Acquisition of Recursive Possessives and Locatives within DPs in Japanese

Akiko Terunuma, Miwa Isobe, Motoki Nakajima, Reiko Okabe, Shunichiro Inada, Sakumi Inokuma, and Terue Nakato

1. Introduction

Recursive structures, where a certain phrasal category is embedded in the same type of category, have attracted increasingly more attention in recent studies of language acquisition within the framework of generative grammar (Chomsky (2007, 2008)). Recursion that is defined as in (1) in traditional phrase structure rules enables one category to appear in the same category, thereby generating structures with two or more phrases of the same type, as in (2) and (3).

(1) XP → X YP
     YP → Y XP

(2) [XP [YP [XP ]]] (two-level recursion of XP)

(3) [XP [YP [XP [YP [XP ]]]]] (three-level recursion of XP)

In previous literature, it has been reported that comprehending and producing recursive structures is difficult for children. Studies on recursive possessives have shown that 3- to 5-year-old English-speaking children have difficulty with two-level recursion, as do 4- to 6-year-old Dutch-speaking children with three-level recursion (Limbach and Adone (2010), Pérez-Leroux et al. (2012), Merx and Hollebrandse (in progress)). Similar observations have been made for the two-
and three-level recursion of locative phrases in English, Hungarian and Romanian (Pérez-Leroux et al. (2013), Sevcenco et al. (2015), Tóth et al. (2016)) and for the two-level recursion of relative clauses in English, Wapichana and Japanese (Sevcenco et al. (2015), Amaral and Leandro (2013), Nakajima et al. (2016)). In addition, the investigation into Japanese-speaking children’s comprehension of noun phrases containing one to four possessive phrases has provided different observations on the developmental path of recursion: Fujimori (2010) has observed that children start to be adult-like with respect to two- to four-level recursion all at once at around the age of 4, while Terunuma and Nakato (2013) reported that they become adult-like with respect to two-level recursion first and then three- and four-level recursion.

The aim of the present study is to provide new data from child Japanese on the acquisition of sentences containing two to four possessive or locative phrases (2- to 4-POSS sentences and 2- to 4-LOC sentences) and to address the following questions:

(4) (i) Is there a specific developmental path to adult-like understanding of recursive structures? (Is three- or higher-level recursion available at the same time as two-level recursion, or is there step-by-step development?) (ii) Are there differences in the development of different types of recursion? (Do children have more difficulty with one type of recursion than another?)

In languages such as English, possessive phrases and locative phrases in the nominal domain are accompanied by different morphemes (genitive markers and prepositions) and appear in different positions relative to the noun they modify. As shown in (5) and (6), possessive phrases occur in front of the noun they modify, while locative phrases follow the noun. In Japanese, by contrast, both possessive phrases and locative phrases are marked by the morpheme no and occur in front of the noun they modify, as shown in (7) and (8).

(5) \[ DP \ [POSSP \ [xNP \ [POSSP \ \text{John’s father} \ ‘s \ car]]] \]

(6) \[ DP \ \text{an apple} \ [PP \ on \ [xNP \ \text{the plate} \ [PP \ on \ [xNP \ \text{the table}]]]] \]

(7) \[ DP \ [POSSP \ [xNP \ [POSSP \ \text{Taro-no} \ otoosan] -no] \ kuruma] \]

\text{Taro-Gen father-Gen car}

‘Taro’s father’s car’

(8) \[ DP \ [LOCP \ [xNP \ [LOCP \ \text{Tsukue-no} \ osara] -no] \ ringo] \]

\text{table-Loc plate-Loc apple}

‘an apple on the plate on the table’

2 The notation $xNP$ represents a certain kind of extended nominal projection (Matushansky (2008)).

3 The following abbreviations are used in the glosses in this paper: Gen = Genitive marker, Loc = Locative marker, Top = Topic particle, Q = Question particle.
In this respect, it is of particular interest to compare the acquisition of recursive possessives and recursive locatives in Japanese.

2. Experiment
2.1. Participants

Fourteen children participated. They were divided into two age groups: eight 4-year-olds (range = 4;3–4;10, mean age = 4;7) and six 5-year-olds (range = 5;5–5;11, mean age = 5;6). Three additional children (one 4-year-old and two 5-year-olds) participated but were excluded from the analysis because they could not complete the experiment. Eight adults were also recruited as a control group. All the participants were monolingual native speakers of Japanese.

2.2. Materials and Procedure

The participants’ task was to answer a question while seeing a picture. (9)–(14) and Figures 1–6 exemplify the six types of target sentences and the pictures presented with the sentences.4,5

(9) 2-POSS:
Pinku-chan-no oneesan-no enpitsu-wa nani-iro kana?
Pinku-chan-Gen elder sister-Gen pencil-Top what-color Q
‘What color is Pinku’s elder sister’s pencil?’

(10) 2-LOC:
Doobutsuen-no kuruma-no neko-wa nani-iro kana?
zoo-Loc car-Loc cat-Top what-color Q
‘What color is a cat on the car in the zoo?’

(11) 3-POSS:
Midori-kun-no otoosan-no kuma-no fuusen-wa nani-iro
Midori-kun-Gen father-Gen bear-Gen balloon-Top what-color kana?
Q
‘What color is Midori’s father’s bear’s balloon?’

4 The young boys and girls in the picture were named after the colors of their clothes so that the participants could memorize their names easily. For example, the name of the young girl in Figures 1, 3 and 5 was Pinku, which means pink in Japanese, because she wore a pink shirt and skirt. The young boy in the same figures, who was in a green shirt and pants, was called Midori, which means green in Japanese.
5 The terms *chan* and *kun* that follow the name of the human characters are the forms of address that express affection to the addressee. *Chan* is basically used for a young girl and *kun* for a young boy.
(12) 3-LOC:
Isu-no koppu-no ohana-no choocho-wa nani-iro kana?
chair-Loc glass-Loc flower-Loc butterfly-Top what-color Q
‘What color is a butterfly on the flower in the glass on the chair?’

(13) 4-POSS:
Midori-kun-no otomodachi-no otoosan-no inu-no booru-wa
Midori-kun-Gen friend-Gen father-Gen dog-Gen ball-Top
nani-iro kana?
what-color Q
‘What color is Midori’s friend’s father’s dog’s ball?’

(14) 4-LOC:
Tsukue-no osara-no koppu-no fooku-no mushi-wa nani-iro
kana? Q
‘What color is a worm on the fork in the glass on the plate on the table?’

Figure 1: 2-POSS

Figure 2: 2-LOC

Figure 3: 3-POSS

Figure 4: 3-LOC
Since it has been reported that children often drop one of the recursive phrases in their comprehension of recursive structures (Limbach and Adone (2010)), we took into consideration possible dropping interpretations of the target sentences when we arranged entities denoted by the noun with recursive phrases in the pictures. As the number of recursive phrases increases, a larger number of dropping interpretations are possible, and hence, more entities are needed in the picture as possible referents of the noun with recursive phrases. The entities denoted by the noun with recursive phrases in our pictures correspond to either the adult-like interpretation or a certain dropping interpretation, although not all the dropping interpretations have a corresponding referent in some pictures.

In the pictures for the 2-POSS sentences, a referent was provided for all the possible dropping interpretations as well as the adult-like interpretation (e.g., Pinku’s elder sister’s pencil, Pinku’s pencil and an elder sister’s pencil for the sentence in (9) in the text). In the pictures for the 3- and 4-POSS sentences, there was a referent for the interpretation where two or more possessive phrases were interpreted, while a referent was not necessarily provided for the interpretation where only one possessive phrase was interpreted. The pictures for the 2- to 4-LOC sentences were made in a similar way. One might say, however, that for the 4-LOC sentences, there was no referent corresponding to the second and third locative phrase dropping interpretations, even though two recursive phrases were interpreted. For example, when the second and third locative phrases are dropped in (14) in the text, the subject noun phrase is interpreted as *tsukue-no fooku-no mushi* ‘a worm on the fork on the table.’ If each *no* presupposes direct contact, the subject noun phrase would not have a referent because no worm is on the fork that is directly on the table in Figure 6. However, the three Japanese-speaking adults we consulted allowed the three worms in Figure 6 to be a possible referent of *tsukue-no fooku-no mushi* ‘the worm on the fork on the table’: the worms that are on the fork that was in or on something on the table. In adult Japanese, *no* might not necessarily presuppose direct contact, and if this is so, the pictures for the 4-LOC sentences would have a referent for the interpretation where the second and third locative phrases are dropped.
The total number of trials for each participant was twenty-eight: three trials each for the six types of target sentences and ten filler trials. These trials were given to the participants in two sessions. In each session, nine target trials interspersed with five filler trials were presented in a fixed order. Half of the child participants started with Session 1 and the other half with Session 2. Prior to each session, they were provided with one warm-up trial to make sure that they understood their task. All the adult participants started with Session 1.

On each trial, the participants were first shown a picture along with verbal descriptions of what were drawn. Then, they were given a target or filler sentence. The target and filler sentences were recorded in advance and played back pretending that a certain character on the computer screen was uttering them.

The child participants took part in the experiment individually, and their responses were written down by the experimenter. The adult participants took part in the experiment all together. They were asked to write their answers on an answer sheet.

2.3 Results

The results are shown in Table 1. The 4- and 5-year-old children’s responses to the 2- and 3-POSS sentences were (considerably) adult-like, which was in sharp contrast to their responses to the 4-POSS sentences. Their responses to the 2-LOC sentences were also fairly adult-like, whereas their responses to the 3- and 4-LOC sentences were still different from adults’ (especially at the age of 4). In addition, children basically made fewer adult-like responses to recursive locatives than to recursive possessives in each level of recursion.
Table 1: The Percentages of Correct Answers

<table>
<thead>
<tr>
<th></th>
<th>2-POSS</th>
<th>3-POSS</th>
<th>4-POSS</th>
<th>2-LOC</th>
<th>3-LOC</th>
<th>4-LOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-year-olds (n = 8)</td>
<td>75%</td>
<td>70.8%</td>
<td>20.8%</td>
<td>58.3%</td>
<td>25%</td>
<td>12.5%</td>
</tr>
<tr>
<td>5-year-olds (n = 6)</td>
<td>94.4%</td>
<td>77.8%</td>
<td>22.2%</td>
<td>66.7%</td>
<td>44.4%</td>
<td>50%</td>
</tr>
<tr>
<td>Adults (n = 8)</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

3. Discussion and Conclusion

The results of recursive possessives show that Japanese-speaking children can generate the structure for the three-level recursion of possessive phrases by the age of 4 or 5. On the other hand, it is unclear from our results whether the structure for the four-level recursion of possessive phrases is also available for them by that age. Because their performance in 4-POSS sentences is quite poor, one might argue that they are unable to generate the structure for the four-level recursion. However, the children’s low performance in 4-POSS sentences observed in our experiment can be ascribed to a factor different from the non-availability of the relevant structure. One such factor is the number of choices in the picture. The number of entities denoted by the noun with recursive phrases in the target sentences increases in proportion to the number of recursive phrases: three for the two-level recursion (see Sentences (9) and (10) presented with Figures 1 and 2), four for the three-level recursion (see Sentences (11) and (12) presented with Figures 3 and 4), and seven for the four-level recursion (see Sentences (13) and (14) presented with Figures 5 and 6). It is reasonable to assume that the difficulty children have in choosing the correct referent of the noun in question would be compounded by the large number of choices, especially in the case of four-level recursion. Moreover, the relational word *tomodachi* ‘friend’ could also be a possible factor in children’s low performance in the 4-POSS
sentences in our experiment. The possessive phrase *tomodachi-no ‘friend’s’* was included in all the 4-POSS sentences but not in any other target sentences, and nearly all of the children’s errors in the 4-POSS sentences were due to the dropping of this phrase. The children (4- and 5-year-olds together) gave a wrong answer to the 4-POSS sentences on 33 out of 42 trials. On 26 out of the 33 trials, they dropped *tomodachi-no ‘friend’s,’* while interpreting the other three possessive phrases correctly. On 6 out of the 33 trials, they dropped *tomodachi-no ‘friend’s’* in addition to one more possessive phrase. Special difficulty with the relational word *tomodachi ‘friend’* might cause the children to give a wrong answer to the 4-POSS sentences.

Turning to the results of recursive locatives, we can say that Japanese-speaking children can generate the structure for two-level recursion at around 4 years of age, but they cannot generate the structure for three- and higher-level recursion at that age. As mentioned above, the children’s low performance in the 4-LOC sentences could partly be caused by the large number of choices in the picture. However, their performance in the 3-LOC sentences is also not good as compared to that in the 2-LOC sentences (especially for 4-year-olds). Our results suggest that there is a developmental stage where the structure for the two-level recursion of locative phrases is available but the structure for three-level (and higher) recursion is not.

If we compare the results of locatives with those of possessives, it can be claimed that there is some asymmetry between recursive possessives and recursive locatives concerning when children move on from one developmental stage to the next. In child Japanese, the three-level recursion of possessive phrases is available at around the age of 4, whereas that of locative phrases is not. Our results also show that children’s performance in 2- to 4-LOC sentences is generally worse than that in 2- to 4-POSS sentences, respectively. It can be said that recursive locatives are more difficult for children to comprehend than recursive possessives in general.

Taken together, the results of our experiment lead us to the following conclusions: First, it is not necessarily the case that three- and higher-level recursion becomes available at the same time as two-level recursion. There might be a step-by-step development in children’s comprehension of recursive structures: children would come to understand two-level, three-level and four-level recursion in an adult-like manner one by one. Second, Japanese-speaking

---

7 As (13) in the text shows, *tomodachi ‘friend’* was accompanied by the prefix *o* in the target sentences. This prefix makes the expression more polite.

8 This is different from what has been previously found in Fujimori (2010) and Terunuma and Nakato (2013). These previous studies observed that the acquisition of recursive possessives in Japanese is not (completely) step-wise: Fujimori has shown that Japanese-speaking children acquire two- and higher-level recursion all at once; Terunuma and Nakato observed that Japanese-speaking children start to interpret 4-POSS sentences correctly as soon as they start to comprehend 3-POSS sentences in an adult-like manner.
children have more difficulty with recursive locatives than with recursive possessives in two senses. One is that the development of recursive locatives falls behind the development of recursive possessives in that the three-level recursion of locative phrases is unavailable even when that of possessive phrases has become available. The other is that children’s performance in recursive locatives at a certain level is generally worse than that in recursive possessives of the same level.

The present study leaves many questions unanswered: Why is three- and higher-level recursion not necessarily available immediately after two-level recursion? Why is there an asymmetry between recursive possessives and recursive locatives with respect to timing when three-level recursion is available? Why is each level of recursive locatives more difficult for children than recursive possessives?

However, their observations might include some experimental artifacts caused by extra-grammatical factors. For example, the pictures they used for 1- to 3-POSS sentences included too many choices as potential referents, which might pose extra-burden for children and result in an underestimation of children’s ability to comprehend the one- to three-level recursion of possessive phrases. In our experiment, the number of potential referents was made as small as possible in order to minimize the effect of extra-grammatical factors.

It does not follow from our results that recursion at any level is made available for possessive phrases first and then for locative phrases. When we take into consideration that lexical possessives are allowed in UG and 2-POSS sentences can be generated without using recursive structures, it can be said that recursive structures emerge in child Japanese for both types of recursion at the same time. See Nakato et al. (in progress) for the details.

One thing should be noted concerning the results of locatives. It has been reported that children allow a conjunctive reading of recursive possessives and recursive locatives. At around the age of 4 or 5, English-speaking children sometimes interpret Jane’s father’s bike as a bike that is shared by Jane and her father and a lion next to a zebra under a crocodile as a lion that is next to a zebra and under a crocodile (Limbach and Adone (2010), Sevcenco et al. (2015)). Similar observations have been made for recursive possessives in Hungarian (Tóth (2016)) and recursive locatives in Hungarian and Romanian (Tóth et al. (2016)). In the items for recursive locatives in our experiment, the correct answer can be made even when a conjunctive reading is assigned to the recursive phrases in the target sentences. For example, in the 2-LOC sentence in (10) in the text above, which was presented with the picture in Figure 2 in the text, the correct referent of doobutsuen-no kuruma-no neko ‘a cat on the car in the zoo’ is the topmost cat in the picture, not only when the two locative phrases are assigned the recursive reading resulting from the structure [a cat [on the car [in the zoo]]] but also when they are assigned the conjunctive reading resulting from the structure [a cat [on the car] (and) [in the zoo]]. However, the same is true of the items for the 3- and 4-LOC sentences, and yet children’s performance in the 3- and 4-LOC sentences was not good. Furthermore, the correct answer cannot be made through a conjunctive reading in the items for recursive possessives. Then, if children have some difficulty with a recursive reading and have a preference for a conjunctive reading, children’s performance in recursive possessives should be worse than that in recursive locatives in our experiment, contrary to the fact. It seems that children’s correct answers to the sentences with recursive locatives in our experiment cannot simply be attributed to the availability of a conjunctive reading.
possessives of the same level? The general difficulty of recursive locatives might be related to semantic variation of a locative marker. While the morpheme no as a possessive marker uniformly expresses the ownership relation, no as a locative marker can express various kinds of spatial relations such as ‘on’ and ‘in,’ as can be found in the sentences in (10), (12) and (14) above. Such semantic variation might cause children trouble when interpreting sentences with recursive locatives. If the semantic variation of a locative marker is a factor in children’s difficulty comprehending recursive locatives, it is predicted that children’s performance would be better when all the instances of no ‘Loc’ in the sentence express the same kind of spatial relation than when such is not the case. The 4-year-olds’ responses to the 2-LOC sentences in our experiment do not contradict this prediction. In our experiment, the 2-LOC sentence in (15) was the only sentence where multiple instances of no ‘Loc’ express the same kind of spatial relation. The two instances of no are both interpreted as ‘in.’

(15) Sunaba-no baketsu-no kaeru-wa nani-iro kana?
sandbox-Loc bucket-Loc frog-Top what-color Q
‘What color is a frog in the bucket in the sandbox?’

In the other two 2-LOC sentences in our experiment, one of which is shown in (10) above, one instance of no is interpreted as ‘in’ and the other as ‘on.’ The 4-year-olds gave more correct answers to (15) than to the other two sentences (87.5% of the time for (15) as opposed to 50% and 37.5% of the time for the others). However, the number of relevant target sentences was small, and no difference was found in the 5-year-olds’ responses to the three 2-LOC sentences in our experiment. It is clear that an experiment on a larger scale is needed to see whether the prediction above is borne out or not. Including the examination of whether semantic variation of a locative marker has an influence on children’s comprehension of recursive locatives, many more investigations are necessary for a better understanding of the acquisition of recursive possessives and recursive locatives.

References


Tóth, Agnes. 2016. The Acquisition of Recursive Possessive Structures in Hungarian. Paper presented at Workshop on the Acquisition of Recursion, University of Bucharest.

Proceedings of the 41st annual Boston University Conference on Language Development

edited by Maria LaMendola and Jennifer Scott

Cascadilla Press Somerville, MA 2017

Copyright information

Proceedings of the 41st annual Boston University Conference on Language Development © 2017 Cascadilla Press. All rights reserved

Copyright notices are located at the bottom of the first page of each paper. Reprints for course packs can be authorized by Cascadilla Press.

ISSN 1080-692X
ISBN 978-1-57473-076-0 (2 volume set, paperback)
ISBN 978-1-57473-176-7 (2 volume set, library binding)

Ordering information

To order a copy of the proceedings or to place a standing order, contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, sales@cascadilla.com, www.cascadilla.com