Production and on-line comprehension of definite articles and clitic pronouns by Greek sequential bilingual children and monolingual children with specific language impairment

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Suggested Reviewers:

Detailed Response to Reviewers

Reviewer 1

We have now fixed all the typos. We would like to thank the reviewer for their very positive comments and for their constructive feedback.

Reviewer 2

We would like to thank the reviewer for suggesting the new terms to us. We have adopted and used them across the entire document, as we think they clarify the terms used previously in the literature. We would also like to thank them as well for their constructive feedback.

Highlights

- The bridging use of definite articles is acquired prior to the anaphoric use
- Children with SLI have problems with the discourse properties of definite articles
- Definite and indefinite articles are not clinical markers for English-speaking children with SLI

Title page

Production of definite and indefinite articles in typically developing English-speaking children and children with SLI

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Abstract

The present paper examines the production of definite and indefinite articles in English-speaking typically-developing (TD) children and children with Specific Language Impairment (SLI). Twenty four English-speaking children with SLI (mean age: 7;5), twenty nine TD age-matched (TD-AM) children (mean age: 7;5) and eleven younger (mean age: 5;5) TD vocabulary-matched (TD-VM) children participated in a production task involving short stories without picture props based on Schafer & de Villiers (2000). Article production was examined in two different semantic contexts for the definite article, namely in the anaphoric and the bridging context. In the anaphoric condition, definiteness is established via linguistic means, whereas in the bridging condition via shared world knowledge. Indefinite article production was examined in the referential specific, non-referential predicational, and non-referential instrumental contexts. The referential specific context involves [+speaker, -hearer] knowledge and the non-referential predicational and instrumental [-speaker, -hearer] knowledge. Results showed that in the definite article contexts, all three groups performed better on the bridging compared with the anaphoric

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Keywords: Definiteness; articles; first language acquisition; Specific Language Impairment

Introduction

The morpho-syntactic abilities of English-speaking children with Specific Language Impairment (SLI) have been extensively studied (see Leonard (1998) for an overview). Most studies have focused on verbal inflection, such as third person *–s*, past tense *–ed* or progressive *–ing* (Leonard, Miller, & Finneran, 2009; Montgomery & Leonard, 1998; Montgomery & Leonard, 2006; Rice & Wexler, 1996; Rice, Wexler, & Hershberger, 1998; Rice, Wexler, & Redmond, 1999). English-speaking children with SLI have been shown to have problems with tense-related morphology, omitting past tense *–ed* or third person *–s*, and not being sensitive to omission errors when processing tense morphemes off-line or on-line. As a result, tense-related morphology has been argued to constitute a clinical marker for English-speaking children with SLI.

To date there are fewer studies examining the acquisition of the nominal domain in English-speaking children with SLI, e.g. the acquisition of plurals (Le Normand, Leonard, & McGregor, 1993; Leonard, Bortolini, Caselli, McGregor, & Sabbadini, 1992; Oetting & Rice, 1993) or articles (Le Normand et al., 1993;

Leonard, Eyer, Bedore, & Grela, 1997; McGregor & Leonard, 1994; Rice & Wexler, 1996; Schaeffer, Hacohen & Bernstein, 2003). The majority of these studies have examined the morpho-syntactic properties of English articles in pre-school children with SLI using naturalistic data and have provided mixed results regarding the vulnerability of articles in this population. A recent experimental study contrasting the acquisition of English definite and indefinite articles in pre-school children with SLI (Polite, Leonard, & Roberts, 2011) has suggested that definite articles are particularly problematic and may constitute clinical markers for English-speaking children with SLI.

In contrast to the paucity of experimental studies investigating the acquisition of articles in English children with SLI, a breadth of studies has examined the acquisition of definite and indefinite articles in typically developing (TD) pre-school English-speaking children using both naturalistic (Brown, 1973; de Villiers & de Villiers, 1973) and experimental methods (Emslie & Stevenson, 1981; Maratsos, 1976; Schaeffer & Matthewson, 2005; Schafer & de Villiers, 2000; van Hout, Harrigan, & de Villiers, 2010). These studies have primarily focused on the ability of pre-school children to acquire the subtle semantic distinctions of English definite and

indefinite articles. For example, the definite article *the* in English may refer to a unique entity which constitutes shared knowledge between the speaker and hearer on the basis of the situational context or the previous discourse. The indefinite article *a*, on the other hand, does not necessarily presuppose knowledge of a particular entity by both speaker and hearer (Hawkins, 1991; Lyons, 1997). TD pre-school children have been shown to have problems with establishing whether or not a particular entity is known by both the hearer and speaker, and, thus, to overuse definite articles in indefinite article contexts.

To date, there are no studies examining the acquisition of the different semantic properties of definite and indefinite articles in children with SLI and in school-aged TD English-speaking children. The present study aims to fill this gap by investigating whether TD school-aged children are sensitive to the subtle semantic distinctions influencing their younger TD peers. This is also the first study to examine whether definite and indefinite article production is affected by semantic context in school-aged children with SLI.

Definiteness in English

Definiteness is a complex semantic notion that encodes the degree to which an entity denoted by a noun phrase is familiar and identifiable by both the speaker and the hearer. Familiarity is concerned with whether or not an entity constitutes shared knowledge or part of the common ground between the hearer and the speaker (Hawkins, 1991; Heim, 1982). In the present paper, we denote the presence of speaker and hearer knowledge as semantic features with a positive or negative feature value, that is as [±hearer, ±speaker] to better describe the semantic distinctions within definite and indefinite articles.[1] Definite expressions presuppose that an entity is familiar to both the hearer and the speaker, i.e. they are part of the common ground between the speaker and the hearer, and thus, presuppose both [+speaker, +hearer] knowledge. Indefinite entities, on the other hand, always entail that the entity is not part of the common ground between the speaker and the hearer; they presuppose lack of hearer knowledge [-hearer], and may or may not entail

[1] In the present analysis, the features [+hearer, +speaker] do not have repercussion on the projection a full DP category, as in the Schafer & de Villiers' (2000) account (see section on acquisition). They are semantic features that encode whether or not the hearer's perspective is taken into account. These features also impact on the form of the article, definite or indefinite.

speaker knowledge [±speaker] (for a more detailed discussion of these issues, see Ionin, 2003; Ionin, Ko & Wexler, 2004).

English uses free prenominal morphemes to indicate the definiteness and indefiniteness of a noun phrase, namely the articles *the* and *a* respectively. Definite articles in English encode that the noun phrase is familiar and identifiable by both the speaker and hearer, as in (1):

(1) I saw a bird and a cat sitting by a tree. *The bird* flew into the sky and *the cat* ran away.

In (1) the two entities *bird* and *cat* are initially known only to the speaker and are introduced with an indefinite article. Subsequent mention of one or both of the entities requires the use of a definite article, as the entities now constitute shared knowledge between the speaker and the hearer, they are part of the common ground. Familiarity in (1) is established via linguistic means, namely the definite phrases signal referents available in the previous linguistic context with the use of indefinite noun phrases. This function of definite articles is called *anaphoric* and is

central to the establishment and maintenance of discourse reference (Karttunen, 1968).

Definite expressions also presuppose that the entities identified in a specific context are unique. In (1) the speaker intended to identify a unique member of the class of birds and of cats. Definite articles can also have associative, non anaphoric uses called *bridging* uses, whereby a referent becomes definite without previous introduction into discourse but by reference to shared world knowledge between the speaker and the hearer, as in (2):

(2) Jane wanted to open a jar. She removed *the lid* and scooped out some jam.

In (2) the definite noun phrase *the lid* constitutes a felicitous first mention definite expression (Hawkins, 1991), because it is shared world knowledge that jars have lids and that the existence of a jar entails the presence of a lid through a part-whole relationship. The hearer, then, accommodates the use of a definite expression by deriving its reference from the bridged referent through the process of entailment (Avrutin & Coopmans, 2000; Hawkins, 1991; Heim, 1982; Lyons, 1997).

When the noun phrase is not familiar to both the hearer and speaker, then indefinite noun phrases are used. Indefinite noun phrases differ in terms of the degree of specificity and referentiality that they encode. Specificity refers to the identifiability of the entity denoted by the DP, and referentiality concerns the degree to which the indefinite noun phrase signals a particular member of a class or general class membership (Fodor & Sag, 1982; Maratsos, 1976). The use of the indefinite article in (1) signals that the entities *a cat* and *a bird* are identifiable by only the speaker, who had a particular member of the class of birds and cats in mind. In this context, the indefinite noun phrases are used to introduce discourse referents (Heim, 1982). This function of indefinite noun phrases renders them referential and these indefinite noun phrases are called *specific* indefinites.

Indefinite noun phrases in English can also take a *non-referential* reading as in (3), whereby the indefinite noun phrase does not signal a specific member within a class but merely denotes class membership.

(3) I would like a bag to put my clothes in (but I don't know which one).

In (3) the entity denoted by the indefinite noun phrase is not known to either the speaker or the hearer. The indefinite can receive what is known as a *de dicto* reading (Bickerton, 1981; Fillmore, 1967) because it refers to an unspecified bag that has the property of belonging to the class of 'bags' rather than to a specific bag.

Non-referential noun phrases can also constitute complements of predicates such as *be* or *have*, as in (4) below:

(4) A policeman has a bat.

Sentence (4) has a generic meaning. The noun phrases in (4) do not refer to particular individuals/objects, they are non-referential. In this context, the noun phrase *a bat* is part of the predicate *have* + indefinite NP and is within the scope of another indefinite noun phrase *a policeman*. This is the predicational use of indefinite articles. In the predicational use of indefinite articles, the entities denoted by the two noun phrases are in an associative relationship, as it is shared world knowledge that policemen have bats.

Following the above analyses, in the present study we investigated the production of definite articles in two semantic contexts, the anaphoric and the bridging one, and of indefinite articles in three semantic contexts, the specific, the non-referential and the predicational one. In the next section we turn to the acquisition of definite and indefinite articles by typically developing and language-impaired English-speaking children before we present the design of the study.

The acquisition of articles in typically developing children and children with SLI

The acquisition of definite and indefinite articles has been extensively studied in pre-school TD English-speaking children using both naturalistic (Brown, 1973; de Villiers & de Villiers, 1973) and experimental (Maratsos, 1976; Schaeffer & Matthewson, 2005; Schafer & de Villiers, 2000; van Hout et al., 2010) methods. Early studies examining the morpho-syntactic properties of English articles have shown that they are acquired by the time children are three years old (Brown, 1973; de Villiers & de Villiers, 1973). However, different semantic properties of definite and indefinite articles may follow different developmental paths and may depend on task type (de Cat, 2011b; Emslie & Stevenson, 1981).

Maratsos (1976) investigated the production of definite articles in 3-to-4-year-old English-speaking children in two different semantic contexts, in an anaphoric and in a bridging context using an elicitation task that involved short stories without any pictures or toy props. Maratsos (1976) showed that the three-year-old children correctly produced definite articles in the anaphoric condition at a rate of 55%, and that by the age of four years the children had mastered anaphoric article use and produced it approximately 95% of the time. In contrast to the anaphoric use, the three-year-old children correctly produced the definite article in the bridging condition 83% of the time and the four-year-old children 98% of the time.

The dissociation between the anaphoric and bridging use of definite articles was subsequently confirmed in a study by Schafer & de Villiers (2000) with English-speaking 3-to-5-year old children. Similarly with Maratsos (1976), Schafer & de Villiers (2000) did not use any visual stimuli or props in their study. Schafer & de Villiers modified the elicitation task of Maratsos (1976) in that in the anaphoric context the elicitation question comprised a referential *wh*-element such as “Guess which”, as in (5). In the bridging context, Schafer & de Villiers (2000) elicited definite noun phrases containing nouns denoting entities that were in a part-whole relation

via world knowledge with entities introduced by an indefinite article in a lead in sentence, as in (6). In (6), it is world knowledge that bananas have skin or that the skin is part of the banana. In Maratsos (1976), on the other hand, the bridging context involved an associative relationship between multiple nouns in the subject position and their predicates, e.g. *the cat meows, the dog barks*.

(5) Definite anaphoric

Experimenter: A bird and a cat were sitting by a tree. One of the animals flew into the sky. Guess which!

Child (expected answer): The bird.

(6) Definite bridging

Experimenter: Mary wanted to eat a banana but first she had to remove something. What did Mary need to peel off?

Child (expected answer): The skin.

As in the study by Maratsos (1976), the children performed better on the bridging compared with the anaphoric condition with an accuracy rate between 70% and 90% for the bridging and between 24%-60% for the anaphoric condition, although there was a lot of between group variability that was not related to age, as some of the five-year-old children performed worse than the three-year-old children. In both conditions, children's errors consisted primarily in omissions (appr. 8%-13% for the bridging and 23%-40% for the anaphoric condition). Children also substituted the definite article with the indefinite one more in the anaphoric (between 3% and 26% of the time) compared with the bridging condition (between 6.5% to 7% of the time). However, contrary to the Maratsos study, where the four-year-old children had ceiling accuracy on the anaphoric condition (approx. 95%), the five year-old children in the Schafer & de Villiers (2000) study did not reach ceiling performance in the anaphoric use of articles. The difficulties with the anaphoric use of definite articles were corroborated in another study with 17 3-to-7-year-old children by de Villiers et al. (2000). Anaphoric articles were produced 61.8% of the time with omissions constituting the most common error type (20.6%) in this group that also comprised older children. The bridging use of articles, on the other hand, was significantly better

than the anaphoric one with a production rate of 79.4% and no omission or substitution errors.[2] However, it is not possible to tell whether these results were carried over by the younger or the older children in the sample given that results are averaged across the three age groups, which comprised a small number of children and a small number of experimental items.

Persistent difficulties with the anaphoric use of articles until the age of five years have been reported in other studies using an experimental paradigm similar to that of Schafer & de Villiers (2000). Van Hout et al. (2010) tested 25 TD English speaking children (mean age: 4;0, range: 3;1-5;8) on the anaphoric use of articles using short stories without pictures and a second group of 19 children (mean age: 4;6, range: 3;7-5;3) using short stories accompanied by pictures. Children performed similarly on the tasks without and with the pictures and their accuracy rate was 64% and 66% respectively.

The difficulties that pre-school TD children face with the anaphoric use of definite articles have been attributed to their inability to assess other people's belief

[2] The remaining errors consisted in the production of mass nouns (14.7%), possessives (2.9%), as well as non-target nouns (2.9%).

perspectives and to capture the [±hearer] distinction (Schafer & de Villiers, 2000). According to the account by Schafer & de Villiers (2000), young children before the age of 5 cannot compute the entailment that is established between a previously mentioned discourse antecedent introduced with an indefinite noun phrase and its subsequent mention by a definite noun phrase due to cognitive limitations related to the development of the Theory of Mind (TOM) and to the lack of the [+hearer] feature in their grammar. According to Schafer & de Villiers (2000), the [+hearer] feature is a semantic feature hosted within the DP, and its presence is a prerequisite for the projection of a fully referential DP. Schafer & de Villiers (2000) argue that children's early nominal projections do not host the feature [+hearer]; instead, their grammar comprises a lexical theP category, which hosts the feature [unique]. *The* is lexically marked as [unique] and occurs with noun phrases whose referent is uniquely identifiable by the child in the context of the utterance (Schafer & de Villiers, 2000: 611). In the bridging condition, children succeed in establishing a uniqueness relationship between the whole and its part due to world knowledge. However, they perform poorly on the anaphoric condition, which requires taking into consideration the interlocutor's or hearer's point of view ([+hearer]) and the projection of a full DP

category in the children's grammar. This account then predicts that the definite articles used by young children do not carry the target, adult-like semantic features, because early definite articles lack the [+hearer] feature linked with TOM.

In contrast to the findings from the use of articles in anaphoric contexts, one study has shown that the computation of a part-whole relationship and the establishment of reference via bridging are acquired early across several languages. Avrutin & Coopmans (2000) examined whether 3-6-year-old Dutch and Russian children can acquire the bridging relation using a truth-value judgment task. In this task, children were presented with a picture depicting a boat sailing past a castle. The boat had a red flag and the castle a blue one. Then they would hear sentences such as "There sails a boat by (sic). The flag is red", which is true, and "There sails a boat by (sic). The flag is blue", which is false, because it refers to the flag of the castle. Results showed that the 3-year-olds were at chance level when it came to rejecting the false contexts in both Dutch and Russian, although they performed almost at ceiling on the true condition. The 4- and the 5-year olds had no problems rejecting the false sentences. Avrutin & Coopmans (2000) interpret these results as showing that children are able to compute this bridging relationship based on world

knowledge. Additionally, they propose that the reason why the younger group performs at chance is due to the lack of processing resources required for conducting these computations. These operations have higher complexity as they require the interaction of both syntactic and extra-syntactic knowledge (Avrutin, 1999). An alternative explanation for the low accuracy in the younger group, is that the task demands of the truth-value judgment task exceed the processing resources of the children at this age. As a result, they fail the conditions, in which there is a mismatch between the sentence and the picture because mismatch conditions lead to a reanalysis that requires additional processing resources compared to matching conditions (Marinis & Saddy, 2013).

The above mentioned studies have primarily focused on the influence of semantic context on accuracy, whereas the error types, substitutions or omissions, have received less attention. However, the error types could also shed light on the children's underlying grammar and the nature of their problems with definite articles. In the previous studies, TD children not only omitted, but also substituted the definite with the indefinite article. Similar substitution errors in the anaphoric context have been reported in studies using story-telling tasks with pre-school children (Hickmann,

2003), and they have been labelled as *incoherence* errors (Emslie & Stevenson, 1981) or as *discourse integration* errors (Krämer, 2003). De Cat (2011b) observes that this type of errors does not indicate problems with the linguistic properties of articles. Rather, she argues that the competence relating to the information structure is in place, but young TD children have trouble with the evaluation of the newness status of referents. This is a cognitive rather than a linguistic limitation. In this respect, the term incoherence errors (Emslie & Stevenson, 1981) may be misleading, as the children may not misrepresent the discourse context. In her study with 2;6 to 5;6 year-old French-speaking children, de Cat (2011b) attributed these types of errors in the anaphoric contexts partly to experimental artefacts and to the lack of continuous visual reference of the characters in the picture stories. Specifically, she argues that TD children before the age of 5 tend not to track the reference of entities that are absent from the visual content and have problems integrating these entities into discourse. Discourse integration errors are not interpreted as competence errors but rather as indicative of failure in performance. De Cat (2011b) argued that corroborating evidence that the problems with the articles in TD children were not linguistic comes from the results of the bridging

condition, in which children did not make any substitution errors. These findings were interpreted in favour of continuity between the child and the adult grammar; the difficulties with the anaphoric use of articles were attributed to discourse integration possibly due to the high demands of processing resources required whilst tracking discourse reference (Serratrice, 2006). This account differs from that of Schafer & de Villiers (2000), in which children's grammar consists of an incomplete projection due to lack of the [+hearer] feature.

Turning to indefinite articles, most studies have focused on whether or not TD English-speaking children overuse definite articles in the context of indefinites (de Cat, 2011a; Schaeffer & Matthewson, 2005; van Hout et al., 2010) and less on whether or not the different semantic contexts affect indefinite article production in children (de Villiers et al. 2000; Schafer & de Villiers, 2000). Studies by Schaeffer & Matthewson (2005) and van Hout et al. (2010) have shown that pre-school children tend to substitute indefinite articles with definite articles (between 25% and 50% of the time) and that performance varies depending on the task, i.e. whether it is picture based (60%-75% accuracy) (Schaeffer & Matthewson, 2005; van Hout et al., 2010) or it contains no picture props (30% accuracy) (van Hout et al., 2010).

Pre-school children's errors of substituting indefinite articles with definite ones have been described as 'egocentric' (Maratsos, 1976), namely as an inability to take the hearer's perspective into consideration, when introducing a new referent only known to the speaker. However, these studies differ in terms of the experimental tasks and the semantic contexts, and these factors have been shown to have a definitive effect on the children's performance (see de Cat, 2011b for an overview of studies and accounts).

The only two studies that do not report any 'egocentric' errors are the ones by Schafer & de Villiers (2000) and de Villiers, Schafer, Pearson, & Seymour (2000). Schafer and de Villiers (2000) examined the production of indefinite articles in the same group of 3-to-5-year old children who participated in the definite article conditions. Indefinite articles were examined in three semantic contexts. These were the referential specific indefinite context, as in (7), the non-referential predicational as in (8), and the non-referential instrumental as in (9).[3]

[3] We would like to thank an anonymous reviewer for suggesting these terms. The terms used in the original Schafer & de Villiers (2000) and Schafer et al. (2000) studies were specific indefinite, predicational and non-referential respectively. We believe that these new terms provide a more accurate description of the different conditions.

(7) Referential specific indefinite

Experimenter: I bet you have something hanging on the wall of your room. What is it?

Child (expected response): A picture.

(8) Non-referential predicational

Experimenter: Think of a policeman. Tell me what he has.

Child (expected response): A bat.

(9) Non-referential instrumental

Experimenter: Mary has jello, soup and cereal to eat. What can she eat it all with?

Child (expected response): A spoon.

Schafer & de Villiers (2000) reported ceiling performance for the non-referential predicational (between 87.5% and 96% depending on the age group) and non-referential instrumental (between 82% and 94%) use of indefinite articles, as well as

for referential specific indefinite articles (between 86% and 97%). The majority of errors across all conditions consisted in omissions, and very few substitutions were observed in the non-referential conditions. De Villiers et al. (2000) examined the production of indefinite articles in 3-to7-year-old children using the same task as Schafer & de Villiers (2000). De Villiers et al. (2000) found that the referential specific indefinite use of articles elicited the most erroneous responses with an average accuracy of 35.3% across all age groups. The non-referential instrumental and predicational uses of *a*, on the other hand, were unproblematic (instrumental: 82.4%, predicational: 94.1% accuracy). The lack of substitution errors in the case of indefinite articles shows that young children do not have problems with the [±hearer] distinction; it rather shows that overuse of *the* in indefinite contexts may be a task effect, when using visual context (de Cat, 2011b). However, the de Villiers et al. (2000) study has the same limitations in terms of participants, experimental items and results as the one with the definite articles mentioned previously.

The acquisition of definite and indefinite articles has received less attention in research on children with SLI. Early studies examining the development of grammatical morphemes in children with SLI using naturalistic data have reported

that they differ from their MLU-matched controls on the production of articles (Leonard et al., 1997; McGregor & Leonard, 1994; Rice & Wexler, 1996), although other studies have found no difference between the two groups (Le Normand et al., 1993).

To-date there are only two experimental studies examining the acquisition of definite and indefinite articles in English-speaking children with SLI (McGregor & Leonard, 1994; Polite et al. 2011).

McGregor and Leonard (1994) examined the effect of phonological context on the acquisition of definite articles in 18 pre-school children with SLI (age range: 3;6-5;4) and 18 TD MLU-matched peers (age range: 2;3-2;7) using a sentence repetition task. Results showed that children with SLI had significantly poorer performance than their TD language-matched peers and this was influenced by phonological context. McGregor and Leonard (1994) attribute this to the weak, unstressed phonological nature of definite articles in English and the fact that they appear before stressed syllables carried by nouns, e.g. *the girl* (SW).

Polite et al. (2011) examined the production of definite and indefinite articles using an experimental task similar to the one in our study, which included short

stories with no pictures or props (Schafer & de Villiers, 2000). Polite et al. (2011) investigated definite article use in an anaphoric context and indefinite article use in a non-referential instrumental context in a group of 12 preschool children with SLI (mean age: 5;1), a group of MLU-matched TD children (TD-MLU) (mean age: 3;3) and a group of age-matched TD children (TD-AM) (mean age: 5;1).

Polite et al. (2011) found that the children with SLI had significantly poorer performance on the use of definite articles in the anaphoric context (19.8%) compared with their TD-MLU-matched peers (44.4%), who in turn differed from the TD-AM controls (76.3%). The three groups did not differ in the indefinite non-referential article context and all three groups exhibited good performance (appr. 85% across groups) in this condition. In terms of error patterns, the children with SLI produced significantly more substitutions of the definite with the indefinite article (50%) than omissions (25%), and more errors overall than the TD-MLU children, who also had more substitutions (36%) than omissions (12%). The TD-AM children produced an equal number of omission and substitution errors (10% and 12% respectively). The three groups did not differ in terms of omission and substitution

errors in the indefinite article context and both error types remained low (between 2% and 8% for all groups).

Polite et al. (2011) carried out a specificity and sensitivity analysis to establish whether or not definite articles could potentially serve as clinical markers for English-speaking children with SLI.[4] This revealed that 83% of the children with SLI were correctly classified as language impaired (sensitivity) and 83% of the TD-AM children as having typical language development (specificity) on the basis of the performance on definite articles, with only two children in each group being misclassified. However, the authors were reluctant to argue for definite articles as being clinical markers of SLI in English given the paucity of previous experimental studies examining definite articles and the fact that the children with SLI in their study were reported to produce definite articles outside the experimental contexts.

Polite et al.'s (2011) study points towards a deficit in definite article production and an unimpaired acquisition of the indefinite article in children with SLI. Polite et al. (2011) attribute the problems with definite articles to the working memory limitations

[4] The sensitivity analysis investigates how many of the language impaired children are correctly classified as language impaired, and the specificity analysis how many of the TD children are correctly classified as having typical development and not misclassified as language impaired.

that children with SLI have been shown to have (Montgomery, 1995). Namely, children need to keep track of the previously introduced noun phrase and then refer to it using a definite article in the anaphoric use of articles. This process requires the involvement of working memory, and this is taxing for children with SLI. However, Polite et al. (2011) investigated definite and indefinite article production only in two contexts, the anaphoric context for the definite article, which has been shown to be problematic for TD children as old as 5, and the non-referential instrumental context for the indefinite article, which has been shown to be unproblematic.

Present study

The present study provides a systematic investigation of the use of articles in children with SLI by including two different semantic contexts for the definite article, the anaphoric and the bridging, and three different semantic contexts for the indefinite article, namely the referential specific, the non-referential predicational and the non-referential instrumental one. Table 1 summarises the semantic properties of English definite and indefinite articles that were examined in the present study.

INSERT TABLE 1 HERE

The two definite article contexts differ in the way definiteness in established. The three contexts for the indefinite article differ in terms of [±speaker] knowledge that they presuppose. The indefinite specific condition presupposes speaker knowledge but not hearer knowledge. The indefinite non-referential predicational and instrumental contexts presuppose no hearer or speaker knowledge.

This study addresses the following research questions:

1) Does semantic context influence definite and indefinite article production in children with SLI and their typically developing (TD) age-matched and language-matched peers?
2) Are error patterns influenced by different semantic contexts in children with SLI and their TD peers?
3) Do the three groups differ in terms of accuracy and error patterns in the different semantic contexts?

Given the findings from previous studies, we expect TD children to perform better on the bridging compared with the anaphoric condition in the case of definite articles. In terms of the semantic uses of the indefinite article, we expect TD children to perform better on the non-referential predicational use of articles compared with the specific, which is discourse related. The non-referential predicational and the instrumental use of articles also share the features [-speaker, -hearer] and could, thus, be expected to pattern similarly. However, the non-referential predicational condition involves a degree of bridging or entailment between two nouns, e.g. *tennis player-racket*. If bridging as a semantic notion is acquired early in children (Avrutin & Coopman, 2000), then we expect children to perform better on this condition compared to the other indefinite conditions. To date there are no studies examining the definite and indefinite article use in different semantic contexts in children with SLI. Therefore, we cannot make predictions based on previous studies. If children with SLI have problems with discourse properties and exhibit a delayed acquisition profile, then they should pattern similarly with their younger TD controls. If definite articles are clinical markers of SLI in English, as indicated in the study by Polite et al.

(2011), there should be a clear separation between the scores of TD children and children with SLI.

Methodology

Participants

Sixty five children participated in this study: 25 children with SLI (18 boys, 7 girls), 30 age-matched TD children (15 boys, 15 girls), and 11 younger children (3 boys, 8 girls) who were matched with the children with SLI on their vocabulary (referred to as TD-VM from now on). The children with SLI were recruited from speech and language therapy resources in mainstream schools. The control children were recruited from schools in Berkshire and Oxfordshire.

The children with SLI were clinically diagnosed with language impairment and were receiving remediation at the time of testing. We confirmed their status using a range of baseline tasks assessing the children's non-verbal and verbal abilities. These included Raven's coloured matrices (Raven, Court, & Raven, 2008), the Test of Reception of Grammar 2 (Bishop, 2003), the British Picture Vocabulary Scales II (Dunn, Dunn, Whetton, & Burley, 1997), Sentence Recall from the Clinical

Evaluation of Language Fundamentals 3 (Semel, Wiig, & Secord, 1995), the Rice/Wexler Test of Early Grammatical Impairment (Rice & Wexler, 2001), and the Children's Test of Non-word repetition (Gathercole & Baddeley, 1996). None of the control children had a history of speech and/or language delay or impairment based on parental report and information from the schools.

Exclusion criteria for all groups was performance below one standard deviation on the Raven's coloured matrices and a history in hearing impairment, frank neurological impairment, psycho-emotional disturbance, and diagnosis of autism. One TD-AM child and one child with SLI scored below one standard deviation on the Raven's coloured matrices and were, therefore, excluded from the study. Inclusion criteria for the children with SLI consisted of a clinical diagnosis of language impairment and performance of at least one standard deviation below the mean in one or more language assessments.

Table 2 illustrates the children's age and their raw and standard scores on the Raven's (non-verbal abilities), the TROG-2 (grammatical abilities), and the BPVS-II (vocabulary).

INSERT TABLE 2 HERE

One-way ANOVAs showed that the three groups differed on age ($F(2,63)=21.59, p<.001\ \eta^2=.414$), on the standard scores of the Raven's ($F(2,63)=9.677, p<.001, \eta^2=.511$), the TROG-2 ($F(2,63)=66.4, p<.001, \eta^2=.685$), and the BPVS-II ($F(2,63)=39.15, p<.001, \eta^2=.562$). In terms of age, the children with SLI did not differ from their age-matched controls ($p>0.1$), but the TD-VM controls were younger than the children with SLI and the TD-AM controls (both comparisons: $p<0.001$). The children with SLI scored lower than both control groups on the standard scores of the Raven's, the TROG-2, and the BPVS-II (SLI vs. both groups in all tasks $p<.001$), whereas the two groups of control children did not differ from each other on the standard scores of all tasks ($p>.1$ on all tasks). The children with SLI did not differ from the vocabulary controls on the raw scores of the BPVS-II ($p>.1$), but scored less well than the vocabulary controls on the raw scores of the TROG-2 ($p<.001$).

A group of ten monolingual English-speaking adults (mean age: 19.1, range: 18-22, SD: 12 months) completed the experimental task in order to find out if adults reach ceiling in this novel task.

Materials

Experimental tasks

To assess whether or not production of definite and indefinite articles is influenced by semantic context in English-speaking TD children and children with SLI, we created a production task with a format similar to that of Schafer & de Villiers (2000) which involved short stories without the use of pictures or props. Definite articles were elicited in two contexts: the anaphoric, as in (5), and the bridging context, as in (6), mentioned previously. Indefinite articles were elicited in three contexts: a referential specific, a non-referential predicational and a non-referential instrumental context, as in (7), (8) and (9) respectively.

In the definite anaphoric condition, the target noun was initially introduced into the discourse with an indefinite article and then it was elicited using the question

"Guess which", as in (5) above. In the bridging condition, the noun in the story and the target noun were strongly associated through a 'whole-part' relation, as in (6). The noun that denoted the whole set from the whole-part relation was presented first. The noun that denoted the 'part' was then elicited with the question "*What …?*'.

Indefinite articles were elicited through the question *"What...?"* in the non-referential predicational and instrumental conditions and the statement *"Tell me what it is"* in the referential specific condition. The context in the lead-in sentence differed depending on the semantic context. In the referential specific indefinite condition, the context presupposes the speaker's knowledge. In the non-referential predicational condition, the indefinite noun phrase was always the complement of the verb *have* and was in an associative relationship with the noun phrase within the lead-in sentence, e.g. *football player-ball*. In the non-referential instrumental condition, the targeted item referred to a specific set of items presupposed by the situational context, e.g. things that can be used to chop up vegetables, but not to a specific item within the set.

All nouns across conditions appeared in the object position and were inanimate because objects are prototypically inanimate. The nouns in the anaphoric

condition were *book, car, poster, doll, shirt, train*, and in the bridging condition *skin, lid, door, engine, wheel, window*. In the indefinite specific condition, the target nouns were *ball, film, dress, picture, flower, letter*, and in the non-referential predicational condition, the pairs were *fireman-hose, football player-ball, cricket player-bat, climber-rope, tennis player-racket, painter-brush*. In the non-referential instrumental condition, the target nouns were *bag/box, pen, pot, mug, map, knife*. The nouns were matched across conditions for frequency (Baayen, Piepenbrock, & van Rijn, 1993), length (number of syllables) and age of acquisition (below 6, MRC psycholinguistic database, 1997). There were 6 items per condition (anaphoric vs. bridging, specific vs. predicational vs. instrumental), giving rise to 30 items in total.

Coding and scoring

For the two definite article conditions, responses involving a definite article and the target noun, i.e. the noun that had already been introduced in the story in the case of the anaphoric condition, or the noun that was part of the whole-part relation in the case of the bridging condition, were coded as ‘correct’. Responses that involved an indefinite article with the target noun were coded as ‘substitutions’. Responses with

bare (articleless) target nouns were coded as ‘omissions’. There were also a number of other responses that were produced by the children, and especially the children with SLI, that were classified as ‘other’. In the anaphoric condition, these were occurrences of a count noun with or without an article, which was not already mentioned in the story, or which was not a member of the whole-part relation in the bridging condition. Children with SLI also produced mass nouns in the definite conditions and these were also classified as ‘other’.

In the three indefinite conditions, responses involving an indefinite article with a target noun, that is a noun that was semantically or pragmatically felicitous, were considered as “correct”. Responses where the target noun was produced but the indefinite article was substituted by a definite article or omitted were treated as substitutions or omissions respectively. Responses with plural nouns, possessives, proper names or pragmatically unrelated nouns were classified as ‘other’. Proportion correct, substitutions, omissions and other responses were calculated out of all four response types (denominator: correct, substitutions, omissions, other). The three groups did not differ in terms of null responses in the five conditions. For all three groups null responses constituted less than 2% of the data.

Analyses

Definite and indefinite articles were analysed separately using repeated-measures ANOVAs with Group (SLI, TD-AM, TD-VM) as the between group factor and Semantic Context (anaphoric vs. bridging; specific vs. predicational vs. instrumental) as the within group factor in per participant (F_1) and per item (F_2) analyses. In the error analyses, we included Error Type (omission, substitution, other) as an additional within group factor. Error rates were calculated by computing the mean for each error type out of the total number of errors. Error rates were calculated for each condition and for each participant separately; we then ran the participant and item analyses with error type and semantic condition as factors. Interactions with group were unpacked using ANOVAs for each group separately. Main effects and within-group interactions were followed up using post-hoc comparisons with Bonferroni correction. When Mauchly's test indicated that the assumption of sphericity had been violated for main effects and interactions, the degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity. Individual variability was investigated by comparing the standard deviations and ranges between the three

groups and also by calculating the proportion of children in each group and condition who performed within specific ranges (0%-25%, 26%-50%, 51%-75%, 76%-100%).

Results

Adult data

The adults had ceiling accuracy across all conditions (bridging: 97.1%, range: 91%-100%, SD: 18; specific: 92%, range: 83%-100%, SD: 22; non-referential predicational: 96.7%, range: 83%-100%, SD: 20; non-referential instrumental: 96.7%, range: 83%-100%, SD: 20), apart from the anaphoric condition where accuracy reached 82.6% (range: 60%-100%, SD: 30). The adults only committed omission errors across all conditions.

Child data

Definite articles

Table 3 and Figure 1 present the accuracy results on the definite article in the anaphoric and the bridging condition for the children with SLI, the TD-AM and TD-VM children.

INSERT TABLE 3 HERE

INSERT FIGURE 1 HERE

The analysis of correct responses revealed higher accuracy in the bridging compared with the anaphoric context ($F_1(1,61)=32.74, p<.001, \eta^2=.35$; $F_2(1,15)=56.65, p<.001, \eta^2=.79$) and a significant difference between the groups ($F_1(2,61)=7.72, p=.001, \eta^2=.20$; $F_2(2,15)=16.90, p<.001, \eta^2=.69$). There was no interaction between semantic context and group. The children with SLI performed significantly worse than the TD-AM children (p=.001), but did not differ from the TD-VM children; the two control groups did not differ from each other.

The analyses looking at individual variability showed that the standard deviation and ranges were similar in the three groups (see Table 3). The analyses of individual data for each group confirmed the differences between the two conditions

and between the children with SLI and the TD-AM children, as shown in Table 4: 67% of the children with SLI (n=16) scored below 25% in the anaphoric condition but only 29% (n=7) in the bridging condition; the respective proportions for the TD-AM children were only 28% (n=8) for the anaphoric and 7% (n=2) for the bridging condition. Moreover, only 8% (n=2) of the children with SLI scored above 75% in the anaphoric condition but 29% (n=7) in the bridging condition, whereas the respective proportions for the TD-AM children were 52% (n=15) for the anaphoric and 59% (n=17) for the bridging condition. The proportions of the TD-VM children were in between the children with SLI and the TD-AM groups (below 25% in the anaphoric condition: 36%, n=4; in the bridging condition: 9%, n=1; above 75% in the anaphoric condition: 27%, n=3; in the bridging condition: 55%, n=6).

INSERT TABLE 4 HERE

INSERT FIGURE 2 HERE

Subsequently, we examined the types of errors (Table 3, Figure 2). Mauchly's test indicated that the assumption of sphericity had been violated for the main effect

of Error Type in the participant analysis ($\chi^2(2)=38.14$, $p<.001$) and the interaction between Context and Error Type in the item analysis ($\chi^2(2)=6.02$, $p<.05$). Therefore, degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity (ε=.68 for Error type and .74 for the interaction between context and error type). After this correction, the error analysis revealed a main effect of Semantic Context ($F_1(1,61)=32.74, p<.001, \eta^2=.35$; $F_2(1,15)=54.10, p<.001, \eta^2=.78$), a main effect of Error Type ($F_1(1.4,82.97)=12.27, p<.001, \eta^2=.17$; $F_2(2,30)=45.55, p<.001, \eta^2=.75$), a main effect of Group ($F_1(2,61)=7.72, p=.001, \eta^2=.20$; $F2(2,15)=16.68, p<.001, \eta^2=.69$), an interaction between Context and Error Type ($F_1(2,122)=15.46, p<.001, \eta^2=.20$; $F_2(1.48,22.23)=21.89, p<.001, \eta^2=.59$), and a three-way interaction between Context, Error type and Group ($F_1(4,122)=3.24, p<.05, \eta^2=.09$; $F_2(4,30)=4.18, p<.01, \eta^2=.36$).

Separate ANOVAs were carried out for each group. For the children with SLI, Mauchly's test indicated that the assumption of sphericity had been violated for the main effect of Error Type in the participant analysis ($\chi^2(2)=14.66$, $p=.001$), therefore, degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity (ε=.67). After this correction, we found a main effect of Semantic Context

($F_1(1,23)=21.49, p<.001, \eta^2=.48$, $F_2(1,5)=15.93, p=.01$, $\eta^2=.76$), a main effect of Error Type ($F_1(1.35,30.94)=4.66, p<.05, \eta^2=.17$; $F_2(2,10)=10.34, p<.01, \eta^2=.67$), and a significant interaction between Context and Error Type ($F_1(2,46)=5.35, p<.01, \eta^2=.19$; $F_2(2,10)=11.65, p<.01, \eta^2=.70$). The interaction was caused by differences between the omission/substitution vs. 'other' errors. There was no difference in terms of 'other' errors in the two semantic contexts, but the children with SLI had significantly more omissions and substitutions in the anaphoric compared with the bridging context ($p<.01$ in both cases). Moreover, within each semantic context, the children made an equal number of substitutions and omissions, and there were more substitution and omission errors than 'other' errors ($p<.001$ in both cases). For the TD-AM children, Mauchly's test indicated that the assumption of sphericity had been violated for the main effect of Error Type in the participant analysis ($\chi^2(2)=25.86$, $p<.001$), and degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity ($\varepsilon=.62$). The corrected analysis revealed a main effect of Semantic Context ($F_1(1,28)=7.12, p<.05, \eta^2=.20$; $F_2(1,5)=14.09, p<.05, \eta^2=.74$), a main effect of Error Type ($F_1(1.24,34.65)=14.57, p<.001, \eta^2=.34$; $F_2(2,10)=36.18, p<.001, \eta^2=.88$), and a significant interaction between Context and

Error Type ($F_1(2,56)=5.14, p<.05, \eta^2=.15$; $F_2(2,10)=4.12, p<.05, \eta^2=.45$). Subsequent pairwise comparisons showed that the children made an equal number of 'other' errors in the two semantic contexts, but there were significantly more omissions and substitutions in the anaphoric compared with the bridging context ($p<.05$ and $p<.01$ respectively). Within each semantic context, there were more omission than substitution errors for both the anaphoric and the bridging condition ($p<.01$ in both cases) and fewer 'other' errors ($p<.001$ in both cases). For the TD-VM children, the analysis revealed a main effect of Context ($F_1(1,10)=10.87, p<.01, \eta^2=.52$; $F_2(1,5)=35.59, p<.01, \eta^2=.88$), and a significant interaction between Context and Error Type ($F_1(2,9)=9.91, p<.01, \eta^2=.49$; $F_2(2,10)=35.29, p<.001, \eta^2=.88$). Subsequent pairwise comparisons showed that there were more substitution errors in the anaphoric compared with the bridging condition ($p<.01$), but omissions and 'other' errors did not differ in the two conditions. Within each semantic context, substitution errors did not differ from omissions. There were significantly more omission and substitution errors than 'other' errors in the anaphoric condition ($p<.05$ and $p<.01$ respectively). Omission and substitution errors did not differ from 'other' errors in the bridging condition.

Post-hoc between group comparisons showed that the three groups did not differ in terms of omission errors. However, the children with SLI made significantly more substitutions than the TD-AM children in both the anaphoric ($p<.001$) and the bridging ($p<.01$) condition, but they did not differ from the TD-VM children. The children with SLI produced more 'other' errors than the TD-AM children in the anaphoric ($p=.059$) and the bridging ($p<.05$) condition but they did not differ from the TD-VM children.

The individual variability analyses showed that the three groups had similar standard deviation and ranges for all error types in the two conditions, except for the substitution errors; in this error type, the children with SLI had considerably larger standard deviations and ranges than the TD-AM children in both conditions and the TD-VM children in the bridging condition (see Table 3). This difference in the substitution errors was confirmed by the individual data analyses, as show in Table 4. 58% of the children with SLI (n=14) had more than 25% substitution errors in the anaphoric and 33% (n=8) had more than 25% substitution errors in the bridging condition. The respective numbers for the TD-AM groups were 14% (n=4) for the

anaphoric and 3% (n=1) for the bridging condition; for the TD-VM group it was 36% (n=4) and 9% (n=1) respectively.

Indefinite articles

Table 5 and Figure 3 show the effect of semantic condition for the indefinite articles.[5]

INSERT TABLE 5 HERE

INSERT FIGURE 3 HERE

The analysis showed a significant difference between the three conditions ($F_1(2,120)=10.02, p<.001, \eta^2=.14$; $F_2(2,30)=9.06, p=.001, \eta^2=.38$). The non-referential predicational context elicited significantly higher accuracy than the referential specific and the non-referential instrumental context ($p<.001$ in both cases), which did not differ from each other. There were no other main effects or interactions.

INSERT FIGURE 4 HERE

[5] One TD-VM child did not complete this part of the task and was excluded from the calculations.

The individual variability analyses showed similar standard deviations and ranges in the three groups (see Table 5). The analyses of individual data confirmed the differences between the non-referential predicational condition vs. the referential specific and non-referential instrumental condition in the children with SLI (79% of children scored between 76% and 100% in the non-referential predicational condition vs. 46% in the referential specific and 50% in the non-referential instrumental conditions) and in the TD-AM groups (76% of children scored between 76% and 100% in the non-referential predicational condition vs. 55% in the referential specific and 59% in the non-referential instrumental conditions). In the TD-VM group 70% of children scored between 76% and 100% in the non-referential predicational condition vs. 50% in the referential specific and 70% in the non-referential instrumental conditions.

In the error analysis, Mauchly's test indicated that the assumption of sphericity had been violated for the main effect of Error Type ($\chi^2(2)=67.27$, $p<.001$) in the participant analysis. Therefore, the degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity ($\varepsilon=.59$ for error type). The analysis revealed significant differences between the semantic contexts

($F_1(2,120)=10.13, p<.001, \eta^2=.14$); $F_2(2,30)=9.91, p<.001, \eta^2=.15$). The non-referential predicational context elicited significantly fewer errors than the referential specific and the non-referential instrumental contexts ($p<.001$ and $p<.01$ respectively), which did not differ from each other. There was also a significant difference between error types ($F_1(1.19,71.42)=12.83, p<.001, \eta^2=.18$; $F_2(2,30)=74.56, p<.001, \eta^2=.28$). Omissions were the predominant error pattern (16.8%) across all semantic contexts, followed by 'other' errors (7.5%) and substitutions (1.6%) ($p<.05$ and $p<.001$ respectively). There were no other main effects or interactions.

INSERT TABLE 6 HERE

The individual variability analyses showed similar standard deviations and ranges in the error types across groups apart from the other response in the non-referential condition, in which there was more individual variability in the children with SLI compared to the control groups. The analyses of individual data confirmed this difference; 37% of children with SLI had more than 25% 'other' errors, whereas the respective proportions of TD were 3% (TD-AM) and 10% (TD-VM). In the 'other'

responses of the non-referential instrumental condition, there was also a qualitative difference between the TD children and the children with SLI. In this condition, children with SLI produced predominantly (11 out of 35 'other' errors) indefinite noun phrases with inappropriate nouns. This is in contrast with the TD-AM and the TD-VM children who never produced an inappropriate noun in a non-referential instrumental context and who produced very few inappropriate nouns overall.

Discussion

In the present study we asked the following research questions: whether semantic context influences definite and indefinite article production in terms of (i) accuracy and (ii) error types in children with SLI and their TD-AM and TD-VM peers, and (iii) whether or not the three groups differed from one another in these respects.

Similarly with previous studies examining the production of definite articles in an anaphoric and a bridging context in pre-school English-speaking children (Maratsos, 1976; Schafer & de Villiers, 2000), we found that the school-aged children in our study differentiated between the two contexts and had higher accuracy on the bridging compared with the anaphoric condition. This asymmetry

between the two conditions was observed across groups regardless of age and impairment status. However, the children with SLI performed worse than their typically developing age-matched controls on both the anaphoric and the bridging condition. These results suggest that definite articles remain a vulnerable area for school-aged children with SLI, as has been previously found for pre-school children with SLI (Polite et al., 2011) and that this impairment is not restricted to the anaphoric use of definite articles.

Influence of semantic context in TD children and children with SLI was also attested in the use of indefinite articles. All groups of children performed better on the non-referential predicational compared with the referential specific and the non-referential instrumental conditions. This finding is in agreement with previous results by de Villiers et al. (2000) with younger and fewer children. The non-referential predicational condition involved the use of indefinite articles in a context that presupposed no speaker or hearer knowledge, but that established an associative relationship between two different indefinite noun phrases, e.g. *baseball player-bat*. It

seems then that establishing a bridging relationship between two entities facilitates article production in both the definite and indefinite noun phrases.[6]

In terms of error patterns with the definite articles, the children with SLI made more substitution errors of the definite with the indefinite article than their TD-AM controls, whose errors were primarily omissions. This suggests that children with SLI often repeated what was available in the input without manipulating the semantic context. Substitutions were also the predominant error pattern in the TD-VM children who were approximately two years younger than the language-impaired children. It seems then that children with SLI are at an earlier developmental stage because they perform similarly to the younger vocabulary-matched peers. An unexpected finding was that children with SLI produced slightly more substitution errors in the bridging condition than their TD-VM peers. Although the difference was not statistically significant, it was confirmed by the individual data analysis and it may indicate that the children with SLI were influenced by the presence of an indefinite noun phrase in the lead-in sentence and repeated what was available in the input.

[6] As one of the reviewers pointed out, the children in the present study did not perform better on the non-referential compared with the specific indefinite condition, as in the Schafer & de Villiers (2000) study. One possible explanation for this discrepancy could lie in the number of items used in the present study (six items) and in the Schafer & de Villiers study (two items). This is an issue that merits further investigation.

Note that substitution errors were never produced by the English-speaking adults who predominantly omitted the definite articles, and that the TD-AM children made more omission than substitution errors, and had significantly fewer substitution errors than the children with SLI.

In the case of indefinite articles, and similarly to previous studies by Schafer & de Villiers (2000) and de Villiers et al. (2000), we found very few 'egocentric' errors in the younger and older typically developing children or the children with SLI. That is, there were very few substitutions of the indefinite with the definite article. A plausible explanation for this finding is that the children in the present study are older than those in previous studies, and therefore, we expect them to be beyond the 'egocentric' stage. A contributing factor to the low occurrence of substitutions of the indefinite with the definite article may also be related to the absence of any visual props that would render the referents more salient and possibly known to the speaker and hearer regardless of linguistic context. Furthermore, it seems that this bridging relationship between two semantically associated indefinite noun phrases gave rise to fewer 'other' responses (4.9%) compared with 14% and 20.5% of 'other'

responses in the referential specific and non-referential instrumental use of articles respectively for the children with SLI.

The above results show that children with SLI and their TD-VM controls have problems primarily with definite articles, and more with the anaphoric than with the bridging use. In the next section, we provide an account as to possible reasons for these problems.

What causes the problems with definite articles in the TD and language impaired children?

The question that arises at this point is how the difficulties with definite articles in the children with SLI and the younger TD children can be explained. Four accounts were reviewed in the present study: (i) the first one presupposes problems with the prosodic properties of articles (McGregor and Leonard, 1994), (ii) the second one attributes difficulties with articles to working memory problems (Polite et al., 2011), (iii) the third account presupposes problems with TOM and the [±hearer] distinction (Schafer & de Villiers, 2000), and (iv) the fourth account attributes problems with definite articles to their discourse properties (de Cat, 2011b). The first two accounts

have been argued within the context of children with SLI, whereas the two latter ones within the context of pre-school TD children.

Starting from the prosodic account, according to McGregor and Leonard (1994) children with SLI have problems with English definite articles because they constitute weak, unstressed syllables that precede a strong syllable carried by the noun, e.g. *the girl* (SW). These prosodic factors cannot account for the results of the present study. If the difficulties in the production of definite articles were due to their prosodic nature, children with SLI should omit definite articles irrespective of the semantic context because the prosody is constant across semantic contexts. In the present study, however, we found that performance depended upon semantic context. Furthermore, although indefinite articles also constitute weak, unstressed syllables, they had higher production rates than definite articles.[7]

Turning to Polite et al. (2011), the difficulties with the anaphoric use of definite articles in SLI children should be caused by working memory problems. Namely, children need to keep track of discourse reference and retain the previously introduced discourse antecedent in working memory. Although no working memory

[7] We would like to thank one anonymous reviewer for pointing out the issue of the indefinite articles to us.

measure was used in the Polite et al. (2011) and in the present study, we believe that working memory does not fully explain the children's difficulties with articles and may only be indirectly involved in the problems with definite anaphoric articles. More specifically, if working memory limitations were the only cause of the problems with the anaphoric use of articles in children with SLI, then we would expect them to have difficulties remembering the already mentioned discourse antecedent, omitting the target noun phrase and/or producing a lot of irrelevant noun phrases not already introduced in the discourse. The children with SLI produced significantly more 'other' responses compared with their typically developing peers, which suggests that they have some problems retaining the target noun in working memory. However, despite this difference, they felicitously produced the target noun 94% of the time in the anaphoric condition, as can be seen in Table 3 by adding the correct responses (24.3%), omissions (31.2%) and substitutions (38.2%). In these contexts the target noun was always produced; in contrast, the children with SLI failed to produce the target article approximately 70% of the time, as can be seen by adding the omission (31.2%) and substitution (38.2%) errors (Table 3). These results suggest that in the majority of cases, children with SLI are able to retain the target noun in working

memory, but fail to appropriately use the discourse requirements, namely use a definite article to refer to an already mentioned discourse antecedent.

Additional evidence supporting the argument that the problems of children with SLI are not related to working memory limitations, but should be attributed to other reasons, comes from the examination of the bridging use of articles. Working memory is involved not only in the anaphoric, but also in the bridging condition. In this condition, the child is required to keep the superset of the part-whole set in working memory and compute a lexically-based relationship between the whole and its part, e.g. *banana-skin*. Children with SLI perform better on this condition; they produce the target noun approximately 92% of the time, as can be seen in Table 3 by adding the correct responses (52.4%), omissions (19.6%) and substitutions (19.4%).

Thus far, the results from the present study refute problems with prosody and working memory as possible sources for the difficulties that children with SLI have with definite articles. We now turn to the accounts on the TD pre-school children that presupposes problems with TOM and the [+hearer] feature, or difficulties with the

discourse properties of definite articles and examine to what extent these can also be applied to children with SLI.

Schafer & de Villiers (2000) have attributed the problems with the anaphoric use of definite articles in TD pre-school children, to lack of TOM and the [±hearer] distinction. In the Schafer & de Villiers' (2000) account, the absence of the [+hearer] feature has repercussions on the syntactic structure of the noun phrase, namely whether or not a full functional category (DP) is projected or merely a lexical noun phrase (theP). Given that the TD and SLI children in the present study are 5-to-9-years old, they are too old for one to suggest that their problems lie in an incomplete projection of a functional category.

Furthermore, a caveat is at stake here. Corpus studies have shown that three-year-old children are able to use a full range of referring expressions, including definite and indefinite articles, at the same time when they fail 'false belief' tasks (Gundel, Ntelitheos & Kowalsky, 2007). Gundel et al. (2007) make an important distinction between TOM as the study of 'false beliefs, that is the ability to verbally attribute beliefs to others that are different from one's own, and TOM as the ability to consider the interlocutor's point of view. This suggests that the TOM interpreted as

the computation of 'false beliefs' may be dissociated from the [±hearer] distinction, namely the ability to recognise the interlocutor's mental state and to linguistically encode shared information. Given that the children in the present study are older than the children in previous studies, we do not expect them to have TOM problems defined as the ability to recognise the hearer's point of view. Studies with young TD children have shown that they are sensitive to their interlocutor's point of view, and thus to the [±speaker, ±hearer] distinction from the age of three years, as well as to the discourse prominence of referential expressions, using similar cues as adults (Song & Fisher, 2005).[8] A study with young SLI children has also shown that their problems with definite articles are grammatical rather than with interpreting shared speaker and hearer knowledge (Schaeffer et al., 2003). Previous studies, thus, suggest that the TD and SLI children of this age should not have problems with the [±hearer, ±speaker] distinction. However, the fact that 36% of the TD-VM children as opposed to 25% of the children with SLI and no TD-AM children substituted more

[8] However, young TD children tend to presuppose a wider common ground between the speaker and the hearer and thus to make 'egocentric' errors, when the discourse referent is salient or visually depicted (de Cat, 2011b).

than 50% of the time suggests that these younger TD children in the sample may have some residual problems with perspective taking.

In the present paper we would like to propose that both the TD children and children with SLI are primarily challenged by the discourse-related properties of the anaphoric use of definite articles and more specifically have difficulties with maintaining discourse continuity via linguistic means. More specifically, their difficulty lies in the integration into discourse of a previously mentioned discourse antecedent (introduced with an indefinite noun phrase) using a definite noun phrase (de Cat, 2011b; Krämer, 2003).

Let us explain. In the anaphoric condition in the present study, the speaker (experimenter) initially introduces two entities using two indefinite noun phrases, e.g. *a book* and *a dress*. These indefinite noun phrases carry the [+speaker, -hearer] features, as they are only known to the speaker. After being mentioned, the two entities become part of the hearer's (the child's) knowledge and a common ground is established. In the present task, the child is required to acknowledge these entities as already introduced and known to the hearer (the experimenter now) and to maintain discourse continuity as the speaker (the child) by referring to one of the two

entities with a definite noun phrase. At this point, the younger TD children and children with SLI in this study showed a large proportion of substitutions and omissions of the definite article. Notice that substitution errors as a main error pattern were also reported in the previous studies with TD children (Schafer & de Villiers, 2000, de Villiers et al. 2000) and children with SLI (Polite et al. 2011) but have not been explained in these studies. We believe that these error types can help us disentangle the nature of the problems of the children with SLI and their language matched controls.

As mentioned above the children not only omitted, but also substituted the definite article with the indefinite one, especially in an anaphoric context. These substitution errors of the definite with the indefinite article in a context that denotes old information and presupposes [+hearer] knowledge have been called *incoherence* or *discourse integration* errors and have been reported in previous studies with young TD children (de Cat, 2011b; Emslie & Stevenson, 1981; Krämer, 2003). In these studies, these errors have been treated as performance-based errors that do not reflect the children's linguistic abilities, and are caused by the children's inability

to integrate linguistically into discourse a previously mentioned entity due to experimental settings (de Cat, 2011b) or processing demands (Serratrice, 2006).

In our study, there was also a clear age effect in the substitution errors, as the younger vocabulary matched children and the children with SLI produced as many omissions as substitutions, whereas the TD-AM children predominantly omitted, and the adults only omitted and never substituted in the anaphoric context.[9] Additional evidence for a qualitative difference between the TD children and the children with SLI comes from the finding that the TD children make very few substitution errors in the bridging condition similarly to the de Cat (2011b) study. The children with SLI, on the other hand, had lower accuracy than the age-matched controls, substituted slightly more than the language-matched children in this condition, and crucially, a much larger number of children with SLI (33%) compared to the TD-VM group (9%) made more than 25% errors of substitution in the bridging condition. This type of error indicates their inability to felicitously disregard the previously mentioned indefinite noun phrase.

[9] A non-parametric Spearman's correlation between age and error types with both groups of TD children merged together revealed a negative moderate correlation between age and substitutions ($r(40)=-.466$, $p<.01$), suggesting that substitutions decrease with age in the TD children. No significant correlations were observed between age and omission and other errors.

Therefore, in the present study the younger TD children and the children with SLI seem to have problems with the discourse integration of entities that have already been established as part of the shared [+speaker, +hearer] knowledge. These problems with the discourse integration of already introduced entities impacts on the children's ability to produce a definite article in the anaphoric context correctly. This difficulty may have been accentuated by the presence of an indefinite noun phrase in the lead-in sentence in the present study. In the children with SLI, the difficulties with integrating discourse information may be further accentuated by their poorer grammatical abilities, as their performance and error patterns on the bridging condition indicates, whereas in the TD-VM children it may be a combination of residual problems with perspective taking as well.

A last point to consider is why the TD-AM children and the adults predominantly omitted in the anaphoric condition instead of substituting the definite with the indefinite article similarly with the TD-VM children and the children with SLI. In the adult group, omissions were driven by two participants who omitted between 83.3% and 100% of the time respectively. In the TD-AM children four children (14%) also had a high omission rate in the anaphoric condition and only 2 (7%) omitted to a

similar extent in the bridging condition. These errors can also be explained as performance errors, and could be attributed to these TD-AM children and adults interpreting the task as a guessing game, where they needed to provide an answer to the experimenter's question focusing on the kind reading of the question, e.g. *Which kind of instrument does one write with? Pen.* (van Hout et al., 2009).[10]

Finally, the results from the present study indicate that definite articles are not clinical markers in English-speaking school-aged children with SLI. Contrary to the Polite et al. (2011) study, we found a large overlap between both groups of TD children (AM and VM) and children with SLI in terms of accuracy and error types. Similarly with Polite et al. (2011), the present results evoke the importance of the examination of different semantic contexts for the same phenomenon, as this may give rise to differential accuracy and error patterns. These provide us with a more fine-grained picture of the nature of the deficits in children with SLI. Taken together, our findings suggest that the difficulties in the production of articles in school-aged children with SLI are due to the discourse properties of articles.

[10] One reviewer notes that omission errors could also be attributed to problems with [+speaker] [+hearer] knowledge. Given that omissions were also elicited in adults, we cannot treat omissions as perspective taking problems.

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Figure 1

Figure 1. Percentage (%) of correct responses on the definite anaphoric and bridging conditions by the children with SLI, the TD age-matched (TD-AM) and the TD vocabulary-matched (TD-VM) children.

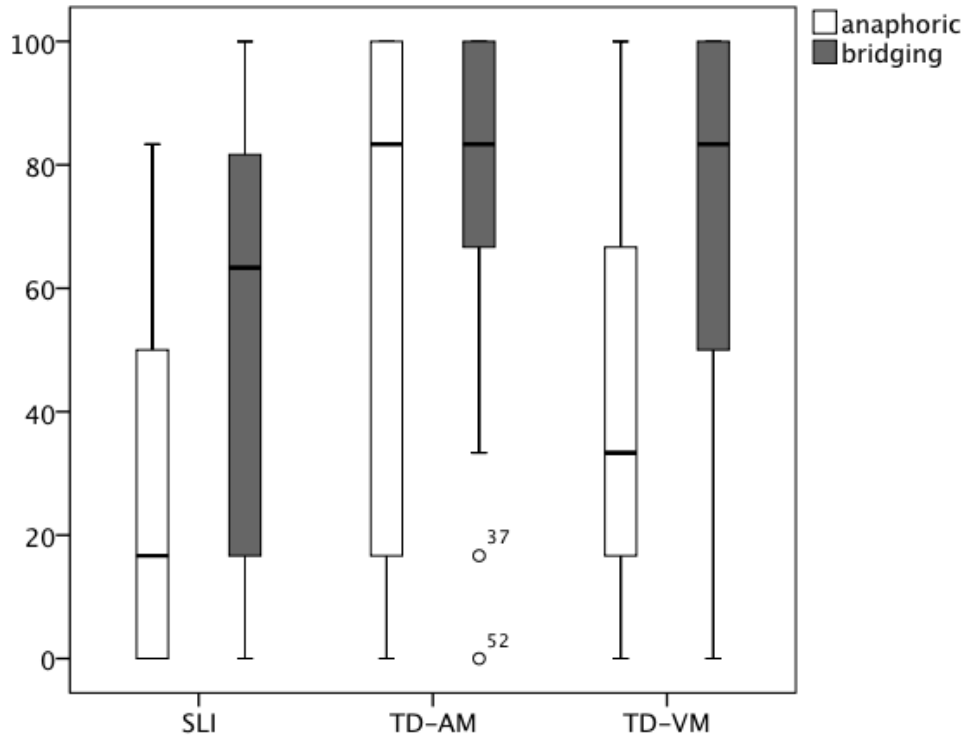

Figure 2

Figure 2. Percentage (%) of omissions, substitutions and 'other' responses on the definite anaphoric and bridging conditions by the children with SLI, the TD age-matched (TD-AM) and the TD vocabulary-matched (TD-VM) children.

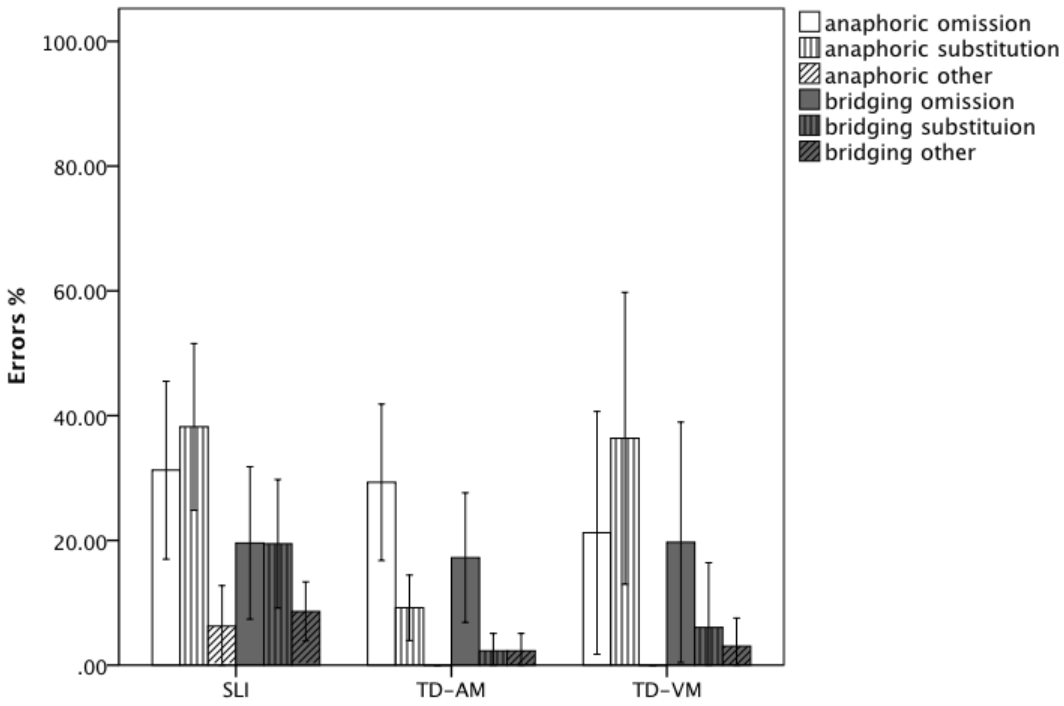

Figure 3

Figure 3. Percentage (%) of correct responses on the indefinite referential specific, non-referential predicational and non-referential instrumental conditions by the children with SLI, the TD age-matched (TD-AM) and the TD vocabulary-matched (TD-VM) children.

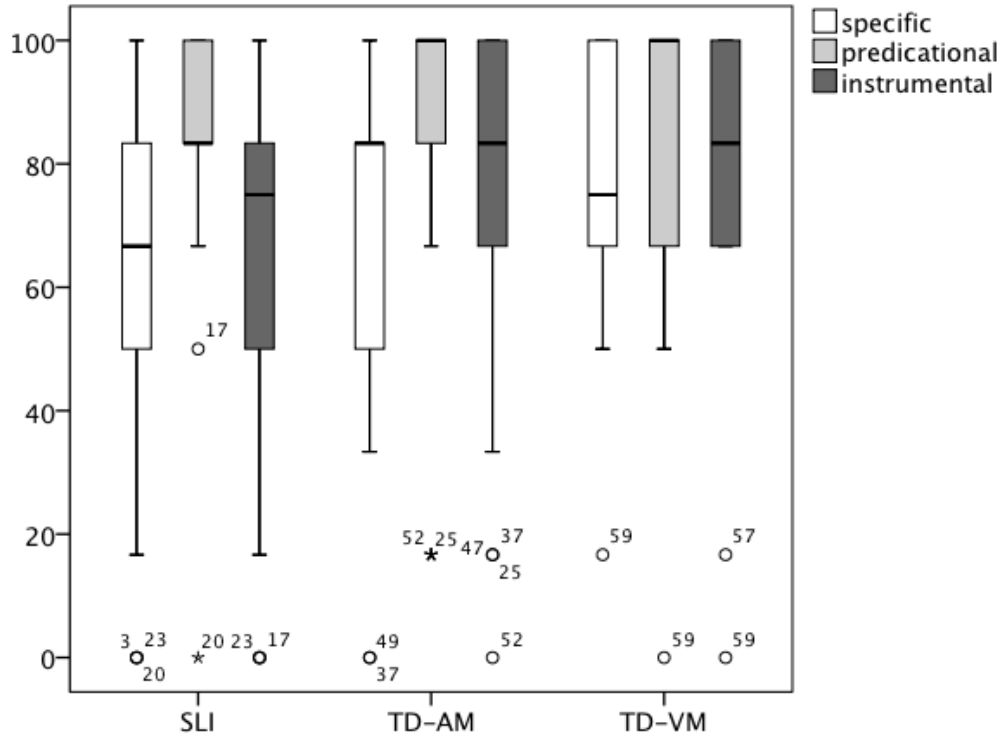

Figure 4

Figure 4. Percentage (%) of omissions, substitutions and 'other' responses on the indefinite referential specific, non-referential predicational and non-referential instrumental conditions by the children with SLI, the TD age-matched (TD-AM) and the TD vocabulary-matched (TD-VM) children.

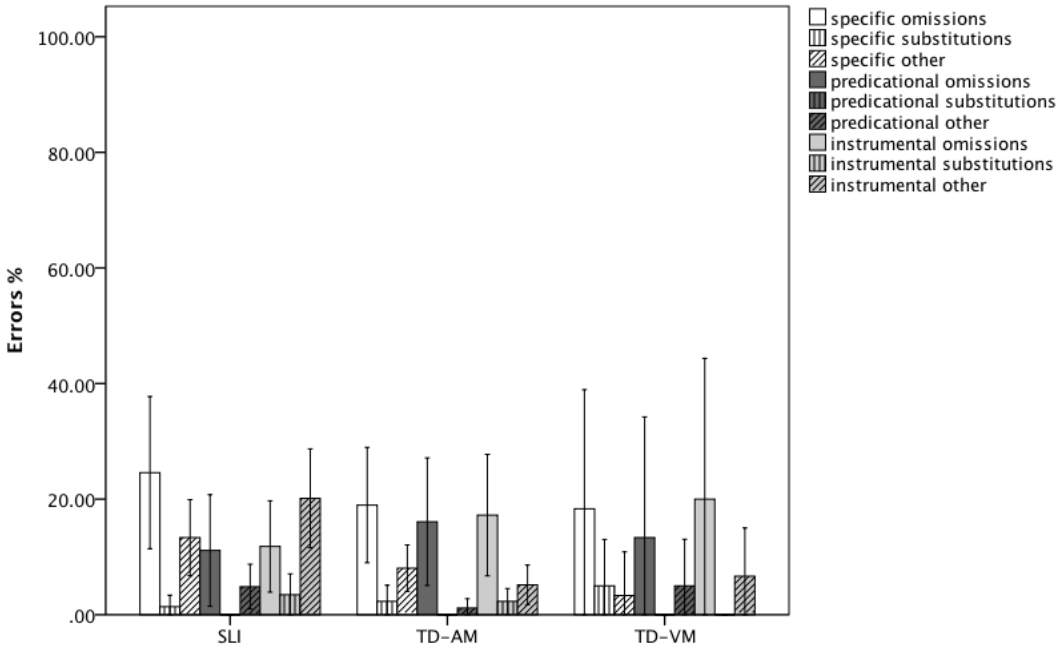

Figure 4-colour

Figure 4. Percentage (%) of omissions, substitutions and 'other' responses on the indefinite referential specific, non-referential predicational and non-referential instrumental conditions by the children with SLI, the TD age-matched (TD-AM) and the TD vocabulary-matched (TD-VM) children.

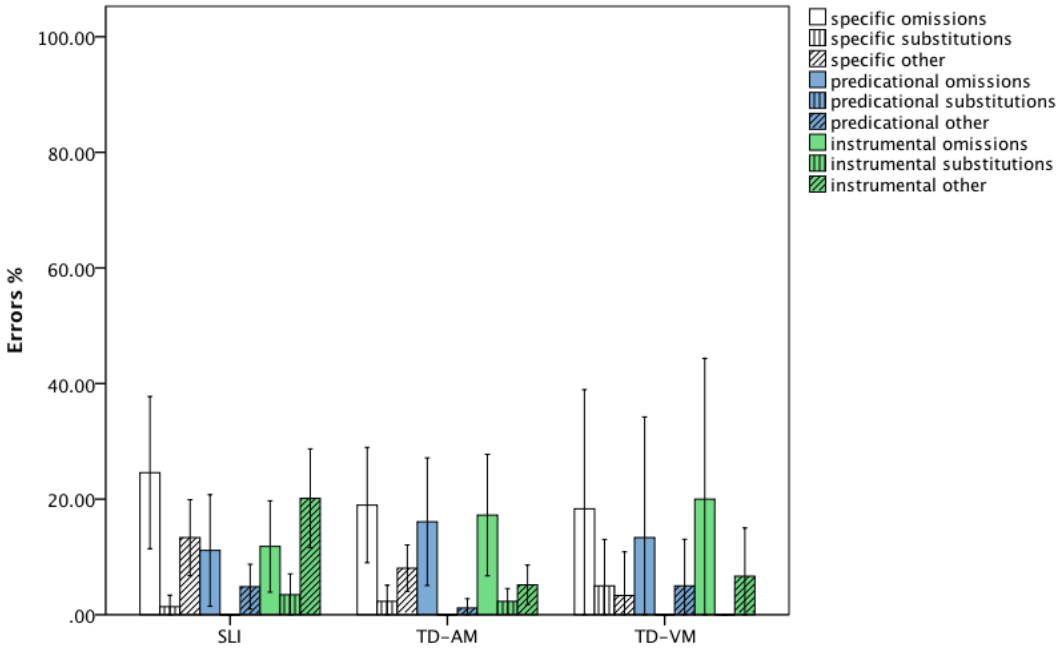

Table 1

Table 1. Semantic uses of definite and indefinite articles in English

	+Speaker	-Speaker
+Hearer	Definite anaphoric (established via discourse reference) Definite bridging (world knowledge or part-whole relation)	
-Hearer	Indefinite referential specific	Indefinite non-referential predicational (complement of *have*) Indefinite non-referential instrumental

Table 2

Table 2: Children's age, raw scores (RS) and standard scores (SS) on the baseline tasks

Group	Age in months	RCPM SS	TROG-2 RS	TROG-2 SS	BPVS-II RS	BPVS-II SS
Children with SLI						
Mean	85.7	97.1	6.9	76.6	63	92.8
SD	11.3	11.3	3.2	13.6	10.8	8.1
Range	71-118	85-120	2-14	55-104	47-86	79-112
TD-AM						
Mean	89.1	110.7	14.2	107.3	91.2	113.1
SD	9.3	9.9	3.6	9.6	12.5	9
Range	72-103	95-130	2-19	81-127	61-119	93-132
TD-VM						
Mean	67.2	109.2	12.3	115.3	70.5	114
SD	4.9	15.4	2.5	9.1	11.3	10.6
Range	61-77	85-125	7-16	97-130	58-95	99-132

RCPM: Raven's Coloured Progressive Matrices; TROG-2: Test for the Reception of Grammar (2nd edition); BPVSII: British Picture Vocabulary Scale (2nd edition); TD-AM: Typically developing age-matched children; TD-VM: Typically developing vocabulary-matched children

Table 3

Table 3. Percentage (%) of correct and erroneous responses on the definite anaphoric and bridging conditions by the children with SLI, the TD age-matched (TD-AM) and the TD vocabulary-matched (TD-VM) children

Group	Anaphoric				Bridging			
	Correct	Omissions	Substitut.	Other	Correct	Omissions	Substitut.	Other
Children with SLI								
Mean	24.3	31.2	38.2	6.3	52.4	19.6	19.4	8.6
SD	29.5	33.8	31.7	15.4	35.1	28.9	24.4	11.2
Range	0-83.3	0-100	0-100	0-66.7	0-100	0-100	0-83.3	0-33.3
TD-AM								
Mean	61.5	29.3	9.2	0	78.2	17.2	2.3	2.3
SD	38.3	32.9	13.8	0	27.5	27.3	7.4	7.4
Range	0-100	0-83.3	0-50	0	0-100	0-100	0-33.3	0-33.3
TD-VM								
Mean	42.4	21.2	36.4	0	71.2	19.7	6.1	3.0
SD	32.8	28.9	34.8	0	34.2	28.7	15.4	6.7
Range	0-100	0-83.3	0-83.3	0	0-100	0-83.3	0-50	0-16.7

Table 4

Table 4. Individual variability analysis for definite articles: proportion and number of children scoring between 0%-25%, 26%-50%, 51%-75%, 76%-100% in correct, omission, substitution, and other responses.

Group	Anaphoric								Bridging							
	Correct		Omissions		Substitutions		Other		Correct		Omissions		Substitutions		Other	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Children with SLI																
0%-25%	67	16	58	14	42	10	92	22	29	7	71	17	67	16	92	22
26%-50%	17	4	21	5	33	8	4	1	17	4	17	4	21	5	8	2
51%-75%	8	2	4	1	4	1	4	1	25	6	4	1	8	2	0	0
76%-100%	8	2	17	4	21	5	0	0	29	7	8	2	4	1	0	0
TD-AM																
0%-25%	28	8	59	17	86	25	100	29	7	2	69	20	97	28	97	28
26%-50%	14	4	14	4	14	4	0	0	10	3	24	7	3	21	3	1
51%-75%	7	2	14	4	0	0	0	0	24	7	0	0	0	0	0	0
76%-100%	52	15	14	4	0	0	0	0	59	17	7	2	0	0	0	0
TD-VM																
0%-25%	36	4	64	7	64	7	100	11	9	1	73	8	91	10	100	11
26%-50%	36	4	27	3	0	0	0	0	27	3	18	2	9	1	0	0
51%-75%	0	0	0	0	9	1	0	0	9	1	0	0	0	0	0	0
76%-100%	27	3	9	1	27	3	0	0	55	6	9	1	0	0	0	0

Table 5

Table 5. Percentage (%) of correct and erroneous responses on the indefinite referential specific, non-referential predicational and non-referential instrumental conditions by the children with SLI, the TD age-matched (TD-AM) and the TD vocabulary-matched (TD-VM) children

Group	Referential specific				Non-referential predicational				Non-referential intrumental			
	Correct	Omissions	Substitut.	Other	Correct	Omissions	Substitut.	Other	Correct	Omissions	Substitut.	Other
Children with SLI												
Mean	60.7	24.6	1.4	13.3	84	11.1	0	4.9	63.9	11.8	3.5	20.1
SD	30.8	31.2	4.7	15.6	22.8	22.9	0	9.2	32.5	18.7	8.5	20.3
Range	0-100	0-100	0-16.7	0-50	0-100	0-100	0	0-33.3	0-100	0-66.7	0-33.3	0-66.7
TD-AM												
Mean	70.7	19	2.3	8	82.8	16.1	0	1.1	75.3	17.2	2.3	5.2
SD	27.7	26.2	7.4	10.6	29	29	0	4.3	29.1	27.6	5.8	9
Range	0-100	0-100	0-33.3	0-33.3	16.7-100	0-83.3	0	0-16.7	0-100	0-83.3	0-16.7	0-33.3

TD-VM												
Mean	71.4	18.3	3.3	5	81.7	13.3	0	5	73.3	20	0	6.7
SD	29.3	28.8	11.3	10.5	33.7	29.2	0	11.2	36.2	34.1	0	11.7
Range	16.7-100	0-83.3	0-33.3	0-33.3	0-100	0-83.3	0	0-33.3	0-100	0-83.3	0	0-33.3

Table 6

Table 6. Individual variability analysis for indefinite articles: proportion and number of children scoring between 0%-25%, 26%-50%, 51%-75%, 76%-100% in correct, omission, substitution, and other responses

	Referential specific								Non-referential predicational								Non-referential instrumental							
	Correct		Omissions		Substitutions		Other		Correct		Omissions		Substitutions		Other		Correct		Omissions		Substitutions		Other	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Children with SLI																								
0%-25%	17	4	58	14	100	24	83	20	4	1	88	21	100	24	96	23	17	4	88	21	96	23	63	15
26%-50%	21	5	29	7	0	0	17	4	4	1	8	2	0	0	4	1	17	4	8	2	4	1	33	8
51%-75%	17	4	0	0	0	0	0	0	13	3	0	0	0	0	0	0	17	4	4	1	0	0	4	1
76%-100%	46	11	13	3	0	0	0	0	79	19	4	1	0	0	0	0	50	12	0	0	0	0	0	0
TD-AM																								
0%-25%	7	2	69	20	97	28	93	27	14	4	79	23	100	29	100	29	10	3	76	22	100	29	97	28
26%-50%	24	7	21	6	3	1	7	2	0	0	7	2	0	0	0	0	10	3	10	3	0	0	3	1
51%-75%	14	4	7	2	0	0	0	0	10	3	0	0	0	0	0	0	21	6	7	2	0	0	0	0
76%-100%	55	16	3	1	0	0	0	0	76	22	14	4	0	0	0	0	59	17	7	2	0	0	0	0
TD-VM																								
0%-25%	10	1	70	7	90	9	90	9	10	1	80	8	100	10	90	9	20	2	80	8	100	10	90	9
26%-50%	10	1	20	2	10	1	10	1	10	1	10	1	0	0	10	1	0	0	0	0	0	0	10	1
51%-75%	30	3	10	1	0	0	0	0	10	1	0	0	0	0	0	0	10	1	0	0	0	0	0	0
76%-100%	50	5	0	0	0	0	0	0	70	7	10	1	0	0	0	0	70	7	20	2	0	0	0	0