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ABSTRACT
        A study investigated whether children and adolescents
use commas and the principle of Late Closure to guide sentence
parsing decisions as adults do in processing syntactically ambiguous
sentences. The study consisted of three experiments, conducted
similarly but with different subject groups: 24 university students;
24 fourth-graders; and 19 sixth-graders. In each, subjects read
sentences containing different arrangements of pre-posed and main
clauses and comma use, and answered simple comprehension questions,
all presented on a computer using a self-paced, one-word
moving-window procedure. Results indicate that all groups had shorter
reading times on the main clause verb in late closure sentences than
in early closure sentences, supporting the domination of late closure
parsing strategy. While results for adults supported the predicted
patterns of comprehension speed involving closure and comma, they
were not statistically significant. The fourth-graders appeared not
to use information about the comma to override the late closure
parsing strategy. The sixth-graders were clearly sensitive to the
late closure strategy, but did not use comma information as
effectively as did adults. Reading times were similar to those of
fourth-graders. Four figures and one table support the data. (MSE)

The Impact of the Comma on Sentence Processing

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Introduction

When adults read sentences, they make grammatical assignments about the words. This process, called PARSING, follows rudimentary principles required in the syntactic and semantic evaluation of text. One of the principles, Late Closure, guides the parser to attach incoming lexical items into the current phrase under construction. Different kinds of syntactically ambiguous sentences (e.g., garden-path sentences, such as (1) While the crowd cheered the popular magician sawed the woman in half.) serve as an effective means for investigating the parsing process.

When adult readers process (1), they typically misanalyze the verb, CHEERED, by selecting the transitive form and attaching the noun phrase, THE POPULAR MAGICIAN to it. Comparing reading times for the verb in the main clause in ambiguous (1) and unambiguous sentences (e.g., (2) While the crowd cheered him(,) the popular magician sawed the woman in half.) indicates significantly longer latencies in the ambiguous sentences at the verb, SAWED.

Longer RTs at the verb in the main clause in ambiguous sentences such as (1) argue for Late Closure guidance. Late Closure guides the parser down the inappropriate path. The attachment error is realized at the verb in the main clause (SAWED). In sentences such as (2), Late Closure guides the parser appropriately to attach the NP, HIM, as the object of the preposed verb, CHEERED. The garden-path error in (1) compared to the "errorless" reading in (2) at the verb in the main clause, reflects support for the Late Closure strategy.

Late Closure misanalysis of sentences such as (1) can be avoided by the insertion of a comma, separating the preposed clause and the main clause (e.g., While the crowd cheered, the popular magician sawed the woman in half.) Most adults identify the comma as a grammatical convention that guides the parser to avoid the Late Closure misanalysis.

Although the Late Closure principle has been investigated extensively in the adult population, research investigating children's parsing strategies is rare. (But see Adams & Royer, 1993; 1995). From an educational and developmental perspective, the following questions become interesting:

(1) Do young children and adults use different parsing strategies when processing syntactically ambiguous sentences?

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(2) Do children and adults comprehend the comma as a guide to disambiguate syntactically ambiguous sentences?

The goals of the study were to examine whether children and adolescents use Commas and the principle of Late Closure to guide parsing decisions as adults do.

Method

<u>Participants</u>

Twenty-one undergraduate volunteers at the University of Massachusetts received course credit for their participation.

<u>Materials, Design, and Procedure</u>

An example of the 20 sets of sentence conditions appears in Table 1. The targets included a preposed clause and a main clause. The four forms of each sentence were developed by the (2 X 2) factorial combination of Early versus Late Closure strategies and the presence versus absence of a Comma. The comma conditions were included as control conditions.

Each participant was tested individually. Each participant read a total of 109 sentences (20 target, 89 fillers). The materials were presented on a computer screen in a self-paced, one-word moving window procedure. Approximately 1/3 of the items was followed by a simple comprehension question.

Results and Discussion

The pattern of results demonstrated that adult readers read the verb in the main clause more quickly in Early Closure sentences than in Late Closure sentences, $F_1(1,20) = 8.15$, p < .01, MSE = 42272.64. Furthermore, adult readers read the verb in the main clause more quickly in sentences with commas than sentences without commas, $F_1(1,20) = 7.18$, p< .05, MSE = 22152.40. As can be seen in Figure 1, adult subjects read the verb in the main clause as predicted. Although predicted, the interaction of Closure and Comma did not achieve significance. Thus, it seems that the Late Closure principle guides the adult parser to attach the postverbal NP to the preposed verb, close the initial clause, and then process the rest of the sentence without difficulty. For adults, the presence of a comma speeded Reading time2 on the verb in the main clause.

Participants

In order to determine the pattern of results for younger readers, 24 fourth graders (9-10 years old), participated in Experiment 2. The fourth graders were elementary school students who attended a school in Northampton, MA.

Materials, Design, and Procedure

The same materials were used in Experiment 2 as in Experiment 1. The fourth graders were tested in a quiet room in the school library. Fourth graders, just as adults, read the materials on a computer screen using a self-paced, one word moving-window procedure.

Results and Discussion

There was a main effect of Closure for fourth graders; i.e., the verb in the main clause was read more slowly in Early Closure sentences than Late Closure sentences, $F_1(1,23) = 7.41$, $p < .05$, MSE = 57909.52. Although the pattern was in the predicted direction (840.5 ms versus 880 ms), the Comma effect did not achieve significance. When a comma was included in a Late Closure sentence or an Early Closure sentence, the time to read the verb in the main clause was not faster than when a comma was absent. The interaction of Closure X Comma did not achieve significance. It seems that fourth graders did not use information about the comma to override the Late Closure strategy. Figure 2 illustrates the RT pattern graphically.

Experiment 3

Participants

Nineteen sixth graders, 11-12 years old, participated in Experiment 3. The sixth graders attended the same elementary school as the fourth graders.

Materials, Design, and Procedure

The same materials were used in Experiment 3 as in Experiments 1 and 2. The sixth graders were tested in the same quiet room in the school library as the fourth graders. Sixth graders, just as adults and fourth graders, read the materials on a computer screen using a self-paced, one word moving-window procedure.

Results and Discussion

There was a main effect of Closure for sixth graders; i.e., the verb in the main clause was read more slowly in Early Closure sentences than Late Closure sentences, $F_1(1,18) = 11.14$, $p < .01$, MSE $= 17040.97$. Neither the Comma effect nor the interaction of Closure and Comma achieved significance. Figure 3 charts the pattern graphically. Sixth graders were clearly sensitive to the Late Closure strategy but did not use comma information as effectively as adults. Surprisingly, the additional 2 years of reading experience relative to fourth graders did not produce differential reading times when the comma was present.

Experiment 4

Participants

Twenty-eight adolescent readers, 14-16 years old, participate in Experiment 4. The adolescent readers were students from three high schools in central Virginia. The adolescents were tested at the University of Virginia while participating in a summer program.

Materials, Design, and Procedure

The same materials were used in Experiment 4 as in Experiments 1, 2, and 3. Adolescents read the materials from a computer screen and progressed through each sentence using a self-paced, one-word moving window procedure.

Results and Discussion

The adolescent readers' data showed a main effect for Closure; i.e., the verb in the main clause was read more slowly in Early Closure sentences than Late Closure sentences, $F_1(1,27) = 7.38$, $p < .05$, MSE $= 94602.77$. There was no main effect of Comma and the interaction of Closure and Comma did not achieve significance. Most surprisingly, adolescent readers did not use the comma information to isolate the preposed clause from the main clause to avoid misanalysis. Although the pattern of reading times represented the predicted pattern (666.3 ms versus 738.8 ms), adolescent readers did not use comma information to avoid the garden path as efficiently as adults.

General Discussion

The present study used syntactically ambiguous and unambiguous sentences to investigate the guidance of Late Closure and the impact of the Comma on sentence processing. All readers (adults, children, and adolescents) displayed the domination of Late Closure by shorter reading time: on the verb in the main clause of Late Closure sentences (While the crowd cheered him(,) the popular magician sawed the woman in half.) compared to Early Closure sentences (While the crowd cheered(,) the popular magician sawed the woman in half).

In contrast, only adult readers demonstrated a Comma effect. The presence of a comma did not shorten reading time in the disambiguating region (the verb in the main clause) for children or adolescents. The time to read Late Closure sentences (comma/+ or comma/-) was not predicted to differ. The data for all readers supported this prediction. However, the presence of a comma was predicted to eliminate garden-path effects. The adult data demonstrated the predicted pattern although no statistical analysis of the Closure X Comma effect achieved significance.

Educational Implications

One of the functions of the comma, *to disambiguate sentences by separating clauses*, was acknowledged and used by only college-educated readers. This simple bit of grammatical and syntactic knowledge may impact the teaching of reading in such a way that the comprehension of less skilled readers will be enhanced significantly.

References

Adams, B.C. & Royer, J.M. (1993). Parsing strategies in sentence parsing: A developmental study. Presentation at the Society for Research in Child Development (SRCD), New Orleans, LA.

Adams, B.C. & Royer, M. (1995). Developmental differences in sentence processing strategies. Presentation at the Society for Research in Child Development (SRCD), Indianapolis,

Table 1

An example sentence in the four conditions

Condition	Sentence
Early Closure/No Comma	While the crowd cheered the popular magician sawed the woman in half.
Early Closure/Comma	While the crowd cheered, the popular magician sawed the woman in half.
Late Closure/No Comma	While the crowd cheered him the popular magician sawed the woman in half.
Late Closure/Comma	While the crowd cheered him, the popular magician sawed the woman in half.

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Figure 1. Mean Reading Time of the Verb in the Main Clause for Adults
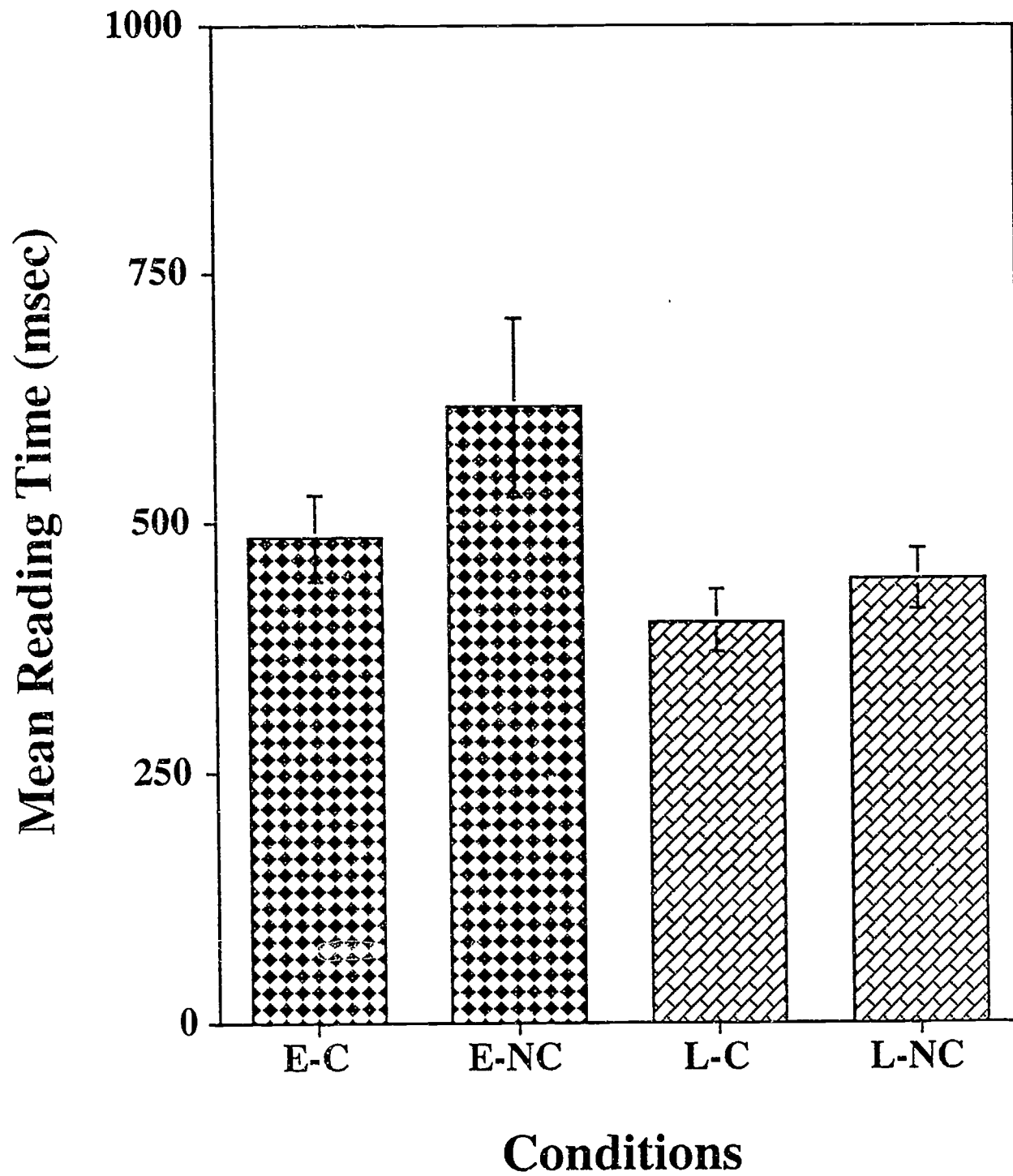
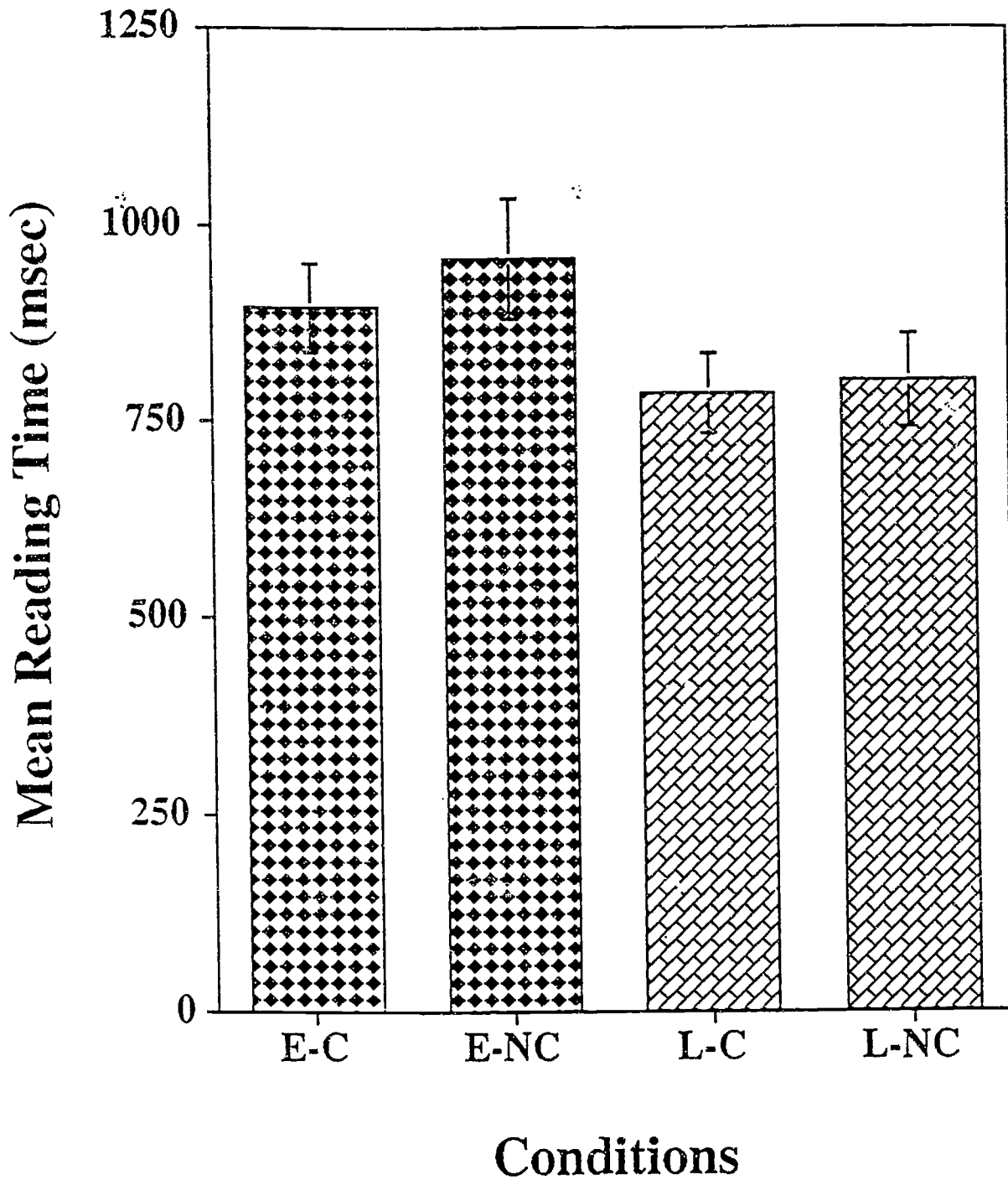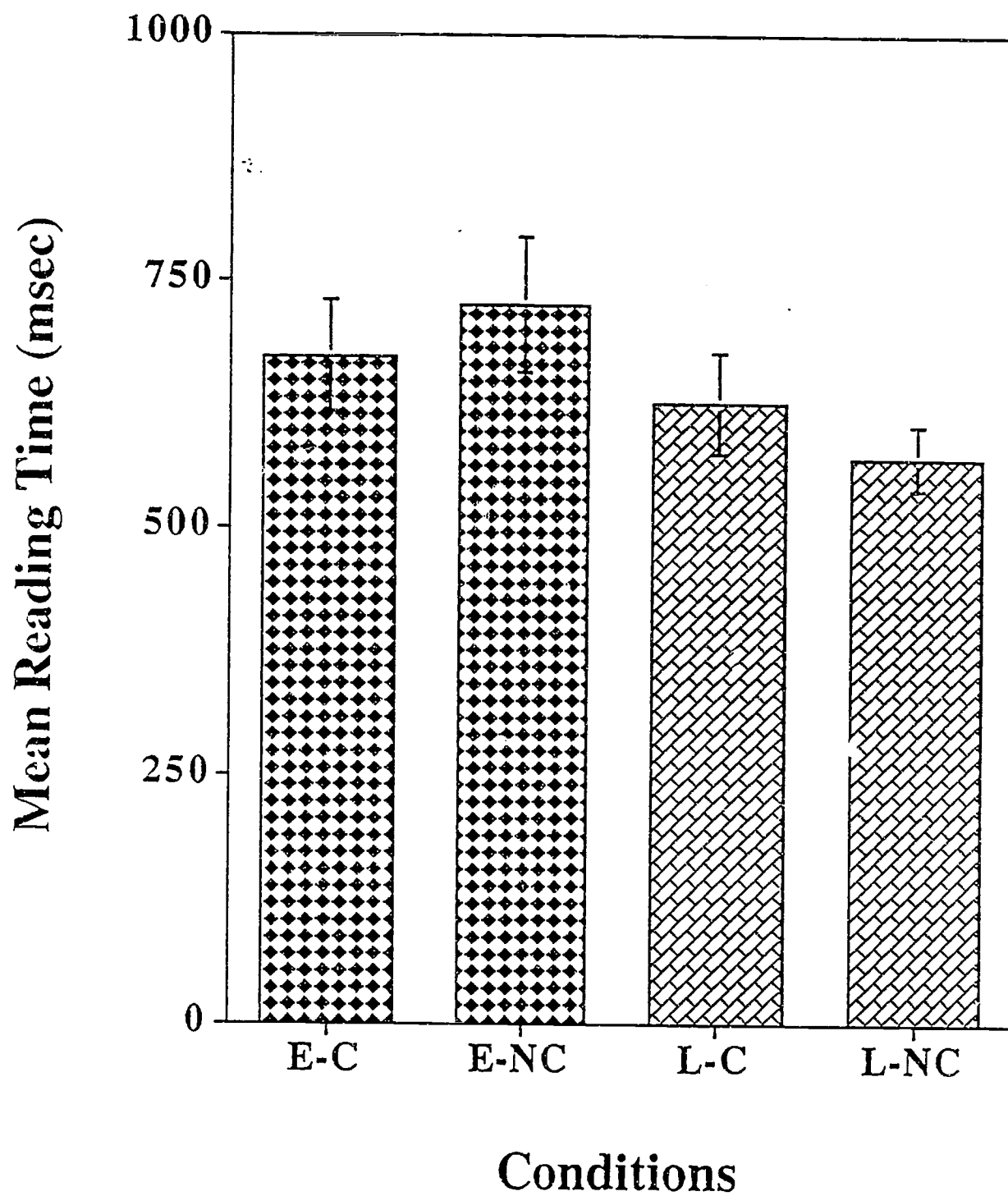# Figure 2. Mean Reading Time of the Verb in the Main Clause for Fourth Graders

Figure 3. Mean Reading Time of the Verb in the Main Clause for Sixth Graders

Figure 4. Mean Reading Time of the Verb in the Main Clause for Adolescents