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<td><strong>Other Contributor(s)</strong></td>
<td>University of Hong Kong</td>
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<td><strong>Author(s)</strong></td>
<td>Luk, Pui-ki, Betty; 陸沛淇</td>
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Children's Comprehension of Relative Clauses

Luk Pui Ki, Betty

A dissertation submitted in partial fulfilment of the requirements for the Bachelor of Science (Speech and Hearing Sciences), the University of Hong Kong, April 28, 1995
Abstract

This study investigates the comprehension of different Cantonese relative clauses by seventy Cantonese-speaking children aged 4;0 to 8;0. Each child was presented with six sentence types distinguished by the functional roles of the head noun phrase and of the relativized noun phrase. The child was instructed to act out the action using toys according to the sentence spoken. The findings show that structural processing strategies, including the noun verb noun strategy, the Minimal Distance Principle and Parallel Function Hypothesis, lead to wrong predictions about the order of difficulty of several sentence types. These strategies cannot be extended to sentences with relativization involving resumptive pronouns in Cantonese. This paper discusses strategies based on syntactic structure and the two-stage parsing model.
Research on children's knowledge of sentence embeddings has been motivated by a number of concerns, not all of them from linguistic theory (Lee, 1992). Some have tried to determine when children attempt to use sentence embedding. Other researchers describe general processing strategies that preschool children may use to interpret complex sentences. This paper investigates comprehension of Cantonese relative clauses (RCs) in children aged from 4;0 to 8;0. It also discusses the adequacy of different processing strategies in the comprehension.

Previous studies

Previous studies on RC comprehension are mostly carried out on children who speak English, French or Japanese as their native language (e.g. de Villier, Tager-Flusberg, Hakuta, 1981; Hakuta, & Cohen, 1979; Sheldon, 1974, 1977; Tavakolian, 1981). Very limited studies can be found on Mandarin-speaking children (e.g. Lee, 1992) and on Cantonese.

Most of the studies on RC comprehension of English-speaking children have typically examined sentences such as 1-4 in Table 1. Sheldon (1974) specifies two variables in the description of a RC construction in English. First, the position of the RC in the sentence, its embeddedness, which changes according to the constituent in the main clause which it modifies. The second variable is the role that the head noun plays in the RC, called its focus.

Table 1

<table>
<thead>
<tr>
<th>Embeddedness (role of complex NP in main clause)</th>
<th>Focus (role of head noun in the RC)</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Subject</td>
<td>Subject</td>
<td>(SS) The cat that bit the dog chased the rat.</td>
</tr>
<tr>
<td>(2) Subject</td>
<td>Object</td>
<td>(SO) The cat that the dog bit chased the rat.</td>
</tr>
<tr>
<td>(3) Object</td>
<td>Subject</td>
<td>(OS) The cat bit the dog that chased the rat.</td>
</tr>
<tr>
<td>(4) Object</td>
<td>Object</td>
<td>(OO) The cat bit the dog that the rat chased.</td>
</tr>
</tbody>
</table>

The two variables give rise to four types of sentences, namely SS, SO, OS and OO sentences. The two subject relatives in English (SS and SO) are center-embedded; and the two object relatives (OS and OO) are right-branching. In a center-embedded sentence, the main clause is interrupted by a relative clause; but in a right-branching sentence, it remains
uninterrupted. The experimental sentences are decidedly unnatural, since semantic cues are removed to study syntactic variables (de Villiers & de Villiers, 1985). Children cannot interpret the sentences with the help of probable event strategies.

Sheldon (1974) focused on looking at the RCs comprehension of English-speaking children from 3;8 to 5;5. The studies agreed that for most of the older age groups, the order of difficulty was SS > OO > OS > SO, with SS being the easiest. This hierarchy of difficulty was also found among French-speaking children of 4- to 9-year olds in Sheldon's (1977) another study. In both languages, structures with parallel functions (SS and OO) were significantly easier than those with non-parallel functions (OS and SO).

de Villiers et al. (1979) conducted a study similar to Sheldon's, using the same sentence types and act-out procedure, with a larger sample of English-speaking subjects. Children's performance on OS sentences was similar to that on SS sentences. The order of difficulty for their subjects were SS = OS > OO > SO.

Tavakolian (1981) investigated comprehension of the same four main sentence types in English. In her findings, SS sentences were well understood while OS sentences were poorly understood. OO and SO sentences were intermediate in difficulty. The order was SS > OO > OS > SO.

The studies on English-speaking children show that the order of difficulty varies slightly because the researchers used identical methodology and highly similar lexical items. Moreover, the subject populations appeared comparable.

In Japanese, relative clauses precede the head noun with no relative pronoun (Clancy, 1985). The surface structure of the sentences have SOV word order in the matrix clause. Hakuta (1981) contrasted the results in her study with English data. She tested twelve children aged between 5;3 and 6;2 and found significantly better performance on left-branching (SS, SO) than center-embedded sentences (OS, OO).

A parallel study on Mandarin Chinese (Lee, 1992) contributes to the understanding of RC acquisition because Chinese has a very different typological characteristics from SVO languages such as English or French. RCs in Chinese precede the head noun and are marked by the morpheme de (的). A gapping strategy is used to relativize subjects and direct objects,
while resumptive pronouns are required for indirect objects, obliques, genitive phrases and objects of comparison (Chao, 1968; Li, & Thompson, 1981). The study shows a different order of difficulty among the RC sentence types (SS > OS > SO > OO). Subjects in the study gave correct responses more frequently when the RC modifies the matrix subject than when it modifies the matrix object.

When the English data is compared with the Chinese data, a very different order is revealed. One major contribution of such great discrepancy should be the difference in typological characteristics of RCs in English and Chinese.

**Relative Clauses in Cantonese**

RCs in Cantonese are similar to those in Mandarin Chinese. They have the reverse order of the English RCs, that is, the head noun comes at the end as in all noun phrases order. According to Matthews and Yip (1994), RCs in Cantonese tend to be of limited length. Unlike English, there is no relative pronouns (e.g. "that") in Cantonese. The particle /ke3/ "既" (denoted as ge) is used to mark the relative clauses. The use of resumptive pronouns /kVy5/ "個" permits some types of RCs which are not possible in English. When the head noun is not the subject or the direct object of the predicate, a resumptive pronoun must be used in the RC to refer forward to the head noun. Besides, another form of RC uses a classifier, and optionally, a demonstrative /ke3/ "個" (distal demonstrative) to mark the Cantonese relatives. The examples corresponding to the four types of RC sentences in English are given in (7-10); relativization of indirect object is exemplified by (11-12).

(7) SS [Vr N] ge N Vm N
抱住 馬騾 既 個狗仔 踢到 大象
hug-ASP monkey ge DEM-CL-doggie kick-ASP elephant
The doggie that is hugging the monkey kicks the elephant.

(8) SO [N Vr] ge N Vm N
馬騾 抱住 既 個狗仔 踢到 大象
monkey hug-ASP ge DEM-CL-doggie kick-ASP elephant
The doggie that the monkey is hugging kicks the elephant.
In English, there are restrictive and nonrestrictive RCs. For example,

(5) The jacket that I saw last week sells for $1000. (restrictive)

(6) This jacket, that I brought last week, cost me $1000. (nonrestrictive)

In Chinese, some grammarians claim that the position of the clause may make such a distinction. In contrast, there are evidence that the RCs do not make any significant meaning difference (Chu, 1983). Matthews and Yip (1994) states that Cantonese does not have any direct counterparts to the nonrestrictive relative. This study focuses on restrictive RCs only.

Lee (1992) compares the word order between Mandarin Chinese and English. The differences imply that some sequences of verbs and noun phrases in the RC sentence types (SO₁ and OOr₁) are unique to Chinese and Cantonese.
Lee (1992) suggests two divergent positions on RC acquisition. The first school assumes that RCs are not acquired until six-year-old (e.g. Hakuta, 1981; Sheldon, 1974). These scholars claim that younger children tend to comprehend RCs with the help of non-syntactic processing strategies. Children at four-year-old have not developed their awareness to syntactic cues in complex sentences. Rather, they comprehend RCs with the help of non-syntactic strategies.

Hamburger and Crain (1982) and Goodluck and Tavakolian (1982) belong to the second school of thought on RC acquisition. They strongly believe that RCs may be acquired as early as four-year-old since children start to employ syntactic strategies in their comprehension. For example, if sentences are semantically reversible, correct interpretation is not possible using the probable event strategy (Strohner & Nelson, 1974) that appears to dominate in the early pre-operational stage of cognitive development (Chapman, 1978). Thus, the child must rely on syntactic cues to interpret spoken message (Abrahamsen & Rigrodsky, 1984).

The two divergent approaches of processing strategies have been proposed to explain the order of difficulty in various literatures. The first approach emphasizes the importance of non-syntactic strategies in children's comprehension of complex sentences. Different scholars account for the order of difficulty of the four RC types in terms of three
non-syntactic strategies, namely the Canonical NVN strategy (Bever, 1970), the Minimal Distance Principle (Smith, 1976) and the Parallel Function Hypothesis (Sheldon, 1974)

Canonical NVN strategy. Bever (1970) claims that children apply the canonical NVN structures to aid accurate sentence interpretation in the absence of specific semantic information. Children tend to interpret the first NVN sequence as "agent-action-recipient". Lahey (1974) suggests that the application of this strategy by four- and five-year-old children accounts for accurate interpretation of center-embedded sentences (SS, SO) and coordinate sentences, but not right-branching ones (OS, OO) in English. If this strategy is applicable to Cantonese, SO sentences will be easier to comprehend than other sentence types.

Minimal Distance Principle. The Minimal Distance Principle is originally proposed by Chomsky (1969) to account for children's comprehension of sentences with complementizers, but can be extended to RCs where constituents are 'missing'. Smith (1976) suggests that when children find a missing noun phrase (NP), they will assign the most recent NP to its location. Then in SS sentence in Cantonese,

e.g. SS [Vr N] ge N Vm N

children tend to assign the head noun "狗仔" (the doggie) to the missing location rather than the third NP "大象" (the elephant). Based on this strategy, SS and SO sentences are easier to comprehend than other types.

Parallel Function Hypothesis. Sheldon (1974) proposes that sentences in which the identical NPs have the same grammatical function in their respective clauses are significantly easier to understand than sentences in which the identical NPs have different functions. In her study on acquisition of RCs in French, Sheldon (1977) hypothesizes that the Parallel Function Hypothesis is a language-independent processing heuristic. With respect to this hypothesis, SS and OO sentences should be easier than other sentences for comprehension in all languages including Cantonese.
In summary, children's comprehension of the six types of RCs based on the three 
non-syntactic strategies is as follows:

Canonical NVN strategy: \( SO, SO_1 > OO, OO_1 > SS > OS \)

Minimal Distance Principle: \( SS, SO, SO_1 > OO, OO_1 > OS \)

Parallel Function Hypothesis: \( SS, OO > SO, OS \)

If the three types of strategies carry equal weight, the predicted order of difficulty of the RC 
comprehension will be: \( SS > SO, SO_1 > OO, OO_1 > OS \).

Syntactic Processing Strategies

The second approach on processing strategies highlights the role of syntactic 
strategies. Children's comprehension of RCs is constrained by structural principles, not just by 
processing strategies.

**Interruption Hypothesis.** Slobin's (1973) universal constraint states that a sentence 
in which the main clause is interrupted by a subordinate clause will be relatively difficult for 
children to process. Hence, sentences which are center-embedded are more difficult than 
sentences in which RCs are left-branching. In Cantonese, \( SS, SO, SO_1 \) sentences are predicted 
to be relatively easier than \( OS, OO \) and \( OO_1 \) sentences.

**Accessibility Hierarchy.** Keenan and Comrie (1977) believe that structures which 
relativize on a position lower in the hierarchy should be more difficult than those which 
relativize on a higher position. They list the order of difficulty as: subject relativization (\( SS, 
OS \)) > object relativization (\( SO, OO \)) > indirect object relativization (\( SO_1, OO_1 \)).

**Conjoined Clause Analysis.** Tavakolian (1981) tries to further explain the 
children's typical errors in comprehending RCs. She argues that her subjects imposed a 
conjoined clause analysis on the complex sentence, treating them as coordinate clauses rather 
subordinate clauses. This analysis works well for \( SS \) in English which have the NVNVN 
configuration. In English \( SS \) sentence, for example,

"The cat that bit the dog chased the rat."

\[
\begin{array}{llll}
N & [that & Vr & N ] & Vm & N
\end{array}
\]

It is hypothesized that children are more likely to ignore the syntactic marker "that". They try 
to interpret the sentence as NVN-and-VN structure with the first NP as the subjects of both
the main clause and the RC. This gives rise to the interpretation that "The cat bit the dog and chased the cat". However, this strategy is not valid for Cantonese RCs (Lee, 1992).

Apart from investigating the adequacy of the non-syntactic strategies, this paper also discusses the role of the syntactic strategies in children's development of RC comprehension.

Method

Subjects

The subjects were 70 Cantonese-speaking children who study in 2 kindergartens or 2 primary schools in Hong Kong. They were divided into 5 groups. Each group consisted of 7 boys and 7 girls.

- 4-year-olds: mean age: 4;2
- 5-year-olds: mean age: 5;3
- 6-year-olds: mean age: 6;2
- 7-year-olds: mean age: 7;2
- 8-year-olds: mean age: 8;3

They were reported to have normal hearing and language abilities.

- There was an adult group which comprised 7 male and 7 female university students aged from 20 to 25.

Materials

The test materials replicated those in Lee's (1992) study with the control for two factors. First, the role of the head noun in the matrix clauses (subject or object). Second, the role of the head noun in the relative clause (subject, direct object or indirect object). This gave rise to six sentence types, namely SS, SO, OS, OO, SOI and OOJ. The test materials consisted of six sentence types, each with four test sentences. Besides, there were four practice sentences. The entire experiment consisted of a total of twenty-eight sentences (see Appendix A).

SS, SO, OS and OO sentences. In designing these sentences, four verbs were used. Two of which denote actions involving the upper limbs (l/p o w/ 拋 "hug" and l/h o y/ 推
"push"). The remaining two signify actions involving the lower limbs (/tʰek/ "kick" and /tsʰ/ "step-on").

Four toy animals of equal size that are not normally perceived to be aggressive were selected. They were a dog, a teddy bear, a monkey and an elephant. Allocation of the toy animals to the three noun phrases positions in the sentences was subject to two restrictions: each toy animal should appear at least once as referent of the lexical NP in the RC, and the three different animals should be used for each sentence.

Within each sentence type, the allocation of the verbs to the embedded verb and the matrix verb of each sentence based on two restrictions. First, each verb should occur at least once in both the embedded and the matrix positions. Second, a verb denoting an action of upper limbs should cooccur with one referring to an action of the lower limbs, and vice versa. The second restrictions ensured that the child would not be inhibited when acting out sentences in which a toy animal might be the agent for both the main clause and the RC. All sentences of these four types of sentences were thirteen syllables in length.

SO₁ and OO₁ sentences. SO₁ and OO₁ sentences were constructed with a different set of verbs. The VPs of the RC used were:

SO₁: /tʰun /k oy s ak ʃ sw ʃ/ "shake-hand with him";
/por /ty s ʃ t ʃ sw ʃ/ "help him brush the hair";
/por /ty s ts ak ʃ ʃ a ʃ/ "help him brush the teeth"; and
/tʰun /k oy s feʃ ʃ sw ʃ/ "wave hand with him".

The matrix verbs, which referred to reversible actions, were

/ken t sy ʃ/ 跟住 "follow"; and
/tʰ ʃ t sy ʃ/ 拖住 "hold hands".

Each of the two sentence types was formed by random selection from eight logical possibilities for the combination of verbs. The NP combinations followed the same restrictions stated in (a) above. Each sentence comprised fifteen syllables in length.

The test sentences were randomized. The experimenter read each sentence with a clear intonation, with a slight juncture after the complex NP subject for SS, SO, and SO₁ sentences, and one before the complex NP object for OS, OO and OO₁ sentences (Lee, 1992).
Procedures

Like many other previous studies on RC comprehension, toy manipulation was employed. Kennedy (1970 cited in de Villier et al., 1979) strongly rejects the use of a picture-cued comprehension task, as the alternative pictures must be small in number to be within the children's scanning pattern. Consequently, the children's performance may be limited.

The experimenter interviewed the subjects individually. At the beginning of every experimental session, the experimenter made sure that the child could name the four type animals and the objects used in the test. The experiment started with the four practice sentences. Only in rare instances were subjects unable to understand the sentences. In such cases the experimenter modeled a response for the child.

For each test item, the experimenter presented three toys, one for each the NPs in the sentence to the child. Three toys were presented rather than all to avoid too much distraction. Then the experimenter instructed the child to act out the actions using the toys according to the sentences spoken. If the child could not hear clearly, the experimenter would repeat the sentence once. The child had to listen carefully and start acting out the actions only after the experimenter had finished speaking the whole sentence.

Scoring

The experimenter recorded the responses obtained from all the subjects coded with Sheldon's (1974) system in the following way. Each NP in a sentence was assigned a number corresponding to its position in the sentence. For example,

\[
\begin{array}{ccc}
V_r & 1 & V_m & 3 \\
\text{抱住} & \text{馬猴} & \text{踢到} & \text{大地}
\end{array}
\]

\[
\begin{array}{ccc}
\text{hug-ASP} & \text{monkey} & \text{kick-ASP} & \text{elephant}
\end{array}
\]

The doggie that is hugging the monkey kicks the elephant

The monkey is labeled 1, the doggie 2 and the elephant 3. Adopting these numbers, the correct response for the matrix clause is 2Vm3 and the RC is 1Vr2. Then the response to this sentence can be recorded as 2Vm3, 2Vr1.

After having coded the responses in this way, a major scoring system awarded 1 point for each correct act-out sequence. A response was scored 1 if both the main clause and
the RC were acted out correctly, otherwise, it was scored 0. Each subject took about 25 minutes to complete the experiment.

Results

The results of the experiment, using the major 1/0 scoring system, are summarized across all age groups in Figure 1. For the first four types of sentences involving subject and object relativization (SS, SO, OS and OO), SS is the easiest and OO the most difficult. Most of the 8-year-olds' responses to SS sentences were correct ($M = 3.929$). However, the scores of OO sentences are still low ($M = 2.071$) at 8-year-old. The mean scores of SO sentences are higher than those of OS sentences for all age groups. The difference between these two types of sentences decreases across age. In the adult group, subjects scored the maximum scores for SS, SO, OS and SO$\_i$ sentences. However, they still made mistake in comprehending OO and OO$\_i$ sentences.

When indirect object relativization is included in the comparison, the scores of SO$\_i$ sentences are higher than those of OS and SO sentences for all age groups. The SO$\_i$ score for 8-year-olds reaches the maximum score of 4. In contrast, OO and OO$\_i$ sentences were more difficult for all age groups.

![Figure 1](image.png)

**Figure 1.** Mean scores of each of the six sentence types for the six age groups. Maximum score = 4
The scores of all the subjects for all the sentence types were analysed with a $5 \times 6$

(Age $\times$ Sentence type) analysis of variance, with the six sentence types as repeated measures.

It reveals significant difference in performance due to the effects of age and sentence types, as well as the interaction between them (see Table 2).

Table 2

Summary of the MANOVA

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>5</td>
<td>57.139*</td>
</tr>
<tr>
<td>Sentence type</td>
<td>9</td>
<td>3146.613*</td>
</tr>
<tr>
<td>Age $\times$ Sentence type</td>
<td>45</td>
<td>37.233*</td>
</tr>
</tbody>
</table>

Note *p < 0.001

Order of Difficulty

In order to determine the significance of the difference between the various sentence types, a post hoc test (Scheffé test) was carried out for each of the five age groups. The results (see Table 3) confirm the general patterns observed in Figure 1.

The significant differences indicate that SS sentences were the easiest for all age groups and the second easiest category were SO$_1$ sentences. The relative order of difficulty across 4.0 to 8.0 can be stated as SS, SO$_1$ > SO > OS > OO, OOi.

Parallel Vs Nonparallel Sentences

To see if parallel function may be one of the factor in determining the order of difficulty of the test sentences, another analysis of variance was included. The subject score on a particular sentence type is the dependent variable. Parallel (SS, OO) and nonparallel (SO, OS) sentences are the within-subject variable. Performance on both the categories of sentences was not significantly different ($p > 0.05$) for all ages grouped together, as well as for individual age group.
Table 3
Significance of the Difference Among Various Sentence Types for Each of the Age Groups

<table>
<thead>
<tr>
<th>Age</th>
<th>Significant Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>4;0</td>
<td>SS &gt; SO, OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SOi &gt; OS, OO, OOi;</td>
</tr>
<tr>
<td>5;0</td>
<td>SS &gt; OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SOi &gt; OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SO &gt; OO, OOi;</td>
</tr>
<tr>
<td>6;0</td>
<td>SS &gt; OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SOi &gt; OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SO &gt; OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>OS &gt; OO</td>
</tr>
<tr>
<td>7;0</td>
<td>SS &gt; SO, OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SOi &gt; SO, OS, OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SO &gt; OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>OS &gt; OO, OOi</td>
</tr>
<tr>
<td>8;0</td>
<td>SS &gt; OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SOi &gt; OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>SO &gt; OO, OOi;</td>
</tr>
<tr>
<td></td>
<td>OS &gt; OO, OOi</td>
</tr>
</tbody>
</table>

Note: The symbol “>” represents that the score of preceding sentence type is higher than the score(s) of the following sentence type(s).

Left-branching Vs Center-embeddedness.

In order to see whether interruption within the matrix clause affects the comprehension of the RCs, the six sentence types were regrouped into two categories: (a) sentences in which RCs are left-branching (SS, SO, SOi) and (b) sentences in which RCs are center-embedded (OS, OO, OOi).

A one-way ANOVA was conducted with each subject's total score on a sentence type as the dependent variable, and the left-branching/center-embedded contrast as the repeated-measure independent variable. The subjects as a whole did significantly better on left-branching types than on center-embedded types, $F(1, 65) = 349.03, p < .0001$. This pattern is true for each of the age groups ($p < .05$), according to the results of Scheffé test.


**Subject Relativization Vs Direct Object Relativization Vs Indirect Object Relativization**

A one-way ANOVA was performed with the subject’s scores on sentences of a particular type as the dependent variable and the position of relativization as the repeated variable. Three categories of sentences were compared: (a) sentences with subject relativization (SS, OS); and (b) sentences with direct object relativization (SO, OO); and (c) sentences with indirect object relativization (SOi, OOi).

The difference among the three categories is significant for all ages combined, $F(2, 195) = 38.21, p < .0001$. The relative order of difficulty can be arranged as:

subject relativization > direct object relativization > indirect object relativization.

However, if different age groups are considered separately, the effect becomes insignificant at any age ($p > .05$).

**Main Clause Vs Relative Clause**

Another scoring system allowed deeper analysis of how subjects process different sentence types. The children’s responses on both the main clauses and the RCs were tabulated separately.

Table 4

**Mean Score on Main Clauses and RCs**

<table>
<thead>
<tr>
<th>Age</th>
<th>SS Main</th>
<th>SS RC</th>
<th>SO Main</th>
<th>SO RC</th>
<th>OS Main</th>
<th>OS RC</th>
<th>OO Main</th>
<th>OO RC</th>
<th>SOi Main</th>
<th>SOi RC</th>
<th>OOi Main</th>
<th>OOi RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4;0</td>
<td>3.14</td>
<td>2.93</td>
<td>2.50</td>
<td>3.00</td>
<td>1.71</td>
<td>1.57</td>
<td>0.57</td>
<td>3.07</td>
<td>2.07</td>
<td>3.71</td>
<td>0.71</td>
<td>3.07</td>
</tr>
<tr>
<td>5;0</td>
<td>3.14</td>
<td>3.36</td>
<td>2.79</td>
<td>3.64</td>
<td>1.50</td>
<td>2.36</td>
<td>1.07</td>
<td>3.21</td>
<td>3.29</td>
<td>3.50</td>
<td>1.00</td>
<td>2.79</td>
</tr>
<tr>
<td>6;0</td>
<td>3.71</td>
<td>3.93</td>
<td>2.93</td>
<td>4.00</td>
<td>3.07</td>
<td>2.00</td>
<td>0.64</td>
<td>3.29</td>
<td>3.57</td>
<td>3.86</td>
<td>1.00</td>
<td>3.14</td>
</tr>
<tr>
<td>7;0</td>
<td>3.78</td>
<td>4.00</td>
<td>2.21</td>
<td>4.00</td>
<td>2.36</td>
<td>2.86</td>
<td>1.00</td>
<td>3.38</td>
<td>3.71</td>
<td>4.00</td>
<td>0.50</td>
<td>3.86</td>
</tr>
<tr>
<td>8;0</td>
<td>3.93</td>
<td>4.00</td>
<td>3.29</td>
<td>4.00</td>
<td>3.43</td>
<td>3.36</td>
<td>2.07</td>
<td>3.93</td>
<td>4.00</td>
<td>3.79</td>
<td>1.86</td>
<td>4.00</td>
</tr>
<tr>
<td>All</td>
<td>3.62</td>
<td>3.70</td>
<td>2.94</td>
<td>3.77</td>
<td>2.68</td>
<td>3.69</td>
<td>1.44</td>
<td>3.46</td>
<td>3.44</td>
<td>3.81</td>
<td>1.43</td>
<td>3.48</td>
</tr>
</tbody>
</table>

From table 4, the mean scores for main clauses are generally higher than those for
RCs. Statistical analysis of Scheffé test confirms the significance of the difference. When all age groups were combined, main clauses rated higher scores than RCs, $F(1,65) = 224.24$, $p < .0001$. When each sentence type was considered separately, the performance on the main clauses was significantly easier for SO, OO and OO₁ sentences for all age groups ($p < .05$).

**Error Analysis**

Toy-manipulation procedure has the advantage of not constraining the child's choice of response in the way that other procedures such as picture-cued comprehension might. A correct response for each sentence requires two actions. An analysis of the systematic errors made by the children is informative. Crosstabulation was used to investigate the effect of age and the difference in performance on various sentence types. See Table 5-10 for a complete distribution of responses to each sentence type.

Some adult subjects made mistakes in comprehending OO and OO₁ sentences. They consistently gave the error response as 12,23. However, the difference between the scores of the correct response and the error pattern is not significant ($p < .01$).

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Distribution of Responses to SS sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Vr N] ge N Vm N</td>
<td>Responses Categories</td>
</tr>
<tr>
<td>1</td>
<td>4;0</td>
</tr>
<tr>
<td>2</td>
<td>5;0</td>
</tr>
<tr>
<td>3</td>
<td>6;0</td>
</tr>
<tr>
<td>4</td>
<td>7;0</td>
</tr>
<tr>
<td>5</td>
<td>8;0</td>
</tr>
<tr>
<td>Total %</td>
<td>83.6%</td>
</tr>
</tbody>
</table>

**Note.** Age effect is significant, $\chi^2(16, N = 70) = 23.03$. Effect of response patterns is significant in 4;0, $\chi^2(16, N = 14) = 42$, $p < .000$; and 5;0, $\chi^2(4, N = 14) = 28$, $p < .001$.

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Distribution of Responses to SO sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>[N Vr] ge N Vm N</td>
<td>Responses Categories</td>
</tr>
<tr>
<td>1</td>
<td>4;0</td>
</tr>
<tr>
<td>2</td>
<td>5;0</td>
</tr>
<tr>
<td>3</td>
<td>6;0</td>
</tr>
<tr>
<td>4</td>
<td>7;0</td>
</tr>
<tr>
<td>5</td>
<td>8;0</td>
</tr>
<tr>
<td>Total %</td>
<td>65.7%</td>
</tr>
</tbody>
</table>

**Note.** Age effect is significant $\chi^2(24, N = 70) = 44.62$. Scores of response patterns differ significantly in 4;0, $\chi^2(16, N = 14) = 56$, $p < .001$; and 5;0, $\chi^2(9, N = 14) = 28$, $p < .001$. 
Table 7
Distribution of Responses to OS sentences

<table>
<thead>
<tr>
<th>Responses Categories</th>
<th>13,32</th>
<th>12,32</th>
<th>13,12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4;0</td>
<td>10</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>5;0</td>
<td>16</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>6;0</td>
<td>12</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>7;0</td>
<td>31</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>8;0</td>
<td>44</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total %</td>
<td>43.9%</td>
<td>14.6%</td>
<td>15.4%</td>
</tr>
</tbody>
</table>

Note. Age effect is significant, $\chi^2 (32, N = 70) = 55.81, p < .001$. Scores for response patterns differ significantly within 6;0, 7;0 and 8;0, as well as all age groups combined ($p < .0001$).

Table 8
Distribution of Responses to OO sentences

<table>
<thead>
<tr>
<th>Responses Categories</th>
<th>23,21</th>
<th>13,21</th>
<th>23,31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4;0</td>
<td>6</td>
<td>34</td>
<td>7</td>
</tr>
<tr>
<td>5;0</td>
<td>7</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>6;0</td>
<td>11</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>7;0</td>
<td>12</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>8;0</td>
<td>29</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Total %</td>
<td>23.2%</td>
<td>61.6%</td>
<td>9.6%</td>
</tr>
</tbody>
</table>

Note. Age effect is not significant, $\chi^2 (12, N = 70) = 10.94, p = .53$. Scores for different response patterns differ significantly within age groups ($p < .001$).

Table 9
Distribution of Responses to SO sentences

<table>
<thead>
<tr>
<th>Responses Categories</th>
<th>23,12</th>
<th>13,12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4;0</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>5;0</td>
<td>44</td>
<td>5</td>
</tr>
<tr>
<td>6;0</td>
<td>49</td>
<td>3</td>
</tr>
<tr>
<td>7;0</td>
<td>52</td>
<td>4</td>
</tr>
<tr>
<td>8;0</td>
<td>56</td>
<td>0</td>
</tr>
<tr>
<td>Total %</td>
<td>80.7%</td>
<td>10.7%</td>
</tr>
</tbody>
</table>

Note. Age effect is significant, $\chi^2 (20, N = 70) = 36.02, p = .017$. Scores for different response types differ significantly ($p < .0001$).

Table 10
Distribution of Responses to OO sentences

<table>
<thead>
<tr>
<th>Responses Categories</th>
<th>13,23</th>
<th>12,23</th>
<th>12,13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4;0</td>
<td>11</td>
<td>32</td>
<td>12</td>
</tr>
<tr>
<td>5;0</td>
<td>9</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>6;0</td>
<td>11</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td>7;0</td>
<td>7</td>
<td>47</td>
<td>1</td>
</tr>
<tr>
<td>8;0</td>
<td>23</td>
<td>33</td>
<td>0</td>
</tr>
<tr>
<td>Total %</td>
<td>21.8%</td>
<td>63.6%</td>
<td>9.3%</td>
</tr>
</tbody>
</table>

Note. No significant effect of age except for 8;0, $\chi^2 (20, N = 70) = 22.09, p = .338$. Significant effect of scores of different response types ($p < .001$).
Discussion

**Inadequacy of the Non-syntactic Processing Strategies**

First and foremost, the observed order or difficulty in this study is similar to that found in Lee (1992). However, the prediction of the non-syntactic strategies regarding the relative order of difficulty of the Cantonese sentence types are not confirmed by the data. The predicted order is SS > SO, SOi > OO, OOi > OS, but the observed order is SS, SOi > SO > OS > OO, OOi. Therefore, the non-syntactic strategies are not adequate to predict the order of difficulty.

The non-syntactic strategies implicitly assume that phrase structure does not play a part in the processing of RCs sentences, children are assumed to neglect the non-syntactic representations. Lee (1992) claims that they “need to fall back on simpler heuristics as shortcuts to comprehension” (p. 61).

Although the Parallel Function Hypothesis shows strong support in Sheldon's (1974) own study, the findings on this study do not confirm it. The results reveal no significantly different performance on parallel (SS, OO) and nonparallel (SO, OS) sentences. Lee (1992), Tavakolian (1981) and de Villiers et al. (1979) also find discrepancy from Sheldon's findings.

Further, the Minimal Distance Principle (MDP) does not accurately reflect the principles governing the comprehension of RCs. Maratsos (1974) shows doubt on the validity of the MDP. It fails to explain why children gave more correct responses to infinitival complements of object-control verbs in the sentence “John tells Bill to leave.” than to those involving subject-control verbs as in “John promises Bill to leave.” Since the MDP does not reflect the true picture with verbal complements, one should not accept it to explain the comprehension of RCs.

The findings not only reveal the inadequacy of the non-syntactic processing heuristics, but also cast doubt on the interaction among various strategies to produce the predicted effects. It remains unclear whether the strategies are of the same strength.
**Role of Syntactic Strategies**

Since the non-syntactic processing strategies are proved to be inadequate to predict the order of difficulty, other strategies are needed to explain the difference in children’s performance on various RCs.

Goodluck and Tavakolian (1982) argue that even 4-year-olds analyze RCs as constituents of NP node. Children’s interpretations are governed by the principle of c-command, a structural condition. Crain and Nakayama (1987) also show that 3- and 4-year-old English-speaking children do not violate structure-dependence in interpreting yes-no questions. Even preschool children’s comprehension of RCs is constrained by structural principles.

The data of the study further support the claim that children, as young as 4-year-old, do employ syntactic strategies in RC comprehension. Sentences with interruption (OS, OO and OO0) are significantly easier than those without interruption. Moreover, the Accessibility Hierarchy is also confirmed by the findings in this study.

The Conjoined Clause Analysis predicts that children will structurally analyze each of the different types of RCs as consisting of conjoined simplex sentence (NVN). When a NP is missing in the surface structure, children posit a missing NP in the second clause. However, Lee (1992) claims that it is not true for Mandarin Chinese because the [NVN] schema is not flexible enough to accommodate the RC structures in Mandarin Chinese.

Although the syntactic strategies such as the Interruption Hypothesis and the Accessibility Hierarchy play certain role in children’s comprehension of RCs, they are unable to explain the occurrence of different response patterns. Lee (1992) tries to adopt Frazier and Fodor’s (1978) two stage parsing model to explain the response patterns. The first stage includes a “shortsighted” device known as Preliminary Phrase Package (PPP). It peers at the incoming sentence through a narrow window which subtends only a few words at a time. It is insensitive in some aspects to the grammatical rules of the language. The main function is to assign lexical and phrasal nodes to groups of words within the lexical string that is received. The second stage of the parsing, Sentence Structure Supervisor (SSS), combines the structured phrases into a complete phrase marker for the sentence by adding higher non-
terminal nodes. It surveys the whole phrase marker for the sentence and keeps track of dependencies between separated items. This two-stage parsing model sounds relevant to children's comprehension of RCs. However, it needs some modifications to make it concrete and less complicated.

Based on this two-stage model, as well as Tavakolian's (1981) Conjoined Clause Analysis, a new two-stage parsing model is proposed to explain the response patterns shown in this study. The new two-stage parsing model still consists of the two stages as in Frazier and Fodor's model. The difference is that the schema of the Conjoined Clause Analysis is included. It is hypothesized that the PPP scans the sentence from the beginning to the end in the first stage of parsing. Children are assumed to be insensitive to the presence of grammatical morphemes that serve as cues to clausal boundaries. They ignore the relative marker ge in the first stage of parsing and cut the incoming relative sentence into [NVN] chunks. The [NVN] chunks are flexible. When a NP is missing from the chunk, it can be replaced by a "null" NP (symbolized as "Δ") which will be further processed in the second stage. The second stage of parsing integrates the chunks and determines the syntactic dependencies. It looks for the NP that the "null" NP refers to and gives rise to the overall structure of the specific sentence. Table 11 indicates the general schematic form of how the parsing is imposed on each RC type. Adult parsings regarding the clausal boundaries are also included for comparison. In each case, the first one or two NP(s) and the first verb are grouped together as a simplex sentence. The remaining NP(s) and verb constitute the second chunk. This missing subject or object is interpreted as being coreferential with the NP of the other chunk. Consider now in greater detail the exact interpretation proposed for each type of RCs.

SS Sentences. In SS relatives, the first Vr-N sequence is parsed as a simplex sentence with a missing subject NP positing a null subject fills the gap in the first clause. This leaves a N-Vm-N sequence remaining for the second clause. Consequently, the first stage (PPP) ends with two chunks [Δ Vr N][N Vm N], corresponding to

[Δ 抱住 藍驢] [狗仔 踢到 大象]
(is hugging the monkey) (the dog kicks the elephant).
Table 11
General Scheme of Imposition of the Two-stage Parsing Model on the Six Types of RCs.

<table>
<thead>
<tr>
<th>Schema:</th>
<th>Child</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ignores marker $ge$</td>
<td>1st parser depends on position of marker $ge$</td>
</tr>
<tr>
<td>SS</td>
<td>$[\Delta \text{Vr} \text{N}] \text{N} \text{Vm} \text{N}$</td>
<td>$[\Delta \text{Vr} \text{N}] \text{ge} \text{N} \text{N} \text{Vm} \text{N}$</td>
</tr>
<tr>
<td>SO</td>
<td>$[\text{N} \text{Vr}] \text{ge} \text{N} \text{Vm} \text{N}$</td>
<td>$[\text{N} \text{Vr} \Delta] \text{ge} \text{N} \text{N} \text{Vm} \text{N}$</td>
</tr>
<tr>
<td>OS</td>
<td>$\text{N} \text{Vm} [\text{Vr} \text{N}] \text{ge} \text{N}$</td>
<td>$[\text{N} \text{Vm} \Delta] [\text{N} \text{Vr} \Delta] \text{ge} \text{N}$</td>
</tr>
<tr>
<td>OO</td>
<td>$\text{N} \text{Vm} [\text{N} \text{Vr}] \text{ge} \text{N}$</td>
<td>$[\text{N} \text{Vm} \Delta] [\text{N} \text{Vr} \Delta] \text{ge} \text{N}$</td>
</tr>
<tr>
<td>SO$_1$</td>
<td>$[\text{N} \text{P \ pro \ Vr}] \text{ge} \text{N} \text{Vm} \text{N}$</td>
<td>$[\text{N} \text{Ve} \Delta] \text{ge} \text{N} \text{N} \text{Vm} \text{N}$</td>
</tr>
<tr>
<td>OO$_1$</td>
<td>$\text{N} \text{Vm} [\text{N} \text{P \ pro \ Vr}] \text{ge} \text{N}$</td>
<td>$[\text{N} \text{Vm} \Delta] [\text{N} \text{Vr} \Delta] \text{ge} \text{N}$</td>
</tr>
</tbody>
</table>

Key. $\rightarrow$ correct response; $\rightarrow$ Incorrect response
The second-stage parser looks for the missing NP in the second chunk. It can refer the "null" subject NP to the second NP (狗仔 doggie) or the third NP (大象 elephant). The former attachment yields the interpretation 2Vm3, 2Vr1 which is the same action sequence as the adult parser. The latter interpretation 2Vm3, 3Vr1 constitutes the major error responses of the children in different age groups (see Table 5).

The high percentage of correct responses to SS would be quite predictable for all age groups if we include the Minimal Distance Principle and the Conjoined Clause Analysis for the explanation. Both strategies facilitate the child to replace the missing NP by the most recent head noun rather than the third noun phrase. Hence, the correct interpretation is more likely to occur than the error pattern. This accounts for the superiority of the performance on SS sentences.

**SO Sentences.** Regarding SO sentences, the initial N-Vr-N sequence forms a simplex sentence. The second clause consists of the remaining Vm-N sequence and an inserted "null" subject. The subject is then interpreted as being coreferential with either the subject of the first clause using the Conjoined Clause Analysis, or the object of the first clause using the Minimal Distance Principle. The former interpretation leads to the only error type 1Vm3, 1Vr2, while the latter produces correct response pattern 2Vm3, 1Vr2.

Under this account, RCs are better understood than the main clauses on SO sentences because RCs form an integral component in the parse, but the main clause does not. Further the difference between the correct response and the error pattern is not statistically significant for younger children (in Table 6), indicating similar probability of the two responses.

**OS Sentences.** The results of the OS sentences carry special significance. The combination of verbs and NPs exhibited in OS sentences is unique to Mandarin Chinese and Cantonese. It cannot be found in English. The findings of this study indicate that OS sentences are more difficult to comprehend than the SS and SO sentences. This may be related to the difficulty in achieving a correct analysis when the children are required to assign two adjacent verbs to different clauses.

In the first stage of parsing, the PPP chunks the incoming OS sentence into two clauses. The first clause constitutes [N Vm Δ] chunk in which the object is missing. The
second chunk is made up of \([Δ Vr N]\) in which the subject is missing. One more NP has been left behind, leading to the analysis \([N Vm Δ][Δ Vr N]\). This analysis is very difficult for children to handle because two "null" NPs have to be inserted. The second stage of parsing is a difficult and confusing task. The SSS looks for the missing NPs. The third NP may function as the object of the first clause and the subject of the second clause, leading to the correct response 1Vm3, 3Vr2. Alternatively, the "null" NPs may be substituted by other NPs in the sentences. This produces two possible error patterns 1Vm2, 3Vr2 and 1Vm3, 1Vr2.

Table 7 shows that the scores for the correct response is not significantly different from that of the other two responses at 4- and 5-year-olds. This indicates that children try all possibilities within the range of response patterns at their early stage of development. In addition, the overall percentage of correct response is low (43.9%). This may be due the availability of three possible response patterns. Under the parsing analysis, main clauses and RCs should score roughly the same number of correct responses. This prediction is confirmed by the data obtained in this study.

**OO Sentences.** OO sentences were one of the two most difficult sentence types, contrary to the prediction. According to the new two-stage parsing model, OO sentences may be parsed into two chunks with \([N Vm N]\) as the first clause and \([Δ Vr N]\) as the second one in the first stage of parsing. In the second stage, the SSS tries to refer the null subject NP in the second chunk to the subject NP or the object NP of the first chunk. The possible analyses are 1Vm2, 2Vr3 and 1Vm2, 1Vr3. However, this parsing does not lead to any correct sequence of actions and explains the relatively low scores for correct responses in OO sentences (below 23.2%) for all age groups. Moreover, the main clauses were interpreted less accurately than RCs because of the children's high tendency to group the subject of the RC as part of the main clause in the first parse.

**SO\(_i\) Sentences.** Children's performance on SO\(_i\) sentences was similar to that on SS, but significantly superior to that on SO sentence. The parsing of SO\(_i\) sentence is similar to that of SO sentence. It is assumed that ge is ignored. The RC forms a clausal unit \([N Vr N]\), while the main clause \([Δ Vm N]\) as the second segment. If the second stage of parsing conjoins the two clauses, it gives rise to an error response 1Vm3, 1Vr2. If the second stage
parser assign the second NP as the missing NP in the sentence, it yields a correct response 2Vm3, 1Vr2. In this sentence, it is impossible for the pronoun to be identified with a following NP; however, in Cantonese backward anaphora for lexical pronominal elements is possible for resumptive pronouns (Lee, 1992).

**OOi Sentences.** OOi sentence present the same segmentation problem as OO sentence, leading to relatively low mean scores for all age groups. The problem is due to the initial [N Vm N] sequence, which contains a clausal boundary between the main and the second NP. The initial [N Vm N] sequence is identified as a clause. The remaining portion of the sentence contains [Vr N] in which the subject NP is missing. This predicts that the children's interpretation may be 1Vm2, 1Vr3 or 1Vm2, 2Vr3. Both of them are error patterns. That is why the children's mean scores for OOi sentences are very low.

The distribution of responses to different sentence types reveals that the scores for correct responses increase and the scores for other possible error patterns decrease with age. This reflects that children tend to restrict their responses to one specific type as they develop their language. It is hypothesized that the syntactic parser relies on a phonological short-term memory to retrieve syntactic information. As children get older, their short-term memory (STM) gradually become larger. The increase in STM's capacity enables children to attend to the information about word order, as well as morphological markers (Romani, 1994). Consequently, children refine their parsing system and eventually acquire the adult's parsing. The data on OO and OOi sentences may be useful to predict when children start to employ the adult parsing. Since both OO and OOi sentences require the adult parsing in order to produce correct responses, the abrupt increase of scores for these two sentence types at 8-year-old indicates the emergence of adult parsing in children's processing of RCs and probably an increase in the capacity of the STM.

**Conclusions**

The preceding discussion has focused on some of the possible parsing analyses carried out by children in their interpretations. It is clear that the particular range of error types possible and the relative ease of comprehension of main and RCs do not follow a straightforward way from the center-embeddedness of RCs (Lee, 1992). The error patterns
cannot be simply explained by processing heuristics such as the NVN, the Minimal Distance Principle and the Parallel Function Hypothesis. Moreover, these non-syntactic strategies fail to predict the order of difficulty of the RCs because they totally exclude the syntactic representations from children's processing mechanism.

Tavakolian's (1981) Conjoined Clause Analysis of RCs, and Frazier and Fodor's (1978) two-stage parsing model are modified to explain children's response patterns in this Cantonese study. One can argue that children perform poorly on OO and OO₁ sentences because the children's parsing is not sophisticated to produce the correct response. The newly adapted two-stage parsing model seems to apply well to all the six sentence types as well as Lee's (1992) findings on Mandarin. This model also explains the major error patterns demonstrated by the subjects.

In addition, the model has two implications. First, the findings of this study indicate that the children as young as four-year-old are able to employ preliminary syntactic strategies in comprehending complex sentences. Although they tend to ignore the syntactic marker in their interpretation, they attend to the overall syntactic structure of the RCs. Second, language processing is narrowly restricted in the early stage of development. Though there are more than twenty possible sequences of actions for each sentence type, children restricted their analyses to only several patterns. Takavolian (1981) states that "the value of such a restriction in language development is that it greatly limits the number and kind of possible hypotheses a child must entertain in constructing a grammar for his language" (p. 185).

Clinical Implications

Because RC comprehension revealed a course of development over the years from 4 to 8 or even onwards, the present study may have some important implications for language assessment in children of this age range. Very few standardized language tests in Cantonese are available for the children at school age. And of those tests that do exist, they contain subtests that assess linguistic skills normally acquired by much younger ages, for example under 7 years old. Because of these limitations, it is very difficult for the clinicians to assess the language ability of the older children. Therefore, it is a need to establish some valid index of later language development.
Limitations and Implications for Further Studies

This study shows a trend of increasing ability to comprehend RCs. However, it cannot tell when children fully acquire the ability. In order to have a complete picture on children's development of RC comprehension, older age groups may be included.

The stimuli sentences may be too long for children to store in their short-term memory. Then their comprehension ability may be hindered. It is expected that children show better performance if the length of the sentences are shortened by replacing transitive verbs in the main clause by intransitive verbs.

Since the two-stage parsing model is newly adopted and applied to explain the response pattern of the subjects in this study, further research on the functioning of this model is recommended. Other complex sentences, for instance verbal complements, may be included in order to test the validity of this model. Moreover, application of the model in reading comprehension may give rise to more information about the two-stage parsing model.

In this study, the prosodic factor is ignored. However, in actual situations, children may take the stress and the pause into their interpretation (Lahey, 1974). Further research may explore the effect of prosodic factors on the comprehension of RCs.

Finally, there are some literatures about the comprehension of RCs in adults with aphasia (e.g. Grodzinsky, 1989). It may be possible to account for the comprehension deficit in the agrammatic comprehension of RCs using the new model proposed in this study.

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- Holy Carpenter Primary School
- Kei Shun Primary School

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References


Appendix A

Test Stimuli

SS Sentences:
1. The monkey that is pushing the elephant kicks the teddy-bear.
   推住 大象 既→個隻馬驢 踢到 熊仔
2. The dog that is hugging the monkey steps on the elephant.
   抱住 馬驢 既→個隻狗仔 推到 大象
3. The elephant that steps on the bear pushes the doggie.
   踏到 熊仔 既→個隻大象 推住 狗仔
4. The teddy-bear that kicks the doggie is hugging the monkey.
   踢到 狗仔 既→個隻熊仔 抱住 馬驢

SO Sentences:
5. The monkey that the doggie steps on is hugging the teddy-bear.
   狗仔 踏到 既→個隻馬驢 抱住 熊仔
6. The doggie that the monkey kicks is pushing the elephant.
   馬驢 踢到 既→個隻狗仔 推住 大象
7. The elephant that the teddy-bear is pushing kicks the doggie.
   象仔 推住 既→個隻大象 踢到 狗仔
8. The teddy-bear that the elephant is hugging steps on the monkey.
   象仔 推住 踏到 狗仔 既→個隻馬驢

OS Sentences:
9. The teddy-bear is pushing the monkey that steps on the doggie.
   熊仔 推住 踏到 狗仔 既→個隻馬驢
10. The elephant is hugging the doggie that kicks the teddy-bear.
    大象 抱住 踢到 熊仔 既→個隻狗仔
11. The doggie kicks the elephant that is hugging the monkey.
    狗仔 踢到 抱住 馬驢 既→個隻大象
12. The monkey steps on the teddy-bear that is pushing the elephant.
    馬驢 踏到 推住 大象 既→個隻熊仔
13. The elephant is pushing the doggie that the teddy-bear kicks.

14. The monkey is hugging the teddy-bear that the elephant steps on.

15. The teddy-bear steps on the monkey that the doggie is hugging.

16. The doggie kicks the elephant that the monkey is pushing.

17. The doggie that the teddy-bear shakes hand with is following the monkey.

18. The elephant that the doggie help combing its hair is pulling the teddy-bear.

19. The teddy-bear that the monkey help bushing its teeth is following the elephant.

20. The monkey that the elephant waves hands with is pulling the doggie.

21. The elephant is following the doggie that the teddy-bear shakes hand with.

22. The teddy-bear is pulling the monkey that the doggie helps combing its hair.

23. The monkey is following the teddy-bear that the elephant helps bushing its teeth.

24. The doggie is pulling the elephant that the monkey shakes hand with.