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Aspects of Pronominal Resolution as Markers of Reading Comprehension:
The Role of Antecedent Variability

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Abstract

This study explored pronominal resolution as a measure of reading comprehension beyond single sentences. Specifically, it was hypothesized the ability to specify the referents of pronouns like *this* and *these* that have variable antecedents would be a good probe of the quality of the reader's mental model. This idea was tested in a study of 123 French eight-year-olds. After controlling for word decoding, vocabulary and syntactic knowledge, various aspects of pronominal comprehension were found to contribute independent variance to reading comprehension: (1) pronominal knowledge as measured in a pronoun selection task, (2) referent specification of pronouns that refer to protagonists. In addition, (3) referent specification of pronouns (French *y* and *en*) with variable antecedents added further independent variance. The results support the idea that the ability to specify referents accounts for unique variance in reading comprehension and may tap the quality of the reader's mental model of preceding text.

Keywords: Reading comprehension; pronoun resolution; referent specification; antecedent variability; children

Aspects of Pronominal Resolution as Markers of Reading Comprehension: The Role of Antecedent Variability

A defining feature of reading comprehension is the construction of a mental model, i.e., a mental representation of the contents of a text (Johnson-Laird, 1983; Kintsch, 1998). The mental model is formed in a complex interplay between activation of prior knowledge and integration of the information from the text.

Pronominal expressions may pose a challenge to the reader because they cannot be directly integrated into the current mental model. Their meaning usually depends on the understanding and memory for prior parts of the text in which the “antecedent” gives a better specification of the referent. Therefore, the ability to interpret pronominal expressions may be a sensitive indicator of integrative processing and reading comprehension beyond the word and single sentence level (e.g., Gellert & Elbro, 2013; Joseph, Bremmer, Liversedge, & Nation, 2015; Oakhill & Yuill, 1986). This possibility has received little attention even though the cognitive mechanisms involved in the interpretation of pronominal expressions have been a topic of much psycholinguistic research (e.g., Almor, 2000; Cornish, 2009; Sanford & Garrod, 1989; Yang, Gordon, Hendrick, & Hue, 2003).

Pronouns can link sentences together by referring to antecedents in previous sentences – and ultimately to the referent, that is, something real or imagined, for example a person, a thing, a place, an action, which the reader has to keep in his or her mental model. Pronouns provide the speaker or writer with a quick way to continue to refer to a referent without fully specifying it. Instead of *Joan of Arc, three kilometres from Lupersat*, and *the enjoyable family meal*, pronouns like *she*, *there* and *it* may be used. However, this quick and easy way of referencing places extra demands on the listener or reader. The listener or reader has to resolve which of potentially many referents a particular pronoun refers to. For example: “Julie admired Joanna’s new pet dog. *She* thought *it* was really sweet and wanted *one* too.”

There is good evidence that readers initiate the processing of pronominal expressions immediately when first fixated but that the termination of the processing varies greatly (e.g., Sanford & Garrod, 1989). Processing time varies with a number of factors, which suggests that pronominal resolution is not always a simple matter.

Processing is relatively fast when there is only one possible antecedent that matches the pronoun on gender, number, case, or other lexical features that are signalled by the pronoun (Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000). Processing time is also shorter when antecedents are closer to the pronoun than when they are distant (Duffy & Rayner, 1990). Syntactic prominence may further contribute independently to the ease of processing: A pronoun that refers to the grammatical subject of the preceding sentence is processed faster than a pronoun that refers to a preceding object – at least for Chinese readers (Crawley, Stevenson, & Kleinman, 1990; Yang et al., 2003).

Processing time also varies with the reader's level of reading comprehension and working memory span (Joseph et al., 2015). However, text-related differences appear to be less salient in *children's* reading when *online* measures of eye movements are taken (Joseph et al., 2015). One reason may be that children simply fail to locate a potential antecedent in difficult cases, so-called *bonding* fails (Garrod & Terras, 2000). Hence, a study of children's pronoun understanding may pick up important variance simply by looking at children's ability to specify antecedents. This type of measure was employed by the present study.

Variability in Children's Comprehension of Pronominal Expressions

Previous research has indicated that children as young as 2½ years can use gender information to act out instructions such as *Snoopy says that Sarah (the child) should point to **him***" (Chien & Wexler, 1990). This ability has also been found at the inter-sentence level. For example, pre-school children can point to the character who wants some milk: *Jack is having lunch with Daisy. **He** wants some milk* (Arnold, Brown-Schmidt, & Trueswell, 2007). From 5 to 8 years, children continue to progress in pronoun processing (see Hickmann, 2003; Hickmann, Schimke, & Colonna, 2015, for reviews). For example, they learn that subject pronouns, like *he* in the above example, usually refer back to a known protagonist (or discourse focus) whereas a subject noun phrase in the same position usually serves to introduce a new protagonist or new focus that is less prominent in the mental model (Hartshorne, Nappa, & Snedeker, 2015; Megherbi & Ehrlich, 2009). Around the age of 8 years, children usually master the significance of gender marking and pronominal marking of given

versus new information. They also show sensitivity to the multifunctional nature of pronouns even though the mastery of pronominal functions continues to develop for some years (Hickmann et al., 2015).

However, there is considerable *individual variability* in children's understanding of pronominal expressions. For example, some school-age children have been found to have difficulties with antecedent specification in reading even at the simple levels that are normally mastered in spoken language before the age of 5 (e.g., Oakhill & Yuill, 1986). These difficulties were not explained by poor word decoding but resided with problems in language comprehension in reading. Such difficulties can probably be explained in part by the de-contextualised nature of written language. During typical reading, referents are not present as physical entities but have to be imagined, and the writer and reader rarely share knowledge to the same extent as do children and their spoken dialogue partners.

A further clue to the source of variation in children's understanding of pronominal expressions in reading was reported by Megherbi and Ehrlich (2005). They found that eight-year-old children with a low level of reading comprehension ability did not display the usual preference for subject (or protagonist) antecedents, but more easily activated close antecedents in sentences like this: *John finally spotted Peter after **he** put his glasses on.* Even though the pronoun *he* (and *his*) is more likely to refer to the subject, John, the children with low levels of ability often thought that the antecedent was Peter. In contrast to other children, the children at low levels of reading comprehension seemed to use a more surface-oriented strategy whereby they scan the preceding text for a noun that would fit with the gender and number information preserved in the pronoun. These children did not consult an *integrated representation* (a mental model) of the preceding part of the text. The present study explored this possibility that *varying levels* of pronominal understanding is related to variance in general reading comprehension.

However, there are many other possible interpretations of these and similar results. Children with difficulties in reading comprehension are known to have weak vocabulary knowledge (Oakhill, Berenhaus, & Cain, 2015; Oakhill & Cain, 2014; Perfetti, 2007), so even though they may know how pronouns link to antecedents, weaknesses in vocabulary may obscure these links. For example, in the above

example, a child with a low comprehension ability may associate *spotted* with spots ('marks') rather than seeing, and thus fail to integrate the two clauses. A low level of comprehension may also reflect syntactic problems that cause problems with integration. In addition, low levels of comprehension may be caused by a poor *knowledge* of the pronominal system in itself, rather than difficulties with the *use* of it to identify antecedents. The present study controlled for these possibilities.

The Present Study

The present study looked further into children's varying ability to specify the correct referent – as a possible indicator of their reading comprehension level. To our knowledge, there are no published studies about the unique contribution of anaphor resolution to reading comprehension beyond the word and sentence levels.

The rationale behind the study was that the ability to specify a plausible referent depends on the *quality of the mental model* of the preceding text in which an antecedent appears. For example, the quality of the reader's mental model of the first sentence, *Joan of Arc and her husband joined the family meal set by the large fireplace*, is likely to set the stage for the resolution of anaphoric links back to this sentence, for example from the next sentence, *He hoped it would be without onions*. A well-specified mental model of the meal scene in the first sentence will make it a straightforward matter to link *he* to the husband, and *it* to the meal. A less well-specified model could result in a confusing linking of *it* to *the fireplace*.

Previous studies have adopted multivariate techniques to control for lower-order difficulties in vocabulary and syntax while investigating the unique contributions of higher-order cognitive processes to reading comprehension. Some of these higher-order processes have been inference making, text structure awareness, and comprehension monitoring (e.g., Oakhill & Cain, 2012). Similarly, by taking lower-order correlates of text comprehension into account, the present study aimed to obtain a first assessment of the contribution of pronominal resolution to text comprehension. In the present study, contributions to comprehension from the word and single sentence levels were taken into account before the contribution to comprehension from pronominal resolution was studied.

The present study focussed on pronominal understanding at *three levels*:

1. At a basic level, *pronominal knowledge* comprises knowledge of the semantic and syntactic contexts in which various pronouns may be used. For the current study, the French adverbial pronouns *en* and *y* ('there' and several other meanings) were employed in a measure of pronominal knowledge. The distribution of these pronouns is somewhat complicated but not traditionally taught in schools. *En* is used to replace an object that is preceded by the preposition *de*, as in *Il revient tout juste de Paris* ('he has just come back from Paris') > *Il en revient tout juste*. (literally 'he from there has just come back', i.e., 'he has just come back from there'). In contrast, *y* is used to replace an object that is preceded by the preposition *à*, as in *Il habite depuis dix ans à Paris* ('he has lived in Paris for ten years') > *Il y habite depuis dix ans* (literally 'he there has lived for ten years') (Grevisse, 1993). In the present study, this level of implicit pronominal knowledge was assessed in a pronoun selection task with *en* and *y* (see the Methods section below). This task allowed us to address the question whether this basic level of pronominal knowledge contributes independent variance to reading comprehension over and above vocabulary knowledge and syntactic knowledge. At the same time, this measure served as a control for basic pronominal knowledge that might influence the more advanced measures of referent specification.

2. *Referent specification* was studied at the inter-sentence level by means of a task where the participants had to *specify the referent*, rather than just select an appropriate pronoun. The question was whether the ability to specify the referent accounts for unique variance in reading comprehension when basic pronoun knowledge (as in (1) above) has been taken into account. This question was answered with respect to two levels of referent specification. At the simple level, subject pronouns (*il*, 'he', *elle*, 'she', and plural forms) may be relatively easy to resolve because subject pronouns have a narrow antecedent variability since the referent is always a noun phrase. For example, *Son seau à la main, la pauvre femme alla au puits chercher de l'eau. Elle se pencha ...* ('With her bucket in hand, the poor woman went to the well to fetch water. She bent forward'). The pronoun *elle* ('she') refers to the woman, and the processing is very easy because only the woman is introduced in the

preceding context, and the gender cue is sufficient to identify the pronoun. In addition, the subject of the preceding sentence is likely to be relatively salient. During primary school, French children are taught that the main function of pronouns is to refer to either a noun phrase or a proper name. So even though a reader may have to remember (or look for) the specification of the pronoun in the preceding sentence, the referent is the protagonist and, thus, salient. Even so, referent specification in such simple cases may be associated with individual variation of importance for reading comprehension.

3. *Referent specification* was also studied with pronouns that typically refer to variable antecedents. Some pronouns, like *en* and *y*, are typically used to refer to a much wider range of antecedents than other pronouns such as *il* and *elle*. Hence, the specification of the referents of these pronouns places high demands on the quality of the mental model of the previous part of the text. The scope for antecedents of *en* and *y* is wide (see the Appendix). Antecedents may be *locations, categories* (of which only some entities are referred to) as in *Pierre aime les pommes. Aujourd'hui, il en a acheté cinq* ('Pierre loves apples. Today, he bought five of them'). Antecedents may be single words, phrases, clauses, or whole arguments (compare with English *this*). Variable antecedent scope raises the question about the importance of readers' ability to specify the referents of pronouns despite large antecedent variability: does the ability to handle antecedent variability explain unique variance in reading – even when lower level pronoun knowledge and reference resolution are taken into account? In order to answer this question, the study employed a test of *referent specification* that comprised two different types of pronouns: one type (subject references) with a *narrow variability* (*il, elle, ils*), (2, above) and one type with a *wider variability* (*en, y*).

In sum, the general purpose of the study was to assess pronominal knowledge and referent specification as markers of higher order reading comprehension. More specifically, the purposes were to investigate:

(1) whether children's basic *knowledge* of the uses of pronouns and the semantic-syntactic contexts in which they occur contributes independent variance to reading comprehension. The question was whether such sensitivity would contribute

independent variance to reading comprehension over and above vocabulary knowledge and syntactic knowledge as measured by standardized tests. At the same time, pronoun knowledge (pronoun selection) worked as a control measure for the following two measures of referent specification.

(2) whether children's ability to *specify the referents* of pronouns across sentence boundaries contributes further variance to the children's reading comprehension once their basic knowledge of the pronouns is controlled.

(3) whether the ability to cope with *antecedent variability* plays a unique role in reading comprehension, since antecedent variability requires a well specified mental model of the text.

Method

Participants

One hundred and thirty third-grade children were randomly selected to participate in the study. They were all of the children in six classes – four classes from Paris and two from Nantes – from five elementary schools. All children were born in France and were exposed to spoken French from birth. None of the children had behavioral or language difficulties according to their teachers. Seven children had incomplete data mainly because of school absence on one or more test occasions. Subsequent data analyses were performed with 123 of the children from whom full data sets were available. The average age of the 123 children (66 boys and 57 girls) was 8;9 years (SD=4 months).

Materials and Procedures

Reading comprehension

Since there is no standardised test of written text comprehension in French for grade 3, a new test of reading comprehension was developed as a part of a larger project on children's reading comprehension development in French (ANR DEVCOM 2010-14). The new test was modelled on traditional question-answering tests like the NARA II (Neale, 1997) and the YARC (Snowling, et al., 2010). Measures of test validity are not yet available, however the strong correlations with vocabulary, syntax, and pronoun specification found in the present study suggest a high validity. The test was not

developed with the present study in mind and is neither more nor less sensitive to pronominal understanding than other tests of reading comprehension. A post hoc analysis showed that 4 of the 67 questions of the test involved understanding of pronouns. The test comprised four narrative and two expository texts with text lengths between 264 words (16 sentences) and 414 words (30 sentences). Each text was followed by 10 – 12 questions, providing a total of 67 questions. The questions required both literal and inferential comprehension. The participants were presented with texts and questions in separate booklets so as to make it easy to switch between texts and questions, and to search texts for clues to questions. Each question was followed by a dotted line on which the child was required to write his or her response. The expected responses were short – just single words or phrases. No time restrictions were imposed. The score was number of correct responses (max=67) irrespective of misspellings.

Written word identification

This test was a one-minute test in which the participant is given one minute to read aloud as many words as possible from a list of words of increasing difficulty. The word list had 50 words which were selected from the larger project on children's reading comprehension development (project ANR DEVCOM 2010-14). Words were one to three syllables long and the list comprised 30 regular and 20 irregularly spelled words. Each child was instructed to read the best he or she could, and informed that reading time was limited. The score was number correct words read per minute. Hence, the score could be higher than 50 if a child completed the list in less than a minute.

Vocabulary

Receptive vocabulary size was measured with the EVIP (*Echelle de Vocabulaire en Images Peabody*, Dunn, Theriault-Whalen, & Dunn, 1993) which is a French adaptation of the Peabody Vocabulary Test (Dunn & Dunn, 1981). For each item, a word is spoken by the administrator and the participant is asked to point to the corresponding picture out of a selection of four pictures. Unlike the original PPVT, which uses an adaptive procedure, all participants were presented with the same 35

items selected to be suitable for the particular age group. The score was number of correct selections.

Syntactic knowledge

Receptive syntactic ability was assessed with the ECOSSE (*Epreuve de compréhension syntaxico-sémantique*, Lecoq, 1996) which is a French adaptation of the TROG (*Test for Reception of Grammar*, Bishop, 1983). For each item, a sentence is spoken by the administrator, and the participant is asked to indicate the corresponding picture out of a selection of four pictures. Sentences are ordered by increasing difficulty. Fourteen age-appropriate sentences were selected for the present study. The score was number correct.

Pronoun knowledge

The materials for the pronoun knowledge task consisted of fifteen short texts each containing two sentences. The length of the texts varied from 19 to 40 words. The first sentence of each text supplied the context and the second sentence contained a blank space from which a pronoun (*en* or *y*) had been omitted. For example: *Dans la ville, le conservatoire recevait plein de jeunes enfants dès l'âge de cinq ans. Dans celui-ci, on _____ apprenait aussi à jouer de la guitare.* ('The conservatory in the town received many young children from the age of five. In this one, students *here* could also learn to play the guitar'). The expected response was *y* ('here'), because it refers to "au conservatoire" ('at the conservatory') (see the introduction). In order to introduce heterogeneity, *en* could either refer to a noun phrase, or to a noun describing a quantity, or more rarely to a prepositional noun phrase referring to a location. The 15 short texts were presented in a booklet of five pages, and the participants were told that a word was missing from each text. They were instructed to complete each text by filling in either *en* or *y*. Two examples were given to ensure that the participants understood the task. The score was percentage correct to facilitate comparisons of scores across measures.

Referent specification: subject

The referent specification tasks were parallel to the pronoun selection task except that the participants were asked to *specify* the referent of selected pronouns. In practice, this meant that the participants were asked to locate the antecedent and phrase it in a way that was suitable for the sentence containing the pronoun. Six of the pronouns were subject pronouns – *il* ('he, it'), *elle*, ('she, it'), or *ils* ('they'). These six pronouns were the basis of the current measure of referent specification of subject pronouns. Another 17 items involved the pronouns *en* and *y* (see the measure below). In the example mentioned in the introduction, *Son seau à la main, la pauvre femme alla au puits chercher de l'eau. Elle se pencha ...* ('With her bucket in hand, the poor woman went to the well to fetch water. She bent forward ...') the pronoun *elle* refers to the woman, and the processing is simple because only the woman is introduced in the preceding context. These basic pronouns can be described as having a narrow variability, since in this task only one referent matched in number and gender and it was always a protagonist from the preceding sentence. In each short text, the pronoun was highlighted, and the children were asked to read the texts and then to identify the referent of the pronoun – to find “the word or words that could take the place of the (highlighted) pronoun” – and write their response on a line just below the text. There were six texts with subject pronouns. The score was percentage correct of 6, and the scoring did not take spelling errors into account.

Referent specification: variable

Seventeen of the pronouns in the referent specification task were *en* and *y*. These pronouns refer to a wide range of antecedents as explained in the introduction (and in the Appendix). The antecedent was an object complement in four items, it was a location in three items, and a quantity noun referent in three cases. In the remaining seven texts the antecedent was a whole proposition describing an idea or an action. Since the pronouns *en* and *y* are not formally taught in schools, the children were told explicitly that *en* and *y* are pronouns, and the pronouns were highlighted as were the subject pronouns above. The children were given four training examples, of which two pronouns referred to a single word and two referred to a whole proposition. The

scoring of the responses did not take spelling errors into account. The score was percentage correct out of 17.

General procedure

Children were tested in small groups (of 6 to 8 children) in five sessions lasting from 15 to 60 minutes and in one individual session (with written word identification). Reading comprehension, vocabulary and syntactic knowledge tests were administered in three group sessions. The pronoun selection and specification tasks were administered in the two final sessions. The texts for the pronoun selection and specification tasks were presented in three different random orders in different booklets so as to prevent children copying from each other.

Results

The scores for all variables were normally distributed (Table 1 provides the descriptive statistics). The measure of syntax (listening TROG) had a low internal homogeneity (Cronbach's $\alpha = .52$). However, the correlation with reading comprehension was strong ($r = .61$) (Table 2) and at the same level as that with the other independent variables, suggesting that the reliability of the syntax measure was at least adequate. All measures were moderately to strongly correlated with reading comprehension (Table 2). The correlations among the other measures (the predictors) were generally lower, suggesting that co-linearity was not a serious issue in the regression analysis to follow.

 Tables 1 and 2 go here

A fixed-order multiple regression analysis, with the reading comprehension measure as the outcome variable, was conducted to address the research questions (Table 3). Performance on the word identification measure was entered at the first step, followed by the measures of vocabulary and syntactic knowledge (TROG listening comprehension) at steps 2 and 3. As predicted from the simple view of reading (cf. Tunmer & Chapman, 2012), each of these measures added unique significant variance to the measure of reading comprehension.

At the fourth step, the pronoun selection task was entered as a basic measure of the children's knowledge of the pronouns in the referent specification task. This task contributed a relatively large amount (10 %) of variance to reading comprehension suggesting that knowledge of the pronouns and the semantic-syntactic contexts into which they fit is an important indicator of reading comprehension, even though, for the present task, inter-sentence comprehension was not strictly required.

At the fifth and sixth steps the referent specification task was entered – with the narrow variability items first and the wider variability items last. Both of these types of items contributed significantly to the variation in reading comprehension. This result indicates that the ability to use inter-sentence information to specify the referent of pronouns is indeed an indicator of reading comprehension. All in all, the independent variables accounted for two thirds of the total variance in reading comprehension.

 Table 3 goes here

Discussion

The results support the idea that pronoun knowledge and anaphor resolution across sentences are good indicators of reading comprehension beyond the word and sentence levels. The answers to all three research questions were positive.

First, both pronoun knowledge and referent specification abilities contributed independent variance to reading comprehension, after decoding, receptive vocabulary and syntactic knowledge had been accounted for. The contribution from the pronoun tasks to reading comprehension was sizeable. Even though word and sentence level measures accounted for more than 50 % of the variance in reading comprehension, the pronoun measures accounted for more than a further 15 % of the variance – presumably near the limit set by the reliabilities of the measures.

Second, the results indicated that referent specification is an independent correlate of reading comprehension. The correlation between referent specification and reading comprehension was not entirely a matter of experience with and knowledge of pronouns (*en* and *y*). The ability to *specify* the referents of the *same*

pronouns across sentence boundaries contributed further variance to reading comprehension.

Thirdly, the ability to cope with antecedent variability was indeed found to make a unique contribution to variation in reading comprehension. Children were generally better readers when they were able to specify the antecedents of the pronouns *y* and *en* despite the variation in the grammatical and semantic functions of their antecedents.

Taken together, the results are in line with the idea that a referent specification task taps the quality of the mental model that the reader can create from the previous part of the text. The task in the present study was certainly not an online measure of comprehension because the participants were stopped and asked to think about the referents of pronouns. Rather, the referent specification task can be seen as a test of what is in the mental model of the preceding part of the text *or can be added* to it when needed.

Obviously, problems with the referent specification task can stem from other difficulties than a lack of specification of certain semantic roles that a pronoun refers to in the mental model. Another source of problems is difficulty with the analysis of the referring sentence that contains the pronoun. A further third source is lack of knowledge of the pronoun itself. The task demanding pronoun knowledge (selection) was intended to be a control measure of these other sources of difficulty. Hence, the study indicated that even when these other sources of comprehension difficulty are controlled, there is still a sizeable amount of variability in comprehension that can be accounted for by the quality of the mental model of the preceding sentence.

The limitations of the study have mainly to do with a possibly limited sensitivity of some of the measures, particularly the measure of subject pronoun specification. This measure was based on only six items and may have had limited sensitivity, though the reliability was high. In addition, the six items occurred in short texts that were also used to assess the specification of pronouns with variable antecedents. The shared context for the different items may have inflated the correlation between the two measures of pronoun specification (subjects and the wider range). The inflated correlation means that the independent variance associated with the variable pronoun specification measure may have been restricted. Hence, the results may

underestimate the true importance of the ability to specify pronouns with variable antecedents as an indicator of reading comprehension.

There are several reasons why it may be more difficult to specify the referents of *y* and *en* type pronouns than referents of subject pronouns. It is not just that subject pronouns are taught (in French schools) whereas *y* and *en* are not. *Y* and *en* also carry very little semantic information about the referent (no gender, number, or case marking), and they give only weak indications that the reader needs to make a link to a referent. Hence, variability of the antecedent is not the only challenge that *y* and *en* pose for the reader. However, these challenges only serve to make the referent specification task more demanding. If anything, they increase the demands for a well specified mental model of the previous part of the text.

In sum, the results indicate that pronoun knowledge and referent specification are good indicators of higher order comprehension processes. Referent specification requires access to a well-specified mental model of the previous part of the text.

Further research is needed to see how these results generalise to other languages. Adverbs (e.g., *there*) can have pronominal functions that resemble the functions of *y* and *en* studied here. More interesting candidate pronouns in English (and other Germanic languages) would be demonstrative pronouns (*this, that, these, those*) because they can have multiple antecedents – single words, phrases, and whole utterances. The inclusion of demonstrative pronouns may also allow for another extension of the present study. Demonstrative pronouns may optionally be followed by the general semantic category of the referent, compare *this* with *this rule* or *this orthographic rule*. Differences in pronominal understanding may be more pronounced – and more tightly associated with general reading comprehension – for the less specific reference (*this*) than for the semantically supported ones (*this rule*).

Further research is also needed to see to what extent the present results generalise to listening comprehension. ‘The simple view of reading’ posits that variance in reading comprehension is a function of the product of word decoding and language comprehension (Hoover & Gough, 1990). In the present study, word decoding (written word identification) was controlled at the first step of the regression analyses. So under the simple view, the present study was entirely concerned with aspects of the language comprehension component and their

importance for reading comprehension. Hence, the results from the present study would be expected to generalise to listening comprehension.

The present study provided an indication that searching for and retrieving a subject (agent) from the preceding sentence is not the same as searching for a variety of other semantic roles. Hence, an important extension of the current study would be to investigate readers' access to referents that occupy specific semantic roles in the mental models. The present study comprised access to text subjects (protagonists or 'agents'), objects, and locations. However, the study employed different pronouns making it difficult to separate effects of different pronouns and the semantic roles of the antecedents in their sentence context. Future studies could compare children's ability to locate and specify antecedents that occupy different semantic roles in the sentence. Such an assessment could be valuable for individual profiling of reading comprehension because some children may have mastered subject referents but not 'instrument' or 'location' referents, while other children may present other reading comprehension profiles.

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Table 1

Descriptive Statistics of the Measures

<i>Measures</i>	<i>Mean</i>	<i>SD</i>	<i>Cronbach's α</i>
Reading comprehension (N = 67)	41.9	12.7	.92
Written word identification (correct / minute)	50.4	14.5	.92 ^(a)
Vocabulary (N = 35)	22.3	5.0	.77
Syntax (listening) (N = 14)	10.8	1.8	.52
Pronoun knowledge (%)	82.6	15.2	.66
Referent specification: subject (%)	73.1	32.7	.84
Referent specification: variable (%)	38.0	28.0	.86

Note. ^(a) based on accuracy scores

Table 2

Pairwise Correlations Between Measures

<i>Measures</i>	RC	WI	Voc	Syn	PKn	RSs	RSv
Reading comprehension	-						
Word identification	.45	-					
Vocabulary	.64	.44	-				
Syntax (listening)	.61	.41	.56	-			
Pronoun knowledge	.60	.17	.42	.41	-		
Referent specification: subject	.55	.26	.43	.47	.37	-	
Referent specification: variable	.64	.42	.49	.56	.34	.66	-

Note. Correlations above .18 are significant at the .05 level.

Table 3

Fixed Order Hierarchical Multiple Regression Analyses, with Performance on the Comprehension Test as the Dependent Variable (N = 123).

<i>Step</i>	<i>Independent variable</i>	<i>R²</i>	<i>ΔR²</i>	<i>β (final)</i>
1	Word identification	.202	.202**	.11
2	Vocabulary	.444	.242**	.22**
3	Syntax (listening)	.517	.074**	.14
4	Pronoun knowledge	.615	.097**	.32**
5	Referent specification: subject	.642	.027**	.07
6	Referent specification: variable	.671	.029**	.26**

Note. ** p < .01