 | 7;9 | 70 (−0·1) | 7;7 | 16 (0·3) | 9;0 | 17 (0·0) | 7;9 | 28 (1·2) | 9;2 |
| 30 | 7;9 | 71 (−0·2) | 7;8 | 18 (1·3) | 11;0 | 18 (0·7) | > 7;11 | 31 (1·8) | > 10;4 |
| 31 | 7;9 | 92 (1·3) | 10;1 | 19 (2·2) | > 11;0 | 19 (1·4) | > 7;11 | 32 (2·2) | > 10;4 |
| 32 | 7;11 | 77 (0·2) | 8;4 | 16 (−0·3) | 9;0 | 18* | > 7;11 | 30 (1·3) | 10;4 |
| 33 | 7;11 | 99 (1·7) | 11;0 | 16 (−0·3) | 9;0 | 18* | > 7;11 | 28 (0·8) | 9;2 |
| 34 | 8;2 | 87 (0·6) | 9;6 | 18 (0·7) | 11;0 | 16* | 6;5 | 28 (0·5) | 9;2 |
| 35 | 8;7 | 88 (0·5) | 7;7 | 18 (0·7) | 11;0 | 18* | > 7;11 | 28 (0·3) | 9;2 |
| 36 | 8;9 | 68 (−1·0) | 7;4 | 16 (−0·3) | 9;0 | 18* | > 7;11 | 25 (−0·3) | 8;2 |

* SS not available.

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## APPENDIX C

ANALYSIS OF THE REFERENCES TO THE TWO MAIN PROTAGONISTS
The following counts were made:

*Types of NPs*:
– indef. NPs
– def. NPs
– pronouns
– zero anaphors
– total number of references (indef. NPs + def. NPs + pronouns + zeros + relative pronouns + possessive determiners)

*Episodes and expressions used for maintaining reference*:
– total number of episodes
– total number of episodes containing at least one maintenance of reference (realized as either a nominal or pronominal device)
– episodes with one or more pronouns and/or zeros referring back to an expression in that episode
– number of def. NPs referring back to a previous expression
– number of pronouns and zeros referring back to a previous expression

*Ambiguous references*:
– Number of ambiguous references for (i) pronouns; (ii) possessive pronouns

*Inappropriate indef. NPs*:
– number of indef. NPs used inappropriately

ANALYSIS OF OTHER ANIMATE CHARACTERS
The following counts were made:

*Types of NPs*:
– number of (i) indef. NPs; (ii) def. NPs; (iii) pronouns; (iv) possessive pronouns; (v) zero pronouns; (vi) relative pronouns; (vii) total number of references.

*Ambiguous references*
– number of ambiguous references for (i) pronouns; (ii) possessive determiners.

*Analyses of total referential expressions*
– a general total of all references was calculated
– a total word count was carried out using the 'Wordperfect' facility

A step by step guide to the coding procedure is obtainable from the author.

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