THE ROLE OF VERB-TRANSITIVITY PREFERENCE IN SENTENCE PROCESSING BY READING DISABLED ADOLESCENTS

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Abstract

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The influence of verb-transitivity preference in sentence processing was investigated in two self-paced reading experiments with normal and reading disabled readers. Experiment 1 compared reading times of Learning Disabled (LD) adolescents diagnosed with reading disabilities with those of normal college students. Experiment 2 compared another group of LD adolescents with reading disabilities with age-matched normal readers. Preferred-transitive (e.g., *visit*) and preferred-intransitive (e.g., *walked*) verbs were inserted into transitive (e.g., *The child visited/walked his dog*) and intransitive (e.g., *The child visited/walked with his friends*) syntactic frames. The results from the normal control groups showed an interaction between verb preference and sentence type and a significant difference between verb preferences in transitive frames. The results from the LD groups showed only a significant difference between verb preference in the transitive contexts in Experiment 1 but no difference between verb types in Experiment 2. The pattern of results from the normal readers supports a version of the lexicalist approach in parsing. According to this approach, sentence parsing is primarily determined by the nature of verb-syntactic frames. The pattern of results from the LD groups suggests a tendency for a verb-syntactic deficit in reading disability.

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Table of Contents

List of Figures

List of tables

Introduction

Verbs are central to language representation and useful because they specify the nature of the events that sentences describe and the nature or the role of the participants in these events. For instance, in a sentence such as (1a), it is clear that the verb *visited* describes the event in which *The boy* and *his dog* are participants and it is clear that it is *the boy* that plays the agent role while *his dog* plays the patient or theme role in the event.

(1)

a. The boy visited his dog.

b. The boy visited last night.

c. The boy was visited last night.

In (1b), however, although *visited* describes an event of similar nature as that of (1a), the role played by *the boy* is not the same as the one in (1a) because there is no specified agent acting upon *the boy*. In (1c) although it has a similar structure as (1a) the verb is taken in its intransitive frame and does not require a direct object.

In the case of (1a), *his dog* is an argument of the verb (it is required by the verb). The verb *visited* is a preferred-transitive verb, meaning that it prefers to be followed by a direct object. In the case of (1c), *last night* is an adverbial phrase, which can be taken as the adjunct of the verb (not part of the verb argument structure). While arguments are taken to designate key properties of the event or state labeled by the verb, adjuncts further specify temporal (1c) or spatial properties of the event or state referred to by either the verb or the whole sentence (see Appendix A for more information about verb specific information).

Any normal native speaker of English can compute the information required by the verb, that is, it can be used in transitive contexts such as in (1a) or (1b), or in intransitive contexts such as in (1c). Furthermore any breakdown in the knowledge of verb-specific information, can cause deficits of production or comprehension that affect the whole sentence structure.

The role that verbs play in language comprehension has been the focus of numerous studies in language processing in aphasics as well as in normals (e.g., Clifton & Duffy, 2001; Gahl, 2002). However, thus far, there have been no studies exploring whether or not verb-specific knowledge may be disrupted during real-time reading by children with reading comprehension difficulties. Research in the field of reading disabilities has largely focused on phonological and lexical aspects of linguistic knowledge during discourse comprehension (e.g., Cain, Oakhill & Bryant, 2000; Hacker, 1997; Mann, Cowin & Schoenheimer, 1989; Nation & Snowling, 1998). Additionally, there are only a few studies investigating the syntactic knowledge in sentence comprehension in reading disabled children. Among these studies, there have been mixed results regarding which aspects of syntactic knowledge may be disrupted in reading. Researchers have failed to reach a consensus regarding whether or not there is a syntactic deficit in diagnosed reading disabled children and adolescents that have no deep or surface dyslexia. Studies conducted by Christiaen, Bashir, and Kruger (1990) and Glass and Perna (1986) found that readers with comprehension difficulties have no specific syntactic impairments. On the other hand, researchers like Nation and Snowling (2000) found that poor readers show signs of having a syntactic deficit.

The role of verb-specific representations in parsing (i.e., in the computation of the syntactic structure of sentences) has been the focus point of much of the current research on sentence processing. Research in this area has led to the development of two main models, the constraint-based model (e.g., McDonald, Perlmutter, & Seidenberg, 1994; Tanenhaus & Trueswell, 1995; see also Homes, Stowe & Cupples, 1989) and the garden path model (e.g., Ferreira & Henderson, 1991; Frazier, 1987; Frazier & Clifton, 1996). The former assumes that all parsing proceeds from the computation of lexical representations together with contextual information. The latter predicts that parsing proceeds mostly from the computation of syntactic structures without lexically-specific information (such as information about a verb's argument structure) playing a primary role in parsing decisions.

The present study focuses on the syntactic information provided by the verb and how learning disabled (LD) adolescents classified as poor readers according to standard LD evaluation tasks process different types of syntactic constructions. The first section of this paper briefly reviews the research on the role of verb information in parsing from the perspective of the main theories of sentence processing. The goal is to outline the psycholinguistic framework that motivates the present research. In the second section, current research on reading comprehension conducted with children with and without reading difficulties is discussed. Finally, the third section of the paper reports two experiments conducted with adults and adolescents with and without reading disabilities. These results are then discussed taking into account the implications of the present research for both, the parsing literature and the study of reading deficits.

The Role of Verb Information in Parsing

As illustrated in (1a), (1b) and (1c) above, it seems that verbs that allow for multiple argument structures constitute the majority of cases, rather than the exception (see Levin, 1993, for a survey of verb classes and their properties). From a processing perspective, the problem is that verbs with multiple argument structures cannot inform the reader in advance whether or not incoming phrases are to be taken exclusively as arguments (thus attached internally to the verb phrase (VP)); or whether they constitute a new branch in the parsing tree (e.g., as in adverbial or prepositional phrases). One can imagine a sentence that unfolds just like (2a) below, but that can continue with noun phrases (NPs) and adverbial phrases (AdvP), which need a "landing site" at the syntactic structure, as in (2b) and (2c):

(2)

a. The door closed.

b. The door closed the hallway to intruders.

c. The door closed the way it never did before.

Readers or listeners of these sentences may be led to take the NP *the way* in (2c) as being the direct object of *closed*, just as *the hallway* in (2b), although it heads an adverbial clause that further specifies the manner in which the door closed.

Thus, it is clear that verbs play a key role in determining how phrases will be analyzed in the structure of the sentence. The question is whether this role is played as new words and phrases arrive at the sentence processor or after initial phrase structure decisions have been made based on syntactic principles. In recent years, much of the research on sentence comprehension has focused on providing an answer to this question.

In particular, studies have investigated whether parsing choices are primarily determined by verb information such as subcategorization and thematic structure, or whether they are determined primarily by syntactic principles of phrase structuring. These two views have led to two major theories of sentence processing: the garden path theory proposed by Frazier, Clifton and colleagues (see, e.g., Clifton & Duffy, 2001 for a review) and the lexicalist, constraint-satisfaction theory, proposed by, among others, Tanenhaus and Trueswell (1995) and McDonald et al. (1994).

Both models assume that verb information is central to the correct parsing and consequently to the comprehension of a sentence. The models differ radically on the role verb information (and lexical information in general) plays in sentence processing. For the garden path model, lexical information plays a role only during a second parse (e.g., Kenninson, 2002; Frazier, 1978, 1987; Ferreira and Henderson, 1991). For the lexicalist model, the process of sentence comprehension relies primarily on information accessed at each lexical entry jointly with information provided by the context (e.g., Gahl, 2002; McElree, 1993; Shapiro, Gordon, Hack & Killackey, 1993; Shapiro, Nagel, & Levine, 1993; Shapiro, Zurif & Grimshaw, 1987, 1989; Trueswell & Kim, 1998; Trueswell, Tanenhaus & Kello, 1993).

The garden path model relies on the assumption that there are parsing principles guiding the analysis of sentences during language comprehension. These parsing principles operate autonomously and are initially independent of lexically-specific information. The main principles of the garden path theory are minimal attachment and late closure. The principle of minimal attachment states that the parser always assumes the simplest possible analysis in terms of structural branching of sentences. Thus, readers

take longer to read the italicized word in sentences like (3b) than in sentences like (3a). This is because, according to Frazier (1978; cited in Frazier & Clifton, 1996), the sentence with conjoined NP's as in (3a) (*John and his brother*) is simpler, i.e., has fewer structural nodes than a sentence formed by two conjoined clauses (as in (3b)).

(3)

a. Mary kissed John and his brother *when* she left.

b. Mary kissed John and his brother *started* to laugh.

The assumption is that this simplicity principle (minimal attachment) is the default given the speed and accuracy that the parser aims for in the analysis of sentences.

Another important principle proposed by Frazier and her colleagues is that of late closure. The late closure principle says that, as new phrases are processed, they are attached (that is, linked hierarchically) to the higher phrase, which is already being processed. As an example, take a sequence of sentences such as (4). As the parser is processing (4a), it takes the next incoming phrase to be the direct object of the verb *knew*.

(4)

a. John knew…

b. John knew [the answer to the difficult problem].

c. John knew [the answer to the difficult problem] by heart.

d. John knew [the answer to the difficult problem] was wrong.

Therefore, it attaches the NP directly to the VP assuming the NP is a complement of the verb. This is the correct analysis for (4c). However, if the sentence turns out to be (4d), with the NP as the subject of the complement clause, the parser produced the incorrect analysis and needs to revise it. Frazier, Clifton and their colleagues produced an

enormous amount of evidence with diverse types of sentence structures supporting these principles (see Frazier & Clifton, 1996).

The proponents of the garden-path model argue that we first recognize the syntactic structure of a sentence and then we fill in its components. Reanalysis occurs when the default structure does not correspond to the already constructed structure. The thematic processor guides reanalysis by taking into account the lexical and contextual effects (Frazier, 1978; cited in Frazier and Clifton, 1996). According to the garden-path model, the degree of difficulty to comprehend a sentence depends on the number of revisions needed in order to understand it (Clifton & Duffy, 2001). Preferred and non-preferred sentences exist depending on the complexity of the sentences. A preferred sentence is one in which there is no element of ambiguity and therefore it is easy to process. A non-preferred sentence would take longer to comprehend, as the first parse path needs to be revised.

Ferreira and Henderson (1991) reported an experiment in which they varied the thematic structure of sentences. The materials included sentences with long ambiguous regions with early closure (5a) or late closure (5b), and with short ambiguous regions with early closure (5c) or late closure (5d). In addition, the verbs used in this study were highly transitive (e.g., *defeat*), highly intransitive (e.g., *jog*) or neutral (both frames were equally preferred, e.g., *race*).

(5)

a. After the Martians invaded the town that bordered the city was evacuated.

b. After the Martians invaded the town that bordered the city the residents were evacuated.

c. After the Martians invaded the town was evacuated.

d. After the Martians invaded the town the residents were evacuated.

Subjects were asked to read sentences and judge each sentence as grammatical or ungrammatical. They predicted that if the thematic information plays an important role in the first parse of a sentence, then sentences containing long ambiguous regions would be far more difficult to parse when the verb is neutral as opposed to when the verb is biased. It was found that the longer the ambiguous region was the more difficult it was to be re-analyzed. Moreover, they noted that the effect of length was more important for early closure than for late closure. The results of this experiment yielded support for their prediction; the syntactic frames are constructed previous to the validation of verb specific information.

By contrast, the constraint-based model, which is an interactive model, states that the syntactic alternatives are processed in parallel. The ability to access all the syntactic alternatives depends on factors such as frequency and contextual congruency (Boland, 1997). This model makes great use of the syntactic information during the initial parsing of a sentence. It takes into account both the lexical and contextual effects. All the possible grammatical structures are accessed at once and some higher-order processes come to a decision regarding which is the most likely structure. Since all the information is processed at once, this model assumes that preferred and non-preferred sentence structures do not exist; at any given point the correct syntactic structure is computed.

This model assumes that during the first parse, the verbs provide us with several types of information regarding possible complements (Shapiro, Nagel et al., 1993). First, the subcategorization/argument structure of the verb is consulted. Given the verb *sleep*, which is strictly intransitive, followed by a direct object (*the bed*) as in (6a) the parser will immediately inform us that the sentence is not grammatical.

(6)

a. Joelle slept the bed.

b. Joelle hoped the answer was wrong.

Secondly, if the verb allows only a sentential complement, the NP (*the answer*) following the verb like in (6b), will be immediately taken as the subject of the embedded clause. In this example, the verb *hope* is known to be followed preferably by a sentential complement over a direct object. When parsing a sentence like (6b), and reading the verb we know that the following word will be an NP, which will be the subject of the embedded clause because this is what the verb demands. If the NP is not the subject of the embedded clause, then reanalysis will be necessary.

Thirdly, if a verb allows multiple subcategorizations, these are hierarchically ordered by preference. For example, the verb *suspect* allows for both a sentential complement, as in (7a) and a direct object as in (7b) (Holmes et al., 1989). This preference will influence the ease of the first parse of the sentence.

(7)

a. I suspected the boy.

b. I suspected that the boy was wrong.

When reading sentences such as (7a) and (7b), the verb preference for a certain syntactic structure will influence its parsing. The most preferred frames will be read faster than the less preferred frames, because no reanalysis will be necessary. Accordingly, this model suggests that the words in the sentence are first attached on the basis of the lexical information provided by the verbs, and then only is the syntactic information analyzed. Shapiro, Holmes, Clifton and others provided an extensive body of evidence supporting this view.

According to the lexicalist model, upon encountering a verb, the preferred argument structure of the verb is activated. A non-preferred argument structure will require the reanalysis of the sentence, which will increase the processing load for the reader.

Shapiro and colleagues (e.g., Shapiro, Nagel, et al., 1993; Shapiro, Gordon, et al., 1993) reported several experiments in which the cross modal lexical decision task (CMLD) was used to measure processing load at the verb and post-verbal positions during sentence processing. Participants listened to sentences, and at either the verb or the NP complement they were asked to make a lexical decision (decide whether the string of letters appearing on the screen forms a word in English or not). Reaction time (RT) to the lexical decision is measured.

In one study employing this technique, Shapiro, Nagel, et al. (1993) manipulated verb transitivity preference. The preferred sentences are formed when the sentence type coincides with the verb type. They predicted that when verbs are found in the non-preferred frame comprehension is disrupted. Shapiro, Nagel, et al. (1993) showed that

lexical decision took longer for the non-preferred sentence type in comparison to the preferred sentence type.

On the contrary, Schmauder (1991) and Schmauder, Kenninson and Clifton (1991) showed that these results are not generalizable. In an attempt to determine whether the argument structure paradigm was generalizable to other on-line tasks, Schmauder (1991) and Schmauder et al. (1991) conducted a series of experiments using different paradigms. They used five categories of verbs: transitives, intransitives, nonalternating datives, alternating datives, two-complement and four-complement. The different paradigms included: eye movements, cross modal naming and CMLD. The results obtained by Shapiro, Nagel, et al. (1993), Shapiro, Gordon, et al. (1993) and Shapiro et al. (1997) were not replicated.

The verb subcategory preference can also be characterized in syntactic terms as distinction between arguments and adjuncts. The distinction between an argument and an adjunct is the fact that the latter indicates a non central aspect of the action and the former indicates a central aspect of the action. Kennison (2002) reported an experiment in which she manipulated the verb type using biased transitive verbs with a noun phrase argument (8a) and a noun phrase adjunct (8b) and biased intransitive verbs with both a noun phrase argument (8c) and a noun phrase adjunct (8d).

(8)

a. Everybody knew that Meredith read every play despite her busy schedule.

b. Everybody knew that Meredith read every week despite her busy schedule.

c. Everybody knew that Meredith performed every play despite her busy schedule.

d. Everybody knew that Meredith performed every week despite her busy schedule.

Kennison (2002) used a self-paced reading paradigm and an eye-tracking device to measure reading time. She found that sentences containing biased transitive verbs were read significantly faster when followed by an argument as opposed to an adjunct. No significant difference in reading time for a biased intransitive verb embedded in a transitive or intransitive frame was observed. The results show that the lexical information provided by preferred-transitive verbs affects first pass parsing.

Clifton (1993) reported an eye-movement study in which he manipulated the NP (animate/ inanimate; plausible/non-plausible) and ambiguity (presence/absence of comma) in sentences. All verbs used permitted an agent/theme ambiguity. For example, in a sentence like (9) there is a tendency for the NP (the Datsun) to be taken as the direct object of the verb when in fact it is the NP subject of the subordinate clause.

(9)

a. While the police stopped the Datsun disappeared into the night.

b. While the truck stopped the Datsun disappeared into the night.

Eye movements recorded in this experiment demonstrated that an NP following an ergative verb (its actions affect the subject and not the object of the verb) with an inanimate subject is initially taken as the object of that verb. An unusual assignment of the thematic role to an inanimate NP will result in an increased reading time at the post

verbal information. The results support the view that the thematic information, subcategorization, etc., are used during the first parse of the sentence.

McElree (1993) reported two experiments that examined the syntactic information provided by the verbs, much like Shapiro, Nagel, et al. (1993). He used two different paradigms, moving window paradigm and speed-accuracy tradeoff (SAT). The syntactic information was manipulated by creating pairs of similar sentences in which only the verb preference and the sentence frame were manipulated. The verbs were either transitive or intransitives and they were embedded into transitive or intransitive frames. Three construction types were built within close constructions, early/late closure and filler gap constructions. He found evidence for parallel processing meaning that all the syntactic frames were activated at the same time but only the preferred one was retained. A significant interaction between the preferred and non-preferred frames was found. In addition, he found no differences in performance between the intransitive frames when a preferred-transitive or a preferred-intransitive verb was embedded. In contrast, within the transitive frames, a significant RT difference was found between preferred-transitive and preferred-intransitive frames at the post verbal information.

Trueswell and Kim (1998) reported a self-paced reading experiment also investigating verb transitivity preference. The subjects read a sentence such as (10) and briefly before seeing the main verb (e.g., *accepted*) another verb (e.g., *obtained*) would be presented for 39 ms. The sentence in example (10) is ambiguous because when arriving at *the fire,* the reader could either take it as the direct object of the verb or the subject of an embedded clause.

(10) The photographer accepted –obtained—the fire could not be put out

Despite the fact that the majority of people did not consciously detect the prime word, they were nonetheless influenced by its preferred argument structure. When a verb with a preference for direct objects was the prime word, the subjects would take longer to read the words in the disambiguating region of the sentence, since they were expecting a direct object. However, when the verb would prefer a sentence complement a significantly smaller reading time at the disambiguating region of the sentence was found, due to the expectation of having a sentence complement.

Gahl (2002) reported a sentence plausibility judgmental task with both normals and aphasics. Lexical biases (or argument structure preferences) were hypothesized to be responsible for some of the aphasic comprehension errors. The sentence frames were either intransitive with a preferred-intransitive verb (11a), active with a preferred-transitive verb (11b), or passive with a preferred intransitive verb (11c).

(11)

a. The butter melted in the pot.

b. The cook melted the butter.

c. The butter was melted by the cook.

In this experiment, the participants had to decide if the sentences heard over the headphones made sense or not. The results showed that both normal and aphasic patients made significantly more errors in interpreting the sentences when there was a mismatch between the lexical bias and the sentence structure. This shows that comprehension was affected by this mismatch between the verb preference for a certain structure and the actual structure of the sentence. Moreover, she demonstrated that normal listeners and some of the aphasics made significantly more errors in interpreting passive sentences

(active transitive) in the mismatch condition. These results suggest a difficulty in interpretation accuracy especially for transitive sentences.

As seen in the previous studies, the verb preference or frequency of usage plays a major role in sentence parsing. Reaction time, reading time, eye-fixations, stop making sense paradigm and other methods employed showed an increase in processing time when the verb was embedded in a non-preferred sentence frame as opposed to a preferred one.

For the garden-path model parsing is based on the preliminary computation of a syntactic frame. As we parse a sentence, the words will fill in the blanks of the parsing tree already established. The default structure is always the simplest structure possible. When the parser encounters a discrepancy, reanalysis occurs and the parser tries to attach it as high as possible in the parsing tree, in order to minimize the number of nodes. This model states that lexical information is accessed after the syntactic information. By contrast, the constraint-based model assumes an interactive parsing system. This model states that we process information in parallel so at any given point we have the correct syntactic structure.

There is a growing body of evidence showing that lexical information provided by the verb is made available during the first parse of a sentence. However, as Tanenhaus and Carlson (1989) argue these studies do not tell us precisely the form of the lexical information provided by the verbs and it might be the case that only verb syntactic alternatives are immediately available during parsing.

Sentence Processing in Children and LD Adolescents

As we have seen, research on the nature of the parsing system—and in particular on the role of verb-syntactic information in sentence processing—has lead to two main models, the lexicalist and the garden-path models. Thus far researchers in this field have not reached a consensus on whether or not the parser is initially guided by verb specific information. As we also have seen, the key to understand the nature of the parser is to understand how lexical preferences and structural principles may contribute to parsing decisions during on-line comprehension. Thus far, most of the investigation on the role of lexical information in parsing has focused on healthy adults (usually, college students) and aphasic patients (e.g., Gahl, 2002), with fewer studies focusing on how children and adolescents compute parsing preferences (e.g., Traxler, 2002). Yet even less attention has been given to sentence processing by learning disabled and reading disabled populations.

Among the few studies that investigated the role of verb-syntactic information in parsing in children and adolescents is Traxler's (2002). In a series of self-paced reading experiments, Traxler presented 8-to-11 year-old children with sentences such as (12) in which verb sub-categorization preferences and complement plausibility were manipulated.

(12)

a. While the boy drank the milk got warm and the food got cold.

b. While the boy drank, the milk got warm and the food got cold.

c. While the boy drank the girl ate some ham.

d. While the boy drank, the girl ate some ham.

In (12a), the NP *the milk* is syntactically ambiguous: it could be the direct object (argument) of *drank* or it could be the NP subject of the matrix clause. The sentence is disambiguated only when the matrix verb *got* is encountered. In (12b), however, the comma disambiguates the reading of the NP *the milk.* Moreover, in (12a) the NP *the milk* is a semantically plausible direct object for the verb *drank.* In (12c), the syntactic ambiguity remains but the NP *the girl* is not a plausible direct object of *drank.* Since, according to Traxler's own norms, the verb *to drink* is strongly preferred with a direct object, he reasoned that if children made use of the subcategory information to guide syntactic decisions, sentences such as (12a) and (12c) would be misanalyzed.

The RT at the main verb (*got*) was found to be significantly higher for sentences such as (12a) than for (12b) suggesting that children had misanalyzed the NP *the milk* as direct object of the subordinate-clause verb *drank* and had to recover from the garden-path once they have encountered the main verb. In the comparison between (12c) and (12d), however, the misanalysis of the sentence without the comma appeared earlier, at the noun head of the main-clause subject NP (*the girl*). Traxler interpreted these results as indicating that the semantic implausibility of the NP had an effect on the immediate analyses and misanalyses of the ambiguous sentences, suggesting that children take into account both syntactic subcategorization and semantic plausibility information at the verb. Although Traxler argued for the compatibility of his results with those supporting the garden-path theory, it seems that the results support a lexicalist view of sentence processing. Children seem to take information at the verb incrementally, adjusting the parsing structure of the sentence to the syntactic and semantic demands of the verb.

In a further experiment, however, Traxler used verbs that would never take a direct object, such as in (13).

(13)

a. When Sue fell the policeman stopped and helped her up.

b. When Sue fell, the policeman stopped and helped her up.

Traxler reasoned that if subcategory information is used immediately at the verb to guide parsing decisions, children would never misanalyze these sentences given that the verb *fell* can not take the NP *the policeman* as direct object. As in the previous comparisons, Traxler predicted that misanalysis would occur if there was a significant RT difference between nouns (*policeman*) or between main verbs (*stopped*) in the two sentences. The results show that the main verb in the comma-absent condition was slower than in the comma-present condition, suggesting that even though subcategorization information for pure intransitive verbs such as *fell* rules out a direct object NP, the initial parsing structure of the sentence probably took the NP *the policeman* as direct object of the subordinate verb. According to Traxler, this shows that information taken at the verb is not used initially to guide the analysis, but to guide reanalysis after a misparse of the sentence, just as predicted by the garden-path theory.

Since the ability to compute verb-specific information—whether in the first-pass analysis of the sentence or in its reanalysis—is key to successful reading comprehension, it is surprising that to this point researchers have not investigated extensively this issue in populations that show impaired reading comprehension in spite of spared word decoding abilities.

Among the few studies that have focused on syntactic knowledge in learning disabled readers (Glass & Perna, 1986; Nation & Snowling, 1998, 2000), there have been no reports of a syntactic-specific deficit associated with poor comprehension by learning disabled kids and adolescents. In their review of the literature up to the mid-80's Glass and Perna (1986) found only a few studies published in this area. Glass and Perna (1986) argued that, although LD readers performed below normal readers in a series of syntactic tasks, there was no causal link established between reading failure and syntactic deficits. This is because the studies they reviewed could not tease apart low performance in syntactic tasks from low reading comprehension in general, suggesting that poor performance by LD could be caused by other linguistic or non-linguistic systems of comprehension, beyond syntactic knowledge.

In their own study, Glass and Perna investigated syntactic comprehension in LD children and normal readers (grade 4) using the vocabulary and reading comprehension subtests of the Stanford Diagnostic Reading Test (SDRT) (Karlsen, Maden, & Gardner, 1976). A poor reader was defined as a participant who scored two years below his grade level in reading. An additional test of syntactic comprehension was administered. Glass and Perna predicted that if there was a central syntactic deficit, poor readers would also have difficulty computing syntactic information during listening. Participants were asked to listen to a sentence and then to choose one of four pictures presented in front of them. The sentences had complex subject NPs with relative clauses (such as in (14a) and (14b)), and explored temporal (14c) and spatial (14d) relationships between events and entities.

(14)

a. The policeman the girl asked pointed to it.

b. The mountain blocking the house from view was reflected in the lake.

c. Before the man shoveled the driveway, he built a snowman.

d. The comfortable chair was near where the boy sat.

Glass and Perna found a small difference in syntactic performance, but did not argue for a syntactic deficit in LD due to the small difference in the number of errors between the good readers and the poor readers on the syntactic tests. They argued rather that these differences should be due to the fact that poor readers have lower vocabulary skills, which could have affected their performance on the sentence-picture matching task. They suggest that poor readers have a more general linguistic deficit and that syntactic competence does not seem to be the main factor affecting comprehension. However, it could be argued that a syntactic comprehension in LD could be confined to reading only, that is, it could be the case that syntactic information is disrupted during visual access of word-specific information such as subcategorization information. Thus, contrary to Glass and Perna's predictions, it is possible that LD syntactic difficulties are not due to a central syntactic mechanism that would affect both reading and aural performance. Instead, it is possible that the syntactic information contained in the lexicon is disrupted during visual access. Thus, it is possible to conceive of a syntactic deficit that is specific to reading mechanisms.

Christiaen, et al. (1990) investigated comprehension of lexically and syntactically ambiguous sentences in adolescents with and without learning disabilities from different socio-educational backgrounds and levels of impairment. They measured reading

comprehension with the Test for Reading Comprehension (TORC) (Brown, Hammill, Wiederhold, 1978). They found a significant positive correlation (.59) between the scores on the Sentence Sequencing subtest of the TORC and the ability to understand syntactically ambiguous sentences as measured by the Interpretation of Ambiguous Sentences Test (IAST), developed by the authors. Moreover, they found a significant positive correlation between the scores on the Syntactic Similarities Subtest of the TORC and the ability to understand syntactically ambiguous sentences, as measured by the IAST. Overall, non-LD adolescents performed better than LD's in interpreting structurally ambiguous sentences. However, they found that performance in the tests was also a function of educational background and level of severity of learning disability. Honors students from a private school, for instance, performed better than regular students from a public school, suggesting that poor syntactic performance could also be due to spurious factors such as level of education and exposure to reading material.

Nation and Snowling (2000) also argue that the ability to manipulate the syntactic structure of spoken language is considered to be related to reading development via reading comprehension. According to them, children with poor comprehension were found to have general language processing difficulties in a series of tasks. Nation and Snowling (2000) investigated the nature of syntactic skills in children with reading comprehension deficits. For their study they used both poor and normal comprehenders between the ages of 6 and 11. The participants were matched on chronological age, decoding abilities (using the Graded Nonword Reading Test; Snowling, Stothard, & McLean, 1996) and non-verbal ability (using the Matrix Analogies Test, short form; Naglieri, 1985). Text reading accuracy and reading comprehension was tested using the

Neale Analysis of Reading Ability- Revised (Neale, 1989). For their experimental test they used a word order correction task in which syntactic complexity and semantic ambiguity were manipulated. The children had to listen to a sentence in which the words were scrambled and then they had to repeat the sentence in the correct order. The sentences were in the active or passive voice. It was found that all children were influenced by semantic ambiguity, meaning that semantic factors—referred by the authors as lexico-pragmatic knowledge—influence syntactic awareness as well as sentence comprehension. Moreover the results indicated that poor readers performed at a lower level than the normal readers, suggesting that they have a weak "syntactic awareness."

This Study

It is well established that language processing at higher semantic levels depends on the processing that occurs at lower lexical and syntactic levels (Haker, 1997). Although several studies have looked at different linguistic variables in children and adolescents with and without reading comprehension difficulties, thus far there has been no study that looked at LD adolescents' parsing of sentences where there is a match or a mismatch between verb subcategorization bias and sentence structure. Since successful reading comprehension depends on what type of lexical—and, in particular, verb—information is accessed and how this information is manipulated by the sentence processing mechanism, research in this field can contribute significantly to our understanding of the sentence processing mechanism and reading performance.

The empirical investigation of cognitive deficits with clinical populations is important for two main reasons: one is the determination of the nature of the

deficit—which may lead to proper treatment—and the other is what the deficit can inform us about normal performance. Regarding sentence processing and reading disabilities, the investigation of the nature of the syntactic deficit—if it exists—can lead to a better understanding of the nature and types of reading disabilities. Moreover, similar to the case of aphasia and other cognitive syndromes, the pattern of dissolution or impairment in sentence processing in learning and reading disabled populations can inform us about the nature of the normal language processing mechanisms.

As mentioned previously, data collected from normal adult readers suggest that sentence parsing is disrupted at the ambiguous element in the sentence. These results were established through studies using varied experimental techniques. Moreover aphasic patients were found to have greater difficulties with transitive ambiguous sentences. However, very few studies looked at the online reading of adolescents with and without reading comprehension problems and none was found to examine the online computation of the verb specific information.

In designing the present study we had two goals. First, we wanted to investigate whether lexical preferences are the key determinant of parsing decisions during sentence reading or whether syntactic principles (in this case, syntactic transitivity or internal argument selection) would override lexical preferences. Second, we wanted to further investigate the syntactic deficit hypothesis in reading disability, but with particular attention to the role that verb-syntactic information plays in sentence processing which has not been investigated in the reading disability literature.

This study employed a self-paced moving window paradigm. This experimental technique is suitable for the present goals because it is considered to be the most sensitive

measure of online sentence comprehension apart from eye-tracking techniques (Ferreira & Henderson, 1991). The materials were constructed in a similar way as those used by Clifton, Frazier and Connine (1984), Shapiro, Nagel, et al. (1993), and McElree (1993). A Pilot study conducted by Constantinescu and de Almeida (2001) using materials modified from Shapiro, Nagel et al. (1993) found an effect of transitivity preference for LD adolescents but not for non-LD normal college students. After a close examination of the materials used in that study, new sentences were constructed taking into account norms for transitivity preference (Connine et al., 1984) and lexical frequency.

Experiment 1 explored the verb transitivity preference in sentence processing by comparing reading time of LD adolescents diagnosed with reading disabilities with those of normal college students. Experiment 2 employed similar materials and procedure as those of Experiment 1, but used a different method in the selection of the normal and LD participants.

In order to demonstrate an effect of verb sub-categorization preference, we that there would be a significant interaction between verb preference (transitive or intransitive) and sentence type (transitive and intransitive). More precisely, it was predicted that in a transitive sentence, the post verbal information would be read faster when the verb prefers a complement as compared to when the verb prefers an intransitive frame. In addition, we assumed that in an intransitive sentence, the post verbal information would be read faster when the verb prefers no direct object as opposed to when it prefers a direct object. Support for a parsing-strategies type of theory such as the garden-path theory would be found if transitive structures (i.e., sentences with a verb-direct object type of frame) would be read faster than intransitive structure, irrespective

of verb-preference. Regarding the pattern of reading for LD adolescents, we predicted that parsing performance would mirror that of the normal groups if their syntactic mechanisms were intact. Any deviation from the normal pattern would then imply support for a syntactic deficit in reading.

Experiment 1

This experiment was designed to investigate sentence reading comprehension of both LD adolescents and a group of normal control college students. Following studies by Clifton and colleagues (Clifton, et al., 1984; Schmauder, et al., 1991; Schmauder, 1991; see also McElree, 1993) we investigated how transitivity preferences may affect verb-complement reading times. Participants were given sentences containing verbs that allow for two complement structures, one with an argument NP and another an adjunct PP. Preferred-transitive (e.g. *visit*) or intransitive (e.g. *walk*) verbs were inserted in sentences that had transitive or intransitive structures.

We assumed that, if lexical preferences were dominant in first-pass sentence processing, then we would observe faster reading times in post-verbal positions for the congruent conditions (those in which preferred-transitive verbs occur in transitive contexts and those in which preferred-intransitive verbs occur in intransitive contexts) than for the incongruous conditions (when preferred-transitive verbs occur in intransitive contexts and preferred-intransitive verbs occur in transitive contexts). However, if syntactic parsing principles such as minimal attachment and late closure (Frazier, 1987) were to override lexical preferences, there would be an advantage of transitive contexts, regardless of verb bias. Furthermore we predicted that the reading pattern of LD readers with poor reading comprehension skills would be different from those of the normal readers. More precisely we predicted that the LD readers would have significantly more difficulties at the post verbal information in case of a mismatch between the verb preference and sentence type when compared with the normal readers. If the locus of

their difficulty was at the verb-syntactic level, then they were expected to perform worse in the incongruent condition.

Method

Participants

The study involved 11 adolescents with learning disabilities and 40 non-reading disabled university students. All subjects were native speakers of English. They were all asked to sign a consent form (see Appendix B), and those subjects who were younger than 18 were given consent forms to be signed by their parents (see Appendix C).

The LD adolescents were recruited from the Taylor Adolescent Program, an after-school tutorial program for adolescents. The adolescents were between the ages of 13 and 18. The participants first received an explanation of the purpose and the procedure of the experiment and then asked if they wanted to participate. All participating adolescents with learning disabilities had been diagnosed by a clinical psychologist or by an educational psychologist upon enrolling in the tutorial program. The adolescents were not diagnosed following the same criteria, but the diagnosing tests most often used were the Stanford Reading Comprehension Test (Karlsen, et al., 1978), the Durell Analysis of Reading Comprehension (Durrell, 1968) and/or the Woodcock Reading Mastery Test Revised (Woodcock, 1987). These tests are standardized and are used to measure major components of reading comprehension such as vocabulary, decoding, and text comprehension. Those participants who scored two grades below their age-matched grade on reading comprehension but had average scores on decoding and vocabulary were considered as LD with reading comprehension problems. The adolescents received no compensation for their participation.

The control subjects were Concordia undergraduate students, between the ages of 19 and 25. They were recruited from different psychology and non-psychology classes.

None of them had been assessed for learning disabilities or had any known perceptual or cognitive deficits. Some students participated for course credit and some were paid $7 for participation.

Design and materials

A 2x2x2x4 factorial design was employed in this study. There were four independent variables and one dependent variable. The first independent variable was reading ability with two levels, LD poor readers and non-LD control College-level subjects. A second independent variable was verb preference with two levels, transitive (TV) and intransitive (IV). The third independent variable was sentence type with two levels: transitive (TS) and intransitive (IS). The fourth independent variable was sentence position –NP1 (subject position), verb, V+1 (Det or Preposition), V+2 (Noun). This fourth variable was introduced just as a way of testing the reliability of the self-paced reading paradigm in order to make sure that different linguistic categories would engender different reading times. Each type of verb preference was embedded into the two types of sentences and thus four lists of materials were formed: TV-TS, IV-TS, IV-IS, IV-TS (see Appendix D). The dependent variable was self-paced reading time at the post verbal word.

In order to construct the materials, norms for transitivity preference were gathered from Connine, et al., (1984). The results of their study were used to calculate the percentage of transitivity and intransitivity for different verbs. For the transitivity preference, the percentages of use for each verb in the following subcategorization frames were added: [*NP*], [*NP*] [*NP*], [*NP*] [*PP*], [*NP*] [*inf- S*], [*NP*] [*wh-S*], and [*NP*] [*that-S*] as shown in (15).

(15)

a. The teacher remembered *his book.* [*NP*]

b. The teacher gave *Tom the book.* [*NP*] [*NP*]

c. The teacher gave *his book to Tom.* [*NP*] [*PP*]

d. The teacher told *Tom to study.* [*NP*] [*inf-S*]

e. The teacher asked *Tom what to teach.* [*NP*] [*wh-S*]

f. The teacher told *Tom that he should study.* [*NP*] [*that-S*]

For the intransitivity preference percentages of use for the following syntactic frames were added: [*O*], [*PP*], [*inf-S*], [*inf-S*] /*PP*/ (Connine, et al. 1984) as shown in (16).

(16)

a. The teacher remembered. [*S*]

b. The teacher remembered *in class.* [*PP*]

c. The teacher remembered *to talk.* [*inf-S*]

d. The teacher remembered *to talk in class.* [*inf-S*] /*PP*/

Since the goal of the study was to compare reading behavior for transitive and intransitive verbs, only the extreme cases of transitivity and intransitivity were chosen This means that transitive verbs were those that were 70% or more preferred-transitive and 30% or less preferred-intransitive. For the intransitive class, verbs that were 70% or more preferred-intransitive and 30% or less preferred-transitive were chosen. For a complete list of the verbs and their percentage of preference, see Appendix E. Verb pairs were created in which one member was preferred-transitive and the other was preferred-intransitive. So, for instance, while *walk* is a preferred-intransitive (with 15% preference

for transitivity and 80 % preference for intransitivity), *visit* is a preferred-transitive verb (with 75% preference for transitivity and 3% preference for intransitivity). Pairs such as *walk/visit* were inserted in transitive and intransitive constructions thus forming four sentence types with consistent and inconsistent matches between verb preference and sentence type. A consistent match was one where the verb was preferred-transitive and the sentence was transitive (TV-TS) or when the verb was preferred-intransitive and the sentence was intransitive (IV- IS). Inconsistent matches were the cases where sentence construction was not consistent with verb preference (IV-TS; TV-IS). Table 1 shows sample materials for the combination of conditions.

All verb pairs were matched for frequency according to Francis and Kucera's (1982) norms as published in the MRC Psycholinguistic database (Coltheart, 1981). There were sixteen verb pairs such as *visit/walk* that formed clusters of four sentences each pair, for a total of 64 unique sentences. The sentences were then divided into four lists with each list containing one member of each cluster for a total of 16 experimental sentences in each list. In addition, 16 fillers and 10 comprehension questions were added to each list of experimental materials. Four practice sentences were added to the beginning of the experiment.

Twenty-one Concordia undergraduate students with no known reading or cognitive deficit rated the plausibility of all experimental sentences. For this normative task, the students received one of four booklets containing the 16 sentences as they were distributed in the experimental lists. In addition, each booklet contained 16 implausible (e.g., *Our parents killed the questions*) and eight plausible filler sentences (e.g., *The children played games all day*). Participants were run individually. They were instructed

Table 1

Sample Sentences for Verb Preference and Sentence Type Conditions.

Verb Preference	Sentence Type	Sentence
Transitive	Transitive	The child visited his dog.
Transitive	Intransitive	The child visited with his friends.
Intransitive	Transitive	The child walked his dog.
Intransitive	Intransitive	The child walked with his friends.

to rate how plausible each sentence in the booklet was using a Likert-type scale between 1 (not plausible at all) and 5 (highly plausible). They were given examples of plausible (e.g. *The policeman chased the gangster*) and implausible sentences (e.g. *The policeman chased the book*) and were instructed to circle a number based on their first instinct. Mean plausibility ratings are presented in Table 2.

An Analysis of Variance (ANOVA) showed that there were no statistically significant differences between the four sentence types, F (3, 59) = 1.7, p = .18, indicating that all sentence materials were equally plausible. Any difference, thus, in reading times between sentence types could not be attributed to differences in plausibility but only to the combination between verb-preference and type of complement (NP argument of PP adjunct).

Procedure

A self-paced reading moving window paradigm was employed. Participants were instructed that each trial would start with the presentation of a row of dashes, with each dash corresponding to a letter and each set of dashes corresponding to a word in the sentence (e.g., "--- ----- ------- --- ---" would correspond to *The child visited his dog*). They were instructed to press the space bar on a computer keyboard and that each time they pressed the bar a word or sentence fragment would be revealed on the screen. With every bar press and as each segment was revealed, the previous word or segment turned back into dashes. For each experimental sentence the words or fragments that appeared at each bar press were the subject NP (*The child*), the main verb (*visited*), the first word following the verb (henceforth, V+1; *his*), the second word (V+2; *dog*), and other words or phrases following that. Of main interest in this experiment were reading times at the

Table 2

Mean Plausibility Ratings (with Standard Deviations in Parenthesis) for the Experimental Materials.

Verb Preference	Sentence Type	Plausibility
Transitive	Transitive	4.3 (.77)
Transitive	Intransitive	4.1 (.59)
Intransitive	Transitive	4.5 (.54)
Intransitive	Intransitive	4.5 (.53)

V+1 position, which signals the type of phrase following the verb (e.g., *his* is the pronoun-determiner of an argument NP; *with* [as in *The child walked with his dog*] is the preposition head of an adjunct PP).

Participants were instructed to try to read each sentence in a normal reading pace but also to pay attention to each sentence because there could be a comprehension question appearing on the screen. For each comprehension question they were instructed to answer yes or no appropriately by pressing the *Y* or *N* keys on the keyboard.

Participants were run individually. The Concordia students were run in dimly lit rooms, each one containing only a desk, a chair, and an Apple Macintosh G3 computer with a 17 " CRT screen. The LD students were run in an office at their tutoring school setting equipped with an Apple Macintosh iBook G3 portable computer. Stimuli were presented in font CourierNew 18 in white with a black background. All stimulus presentation and data collection were done via PsyScope (Cohen, MacWhinney, Flatt & Provost, 1993). Participants were given four practice trials before the beginning of the experimental session.

Results and Discussion

Reading times for each subject for each sentence in all the positions were recorded. Data points two standard deviations above or below the mean of each condition for each subject were replaced by the cutoff values. The results were analyzed in a four factor (sentence type: transitive vs intransitive; verb preference: transitive vs intransitive; group: normal vs LD; sentence position: NP, V, V+1, V+2) ANOVA with repeated measures in all factors except group. In addition, two main types of analyzes were carried out: we analyzed the post-verbal information combined (V+1 and V+2) and the V+1 position only for the different levels of verb-sentence type combinations for both groups.

There was no difference between the two groups, F (1,9)= 2.582, p =.1425 even if the mean for the LD group (M= 866, SD= 346.152) was higher than the mean for the control group (M= 673, SD= 259.593). The power was small (d= .29) so maybe with an increased number of subjects in the LD group we would have achieved significance. With about 21 subjects and an alpha of .05, we would have achieved a large effect size of about .8. In addition, a significant main effect of sentence position, F (3, 9)=21.748, $p<$ .0001, was found, showing that the technique is sensitive to different properties of the different linguistic segments. Also, an interaction between group and sentence position was found, F (3, 27)=4.948, $p<$.0073, indicating that the two groups responded differently to different positions in the sentence.

A four factor repeated measures ANOVA for the post verbal information (V+1 and V+2) revealed a marginally significant main effect of group, F (1, 9)= 4.77, p= .0568. Once again, a significant interaction was found between group and post verbal

position, F (1,9)= 15.52, p= .0034, indicating that the difference between groups is at the post-verbal positions of the sentences. The difference in reading time between the two groups almost reached significance. This result is not surprising since the college students were expected to read faster than adolescents in high-school due to age and reading experience difference.

In the analysis of the V+1 position only, a 2 (group) by 2 (verb type) by 2 (sentence type) ANOVA with repeated measures at the verb and sentence factors showed a significant main effect of group, F (1,10)= 6.592, p= .028. This indicates that the RT at the V+1 was different for the two groups (for all ANOVA tables for Experiment 1 see Appendix F). The LD readers took longer to read this part of the sentence as compared to the controls, even if word length was controlled and the same post verbal word was analyzed for each group of subjects. Mean reading times for each condition at the V+1 position are presented in Figure 1 (See Appendix G for means and standard deviations).

For the LD group, there was no significant interaction between the preferred and non-preferred sentences, F (1, 10)= 2.25, p= .16. However, there was a significant difference between the transitive sentences when a preferred-intransitive verb was embedded as opposed to when a transitive verb was embedded, F (1, 10)= 6.79, p= .0262. These results indicate that when the sentence frame is intransitive the verb does not impact on the reading time. On the contrary, when the frame is transitive, having a preferred-transitive verb will ease the reading (faster RT), and having a preferred intransitive verb will worsen it (longer RT).

For the normal control group there was a significant interaction between the sentence type and verb preference, F (1, 39)= 7.14, p= .0109, suggesting that post-verbal

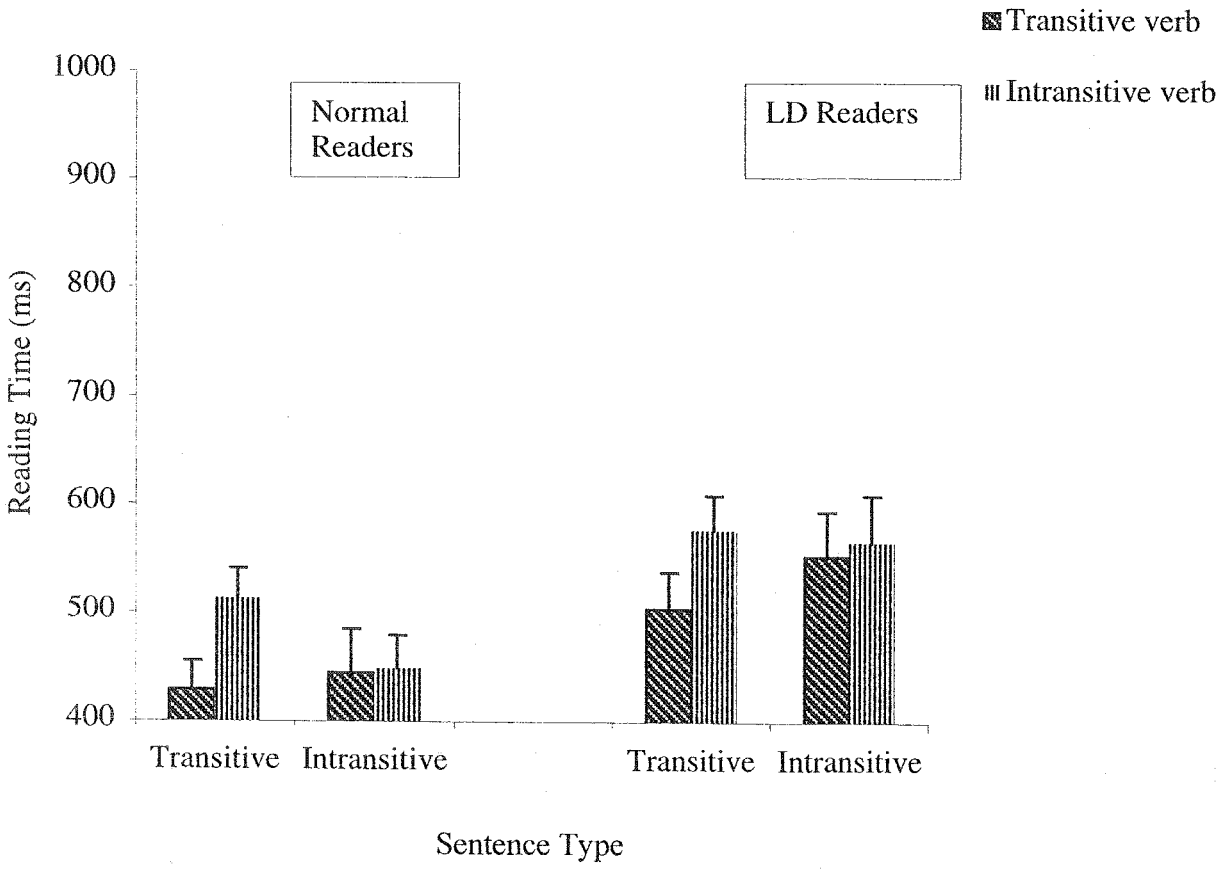

Figure 1. Post-verbal reading times for preferred-transitive and preferred-intransitive verbs in Experiment 1.

reading times were influenced by verb preferences. There was also a significant difference between transitive sentences when a preferred-intransitive verb as opposed to when a preferred transitive was embedded, F (1, 39)= 15.94), p= .0003. No such difference was found when the sentence frame was intransitive.

No other simple comparisons were found to be significant. The results were very similar to those from the LD readers showing that when the sentence frame was intransitive the verb preference did not affect their reading; quite the opposite, when the sentence was transitive, the verb would impose its preference on the reading time. When a preferred-transitive verb coincided with the sentence frame (transitive) reading time was shorter.

These results are in accordance with those of Theakston, Lieven, Pine and Rowland (2001). They investigated the role of performance limitation in children's early acquisition of verb argument structure. They tested whether it is easier for young children (ages 2 to 8) to produce intransitive frames because they require less cognitive processing. It was found that the children produced utterances with fewer direct objects with intransitive verbs but they were consistent in producing utterances with direct objects with transitive verbs. In the case of intransitive frames, the use of both transitive and intransitive verbs was consistent. These results could explain why previous studies found a difference in RT in a transitive sentence where the verb was followed by a preferred or a not preferred complement.

Overall, we found that readers in each group had a similar reading pattern in all conditions except for the interaction between the verb preference and sentence type,

which was found to be significant in the normal readers but not in the poor readers. One of the limitations of this study was the fact that the participants in the LD group were not screened for reading ability and were not matched in age with those of the control group. Since our participants were not age-matched, it could be the case that the differences found in reading time between the two groups were due solely to age differences. In addition, we relied on the data provided by psycho-educational tests administered in the past, with no measure of current reading level. We believed that a more current reading level assessment was needed for more accurate results. This led us to Experiment 2, where these limitations were taken into account.

Experiment 2

In this experiment we employed the same materials and procedure as those in Experiment 1, but applied different criteria in the selection and screening of participants. Experiment 2 involved adolescents with diagnosed learning and reading disabilities and an aged-matched control group. Both groups were administered the same standardized tasks in order to determine their overall reading abilities. For this study we used the Test of Reading Comprehension (TORC-3, Brown, et al., 1978) to assess the students' reading comprehension abilities, and the Woodcock Reading Mastery Tests - Revised (WRMT-R, Woodcock, 1987) to assess their decoding abilities and the self-paced reading test employed in the previous experiment.

Furthermore, the criteria for being placed in the LD group changed slightly from Experiment 1. In Experiment 2 we decided to use a more stringent approach in the selection of participants. In order to be classified as LD, the participants had to score 1.5 standard deviations below the mean on the reading comprehension tests and at the average level on the decoding test.

Method

Participants

Thirty-seven adolescents participated in this study but only 33 completed the entire battery of tests and were all given a five-dollar movie gift certificate for their participation. They were all native speakers of English and had not participated in Experiment 1.

The adolescents were recruited from one private high school from the area of Montreal and from different sites of the Taylor Adolescent Program. To recruit from the private school, letters were sent to about 150 of the parents whose children were attending that particular high school (see Appendix H for the letter sent to the parents). From these, only 8 agreed to let their children participate in our study. Then, after the parents consented to the children participating in the research, the adolescents were interviewed and asked to sign a consent form if they wanted to participate. In order to recruit from the Taylor Adolescent Program, the same procedure was used as explained in Experiment 1 (see Appendix I for the consent forms).

The adolescents were post-classified as good and poor readers based on the results of the standardized reading tests administered. The TORC-3 was administered to measure their reading comprehension abilities. Scores on four sub-tests were taken into account: Vocabulary, Sentence Sequencing, Paragraph Reading and Syntactic Similarities. The Word Identification and Word Attack subtests from the WRMT-R were administered to measure their decoding level. The scores for both tests were transformed into z scores, with a mean of 100 and a standard deviation of 15. Those who had a score greater than 85

on the TORC-3 and lower than 85 on any of the WRMT-R sub-tests, were classified as reading disabled. Those adolescents who scored above 85 on both tests (TORC-3 and WRMT-R) were classified as the control group. This procedure resulted in 13 adolescents being assigned to the poor reading group and 12 to the normal group. All participants had normal or corrected-to-normal vision and had no other diagnosed cognitive deficits.

The mean age of the adolescents participating in the study was 15.3 and the range was 13.2 to 18.3 years of age. The normal reading group had a mean age of 15.58 and the LD group had a mean age of 15.1. Information about participants such as gender, age and scores on both standardized tests is presented in Appendix J.

Design and materials

TORC-3 is a silent reading comprehension test created based on current psycholinguistic and cognitive theories according to Brown, et al., (1978). It is divided into four sub-tests: General Vocabulary, Syntactic Similarities, Paragraph Reading and Sentence Sequencing plus three sub-tests not used in this study, designed to test vocabulary in specific subjects (e.g. math, social sciences and science) (see sample examples in Appendix K). The results on all of these sub-tests taken together formed a score called Reading Comprehension Quotient (RCQ). The items used in this test were chosen experimentally on the basis of analysis of item difficulty and discriminating power. The authors report that the internal consistency of this test was analyzed and all coefficients were found to be greater than .80. The test/retest reliability coefficients ranged between .79 and .88. The reliability for the RCQ score was found to be .85. The validity of the test, according to its manual, was supported by sub-test correlation with other tests such as SAT Reading, SRA Reading and PIAT Reading (Dunn & Markwardt,

1970). The norms were based on test performance of 1962 students living in 19 different states in the United States.

The reading comprehension test is composed of four sub-tests, all with multiple-choice questions. The Vocabulary sub-test has 25 items and is used to measure the reader's understanding of a set of vocabulary items that are related. The participant is asked to think about the relation between the three words and choose two that "go together" with the other three, such as in the sample items in (17), where, *yellow*, *red* and *blue* are colors so the correct response would be number (1) *black* and number (3) *green*, which are colors too.

(17) Yellow Red Blue

1. Black.
2. Grass.
3. Green.
4. Yes.

The Syntactic Similarities sub-test contained 20 items and it is used to measure the reader's understanding of semantically similar but syntactically different sentence structures. The participant is required to choose the two sentences that are almost the same, as in the example materials in (18).

(18)

A. Sam plays.

B. Sam will not play.

C. Sam has played.

D. Sam is playing.

E. Sam is going to play.

The Paragraph Reading sub-test had six paragraphs with five questions each and it is used to measure the reader's ability to answer questions related to story-like paragraphs. The participants were required to read a paragraph and answer 5 questions, such as in (19).

(19)

Juan wanted to watch cartoons on TV. Mother said, "No, Juan. You may not watch TV because you did not do your work." Juan jumped up and went to work.

1. What is the best name for this story?

A. TV Cartoon.

B. Juan Watches Cartoons.

C. Mother Watches Cartoons.

D. No TV for Juan.

2. What did Juan do?

A. go to school.

B. go to play.

C. go to work.

D. go to bed.

The Sentence Sequencing sub-test contained 10 items and was used to measure the reader's ability to order sentences into plausible paragraphs. The participants were asked to arrange five sentences in the right order, as shown in (20).

(20) _____ _____ _____ _____ _____

A. Soon it will be noon.

B. Next it will be night.

C. It is morning.

D. Then it will be morning again.

E. Then it will be this afternoon.

The WRMT-R is a comprehensive individual assessment of reading ability. It contains nine tests but only two of them were used in the present study, Word Identification (e.g. *sleep*) and Word Attack (e.g. *weat*) (see sample in Appendix L). The normative data were gathered throughout two complete school years. These continuous-year norms include grade and age equivalents. The norms were based on test performance of 1219 students between grade 7 and grade 11.

Procedure

All students were run individually in a room at their school setting. The study was divided into two phases: the two standardized reading tests (TORC-3 and WRMT) and the self-paced reading experiment.

For the standardized tests, the participants were given instructions using examples to help them understand what they were asked to do. The experimenter made sure that the students knew exactly what they had to do before starting the actual test. For each test and sub-test there was a ceiling rule. The experimenter recorded each student's answer on an answer sheet, keeping track of their errors in order to detect their ceiling.

In the first part of the experiment, the LD adolescents completed the TORC reading comprehension test. This part of the experiment took between 30 and 45 minutes to be completed. From TORC-3 the four sub-tests used were General Vocabulary, Syntactic Similarities, Paragraph Reading and Sentence Sequencing. In the first and

second sub-test, General Vocabulary and Syntactic Similarities, the participants were stopped after three errors made in any consecutive five questions.

For the third sub-test, Paragraph Reading, the participants were instructed to read a paragraph and answer five multiple-choice questions. The participants reached ceiling if they had two or more wrong answers for any one paragraph. In the fourth sub-test, Sentence Sequencing, the participants were instructed to read the five sentences in the example and then arrange them in chronological order. Once they understood the task they were instructed to do the same, starting with number 1. The participants reached ceiling when they would have a score of 3 or lower on any two consecutive items.

In the Word Identification sub-test the participants were instructed to read aloud words that appeared in large print on the subject pages in the test easel. The experimenter would point to a word and the participants had to pronounce it out loud. The Word Identification sub-test had different starting points for different grades. In case the test would not start with item number one, the experimenter would automatically give points for the first items. Ceiling would be reached if the six highest-numbered items on a page were failed. Since not everybody started with item number one, a basal rule was used. In this case if the participant missed the six lowest-numbered items administered, it meant that a basal level had not been established and that we had to go back one page in the test book. The experimenter would go back page by page until the participant established a basal level and then we would go back to the starting point and establish the ceiling level.

The Word Attack sub-test requires the subject to read either nonsense words (letter combinations that are not actual words) or words with a very low frequency of occurrence in English. The experimenter would point to the words on the page in order of

increasing difficulty. The response was scored as 1 if the participant was correct in their pronunciation and 0 if the participant did not pronounce well the word. In the Word Attack sub-test all participants started with the number one item and continued until they reached ceiling.

In the second part the students were asked to read sentences on the screen of a computer. The procedure was the same as that of Experiment 1.

Participants were given the two parts of the present experiment together with other tests that are not included in the present research report. In general, it took each subject a total of one hour to complete the two parts of this experiment and a total of about two hours to complete the whole battery of tests.

Results and Discussion

After analyzing the results, of the 33 adolescents who completed all three tests, the scores of 5 participants were eliminated since they did not match the criteria for having an above average score on decoding. The criteria to be assigned to the control of the LD group required the subjects to either have an above average score on both the TORC-3 and the WRMT (control group) or to have an above average score on WRMT and a below average score on the TORC-3 (LD-group). A third requirement was to have participants still attending high-school at the time of the testing. The scores of three more subjects were eliminated due to the fact that they had already graduated from high-school, so again the criteria did not match. In all, the scores of 25 subjects were analyzed in Experiment 2.

All data analyses, including the exclusion of the extreme values, were conducted in the same way as in Experiment 1. Figure 2 shows mean reading times at the post-verbal information for each group in each of the four conditions. Data points two standard deviations above or below the mean of each condition for each subject were replaced by the cutoff values. This represented a total of 4% of the raw data.

The results were analyzed in a four factor (sentence type: transitive vs intransitive; verb preference: transitive vs intransitive; group: normals vs LD; sentence position: NP, V, V+1, V+2) ANOVA with repeated measures in all factors except group. The overall analysis resulted in a significant main effect of sentence position, F (4,44)= 10.07, $p< .0001$, indicating that the technique is sensitive to the different properties of the different linguistic segments.

Next we conducted an analysis of the post-verbal information including both V+1 and V+2. A significant interaction between sentence type and verb preference was found, F (1,11)= 5.409, p= .0402, indicating that at the post verbal information the RT was influenced by the interaction between verb preference and sentence type.

At the V+1 position, data were analyzed taking into account subjects (F_1) and items (F_2) as random factors (see Appendix M for all ANOVA tables for Experiment 2). Items analyzes were carried out in order for us to be able to generalize over the different types of verbs and sentence constructions. These results were examined in a three factor (sentence type: transitive vs intransitive; verb preference: transitive vs intransitive; group: normals vs LD) repeated measures ANOVA. We found an overall significant main effect of group, F_1 (1,11)= 7.33, p= .0204, F_2 (1,92)= 12.987, p= .0005, and a significant interaction between sentence type and verb preference, F_1 (1,11)= 6.71, p= .0250, F_2 (1,92)= 5.556, p= .0205. These results indicate that at the word following the verb, overall the subjects in the LD group were faster than the subjects in the control group. The group vs sentence type vs verb preference interaction was significant only for the subjects analysis, F_1 (1,11)= 5.37, p= .0407, but not for the items analysis F_2 (1,92)= 2.208, p= .1408.

Planned comparisons between the sentence type and verb preference for each group were conducted (See Figure 2). For the control group, there was a significant interaction between the sentence type and verb preference, F_1 (1,11)= 7.82, p= .0173; F_2 (1, 61)= 6.302, p=. 0147. Furthermore, there was a significant difference between the transitive sentences when a preferred-transitive verb was embedded as opposed to when a

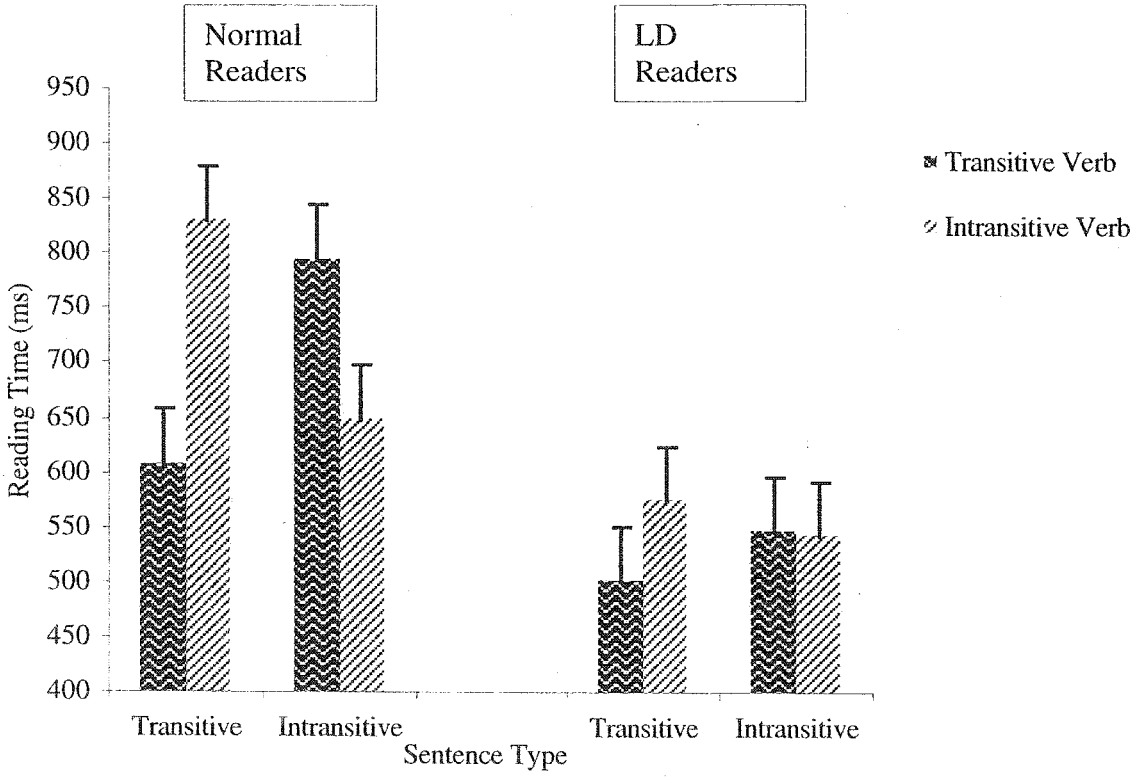

Figure 2. Post-verbal reading times for preferred-transitive and preferred-intransitive verbs in experiment 2.

preferred-intransitive was embedded, F_1 (1,11)= 5.1, p= .0451; F_2 (1,30)= 5.741, p= .0230. For a table of means and standard deviation for each group in each condition see Appendix N.

The results of the planned comparisons suggest that the interaction between the verb preference and sentence type has a significant effect on the RT. This interaction shows that in the disambiguating region, the word after the verb, the subjects were faster in the preferred condition as opposed to the non-preferred condition. Parallel to the findings in Experiment 1, we found that only in sentences with a direct object, but not those with an indirect object, the verb preference impacted on the ease of parsing. Following preferred-transitive verbs, parsing turned out to be easier.

In the LD group the pattern of results was different from that of the normal group. No overall significant interaction was found for the LD group. This implies that LD readers were not affected by the preferred or non-preferred conditions. Since no significant difference was found at the V+1 level for the LD group we decided to analyze the percentage of correct responses to the comprehension questions. We found that the normal group made about 1.6% of errors as opposed to the LD group, which made about 7.6% errors. By conducting a t-test we found that the LD group made significantly more errors as compared to the normal group, t (1, 119)= 2.915, p= .004.

In conclusion, we found that adolescents with poor reading comprehension skills behave differently from adolescents with good reading comprehension skills. Their pattern of results is not the same: the good readers' RT is disrupted when a non-preferred verb complement is presented. Overall, the reading time for the LD group did not seem to

be disrupted, which could be explained by a lack of ability to predict the syntactic structure of the segment following the verb. More studies are needed in order to uncover the locus of these readers' comprehension difficulties.

General Conclusion

The present study investigated two main hypotheses. First we explored whether the key determinants in sentence processing are of lexical or syntactic nature, more precisely whether first-pass reading follows syntactic principles or lexical-specific preferences. Secondly we wanted to shade light onto the ways in which LD adolescents' parsing is influenced by either the syntactic or semantic information provided by verbs. Our results partially supported the lexicalist view. It seems that parsing is influenced by verb complement structures. Experiment 2 demonstrated that LD readers that exhibit reading comprehension difficulties seemed to behave differently than their age matched counterparts. The results appeared to support the syntactic deficit hypothesis. In the sections to follow we will provide: (1) a summary of results and discussion, (2) discuss the implications of the present results, (3) address the limitations of the present study, (4) and discuss further work.

Summary of Results

In Experiment 1, we found a significant interaction between the verb preference and sentence type but only in the normal college readers. Additionally, we found that in the transitive frames the verb lexical information influenced the parsing of the sentences. In the post verbal position, both groups took longer to read the determiner (e.g., *the*), when the verb preference was intransitive, indicating that at this point reading was disrupted. It seems that the dissonance was detected at the post verbal information, and the sentence reanalyzed at the disambiguating element in the sentence but only in the case of a transitive frame. In the intransitive frames, no difference was found when a

preferred-transitive as opposed to a preferred-intransitive verb was embedded, indicating that the verb lexical preference did not influence the reading of a preposition such as *with* which indicates an adjunct PP.

In Experiment 2, we replicated Experiment 1 but this time the groups were matched by age, so that all our participants were adolescents in high school. This ensured a more accurate comparison between the groups. Since our participants were still in high school their reading abilities were still developing so an up-to-date measure of their reading skills was crucial. Standardized tests were administered in order to measure their current reading level. Moreover, when we divided the participants into groups we used a more stringent criterion. We calculated their overall score and only those that scored 1.5 standard deviations or more below the mean on the reading comprehension test were considered LD. Participants with scores in the average range on both decoding and comprehension were considered our control group. On the reading comprehension measure, the groups differed significantly $t\,(1,11)= -7.951$, $p< .0001$.

The results from the control group showed a significant interaction between sentence type and verb preference at the V+1 position. This indicates that the adolescence normal readers were influenced by the lexical information provided by the verbs. A clear preference of verbs for certain complements was shown. Furthermore, in the transitive sentences the disruption was significant when a preferred-intransitive verb was embedded as opposed to a preferred transitive verb. Again, a non-preferred verb complement in the transitive frame seemed to have been taken as a discrepancy in the sentence structure and the reanalysis increased the processing load and, consequently, the RT. These results replicated the results from the normal college readers from Experiment 1, indicating that

our control group used the same linguistic strategies as the college readers in parsing the sentences.

The LD group performed quite differently from the control group. No significant difference was found between any of the conditions. The percentage of errors in the comprehension questions indicated that they made significantly more errors than the control group. It is clear that these readers were not influenced by the lexical information provided by the verbs. It could be hypothesized that their ability to predict and anticipate verb complement structures is not well developed, which is not unusual for readers with comprehension difficulties (see, e.g., Hacker, 1997; Nation & Snowling, 2000). Moreover, these readers behaved quite differently than those from the LD group in Experiment 1. The results demonstrate that the method of recruiting was much more accurate in the second experiment. The LD readers' pattern of results in Experiment 2 show a possible syntactic impairment. On the contrary, the results of the LD group in Experiment 1 show that those readers did not behave as normal readers but neither as the truly LD readers of Experiment 2. It could be argued that because of possible intensive tutoring since the date of the psycho-educational report, these readers improved significantly their reading comprehension abilities.

The results obtained do not support the studies that show that parsing is first guided by syntactic principles with the lexical information being accessed only in the second parse (Kennison, 2002; Fraizer, 1978; Ferreira & Henderson, 1991). The garden-path model states that the syntactic structure is constructed in advance and while listening or reading a sentence we fill in the blanks of the already built syntactic tree. In addition,

the minimal attachment principle states that we attach the incoming words and phrases as high as possible in order to have less syntactic nodes.

If our results were to support the garden path model, then the transitive frame should be the default structure. In this case we should have found that a sentence like (21d) was read significantly slower compared to sentences such as (21a), (21b), and (21c).

(21)

a. The child walked his dog.

b. The child visited his dog.

c. The child walked with his dog.

d. The child visited with his dog.

If the RT in the post verbal position was the same for sentences (21a), (21b), and (21c) then we could have argued that the reader took the post verbal information (NP *and* PP) as the complement of the verb. But in the case of *walked his dog* the RT increased since, by hypothesis, reanalysis occurred when the reader "discovered" that the lexical preference for the verb does not match the complement.

The results obtained from our two control groups are consistent with previous findings on verb transitivity preferences in normal readers (e.g., McElree, 1993; Shapiro et al., 1993, 1987, 1989; Gahl, 2002; Holmes, Stowe, & Cupples, 1989). We found evidence supporting the lexicalist view that states that lexical information is consulted before the syntactic information. It was found that the match or mismatch between sentence type and verb preference influenced the parsing especially in a transitive frame. These results support Shapiro, Nagel et. al., (1993), Shapiro, Gordon, et al., (1993),

Shapiro et al., (1987) studies that show that verbs have strong preferences for certain syntactic structures and that the parsing is influenced by this preference.

In McElree's (1993) study, the sentences had been created in a way similar to the one used to create the sentences for the present experiment. The norms were taken from the same source (Connine et al. 1984) and the same four conditions were created. The difference was that in his experiment there was an additional condition, the early as opposed to late closure. The SAT paradigm was used but the results paralleledmine. He found a significant difference in RT only in the transitive frames when a preferred-transitive as opposed to a preferred-intransitive verb was embedded. The normal college readers in his experiment behaved the same as our control groups.

Furthermore the results are supported by Tannenhaus and Carlson's (1989) study. They found that in a transitive sentence the RT is longer when an implausible filler was following the verb. No such difference was found in the intransitive sentence frames. The plausible and implausible fillers could be conceptualized as the preferred and non-preferred complements, which would support our results.

Gahl (2002) conducted a similar experiment using a different paradigm (Stop Making Sense) using both normal and aphasic patients. Again the results matched ours, since the only difference found was in the transitive frames.

The results from the LD groups in both experiments do not seem to follow a particular processing pattern. As mentioned previously, the LD readers in Experiment 1 seemed to behave much as the normal readers. It might be argued that due to the selection criterion our group might have not been a truly reading disabled one. But the interesting results come from the LD group in Experiment 2.

Albeit no significant differences were found for the LD group, the results are very informative regarding one of the problems with their reading skills. One of our questions was whether these adolescents with reading comprehension difficulties have a syntactic deficit. When the LD categorization was made strict and present reading ability were taken into account, these readers performed very poorly. The results show their inability to use lexical information in order to monitor their reading. Since our adolescent group from the first study and the normal adolescent group from the second study behaved similarly (albeit the criterion was less stringent in Experiment 1) we can conclude that our reading disabled readers lack the ability to monitor their comprehension and thus the dissonance found in the reading of the different sentence constructions.

The ability to use the lexical information provided by the verbs is part of the ability to monitor comprehension. A person with good comprehension skills is actively able to monitor and control their own reading, and hence to use the information provided by the words in the sentence to aid in comprehension. Hacker (1997) found that reading experience and age play an important part in the capability to monitor reading comprehension in particular at the lexical and semantic levels. It is quite possible that our LD group from Experiment 2 had difficulties with these two types of information provided by verbs. Since they have reading comprehension difficulties, they might have less reading experience, which in turn might lead to poor ability to monitor and control their reading processor.

Implications

The main findings of the present study provide insight into the online reading processing of adolescent normal readers and those with reading comprehension

difficulties. These findings contribute to the growing literature on the parsing of verb syntactic information by using adolescents as participants. They also shed light into some of the main sources of reading difficulty of LD adolescents.

Thus far little is known about the linguistic variables that affect reading performance by LD adolescents. The present research points to the importance of studying one such variable - verb-syntactic information - and how it affects sentence reading. To my knowledge this is the first study that explores verb-complement information using an online task. Finding a deficit at this level can be the starting point of more in depth analysis of reading disabilities at the lexical and sentence levels. Research in this area is particularly important because it can aid in the development of new teaching and tutorial techniques meant to develop metacognitive skills in readers with reading comprehension difficulties.

Limitations

Our first experiment had a number of limitations. For one, the groups were not matched by age. Secondly the participants' reading level at the time of the testing was not available. Third, the number of participants in the LD group was very small compared to the number of participants in the second group.

In our second experiment, we controlled for all the above limitations. But, we believe that the number of participants in each group could be increased for a robust result. The materials used could also be modified in such a way that the length of the sentences were controlled. We believe that if we had controlled for length at V+2 and V+3 positions, we would have been able to point the locus of disambiguation for the LD

group. This would have given us key information about the parsing of different segments in the sentence beyond the V+1 position studied in the present experiments.

Another limitation is the method used to study parsing sentences. A more sensitive and more accurate method is eye-tracking. Unfortunately it was not possible to use such a device in the present study because of the extensive procedures necessary to bring LD adolescents into the lab.

Future Work

As mentioned previously, the literature on the online parsing by adolescents, both normal readers and those with reading deficits is scarce. We intend to continue our work with adolescents with and without reading difficulties.

Future work would include a collection of norms for verbs and their preferred argument structures. It would be interesting to ask a large population of students (adolescents and adults) to write sentences with these verbs. In this way we would be able to tabulate the preferences and then construct sentences with the preferred and non-preferred structure frames.

As a method of testing it would be interesting to use both self-paced reading but also self-paced listening and eye-movements monitoring. Using this latter paradigm, we could play with the intonation, verb preference and sentence structure. In the eye-movements technique we could also include a context, in which the child is presented with objects and at the same time he is listening to a sentence. It would be interesting to see if the child stares more at an object that is the NP object of a preferred-intransitive verb.

Another way of continuing this work would be to have transitive and intransitive contexts with verbs preferred transitive, intransitive and neutral words. It would be interesting to see if the context would influence the parse of a sentence that matches or not the context. Additionally it would be interesting to see what happens in case of a neutral verb.

Holmes' (1987) technique of word-by-word grammaticality judgment task would be very interesting to perform with our adolescents. The fact that the words accumulate on the screen and they have to take a decision would force them to perform a metalinguistic task, which may prove informative about their understanding of the syntactic structure.

In conclusion, this research adds to the body of evidence supporting the lexicalist model. In addition, it contributes to the small number of studies that explored adolescents with reading comprehension difficulties. In order to be able to better help children develop their reading skills we need to learn more about the locus of disruption. Only a study that combines both linguistics research methods and a clinical population will be able to achieve this goal.

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Appendix A

Verb specific information

Shapiro, Nagel and Levine (1993) discussed the lexical entries of a word (See, Chomsky, 1986) in terms of *syntactic category*, *syntactic sub- categorization*, *argument structure* (*a-structure*) and *thematic information*. As an example, consider the verb *to give*. The syntactic category is the grammatical category of the lexical item. In this case the name of the grammatical category is verb (V). Strict sub- categorization means that the verb selects for different complements located within the verb phrase. The following example (Shapiro, Zurif, & Grimsaw, 1989) shows that the verb *to give* allows two types of complements, a Noun Phrase - Prepositional Phrase (NP- PP) and a NP- NP.

(1) a. Joelle [VP [V gave][NP the book][PP to Mitzi]].

b. Joelle [VP [V gave][NP Mitzi][NP the book]].

Verbs can also be represented by *a structure*, which specifies the number of arguments that a verb allows (Shapiro, Nagel, & Levine, 1993). Example 3a shows that the verb *to give* allows three arguments. The variables (*x, y, z*) are used to stand for the arguments.

c. Joelle$_x$ gave the book$_y$ to Mitzi$_z$.

In this case the $\underline{x}$ argument refers to the subject *Joelle*, the $\underline{y}$ argument refers to the direct object NP *the book* and the $\underline{z}$ argument to the indirect object PP *to Mitzi*.

Another type of lexical information provided by the verb is the thematic grid that is a set of thematic roles assigned to the arguments in a sentence. So, taking the above example, the subject, *Joelle*, is assigned the Agent Role, the direct object, *the book*, is assigned the Theme Role and the indirect object, *to Mitzi* is assigned the Goal Role. These thematic roles are part of the lexical conceptual structure (Grimshaw, 1990).

The thematic roles presented above are considered to be simple; but verbs also select for complements of more complex semantic types. Consider for example:

(2) We knew [S' that Joelle would be wild].

Proposition (P)

(3) We knew [S' how wild Joelle would be].

Exclamation (E)

(4) (Only) We knew [S' how wild Joelle would be].

Interrogative (Q)

In (2), (3) and (4) it is shown that the verb *to know*, allowing a sentential complement (i.e., *S'*) as its strict sub-categorization in all cases, allows different complex semantic realizations (*P, E* and *Q*).

In summary, the lexical information provided by the verb includes: *syntactic category, strict sub- categorization, a structure, and thematic information.* It provides us with information about the syntactic and semantic character of a sentence in which the verb is embedded. Knowledge of these properties is essential for normal language comprehension and production. A listener or a reader who has difficulty accessing or computing verb-specific properties will have difficulty comprehending whole sentences.

Appendix B

Consent form for participants in Experiment 1

CONSENT FORM TO PARTICIPATE IN A RESEARCH

This is to state that I agree to participate in a program of research being conducted by Ioana Constantinescu of the Department of Psychology at Concordia University under the supervision of Dr. Roberto de Almeida.

A. PURPOSE

I have been informed that the purpose of the research is to investigate reading comprehension and that the research is being conducted to fulfill the course requirements for Psyc 690, master thesis.

B. PROCEDURE

I have been informed that the experiment involves a reading task. I will be presented with words appearing on the screen of a computer and after reading each word I will have to press the space bar. Some of the sentences will be followed by a question that will involve a Yes/No answer and I will have to press Y or N key. The experiment will take place at the Taylor Adolescent After School Program during the time I am there. I will not be required to do any other task than that described above. I have been informed that my age and gender will be recorded but that my name will not be associated with such information nor will my name be associated with the data in the experiment. The participation in the experiment and the information and data provided will be kept strictly confidential. If the results of the study are published only group results and not individual data will be reported to preserve the confidentiality of their participation.

C. CONDITIONS OF PARTICIPATION

- I understand that I am free to decline to participate in the experiment without negative consequences.
- I understand that I am free to withdraw the consent and discontinue the participation at any time without negative consequences.
- I understand that the participation in the study is confidential (i.e., the researcher will know but not disclose my identity)
- I understand that the data from this study may be published
- I understand the purpose of this study and know that there are no hidden motives of which I have not been informed.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARY AGREE TO PARTICIPATE IN THIS STUDY.

NAME (please print)_____

SIGNATURE_____

DATE_____

Appendix C

Consent form for the parents

CONSENT FORM FOR MY ADOLESCENT TO PARTICIPATE IN A RESEARCH

This is to state that I hereby give my permission to my adolescent to participate in a program of research being conducted by Ioana Constantinescu of the Department of Psychology at Concordia University under the supervision of Dr. Roberto de Almeida.

D. PURPOSE

I have been informed that the purpose of the research is to investigate reading comprehension and that the research is being conducted to fulfill the course requirements for Psyc 690, master thesis.

E. PROCEDURE

I have been informed that the experiment involves a reading task. I will present them with words appearing on the screen of a computer and after reading each word they will have to press the space bar. Some of the sentences will be followed by a question that will involve a Yes/No answer and they will have to press Y or N key. The experiment will take place at the Taylor Adolescent After School Program during the time they are there. They will not be required to do any other task than that described above. They have been informed that their age and gender will be recorded but that their name will not be associated with such information nor will their name be associated with the data in the experiment. The participation in the experiment and the information and data provided will be kept strictly confidential. If the results of the study are published only group results and not individual data will be reported to preserve the confidentiality of their participation.

F. CONDITIONS OF PARTICIPATION

- I understand that he/she is free to decline to participate in the experiment without negative consequences.
- I understand that he/she is free to withdraw the consent and discontinue the participation at any time without negative consequences.
- I understand that the participation in the study is confidential (i.e., the researcher will know but not disclose my identity)
- I understand that the data from this study may be published
- I understand the purpose of this study and know that there are no hidden motives of which I have not been informed.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARY AGREE TO PARTICIPATE IN THIS STUDY.

NAME (please print)_____

SIGNATURE_____

DATE_____

Appendix D

Sentence Stimuli for Experiments 1 and 2, with corresponding questions indicated with an asterix

1a. The policeman chased the boy. *
b. The policeman chased all day.
c. The policeman rushed the boy.
d. The policeman rushed all day.

Question: Did the policeman chase the boy?

2a. The echo carried the man's call.
b. The echo carried well over the water.
c. The echo continued the man's call.*
d. The echo continued well over the water.

Question: Did the echo continue the man's call?

3a. The child visited his dog.
b. The child visited with his friends.*
c. The child walked his dog.
d. The child walked with his friends.

Question: Did the child visit his grandparents?

4a. The fisherman saved the boat.
b. The fisherman saved with success.
c. The fisherman escaped the boat.*
d. The fisherman escaped with success.

Question: Did the fisherman escape the house?

5a. The teacher kicked the boy. *
b. The teacher kicked for hours.
c. The teacher hurried the boy.
d. The teacher hurried for hours.

Question: Did the teacher kick the dog?

6a. The girl copied the song.
b. The girl copied with passion.
c. The girl sang the song. *
d. The girl sang with passion.

Question: Did the girl sing the song?

7a. The runner watched the starting signal. *
b. The runner watched with patience.
c. The runner waited the starting signal.
d. The runner waited with patience.

Question: Did the runner watch the starting signal?

8a. The crane moved the load.
b. The crane moved with firmness.
c. The crane stood the load. *
d. The crane stood with firmness.

Question: Did the crane stand the load?

9a. The student read the exercises. *
b. The student read a lot.
c. The student tried the exercises.
d. The student tried a lot.

Question: Did the student read the book?

10a. The driver unloaded the truck.
b. The driver unloaded under a lot of pressure.
c. The driver surrendered the truck. *
d. The driver surrendered under a lot of pressure.

Question: Did the driver surrender the truck?

11a. The boss hired the new employee.
b. The boss hired with authority.
c. The boss refused the new employee.*
d. The boss refused with authority.

Question: Did the boss hire the new employee?

12a. The governor passed the law.
b. The governor passed with great dignity.
c. The governor objected the law.*
d. The governor objected with great dignity.

Question: Did the governor object the law?

13a. The lawyer and the client described the contract with the firm was bad. *
b. The lawyer and the client described entirely.
c. The lawyer and the client agreed the contract with the firm was bad.
d. The lawyer and the client agreed entirely.

Question: Did the lawyer and the client describe the contract with the firm was good?

14a. The neighbors called the entire night.
b. The neighbors called very fast.
c. The neighbors talked the entire night. *
d. The neighbors talked very fast.

Question: Did the neighbors talk all day?

15a. The muggers pushed the woman in the fur coat. *
b. The muggers pushed without premeditation.
c. The muggers jumped the woman in the fur coat.
d. The muggers jumped without premeditation.

Question: Did the muggers push the child?

16a. The politician reviewed the night with his wife.
b. The politician reviewed in his office.
c. The politician stayed the night with his wife. *
d. The politician stayed in his office.

Question: Did the politician stay the day with his wife?

Appendix E

Frequency and percentage of verb transitivity and intransitivity

Table E1

Frequency and percentage of transitivity for preferred-transitive verbs

Preferred-transitive verbs

Verb	% of transitivity	% of Intransitivity	Frequency
Chase	69	18	18
Carry	96	6	88
Visit	95	6	109
Save	100	0	62
Kick	77	11	16
Copy	72	13	38
Watch	79	10	81
Move	73	18	171
Read	80	19	173
Unload	97	3	7
Hire	79	11	15
Pass	76	7	89
Describe	90	0	41
Call	75	19	188
Push	93	6	37
Review	75	3	56

Table E2

Frequency and percentage of intransitivity for preferred-intransitive verbs.

Preferred-intransitive verbs

Verb	% of transitivity	% of Intransitivity	Frequency
Rush	19	69	20
Continued	3	95	107
Walk	15	80	100
Escape	20	65	65
Hurry	3	77	36
Sing	29	56	34
Wait	0	98	94
Stand	3	69	148
Try	3	98	140
Surrender	21	70	22
Refuse	0	98	16
Object	3	90	65
Agree	0	64	51
Talk	0	98	154
Jump	7	69	24
Stay	0	78	113

Appendix F

ANOVA tables for Experiment 1

Table F1

ANOVA summary table: Mean reading time for both groups at V+1.

Source	df	SS	MS	F-value
Subject	10	707859.544	70785.954	
Group	1	493800.727	493800.727	6.592*
Group X Subject	10	749059.320	74905.932	
Sentence Type	1	3809.557	3809.557	.425
Sentence Type X Subject	10	89655.521	8965.552	
Verb Preference	1	17150.139	17150.139	2.628
Verb Preference X Subject	10	65257.220	6525.722	
Group X Sentence Type	1	22496.011	22496.011	2.552
Group X Sentence Type X Subject	10	88156.473	8815.647	
Group X Verb Preference	1	4705.594	4705.594	1.010
Group X Verb Preference X Subject	10	46570.922	4657.092	
Sentence Type X Verb Preference	1	4277.071	4277.071	1.819
Sentence Type X Verb Preference X Subject	10	23510.101	2351.010	
Group X Sentence Type X Verb Preference	1	5139.276	5139.276	1.247
Group X sentence Type X Verb Preference X Subject	10	41202.865	4120.287	

* $p < .05$

Table F2

ANOVA Summary table: Mean reading times for LD group at V+1.

Source	Df	SS	MS	F-value
Subject	10	432656.477	43265.648	
Sentence Type	1	3895.364	3895.364	.385
Sentence Type X Subject	10	101071.386	10107.139	
Verb Preference	1	19911.273	19911.273	.2.685
Verb Preference X Subject	10	74149.727	7414.973	
Sentence Type X Verb Preference	1	9396.568	9396.568	2.254
Sentence Type X Verb Preference Subject	10	41681.557	4168.156	

Table F3

ANOVA Summary table: simple comparisons for the LD group at V+1.

Source	df	SS	MS	F-value
IS-IV/IS-TV	1	975.557	975.557	.234
TS-IV/TS-TV	1	28332.284	28332.284	6.797*

* $p < .05$

Note. IS= Intransitive Sentence

IV= Intransitive Verb

TS= Transitive Sentence

TV= Transitive Verb

Table F4

ANOVA Summary table: Mean reading times for normal group at V+1.

Source	Df	SS	MS	F-value
Subject	39	5247364.590	134547.810	
Sentence Type	1	22687.360	22687.360	.2.763
Sentence Type X Subject	39	320252.375	8211.599	
Verb Preference	1	79265.635	79265.635	10.105*
Verb Preference X Subject	39	305915.162	7843.979	
Sentence Type X Verb Prefere	1	64090.032	64090.032	7.148*
Sentence Type X Verb Prefere Subject	39	349670.703	8965.915	

* $p < .05$

Table F5

ANOVA Summary table: simple comparisons for the normal group at V+1.

Source	df	SS	MS	F-value
IS-IV/IS-TV	1	402.753	402.753	.045
TS-IV/TS-TV	1	142952.913	142952.913	15.944*

* $p < .01$

Note: IS= Intransitive Sentence

IV= Intransitive Verb

TS= Transitive Sentence

TV= Transitive Verb

Appendix G

Table of means and standard deviations at the V+1 position, Experiment 1.

Table G1

Table of means and standard deviations for each condition at the V+1 position for the LD group, Experiment 1.

LD

	Mean	Std. Dev.
Transitive S-Transitive V	503.932	114.433
Transitive S- Intransitive V	575.705	136.662
Intransitive S-Transitive V	551.977	108.443
Intransitive S- Intransitive V	565.295	146.372

Table G2

Table of means and standard deviations for each condition at the V+1 position for the normal group, Experiment 1.

Normals

	Mean	Std. Dev.
Transitive S-Transitive V	428.85	163.35
Transitive S- Intransitive V	513.394	256.178
Intransitive S-Transitive V	445.062	175.981
Intransitive S- Intransitive V	449.55	190.497

Appendix H

Letter sent to the parents of the children

from the private school

Dear Parent or Guardian,

We are conducting research on the nature of reading and the causes of reading disabilities in children and adolescents. As you know, reading is a major cognitive function and plays a central role in the educational process. Unfortunately, reading disabilities and reported delays in reading development have been on the rise in Canada. Our research focuses on specific aspects of reading, those that occur at the level of sentence processing. We are writing to you at this time to request your permission to conduct our research with your child. Basic research depends on the good will of millions of volunteers who every year contribute their time and effort in order to help scientific progress in this very important area. We are recruiting children and adolescents (ages 13-18) who have no known reading problems and others who have been diagnosed as having reading disabilities.

Our study is comprised of a battery of tests (word games, sentence completion, sentence self-paced reading, etc; some of them on the computer, some on booklets) that are fun, non-stressful and non-intrusive. In summary, the tests are designed in such a way that the child does not have the feeling of being tested. Once the results are obtained, they can be made available to you in a way that compares your child's results with standard scores (based on age and grade level norms). But the results are never published (or made available) in a way that your child can be identified. **We assure you total confidentiality in the results**.

The tests will take approximately one hour and will take place in the school setting at a time and date that will be determined in conjunction with the school principal and teachers (some time during the 2002-2003 year). Your child will be compensated with a **Gift Certificate** for a movie pass. If you are willing to collaborate with us at this time, please sign this letter in the section below saying that you agree for your child to participate in our research project. Please also have your child sign below so that we know that they are aware of the goals of this study and the methods we are going to use. In order to return the signed form, just drop it at the office with the secretary. If you have any concerns or observations in regard to the goals of this study or if you would like to obtain a copy of the results of your child's standardized test, please use the space below to provide us with your address. Please do not hesitate to contact us if you have any questions.

We thank you very much for your collaboration

Ioana Constantinescu, MA candidate,
Department of Psychology,
Concordia University
ioana@alcor.concordia.ca
514-848-2210

Roberto G. de Almeida, PhD
Assistant Professor, Department of Psychology
Concordia University
almeida@alcor.concordia.ca
(514) 848-2232

Child's name:_____
Signature_____
Parent's name:_____
Signature_____

Address (if would like to receive confidential results, only):

_____

_____

Concerns/Questions:_____

_____

Appendix I

Letter sent to the parents of the children enrolled

in the Taylor Adolescent Program

Dear Parent or Guardian,

We are conducting research on the nature of reading and the causes of reading disabilities in children and adolescents. As you know, reading is a major cognitive function and plays a central role in the educational process. Unfortunately, reading disabilities and reported delays in reading development have been on the rise in Canada. Our research focuses on specific aspects of reading, those that occur at the level of sentence processing. We are writing to you at this time to request your permission to conduct our research with your child. Basic research depends on the good will of millions of volunteers who every year contribute their time and effort in order to help scientific progress in this very important area. We are recruiting children and adolescents (ages 13-17) who have no known reading problems and others who have been diagnosed as having reading disabilities.

Our study is comprised of a battery of tests (word games, sentence completion, sentence self-paced reading, etc; some of them on the computer, some on booklets) that are fun, non-stressful and non-intrusive. In summary, the tests are designed in such a way that the child does not have the feeling of being tested. The results are never published (or made available) in a way that your child can be identified. **We assure you total confidentiality in the results.**

The tests will take approximately one hour and will take place at the Taylor Adolescent Program before the start of the program or at Concordia University depending on your choice of location (some time during the 2002-2003 year). If you are willing to

collaborate with us at this time, please sign this letter in the section below saying that you agree for your child to participate in our research project. Please also have your child sign below so that we know that they are aware of the goals of this study and the methods we are going to use. If you have any concerns or observations in regard to the goals of this study please use the space below. Please do not hesitate to contact us if you have any questions.

We thank you very much for your collaboration.

Ioana Constantinescu
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Leonard Shenker, PhD
Senior Psychologist and
Co-Director
Taylor Adolescent
After- School Program
at the Learning Associates
of Montreal

Child's name:_____
Signature_____

Parent's name:_____
Signature_____

Concerns/Questions:_____
_____

Appendix J

Subjects' information

Group	Age	Sex	TORC-RCQ	Word-ID	Word attack
Normals					
1	14.9	M	123	97	106
2	17.1	M	98	100	98
3	15.8	F	92	100	99
4	13.11	M	87	94	91
5	16.7	M	100	109	97
6	15.6	M	107	127	117
7	15.8	F	90	88	87
8	16.9	F	100	108	118
9	14.4	M	92	102	106
10	15	M	95	99	102
11	17.1	M	103	96	102
12	14.6	M	98	91	104
LD					
1	13.2	F	68	90	99
2	16.1	M	77	102	104
3	16.3	M	78	97	117
4	14.4	M	72	95	88
5	14.7	M	78	105	106

6	15.5	M	63	98	96
7	14.8	F	73	109	100
8	17.11	M	80	89	89
9	14.1	M	62	101	99
10	13.6	M	67	105	105
11	13.9	M	68	111	100
12	18.3	F	40	105	91
13	14.4	M	65	96	100

Appendix K

Sample from TORC

General Vocabulary

1. Daddy baby mother
   A. father
   B. found
   C. sister
   D. over

2. help work play
   A. cake
   B. new
   C. sing
   D. walk

3. banana market sugar
   A. squawk
   B. jacket
   C. flour
   D. grocery

4. wire motor spark
   A. beauty
   B. battery
   C. lightening
   D. mystery

5. Fish goat dog
   A. can't
   B. got
   C. cat
   D. rabbit

6. heavy big giant
   A. large
   B. thumb
   C. ladder
   D. tall

7. beak nest feather
   A. chicken
   B. dragon
   C. cherry
   D. wing

Syntactic Similarities

1. A. Many were there.
   B. Few were there.
   C. None were there.
   D. Not many were there.
   E. Who was there?

2. A. Billy went.
   B. Billy cannot go.
   C. Billy can't go
   D. Billy may go.
   E. Billy wants to go.

3. A. The boy was chased by the dog.
   B. The dog and the boy chased each other.
   C. The dog chased the boy.
   D. The other chased the dog and the boy.
   E. They run.

4. A. We ran yesterday.
   B. We run daily.
   C. We will run tomorrow.
   D. We run.
   E. We run every day.

5. A. They are different.
   B. It is different from the others.
   C. Aren't they the same.
   D. They are alike.
   E. They aren't the same.

6. A. He wondered why she didn't like him.
   B. She didn't like him, and she wondered why.
   C. Why didn't she like him? I wonder.
   D. She wondered why she didn't like her.
   E. Wonder why he didn't like her much.

Paragraph Reading

1. Juan wanted to watch cartoons on TV. Mother said, "No Juan. You may not watch TV because you did not do your work". Juan jumped up and went to work.
    1. What is the best name for this story
        A. TV Cartoons.
        B. Juan watches cartoons
        C. Mother watches cartoons
        D. No TV for Juan
    2. What did Juan do?
        A. go to school
        B. go to play
        C. go to work
        D. go to bed
    3. What did Juan want to see?
        A. a game show
        B. the news
        C. Bugs Bunny
        D. A ball game
    4. What could not go in the story?
        A. Juan did not do his work
        B. Juan worked fast
        C. Juan did not do his work
        D. Juan did not watch cartoons
    5. Who told Juan to get to work?
        A. cartoons
        B. teacher
        C. father
        D. mother

2. Most of the students in the class liked Ms. Fletcher because she new so much about sports. She memorized all the statistics on earned run averages of pitchers, the yards gained by the quarterbacks, upsets in basketball, and even saves made by goalies during hockey season. She didn't keep her secrets to herself, but showed those of us who were interested how to read the sports page and how to use our hand-held calculators to check the statistics of games and players that were popular.

1. What is the best title for this story?
   A. Sports Statistics
   B. A Sports minded Teacher
   C. Calculators to the Rescue
   D. Ms. Fletcher's students

2. How did the students check the sports statistics?
   A. with each other
   B. with Ms. Fletcher's statistics
   C. with their calculators
   D. with Ms. Fletcher's calculator

3. Which sentence is probably very true of Ms. Fletcher?
   A. Ms. Fletcher only liked sports.
   B. Ms. Fletcher enjoyed helping children earn new things
   C. Ms. Fletcher thought that girls didn't need sports.
   D. Ms. Fletcher just learned about sports herself.

4. Which sentence could **not** go in this story?
   A. Most of the students were bored with sports.
   B. Some students learned a lot about sports that year.
   C. Some students knew how to use calculators.
   D. Some students learned a lot about math that year.

5. The stats of goalies are calculated by the number of
   A. baskets made
   B. yards gained
   C. ERAs
   D. Saves

Sentence Sequencing

1. ___ ___ ___ ___ ___
   A. We saw the new baby zebra.
   B. We went to the Zoo on a big orange bus.
   C. Then we all went back to school.
   D. We saw all the other animals there, too.
   E. We said good-bye to schoolwork for the day.

2. ___ ___ ___ ___ ___
   A. We got there just before they closed.
   B. Boy, was that ever close!
   C. We went to the Big Burger.
   D. Mother did not want to cook.
   E. She wanted to go out to eat.

3. ___ ___ ___ ____ ____
   A. We couldn't guess where he had gone.
   B. We found "Jack" with four babies.
   C. The next day we had a big surprise.
   D. We looked until the sun went down, but we couldn't find Jack.
   E. Our pet rabbit, Jack was lost.

4. ___ ____ ____ ____ ____
   A. Those two trucks stayed through the night to be sure that the fire was out.
   B. A fire broke out by the big rocket.
   C. All but two trucks returned to the fire station.
   D. The fire alarm went off.
   E. The firemen came in their trucks to put out the fire.

Appendix L

Sample from WRMT

Word Identification	Word Attack
is	tat
you	op
and	dee
up	ap
cat	ift
stop	raft
come	bim
jump	nan
help	un

Appendix M

ANOVA Summary tables for Experiment 2

Table M1

ANOVA Summary table: Mean reading times for both groups at V+1.

Source	df	SS	MS	F-value
Subject	11	1899561.3	172687.394	
Group	1	816966	816966	7.330*
Group X Subject	11	1225977	111452.455	
Sentence Type	1	3037.5	3037.5	.131
Sentence Type X Subject	11	255614	23237.636	
Verb Preference	1	29190.375	29190.375	.628
Verb Preference X Subject	11	511205.625	46473.239	
Group X Sentence Type	1	384	384	.010
Group X Sentence Type X Subject	11	403498	36681.636	
Group X Verb Preference	1	1162.042	1162.042	.01
Group X Verb Preference X Subject	11	810691.458	73699.223	
Sentence Type X Verb Preference	1	368280.375	368280.375	6.719*
Sentence Type X Verb Preference X Subject	11	602947.625	54813.420	
Group X Sentence Type X Verb Preference	1	125137.042	125137.042	5.378
Group X sentence Type X Verb Preference X Subject	11	255969.458	23269.951	

* $p < .05$

Table M2

ANOVA Summary table: Mean reading time for the LD group at V+1.

Source	Df	SS	MS	F-value
Subject	12	943784.69	78648.72	
Sentence Type	1	232.69	232.69	.023
Sentence Type X Subject	12	119915.3	9992.94	
Verb Preference	1	18019.69	18019.69	.937
Verb Preference X Subject	12	230836.3	19236.35	
Sentence Type X Verb Preference	1	25698.769	25698.76	.257
Sentence Type X Verb Preference Subject	12	218553.231	18212.76	

Table M3

ANOVA Summary table: Simple comparisons for the LD group at V+1.

Source	df	SS	MS	F-value
IS-IV/IS-TV	1	339.84	339.84	.019
TS-IV/TS-TV	1	43378.61	43378.61	2.382

Note: IS= Intransitive Sentence

IV= Intransitive Verb

TS= Transitive Sentence

TV= Transitive Verb

Table M4

ANOVA Summary table: Mean reading time for normal group at V+1.

Source	Df	SS	MS	F-value
Subject	11	2181992.41	198362.94	
Sentence Type	1	2790.75	2790.75	.057
Sentence Type X Subject	11	540618.75	49147.159	
Verb Preference	1	9352.083	9352.08	.094
Verb Preference X Subject	11	1094365.417	99487.765	
Sentence Type X Verb Preferenc	1	461384.083	461384.083	7.827*
Sentence Type X Verb Preferenc Subject	11	648462.417	58951.129	

* $p < .05$

Table M5

ANOVA Summary table: Simple Comparisons for normal group at V+1.

Source	df	SS	MS	F
IS-IV/IS-TV	1	169680.167	169680.167	2.878
TS-IV/TS-TV	1	301056.000	301056.000	5.107*

* $p < .05$

Note: IS= Intransitive Sentence

IV= Intransitive Verb

TS= Transitive Sentence

TV= Transitive Verb

Table M6

ANOVA Summary table: overall analysis for items at V+1.

Source	df	SS	MS	F-value
Group	1	843956.831	843956.831	12.987*
Sentence Type	1	2368.082	2368.082	.036
Verb Preference	1	26483.736	26483.736	.408
Group X Sentence Type	1	757.682	757.682	.012
Group X Verb Preference	1	541.336	541.336	.008
Sentence Type X Verb Preference	1	361057.853	361057.853	5.556*
Group X Sentence Type X Verb Preference	1	143452.413	143452.413	2.208
Residual	92	5978528.538	64984.006	

* $p < .05$

Table M7

ANOVA Summary table: Item analysis for the normal reading group.

Source	df	SS	MS	F-value
Sentence Type	1	2202.859	2202.859	.023
Verb Preference	1	81910.694	81910.694	.859
Sentence Type X Verb Preference	1	601220.713	601220.713	6.302*
Residual	61	5819521.654	95401.994	

* $p < .05$

Table M8

ANOVA Summary table: Simple comparisons for item analysis for normal reading group.

Source	df	SS	MS	F-value
IS-IV/IS-TV	1	121463.276	121463.276	1.290
TS-IV/TS-TV	1	555194.531	555194.531	5.741*

* $p < .05$

Note: IS= Intransitive Sentence

IV= Intransitive Verb

TS= Transitive Sentence

TV= Transitive Verb

Table M9

ANOVA summary table: Item analysis for LD group.

Source	df	SS	MS	F-value
Sentence Type	1	618.766	618.766	.038
Verb Preference	1	32625.391	32625.391	1.994
Sentence Type X Verb Preference	1	9726.891	9726.891	.595
Residual	60	981671.562	16361.193	

Table M10

ANOVA Summary table: simple comparisons for the item analysis for LD group.

Source	df	SS	MS	F-value
IS-IV/IS-TV	1	3362	3362	.230
TS-IV/TS-TV	1	38990.281	38990.281	2.157

Note: IS= Intransitive Sentence

IV= Intransitive Verb

TS= Transitive Sentence

TV= Transitive Verb

Appendix N

Table of means and standard deviations (ms) at the V+1 position, Experiment 2.

	LD		Normal	
	Mean	SD	Mean	SD
Transitive S-Transitive V	502	103	609	196
Transitive S- Intransitive V	583		833	339
Transitive S- Intransitive V	550	212	820	442
Intransitive S- Intransitive V	543	173	652	238