Context effects and children's knowledge of sentence ambiguity

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CONTEXT EFFECTS AND CHILDREN’S KNOWLEDGE
OF SENTENCE AMBIGUITY

A Thesis
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirement for the Degree
Master of Arts
in
Psychology

by
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June 1994
ABSTRACT

This study was designed to investigate whether children possess adult-like capabilities when interpreting ambiguous sentences involving two quantifiers. Their capabilities were assessed by two different experiments using two different methodologies: 1) the context-available method and 2) the context-unavailable method. In the context-available method (the yes/no judgement task), various pictures depicting different interpretations of the sentences were presented. The subject's task was to determine the match or mismatch between the picture and the sentence presented. In the context-unavailable task (the act-out task), there were no appropriate contexts given to the subject. The subject's task was to perform a simple drawing corresponding to the meaning depicted in the sentence. The rationale for this study was as follows: Even though children may respond differently than adults do when there are no appropriate contexts available, if they do possess adult-like interpretations of the ambiguous sentences, they should be able to respond appropriately when context cues are available. On the other hand, if provided with clear context cues, children still perform differently from adults, then, we will conclude that children do not possess the adult-like interpretations. Overall, 115 English-
speaking children (between the ages of three and eight) and 34 English-speaking adults were tested. The differences between the subjects' response rate to the various interpretations for each experimental sentence were calculated for the various age groups. Chi-square tests were conducted to test the differences between the results of a particular sentence type in each of the two experiments. For data analysis, \( p = .05 \) was set to determine statistical significance. The results suggested that children and adults seem to share similar knowledge structures for certain quantificational sentences, while displaying different knowledge structures for others. However, when context cues were made available to the children, they did demonstrate the ability to assign various meanings to different ambiguous sentences. The study demonstrated that in order to assess whether children can appropriately retrieve and express different meanings, proper methodology should be applied.
ACKNOWLEDGMENTS

I would like to thank my thesis chair, Yu-Chin Chien, for her continuous support, guidance, and concern. Without her backing, knowledge, and support, this thesis could not have been possible.

I would also like to thank my other committee members, Joanna Worthley and David Chavez, for their useful comments and suggestions regarding my thesis.

Finally, I would like to thank my parents, Dr. Yusuf and Mrs. Farida Dhar, my brother, Dr. Mohsin Dhar, Auntie Parveen and my dear friends for their everlasting love, faith, and encouragement throughout my academic years.
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INTRODUCTION

An essential aspect of cognition is the ability to disentangle ambiguities that come across in language. In this thesis, we examined children's ability to deal with sentences that were ambiguous. We asked the following questions: Do children possess adult-like interpretations when they are exposed to ambiguous sentences? In other words, when children come across ambiguous sentences, do they access all the possible readings that would be perceived by an adult or do they access just one particular reading? This issue can be examined by studying the role of context in children's processing of ambiguous sentences. If, given appropriate contexts, children can be prompted to access different readings, this will indicate that they do possess adult-like interpretive abilities.

There has been extensive research on the effect of context on ambiguity processing, many of them concerning lexical ambiguity. According to Neill, Hilliard, and Cooper (1988) among others (e.g., Burgess & Simpson, 1988), there are three models which are expressly designed to account for ambiguity processing: 1) the context-dependent model, 2) the context-independent (or the exhaustive/multiple access) model, and 3) the ordered access (or the single access) model. The context-dependent model states that the meaning retrieved from memory for an ambiguous word is inferred from
the context in which the word presents itself (e.g., Perfetti & Goodman, 1970; Simpson, 1981). For example, given sentences (1) and (2) with an ambiguous lexicon "drill," the word "general" in (1) would serve as the context to prompt the context-appropriate meaning "marching" instead of the context-inappropriate meaning "machine tool." On the other hand, "cement truck" in (2) would trigger the context-appropriate meaning "machine tool," but not the context-inappropriate meaning "marching."

(1) After the general arrived, they started their drill.

(2) After the cement truck arrived, they started their drill.

In its strong form, this context-dependent model claims that the context-inappropriate meanings of a word are not processed at all (Schvaneveldt, Meyer, & Becker, 1976).

The context-independent model, on the other hand, holds the view that, initially, every meaning of an ambiguous word is triggered equally in memory. Depending upon the context in which the ambiguous word is surrounded, a particular meaning is then selected for further processing (e.g., Conrad, 1974; Marcel, 1980; Onifer & Swinney, 1981; Simpson, 1984). Considering sentence (1) again, when one first hears the word "drill," both the meaning "marching" and the meaning "machine tool" are activated. The context word
"general" would then select the meaning "marching" for further processing.

The ordered access model, proposed by Hogaboam and Perfetti (1975), claims that it is the "meaning frequency" of an ambiguous word that plays a significant role in determining which meaning of that word is retrieved first. In other words, only the primary meaning of an ambiguous word is initially activated. If the surrounding context is consistent with the retrieved meaning, then no other secondary meanings are retrieved. On the other hand, if the surrounding context is inconsistent with the meaning that is retrieved, then the secondary meanings of the word will be searched through until the appropriate match corresponding to the context is found. Consider sentences (1) and (2) again. Assuming that the meaning "marching" is more common than the meaning "machine tool" for the word "drill," if one were to be exposed to either (1) or (2), only the meaning "marching" would be activated, initially. For sentence (1), since the activated meaning matches the context, no other meanings need to be retrieved. For sentence (2), since the first activated meaning does not match the context, an alternate meaning (e.g., "machine tool") would be searched for in order to match the context.

In support of the context-dependent model, Schvaneveldt and his collaborators (1976) conducted an experiment which
suggested that the context word preceding an ambiguous word tends to bias the interpretive processing even before the ambiguous word is encountered. In their experiment, they included three conditions, all consisting of three-word sequences such as "heavy-light-weight" and "dark-light-weight." The middle word in the sequence (i.e., light) is ambiguous; it can mean light, as in "brightness," or light, as in "weight." The three conditions differed in the relationship between the meanings of the first and the last words in relation to the middle ambiguous word. In one condition, these two words (heavy and weight) are related to the same reading of the ambiguous word (light); in another condition, the meanings of these two words (dark and weight) are related to different readings of the ambiguous word (light); in the third condition (a control condition), the first and the last words are not related to each other. The rationale behind this study is that if the context word preceding an ambiguous word biases the interpretive processing even before the ambiguous word is encountered, then the meaning of the first word will decide the meaning of the ambiguous word, and only that particular meaning will be accessed. As a result, the word "heavy" decides the meaning for "light" as in "weight," and thus facilitates the reaction time of the word "weight," when the result is compared to the control condition. On the other hand, the
word "dark" decides the meaning for "light" as in "brightness," and thus does not facilitate the reaction time of the word "weight." The result of this study confirmed the prediction and was used as evidence in support of the context-dependent model.

However, as pointed out by Simpson (1984), there are many studies which have indicated that various meanings of an ambiguous word are activated, regardless of the appropriateness of the context. For example, Conrad (1974) conducted an experiment to demonstrate that there existed a lexical look-up process during sentence comprehension. During this process, the meanings of words are activated without the influence of the linguistic contexts. In her experiment, two conditions were included. In one condition (the context-before condition) subjects were presented with sentences that contained an ambiguous word preceded by a disambiguating context. In the other condition (the context-after condition) subjects were presented with sentences that contained an ambiguous word followed by a disambiguating context. The subjects' task was to listen to each sentence and then name aloud the color of a word which was visually presented after the sentence was heard and to repeat the whole sentence. The visually presented colored word was either the ambiguous word used in the sentence, the appropriate category of the ambiguous word, or the
inappropriate category of the ambiguous word. The rationale for the study was as follows: If there exists a lexical look-up process during sentence comprehension, in which meanings of words are activated independent of their context, then, no differences in reaction time in naming the color words between the context-before and the context-after conditions should be observed regardless of the nature of the color words (i.e., the ambiguous word itself, the appropriate category of the ambiguous word, or the inappropriate category of the ambiguous word). This is due to the fact that if context does have an effect on the lexical look-up process, it would do so before the ambiguous word is heard in the sentence. The results of Conrad’s study suggested various meanings of an ambiguous word are activated; context is effective in disambiguating lexical ambiguities only after these meanings are accessed.

As noted by Oden and Spira (1983) among others (e.g., Marcel, 1980; Swinney & Hakes, 1976; Underwood, 1980), the data that claim to support the context-independent model are not fully conclusive. The context-independent model would suggest that different readings of an ambiguous word are activated equally in terms of speed and strength. However, there does exist some empirical data which show the effect of "meaning frequency" of an ambiguous word, that is, the primary meaning is activated faster and more strongly than
the secondary meaning. This factor (namely, meaning frequency) interacts with the compatibility (or appropriateness) of the context to determine which reading of the ambiguous word is activated first and whether or not the secondary meaning should be activated. By using a similar procedure adopted by Conrad (1974), Oden and Spira confirmed the finding that, to a certain degree, various readings of an ambiguous word are activated. However, different readings of an ambiguous word are activated in different degrees and at different speeds; it is the context that determines the strength and the need for further activation of other meanings.

In reviewing the literature regarding the three models related to context effects on lexical ambiguity processing, we found that there was evidence both for and against each model. Nevertheless, a converging conclusion can be reached; that is, contexts do play a significant role in retrieving appropriate meanings for ambiguous sentences. Based on these suggestions, we hypothesized that if, given appropriate contexts, children could be prompted to access different readings, this would indicate that they do possess adult-like interpretive abilities. But, on the other hand, if children accessed just one particular meaning despite the availability of various contexts, this would suggest that children do not possess the same interpretive abilities that
adults have.

In the following section, we present the design of a study (consisting of two experiments) which was used to examine children's ability to disentangle ambiguous sentences. As will be seen in the methodology section, two different methods were included. Using one method (the context-available method), an ambiguous sentence was given following the presentation of a picture which depicted a particular meaning related to the sentence; using another method (the context-unavailable method), an ambiguous sentence was given without any context. Comparing the similarities and differences between children's responses to the ambiguous sentences using these two methods enabled us to determine whether children do possess adult-like abilities in disentangling ambiguous sentences.
METHOD

Subjects

This study included 115 English-speaking children between the ages of three and six and 34 English-speaking adults. There were 55 children and 14 adults for the first experiment (i.e., the context-available task); and 60 children and 20 adults for the second experiment (i.e., the context-unavailable task). These children were recruited from preschools, kindergartens, and elementary schools in Orange County and San Bernardino County. The children were classified into three age groups with one-year intervals. For the first experiment, there were 15 subjects in the first group and 20 subjects in each of the remaining two groups. The mean age of the child subjects tested in the first experiment was 4;05(10) (years; months (days)). The 14 adults tested in the first experiment were undergraduate students attending California State University at San Bernardino. The mean age of these adult subjects was 34;05(21). For the second experiment there were 20 subjects in each group. The mean age of the children tested in the second experiment was 4;06(24) and that of the adults was 21;10(26). The 20 adult subjects tested in the second experiment were undergraduate students attending University
of California at Irvine. The subjects tested in this study were recruited on a voluntary basis. Only those subjects who had no speech handicap and who were willing to participate in this study were included.

Tasks

Two different tasks, a yes/no judgement (YNJ) task and an act-out (AO) task, were used in this study. The YNJ task represented the context-available method; the AO task represented the context-unavailable method. These two tasks were used to assess the subject's interpretation of sentences including quantificational concepts. In the YNJ task, the subject was presented with a series of question-picture pairs, one pair at a time. Each picture depicted two groups of cartoon characters (e.g., three clowns) or objects (e.g., three flowers). The corresponding question was a yes/no question such as "Is a clown holding every flower?" which asked the subject about the interaction between the two groups of cartoon characters or objects depicted in the picture. In certain pictures, the first and

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1The substantial difference between the mean ages of the adult subjects in the first and second experiments is due to the make-up of the students attending two different campuses. We realize that this difference may introduce some confounding effects to the experiments. However, grammatical knowledge generally remains stable in adulthood. Thus, we do not expect this to affect the results.
the second groups of characters or objects held a one-to-one correspondence. In other pictures, no such correspondence was depicted. If, after an inspection of the picture, the subject agreed that the sentence described what was depicted in the picture, then he or she was expected to give a "yes" response. If the subject disagreed with the association between the sentence and the picture, then he or she was expected to give a "no" response.

In the AO task, the subject was presented with a sheet of paper with three empty squares (1" x 1"), a card (5" x 7") with three numbers (or three letters or three figures) or a set of three markers with different colors. The subject was also presented with a series of imperative sentences, one at a time, such as "Write a number in every box." He or she was asked to perform an action according to the sentence presented to him or her. An illustration of the experimental setting is given in Figure 1.
Figure 1. Illustration of the experimental settings of the act-out task.

Sample sentence: "write a number in every box."

Design of the Experimental Questions and Pictures For the YNJ Task

Four different types of experimental questions were used in this experiment. These questions were presented in the active tense. The questions varied as to whether the subject NPs and the object NPs were quantified with the universal quantifier "every" or the existential quantifier "a." According to the type of quantified NPs which appeared in the subject and the object positions, there were four experimental conditions: 1) the "every-every" condition, 2)
the "every-a" condition, 3) the "a-every" condition, and 4) the "a-a" condition. The experimental questions are exemplified in Table 1.

Table 1

Sample Experimental Questions Tested in the Yes/No Judgement Task

<table>
<thead>
<tr>
<th>Sentence type</th>
<th>Sample test sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every-every</td>
<td>1. Is every child holding every balloon?</td>
</tr>
<tr>
<td>Every-a</td>
<td>2. Is every boy pulling a pig?</td>
</tr>
<tr>
<td>A-every</td>
<td>3. Is a boy blowing every balloon?</td>
</tr>
<tr>
<td>A-a</td>
<td>4. Is a gorilla hugging a bear?</td>
</tr>
</tbody>
</table>

The every-a and the a-every conditions. As can be seen from the sample questions, the sentences with different quantified NPs (i.e., the "every-a" and the "a-every" conditions) are ambiguous. For example, in a declarative form, question 2 in Table 1, "Every boy is pulling a pig," is ambiguous in two ways. One corresponds to the reading "for each x=boy, there is a y=pig such that x is pulling y;" the other corresponds to the reading "there is a y=pig such
that for all $x=\text{boy}$, $x$ is pulling $y$." To put these two interpretations in a more casual manner, the first reading would correspond to "all boys are pulling a different pig," whereas the second reading would correspond to "all boys are pulling the same pig."

In order to test the subjects' knowledge concerning the ambiguous interpretations for each sentence type, two different pictures were included, each depicting one of the two meanings (e.g., Figure 2 for the "every-a" sentences; Figure 3 for the "a-every" sentences).

These two picture types were held to be the matched conditions, as they corresponded to the two possible meanings of the given sentence. For each matched condition, there were two question-picture pairs.

In addition to the matched conditions, there was a mismatched condition which consisted of three question-picture pairs. In these three question-picture pairs, what was depicted in the picture did not correspond to any of the two meanings possible in the given sentence. Examples of the mismatched question-picture pairs are given in Figure 4.
Figure 2. Sample pictures corresponding to the two possible interpretations of the "every-a" condition.

"Is every boy pulling a pig?"

"Is every boy pulling a pig?"
Figure 3. Sample pictures corresponding to the two possible interpretations of the "a-every" condition.

"Is a boy blowing every balloon?"

"Is a boy blowing every balloon?"
Figure 4. Sample pictures corresponding to the mismatched cases of the "every-a" condition.

"Is every clown riding a bike?"

"Is every cat chasing a mouse?"

"Is every smurf eating a cookie?"
The every-every and the a-a Conditions. For those sentences with the same quantified NP (i.e., the "every-every" and the "a-a" conditions), there were also matched as well as mismatched conditions. According to the majority of English-speaking linguists, for adult speakers, the "every-every" sentences have only one meaning. For example, in a declarative form, question 1 in Table 1, "Every child is holding every balloon," carries the meaning depicted in the top picture of Figure 5. However, a pilot study has demonstrated that children tend to interpret the "every-every" sentence in non-adult-like fashion; for example, they interpret "every child is flying every kite" as having the meaning "for each x=child, there is a y=kite such that x is flying y (see the bottom picture of Figure 5)." Again, for each case, there were two question-picture pairs.

In addition, there were mismatched cases for the "every-every" condition which consisted of three question-picture pairs. In these three pairs, what was depicted in the picture did not correspond to what was being asked in the sentences.
Figure 5. Sample pictures corresponding to the two possible interpretations of the "every-every" condition employed by children.

"Is every child holding every balloon?"

"Is every child flying every kite?"
For the "a-a" sentences (e.g., "A gorilla is hugging a bear"), there are two possible readings. One is a generic reading "for every x=gorilla, there is a y=bear such that x is hugging y," and the other carries the meaning "for a particular x=gorilla, there is a particular y=bear such that x is hugging y." The pictures that corresponded to these two meanings comprised the matched cases. Again, there were two question-picture pairs for each matched case. Examples are given in Figure 6.

Similar to the other sentence types, there was also a mismatched case for the "a-a" condition. The mismatched case included 3 question-picture pairs.

All together, there were 28 question-picture pairs in the experimental conditions. The block randomization technique was used to organize these 28 pairs into seven test batteries (A to G) so that each of these test batteries contained a question-picture pair from each sentence type.
Figure 6. Sample pictures corresponding to the two possible interpretations of the "a-a" condition.

"Is a gorilla hugging a bear?"

"Is a gorilla hugging a bear?"
Design of the Control Questions and Pictures for the YNJ Task

In addition to the experimental question-picture pairs, we also included two different control conditions: the active "name-name" condition and the "active-every" condition. The examples are given in Table 2.

Table 2
Sample Control Questions Tested in the Yes/No Judgement Task

<table>
<thead>
<tr>
<th>Sentence type</th>
<th>Sample test sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name-name</td>
<td>1. Is Mickey Mouse pushing Donald Duck?</td>
</tr>
<tr>
<td></td>
<td>2. Is Papa Smurf touching Gargamel?</td>
</tr>
<tr>
<td>Active-every</td>
<td>3. Is every tiger sleeping?</td>
</tr>
<tr>
<td></td>
<td>4. Is every window round?</td>
</tr>
</tbody>
</table>

The "name-name" sentences were included to test children’s general ability to handle the sentence constructions that were used in this experiment. The "active-every" sentences were included to assess children’s general knowledge of the concept of "every." For each control condition, there were two matched and two mismatched
question-picture pairs. Examples of these question-picture pairs are presented in Figures 7 and 8.

All together there were eight control question-picture pairs. These eight pairs were randomly arranged in one test battery (Battery H).

Figure 7. Sample pictures corresponding to the two "name-name" conditions (matched and mismatched).

"Is Mickey Mouse pushing Donald duck?"

"Is Papa Smurf touching Gargamel?"
Figure 8. Sample pictures corresponding to the two "active-every" conditions (matched and mismatched).

"Is every tiger sleeping?"

"Is every window round?"
Design of the Test Sentences For the AO Task

Similar to the sentences used in the YNJ task, there were four different types of experimental sentences. These sentences were presented in the imperative form. The sentences varied as to whether the subject NPs and the object NPs were quantified with the universal quantifier "every" or the existential quantifier "a." According to the type of quantified NPs which appeared in the subject and the object positions, there were four experimental conditions: 1) the "every-every" condition, 2) the "every-a" condition, 3) the "a-every" condition, and 4) the "a-a" condition. For each experimental condition, there were four items. The experimental sentences are exemplified in Table 3.

Table 3

Sample Constructions Used in the Act-Out Task.

<table>
<thead>
<tr>
<th>Sentence type</th>
<th>Sample test sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every-every</td>
<td>1. Write every number in every box.</td>
</tr>
<tr>
<td>Every-a</td>
<td>2. Write every number in a box.</td>
</tr>
<tr>
<td>A-every</td>
<td>3. Write a number in every box.</td>
</tr>
<tr>
<td>A-a</td>
<td>4. Write a number in a box.</td>
</tr>
</tbody>
</table>
Altogether, there were 16 sentences in the experimental conditions. These 16 items were organized into 4 test batteries (A to D).

In addition to the experimental sentences, we also included a set of four control sentences such as "Draw every figure on this paper." These control sentences were used to assess the child's general ability in handling the concept of "every."

General Procedures

Due to the length of each experiment, each subject was tested in only one experiment. The study was conducted by two experimenters. One experimenter tested each subject individually in an empty classroom. The other experimenter observed and recorded the subject's responses related to the experiment. The experiment included two sections: a training section and a testing section. In the training section, the subject was given the chance to become familiar with the characters and materials that would be used in the experiment. A set of simple training items was administered to ensure that the subject understood the testing procedure. The training items did not overlap with the test items in the major lexical content and the major structures. In the training section, if the subject responded incorrectly, he or she was corrected and the training items were
readministered to the subject as many times as was necessary. In the testing section, the eight test batteries (A to H) from the YNJ task were presented to the subject in a random order. The four test batteries (A to D) from the AO task were also presented to the subject in a random order. There was no correction of incorrect responses during the testing section. In addition, the test sentences were not given more than two times. Only positive verbal reinforcement (e.g., "very good" or "good job") was used in the experiment, regardless of whether the subject's response was correct or incorrect. However, words giving an indication of direct feedback to the subject (e.g., "correct" or "right") were not used. Depending on the age of the subject, the experiment was completed within two to four testing periods (on different days). Each testing period lasted approximately 20 to 30 minutes. During the entire experiment, a cassette tape recorder was used to record the experimenter's presentation of the sentences and the subject's responses to these sentences. In addition, a set of response sheets was used to record the subject's answers.
Scoring and Analyses

The subject's response to each question-picture pair from the YNJ task was scored as "yes" or "no." The "yes" response indicated that the subject accepted the meaning depicted by the picture for the corresponding question. The "no" response indicated that the subject rejected the association between the question and the meaning depicted by the corresponding picture. For every matched case in each experimental condition, the acceptance or rejection score ranged from zero to two. For every mismatched case in each experimental condition, the acceptance or rejection score ranged from zero to three. For each age group, subjects' acceptance or rejection rate to each experimental condition was calculated. For each group (also for children as a whole), a 2 x 2 Chi-Square test was conducted to assess the differences between the major interpretations for each sentence type. A level of p=.05 was adopted to conclude the significance of each test.

The subject's responses to the experimental sentences from the AO task were classified into eight different types (A to H). An example of each of the eight response types is illustrated in Figure 9.
Figure 9. The eight response types to the experimental sentences tested in the act-out task.

<table>
<thead>
<tr>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="1 1 1" /></td>
<td><img src="image" alt="1 1 1" /></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Type C</th>
<th>Type D</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="1 2 3" /></td>
<td><img src="image" alt="1 1 2" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type E</th>
<th>Type F</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="2 1/3" /></td>
<td><img src="image" alt="2 1/3" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type G</th>
<th>Type H</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="1 2 3" /></td>
<td><img src="image" alt=" " /></td>
</tr>
</tbody>
</table>
According to the response types, subjects’ mean acceptance (or rejection) rate to each interpretation for each experimental sentence was calculated for each age group. Due to the nature of the AO task, for each group (also, for children as a whole) the Chi-Square test for one-way classification was used to assess differences between the major interpretations for each sentence type. A level of $p=.05$ was adopted to conclude the significance of each test.\(^2\)

\(^2\)Due to the nature of the two tasks, the possible response rates for the AO task and that of the YNJ task were not the same. Considering the AO task, for each child, the $\%$ of Type F and that of the Type C responses will add up to the maximum of $100\%$ (here the "every-every" sentence). This is due to the fact that in the AO task, for each kind of sentence, each subject was given four items (one item at a time); and was asked to act out the sentence. If the subject acted out the meaning corresponding to the Type C response one time and the meaning corresponding to the Type F response three times, then we know that this subject gave Type C response $25\%$ of the time and Type F $75\%$ of the time. Different from the AO task, in the YNJ task, each subject was asked to make a judgement about a particular interpretation for a particular sentence (two matched items for each sentence type). The response rate for different interpretations were independent from one another. Thus, the maximum response rate for a particular interpretation was $100\%$. 

RESULTS AND DISCUSSION

The results concerning subjects' correct responses to the control constructions are summarized in Tables 4 and 5. The major interpretations of the four types of quantificational sentences are summarized in Table 6 to Table 13.

The Results of the Control Constructions

Table 4 summarizes the results of the control constructions in the AO task which were used to test children's ability in handling the concept of "every." The results suggested that children younger than four (i.e., G1 children) did show some difficulty in dealing with the concept of "every." Slightly older children (children in G2 and G3) did not indicate any such difficulty.

3We only report and discuss the results of the major interpretations. Other possible interpretations will be mentioned when necessary.
Table 4

Results of the Control Constructions in the Act-Out Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>Correct Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>3;07(14)</td>
<td>79.00%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;07(17)</td>
<td>91.00%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(10)</td>
<td>96.25%</td>
</tr>
<tr>
<td>Adult</td>
<td>20</td>
<td>21;10(26)</td>
<td>99.00%</td>
</tr>
</tbody>
</table>
Table 5 summarizes the results of the control constructions in the YNJ task. The name-name sentences were used to test children’s general ability in handling the test constructions that were used in the YNJ experiment. As can be seen from Table 5, children in groups 1 and 2 showed some difficulty in dealing with the test constructions. Their correct response rate was lower than the level of 80%. Children older than 5 showed little difficulty in dealing with these test constructions, responding correctly 81.37% of the time. Their correct response rate was close to the level performed by the adults (89.28%). The active-every sentences were used to test children’s ability to handle the concept of "every." As indicated in Table 5, in regards to children’s concept of "every," children younger than four had a bit of a problem whereas children older than four didn’t display any such difficulty.
Table 5

Results of the Control Constructions in the Yes/No Judgement Task (Average over the Matched and Mismatched Cases)

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>Name-Name</th>
<th>Active-Every</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>3;06(07)</td>
<td>58.25%</td>
<td>63.25%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;06(16)</td>
<td>73.75%</td>
<td>92.50%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(15)</td>
<td>81.37%</td>
<td>86.25%</td>
</tr>
<tr>
<td>Adult</td>
<td>14</td>
<td>34;05(21)</td>
<td>89.28%</td>
<td>85.72%</td>
</tr>
</tbody>
</table>
The Results of the Every-Every sentences

The major findings concerning the "every-every" sentences are stated in (A) and (B):

(A) As mentioned in the methodology section, there is only one correct interpretation for sentences involving two universal quantified NPs. In the AO task (i.e., the context-unavailable-task), when subjects were instructed to "write every number in every box," the only correct response was to write all three numbers (1, 2, and 3) in each of the three boxes provided (i.e., the Type F response). As can be seen from Table 6, when dealing with the "every-every" sentences, the adult subjects gave the correct Type F response about 91% of the time. About 1% of the time, they gave the incorrect Type C response by assigning the "sum of plurals" reading to this type of sentence. They put one number in one box; a second number in the second box; and a third number in the third box. The difference between the adult subjects' Type F responses and their Type C responses was significant (*χ2).

We use *χ2 to denote the inappropriateness of the χ²-test due to the violation of a certain assumption for this test. Sometimes, the term "significant" is used without statistical test if the difference (e.g., 90:1) is obviously big.

As can be seen from the same table, when context cues were not available, the child subjects gave the "sum of plurals" interpretation (Type C response)
more frequently than the correct Type F responses (Type C: G1-G3 average 49%; Type F: G1-G3 average 10.67%). The difference between children’s Type C and Type F responses was significant for children as a whole ($\chi^2(1, N = 60) = 24.62, p<.05$) and for children in each group (G1: $\chi^2(1, N = 20) = 25.39, p<.05$; G2: $\chi^2(1, N = 20) = 15.84, p<.05$). Their response pattern was opposite to the one exhibited by the adults.

Table 6

Major Responses for the Every-Every Condition in the Act-Out Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>Major Response Types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type F</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>3;07(14)</td>
<td>0.00%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;07(17)</td>
<td>7.75%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(10)</td>
<td>24.25%</td>
</tr>
<tr>
<td>Adult</td>
<td>20</td>
<td>21;10(26)</td>
<td>90.75%</td>
</tr>
</tbody>
</table>

**Note.** Due to the nature of the AO task, the percentage of Type F and Type C responses will always add up to a maximum of 100% for each group.
(B) In the YNJ task (i.e., the context-available task), the only correct picture corresponding to the sentence "every child is holding every balloon" was the one carrying the meaning "for each $x=$child, there are three $Y$'s, $Y=$balloon, such that $x$ is holding all $Y$s" (i.e., the top picture in Figure 5 given on page 19). As indicated in Table 7, when context was available, adults gave correct responses 85.71% of the time. Interestingly but somehow unexpectedly, they gave the apparently incorrect "sum of plurals" interpretation 42.86% of the time. The difference between these two types of interpretations was significant, $\chi^2(1, N = 14) = 39.99$, $p < .05$. 
Table 7
Major Responses for the Every-Every Condition in the Yes/No Judgement Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>Adult-like</th>
<th>Sum of Plurals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>3;06(07)</td>
<td>83.33%</td>
<td>86.67%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;06(16)</td>
<td>57.50%</td>
<td>75.00%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(15)</td>
<td>65.00%</td>
<td>90.00%</td>
</tr>
<tr>
<td>Adult</td>
<td>14</td>
<td>34;05(21)</td>
<td>85.71%</td>
<td>42.86%</td>
</tr>
</tbody>
</table>

Note. Due to the nature of the YNJ task, the percentage of each major response type for each group will be a maximum of 100%.

Looking at the same table, we found that, in general, children allowed the "sum of plurals" (83.64%) reading more frequently than the correct adult-like reading (67.27%), $\chi^2(1, N = 55) = 17.92, p<.05$. Group 1 children allowed both kinds of interpretations about the same amount of time. Group 2 and Group 3 children allowed the non-adult-like "sum of plurals" interpretation more frequently than the correct adult-like interpretation. The difference between these two types of responses was significant for both the children in Group 2, $\chi^2(1, N = 20) = 6.85, p<.05$, and the children in
Group 3, $\chi^2(1, N = 20) = 17.92, p<.05$. Again, the response pattern exhibited by children was different from the one exhibited by the adults.

When dealing with the "every-every" sentences, we found that many of our Group 1 children did not correctly reject the mismatched cases. Their correct response rate was 37.78%. Children in Groups 2 and 3 showed better control of these mismatched cases. Group 2 children correctly rejected these cases 71.67% of the time and Group 3 children 75% of the time.

The results presented in (A) and (B) above indicate that children allow non-adult-like "sum of plurals" interpretation to "every-every" sentences. This is true no matter which task (context-unavailable or context-available) they were engaged in. The results also suggest that when context cues are not available, children do not indicate clear knowledge of the adult-like (Type F) interpretation of the "every-every" sentences. This apparent lack of knowledge of the adult-like interpretation was not as clearly indicated when context cues were available. In other words, some children seemed to be able to pick up the cues depicted in the picture and thus be able to make a linkage between these cues and their knowledge of the "every-every" sentences. For some children, the adult-like interpretation of the "every-every" sentences is possible.
The reason why children did not indicate this interpretation for this type of sentence in the context-unavailable task may be explained as the strong asymmetry between the two meanings in their grammars. Based on the data obtained, we speculate that, for children older than four years (children in G2 and G3), both the adult-like interpretation and the non-adult-like "sum of plurals" reading are grammatical, however, the primary one for them is the non-adult like "sum of plurals" reading. For children younger than four years (children in G1), no clear conclusion can be made regarding their knowledge about the "every-every" sentences, due to the instability of their responses.

As reported earlier, we did obtain some interesting but unexpected data from the adult subjects. When dealing with the context-available task, about 40% of the time, our adult subjects also accepted the "sum of plurals" reading. A possible interpretation to this somehow unexpected result is as follows: the "sum of plurals" reading is also a possible reading for the adults. Similar to the child's grammar, both readings are possible for the adults; and there exists a strong asymmetry between these two readings in their grammar. However, for adults, the "sum of the plurals" reading is the secondary reading. An alternative explanation for this set of unexpected results is that for adults, there is only one interpretation, as suggested by
the majority of the linguists; and the 40% acceptance rate for the "sum of the plurals" reading exhibited by the adults is a task-specific artifact. Which alternative is the more probable one awaits more empirical tests.

One obvious point we may stress is that adults and children demonstrate different knowledge structures concerning the "every-every" sentences.

The Results of the Every-a sentences

The major findings regarding the subjects' interpretations of the "every-a" sentences are summarized in (C) and (D) (also see Tables 8 and 9):

(C) As mentioned in the methodology section, the "every-a" sentences are ambiguous in two ways. In the AO task (i.e., the context-unavailable-task), the two meanings that corresponded to the sentence "write every number in a box" are (i) the Type E response (i.e., all three numbers (1, 2, and 3) were written in a particular box); and (ii) the Type C response (i.e., one number was written in the first box; a second number in the second box, and a third number in a third box). As can be seen from Table 8, when dealing with the "every-a" sentences, the adult subjects gave the Type E response 90.50% of the time. They gave the Type C response 3% of the time. The difference between the adult subjects' Type E and their Type C responses was
significant (*χ²). As can be seen from the same table, when context cues were not available, the child subjects gave the Type C interpretation more frequently than the Type E interpretation (Type C: G1-G3 average 41.25%. Type E: G1-G3 average of 22.67%). The difference between children's Type C and Type E responses was significant for children as a whole (χ²(1, N = 60) = 5.40, p<.05) and for children in Group 1 and Group 3 (G1: χ²(1, N = 20) = 6.48, p<.05; G3: χ²(1, N = 20) = 7.96, p<.05). Their response pattern was opposite to the one exhibited by the adults.
Table 8

Major Responses for the Every-A Condition in the Act-Out Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>Major Response Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>3;07(14)</td>
<td>Type E: 11.75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type C: 27.75%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;07(17)</td>
<td>Type E: 27.50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type C: 41.50%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(10)</td>
<td>Type E: 28.75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type C: 54.50%</td>
</tr>
<tr>
<td>Adult</td>
<td>20</td>
<td>21;10(26)</td>
<td>Type E: 90.50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type C: 3.00%</td>
</tr>
</tbody>
</table>

Note. Due to the nature of the AO task, the percentage of Type E and Type C responses will always add up to a maximum of 100% for each group.

(D) In the YNJ task (i.e., the context-available task), the pictures corresponding to the two meanings of the "every-a" sentences (e.g., every boy is pulling a pig) are the one depicting the "one-to-one" meaning "all boys are pulling a different pig (i.e., the top picture in Figure 2 given in page 15)," and the one depicting the "all-to-one" meaning "all boys are pulling the same pig" (i.e., the bottom picture in Figure 2 given on page 15). As indicated in Table 9, when context cues were available, adults gave both kinds of readings the same amount of time (96.43%).
Table 9

Major Responses for the Every-A Condition in the Yes/No Judgement Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>All-to-one</th>
<th>One-to-one</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>3;06(07)</td>
<td>70.00%</td>
<td>86.67%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;06(06)</td>
<td>52.50%</td>
<td>77.50%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(15)</td>
<td>47.50%</td>
<td>87.50%</td>
</tr>
<tr>
<td>Adult</td>
<td>14</td>
<td>34;05(21)</td>
<td>96.43%</td>
<td>96.43%</td>
</tr>
</tbody>
</table>

Note. Due to the nature of the YNJ task, the percentage of each major response type for each group will be a maximum of 100%.

Considering children's responses, we found that, children accepted the "one-to-one" reading (83.64%) more frequently than the "all-to-one" reading (55.45%), $\chi^2(1, N = 55) = 18.45, p<.05$. The difference between these two types of responses was significant for children in each of the three groups (G1: $\chi^2(1, N = 15) = 8.19, p<.05$; G2: $\chi^2(1, N = 20) = 13.74, p<.05$; G3: $\chi^2(1, N = 20) = 36.47, p<.05$).

Again, the response pattern exhibited by children was different from the one exhibited by the adults.

When dealing with the "every-a" sentences, we found that many of our Group 1 and Group 2 children did not
correctly reject the mismatched cases. The correct rejection rate was 51.11% for Group 1 and 68.33% for Group 2. Children in Group 3 showed better control of these mismatched cases; their correct rejection rate was 88.33%.

The results presented in (C) and (D) above suggest that children younger than five do not demonstrate that they possess stable knowledge of the "every-a" sentences. To a certain degree, children older than five allow both kinds of interpretations to the "every-a" sentences. This is indicated in either kind of task (context-unavailable or context-available) they were engaged in. The results also suggest that the "one-to-one" reading is the primary reading for these children.

Obviously, for adults, both the "one-to-one" and the "all-to-one" readings are grammatical. This is demonstrated by their almost perfect performance in the YNJ task for both readings. However, when they have to make a choice between these two readings (as in the AO task), they strongly preferred the "all-to-one" reading. Once again, adults and children demonstrate different knowledge structures concerning the "every-a" sentences.
The Results of the A-Every Sentences

The major findings concerning the subjects' interpretations of the "a-every" sentences are summarized in (E) and (F) (also see Tables 10 and 11):

(E) Similar to the "every-a" sentences, the "a-every" sentences are ambiguous in two ways. In the AO task (i.e., the context-unavailable-task), one meaning corresponding to the sentence "write a number in every box" is the Type B response, that is, a particular number (e.g., 1) was written in all three boxes (leaving two numbers unused). The second meaning corresponding to the same sentence is the Type C response (i.e., one number was written in the first box; a second number in the second box; and a third number in a third box). As can be seen from Table 10, when dealing with the "a-every" sentences, the adult subjects gave the Type B response 26.5% of the time. They gave the Type C response 67.75% of the time. The difference between the adult subjects' Type B and their Type C responses was significant, χ²(1, N = 20) = 18.59, p<.05. As can be seen from the same table, when context cues were not available, the very young children (i.e., the children in Group 1) gave both types of responses about equally. The slightly older children (children in Group 2 and Group 3) gave Type C responses more often than Type B responses. The difference between children's Type B and Type C responses was significant for
children as a whole (Type B average = 12.67%; Type C average = 57.33%, \( \chi^2(1, N = 60) = 28.49, p<.05 \)). The difference between these two types of responses was also significant for children in Group 2, \( \chi^2(1, N = 20) = 35.31, p<.05 \), and children in Group 3 (*\( \chi^2 \)). The response pattern exhibited by the children in Group 2 and Group 3, to a certain degree, was similar to the one exhibited by the adults.

Table 10

Major Responses for the A-Every Condition in the Act-Out Task

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean age</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>3;07(14)</td>
<td>27.75%</td>
<td>29.00%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;07(17)</td>
<td>9.50%</td>
<td>58.50%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(10)</td>
<td>0.75%</td>
<td>84.50%</td>
</tr>
<tr>
<td>Adult</td>
<td>20</td>
<td>21;10(26)</td>
<td>26.00%</td>
<td>67.75%</td>
</tr>
</tbody>
</table>

Note. Due to the nature of the AO task, the percentage of Type B and Type C responses will always add up to a maximum of 100% for each group.
In the YNJ task (i.e., the context-available task), the two pictures corresponding to the meanings of the "a-every" sentences such as "a boy is blowing every balloon" are the one depicting "one-to-one" meaning "all boys are blowing a different balloon" (i.e., the top picture in Figure 3, and the one depicting "one-to-all" meaning "a particular boy is blowing all three balloons" (the bottom picture in Figure 3). As indicated in Table 11, when context cues were available, adults accepted the "one-to-all" reading 96.42% of the time. However, they only accept the "one-to-one" reading 35.71% of the time. The difference between these two types of responses was significant, $\chi^2(1, N = 14) = 82.20, p<.05$. This set of results given by the adults was unexpected according to the judgement made by the majority of the linguists. The pattern revealed by the YNJ task is opposite to that revealed by the AO task.
Table 11

Major Responses for the A-Every Condition in the Yes/No Judgement Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>One-to-all</th>
<th>One-to-one</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>3;06(07)</td>
<td>60.00%</td>
<td>83.33%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;06(16)</td>
<td>45.00%</td>
<td>67.50%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(15)</td>
<td>45.00%</td>
<td>97.50%</td>
</tr>
<tr>
<td>Adult</td>
<td>14</td>
<td>34;05(21)</td>
<td>96.42%</td>
<td>35.71%</td>
</tr>
</tbody>
</table>

Note. Due to the nature of the YNJ task, the percentage of each major response type for each group will be a maximum of 100%.

In regards to children's responses to the "a-every" sentences, we found that children as a whole accepted the "one-to-one" reading more frequently than the "one-to-all" reading (82.73% vs. 49.09%), \( \chi^2(1, N = 55) = 25.18, p < .05 \). The difference between these two types of responses was significant for each of the three groups (G1: \( \chi^2(1, N = 15) = 13.40, p < .05 \); G2: \( \chi^2(1, N = 20) = 10.27, p < .05 \); G3: \( \chi^2(1, N = 20) = 62.28, p < .05 \)). The response pattern exhibited by children in the YNJ task was opposite to the one exhibited by the adults.
When dealing with the "a-every" sentences, we found that many children in all three age groups tested in this study did not correctly reject the mismatched cases. The correct rejection rate was 40% for Group 1, 58.33% for Group 2, and 60% for Group 3. Adults correctly rejected the mismatched cases 88.09% of the time.

The results presented in (E) and (F) above suggest that, to a certain degree, children allow both kinds of interpretations to the "a-every" sentences. This is indicated in either kind of task (context-unavailable or context-available) they were engaged in. The results also suggest that the "one-to-one" reading is the primary reading for the children. However, it is important to stress the point that children in all age groups tested in this study did not have steady control of the "a-every" sentences (which was evidenced by their low correct rejection rates to the obviously mismatched cases). Because of this, this set of results should be interpreted with caution. For adults, both interpretations were accepted. However, a cognitive dissociation phenomenon was observed (Roediger, Weldon, & Challis, 1989). Adults' preference for a particular reading was influenced (in an opposite direction) by the tasks they were engaged in. By following the suggestions given by most linguists, we agree that both the one-to-one and the one-to-all interpretations are syntactically possible for the "a-
every" sentences. Adults do have these two interpretations in their grammar. However, the one-to-one reading is somehow pragmatically odd; this oddness will only be detected when pragmatic (or contextual) information is required in a task. The YNJ task used in this study requires the subjects to make a judgement about the match or mismatch between a picture and a sentence. Obviously, pragmatic (or contextual) information is relevant in this task. Thus, adults may reject the one-to-one reading for the "a-every" sentences because of this pragmatic reason. This explains why many adults allow the one-to-one reading in the AO task (i.e., the context-unavailable task), while rejecting this one-to-one reading in the YNJ task.

The Results of the A-A Sentences
The major findings concerning the "a-a" sentences are summarized in (G) and (H) (also see Tables 12 and 13):

(G) As stated in the Method section, the "a-a" sentences have two possible readings. In the AO task (i.e., the context-unavailable-task), one meaning corresponding to the sentence "write a number in a box" is the Type A response, that is, a particular number (e.g., 1) was written in one of the three boxes (leaving two numbers unused and two boxes empty). The second meaning corresponding to the same sentence is the Type C response (i.e., one number was
written in the first box; a second number in the second box; and a third number in a third box). The Type C response corresponding to the "a-a" sentences is also known as the generic reading of this type of sentence. As can be seen from Table 12, when dealing with "a-a" sentences, the adult subjects gave the Type A response 95.75% of the time. They gave the generic Type C response 3% of the time. The difference between the adult subjects' Type A and their Type C responses was significant ($\chi^2$). Similar to the adults, when context cues were not available, children gave Type A responses more frequently than the generic Type C response. The difference between children's Type A and Type C responses was significant for children as a whole (Type A average = 68%; Type C average = 16.58%, $\chi^2(1, N = 60) = 31.26, p < .05$). The difference between these two types of responses was also significant for children in each of the three groups (G1: $\chi^2(1, N = 20) = 40.22, p < .05$; G2: $\chi^2(1, N = 20) = 19.64, p < .05$; G3: $\chi^2(1, N = 20) = 36.52, p < .05$). The response pattern exhibited by the children, to a certain degree was similar to the one exhibited by the adults.
Table 12
Major Responses for the A-A Condition in the Act-Out Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>Type A</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>3;07(14)</td>
<td>63.25%</td>
<td>9.25%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;07(17)</td>
<td>62.00%</td>
<td>21.50%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(10)</td>
<td>78.75%</td>
<td>19.00%</td>
</tr>
<tr>
<td>Adult</td>
<td>20</td>
<td>21;10(26)</td>
<td>95.75%</td>
<td>3.00%</td>
</tr>
</tbody>
</table>

Note. Due to the nature of the AO task, the percentage of Type A and Type C responses will always add up to a maximum of 100% for each group.

(F) In the YNJ task (i.e., the context-available task), the two pictures corresponding to the meanings of the "a-a" sentences such as "a gorilla is hugging a bear" are the one depicting the "one-one" meaning "a particular gorilla is hugging a particular bear" (i.e., the bottom in Figure 6), and the one depicting the generic meaning "each gorilla is hugging a bear" (the top picture in Figure 6). As given in Table 13, when context cues were available, adults accepted the "one-one" reading 100% of the time. The generic meaning of the "a-a" sentence was as assessable to the adult subjects as the "one-one" meaning. They accepted the generic reading 92.86% of the time.
Table 13
Major Responses for the A-A Condition in the Yes/No Judgement Task

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean age</th>
<th>One-one</th>
<th>Generic Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>3;06(07)</td>
<td>90.00%</td>
<td>83.33%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>4;06(16)</td>
<td>77.50%</td>
<td>90.00%</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>5;05(15)</td>
<td>85.00%</td>
<td>97.50%</td>
</tr>
<tr>
<td>Adult</td>
<td>14</td>
<td>34;05(21)</td>
<td>100.00%</td>
<td>92.86%</td>
</tr>
</tbody>
</table>

Note. Due to the nature of the YNJ task, the percentage of each major response type for each group will be a maximum of 100%.

Looking at children's responses to the "a-a" sentences, we found that, children as a whole accepted the generic reading slightly more than the "one-one" reading (90.91% vs. 83.64%). The difference between these two types of responses was not significant for children as a whole. The results given in Table 13 also indicate that children in each of the three groups accepted both kinds of readings for the "a-a" sentences. For children in Group 2 and Group 3, the generic reading was preferred to the one-one reading (G2: $\chi^2(1, N = 20) = 5.74$, $p<.05$; G3: $\chi^2(1, N = 20) = 9.78$, $p<.05$). The response pattern exhibited by children in the
YNJ task was similar to the one exhibited by the adults. When dealing with the "a-a" sentences, we found that many children in Group 1 and some children in Group 2 did not correctly reject the mismatched cases. The correct rejection rate was 64.44% for Group 1 and 76.67% for Group 2. Children in Group 3 and adults correctly rejected the mismatched cases. The rejection rate for Group 3 children was 83.33% and that for the adults was 100%.

The results presented in (G) and (H) above suggest that children younger than four do not show steady control for the "a-a" sentences. Children older than four accept both kinds of interpretations to the "a-a" sentences. This is clearly indicated when they were dealing with the context-available (YNJ) task. Moreover, in this task (YNJ), these older children demonstrated a higher performance for the generic reading over the one-one reading. However, the results of the AO task suggested that the "one-one" reading was the primary reading for these children. This is due to the fact that when context cues were not available to them and when they have a chance to make a choice between these two readings, children prefer the "one-one" reading to the generic reading. Adults also indicate acceptance of both kinds of interpretations. Like children, when they had a choice between these two meanings, the adult subjects preferred the "one-one" reading over the generic reading.
SUMMARY AND CONCLUSION

This study assumes the implication derived from several different models which were proposed to account for the effect of context cues in disentangling sentence ambiguity. The implication is that context does play a significant role in the retrieval of appropriate meanings for sentences that are ambiguous (e.g., Burgess & Simpson, 1988; Ferreira & Clifton, 1986). By assuming this implication, we speculated that some apparent differences observed between children's and adults' interpretations of certain ambiguous sentences may be attributed to the so-called task-specific effect. In other words, certain types of tasks (such as the context-unavailable task used in the current study) may restrict the subjects' ability to retrieve and/or express all possible interpretations for a given sentence.

In this study we tested both English-speaking children and English-speaking adults on their ability to deal with ambiguous sentences involving quantificational concepts. Two different tasks (a context-unavailable (AO) task and a context-available (YNJ) task) were used to assess (i) whether children possess adult-like interpretations for these quantificational sentences, and (ii) whether, given appropriate contexts, children can be prompted to access different readings of particular ambiguous sentences like adults do. The results of our study suggest that the very
young children tested in this study (i.e., children younger than four) did not indicate steady control of the quantificational sentences tested in this study. This was evident by their inability to reject the obviously mismatched cases used in the YNJ task. Because of this, we will not draw any specific conclusion for children in this particular group. Slightly older children (i.e., children older than four) indicated better control of the sentences tested in this study. They demonstrated a good grasp of the quantificational sentences that were presented to them. One major finding of this study is that when context cues were made available to these children, they demonstrated the ability to assign various meanings to these ambiguous sentences. Children and adults seem to share similar knowledge structures for certain quantificational sentences, while displaying different knowledge structures for others. For children, the "every-every" sentences have two different meanings, the non-adult-like meaning (i.e., the "sum of plurals" meaning) being the predominant one. Among the adults, very few allow the "sum of plurals" meaning, while most prefer the "adult-like" interpretation. For children, the "every-a" sentences also have two meanings (i.e., the "one-to-one" meaning and the "all-to-one" meaning). The primary meaning for them in this case is the "one-to-one" reading. For adults too, the "every-a" sentences carry the
same two interpretations. However, the primary reading for them is the "all-to-one" reading. For the "a-every" and the "a-a" sentences, children and adults demonstrate similar knowledge structures. These two sentence types both carry two different meanings. Considering the "a-a" sentences, for both children and adults, even though the generic reading is quite popular with context cues being available, the preferred reading for them is the "one-one" reading. In regards to the a-every sentences, children and adults both prefer the "one-to-one" reading to the "one-to-all" reading when context cues are not available. However, as discussed earlier, when the meanings are depicted in the YNJ task, the "one-to-one" reading of the a-every sentences is somehow pragmatically odd. The adults' responses to the a-every sentences are found to be influenced by this pragmatic factor.

Putting aside some limitations that might have been associated with the current study (e.g., not exactly similar sentence structure used in the different tasks and the small sample size for each group), this study provides us with some important information regarding children's ability to disentangle ambiguities that may come across in their early stages of language acquisition. Similar to adults, children do seem to possess various meanings for different ambiguous sentences. One may argue that the research methods adopted
in this study are tasks which may be influenced by performance factors or task-specific factors. However, similar to other tasks, some research methods seem to tap language competence better than others. The act-out task (i.e., the context-unavailable task) requires the subject to act-out the meaning of a sentence. The acted-out meaning may thus be the preferred one among many readings. The YNJ task (i.e., the context-available task) allows the subject to reject or accept a particular meaning of a sentence. It should prompt the non-preferred reading more often than the act-out task does. However, it should be pointed out that the YNJ task may be influenced by pragmatic factors. Obviously, in order for subjects to retrieve and express different meanings, different methods should be applied. This will allow valid conclusions to be drawn from a comparison of convergent results.
REFERENCES


