Experimental Studies on Japanese Children's Acquisition of the Righthand Head Rule*

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1. Introduction

1.1. Head Parameter in Phrase Structure and Word Structure

Under the Principles and Parameters approach, phrase structure building is constrained by X'- theory. Under this approach, word order variation is attributed to the Head Parameter, which determines the relative order of the head and its complement. English is a head-initial language and Japanese is a head-final language.

(1) a. [$_{VP}$ [$_{V}$ eat] an apple]
b. [$_{VP}$ ringo-o [$_{V}$ taberu]]
apple-Acc eat

Expressions which consist of several elements are not limited to phrases. They can be single words which are often called compounds. Consider the following expressions.

(2) a. darkroom
b. dark room

(2a) is a compound and (2b) is a phrase. They are different in some respects. First, the phrase in (2b) has a meaning which is derived compositionally, while the compound in (2a) has a permanent and special lexicalized meaning: a room used to develop film. Second, there is a difference in stress. (2b) is pronounced with the heaviest stress on the second element, *room*, whereas (2a) has the heaviest stress on the first element, *dark*. Third, in (2a), no elements can intervene between the first element and the second one: **darkerroom*. If we assume that syntax and morphology constitute independent modules in the language faculty, word structure and phrase structure should be treated separately.

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As we have seen above, the Head Parameter exists in phrase structure. Is it the case that this parameter also exists in word structure concerning the word order within a compound? Or is the position of the head of a compound cross-linguistically fixed? In this respect, in many languages including English and Japanese, the head of a compound is necessarily its righthand element. See (3), for example.

(3) a. towel rack
b. musi-megane
insect-glasses
'magnifier'

A towel rack is not a kind of towel but a kind of rack, and *musi-megane* can never be a type of *musi* (insect) but is rather a kind of *megane* (glasses). So, *rack* and *megane* (glasses), respectively, are the heads of (3a) and (3b). Moreover, in some cases such as (4), it is possible to reverse the two elements in a compound, which results in different meanings. (Such compounds are called 'reversible compounds.')

(4) a. hati-mitu
bee-honey
'honey'
b. mitu-bati
honey-bee
'honey bee'

When the righthand element is *mitu* (honey), the compound means honey (collected by bees) as a whole, while it refers to a bee (which collects honey) when *hati* (bee) is on the right.[1]

To explain these facts, Williams (1981) proposes that the rule in (5) is operative in the morphological component.

(5) The Righthand Head Rule (henceforth, RHR):
The head of a morphologically complex word is the righthand member of that word.
(Williams (1981: 248))

Though it is generally assumed that this rule universally holds true, it has been reported that in some languages like Italian, the head of an N-N compound is located in its left as illustrated

[1] In (4b), *hati* is pronounced as *bati*. This is because Japanese has a phonological rule called *Rendaku*, which voices the initial consonant of the second element in the compound (in some environments).

in (6).

(6) $[capo]_N$ $[stazione]_N \rightarrow [[capo]_N [stazione]_N]_N$
'head' 'station' 'station-master' (Scalise (1992: 176))

Thus, there must be a parametric choice concerning which element of a compound functions as the head, similarly to the Head Parameter in phrase structure. Italian is morphologically head-initial, while Japanese and English are morphologically head-final.

1.2. Some Questions about the Parameter-Settings

Logically, languages are classified into four types in terms of the combination of the value of the Head Parameter in phrase structure and that in word structure as shown in Table 1.

Table 1 Value of the Head Parameter in Phrase Structure and Compounding Word Structure

compounds / phrases	righthand head	lefthand head
righthand head	Japanese Afrikaans[2]	——[3]
lefthand head	English	Italian French[4]

When we examine the table, there arise two questions. The first question is whether there is any interaction between the value of the Head Parameter in phrase structure and the value of the Head Parameter in word structure, and if so, whether it affects children's process of acquisition. It is generally assumed that typologically correlating syntactic properties are thought to be epiphenomena of setting the value of one parameter. Then is it plausible to think that the value of each parameter is always set independently from others? If so, the value of the Head Parameter in compounding word structure is determined independently from the value of the Head Parameter in phrase structure. However, the Head Parameter in phrase

2 DiSciullo and Williams (1987) give examples such as *Leeu* (lion)-*byter* (biter) 'one who bites lions'.

3 As far as we know, there are no languages which have a righthand head in the phrase structure and a lefthand head in the compounding word structure.

4 Lieber (1992) argues that primary compounds in French are primarily left-headed such as *timbre* (stamp) *poste* (postage) 'postage stamp', while Di Sciullo and Williams (1987) call such compounds 'listed phrases' and regard French morphology as right-headed.

structure and that in word structure are extremely alike and seem to have something to do with each other.

Indeed, Goodluck (1991) explains that English-speaking young children mistakenly produce the compound *present-giver* as *giver-present* because they apply the same order of 'head-complement (*give a present*)' used in English phrase structure. If this is the case, the setting of the value of the Head Parameter in phrase structure affects the Head Parameter in word structure.

In Japanese, the Head Parameters in both phrase structure and word structure are specified as 'Righthand.' In this language, the parameter-setting in syntax would never impede the acquisition of the RHR in the same way as the *giver-present* example. If the English-speaking children have more difficulty in acquiring the RHR than Japanese children do, then it may mean that children's syntactic parameter-setting might somehow affect their morphological parameter-setting. If not, the parameter-setting in syntax and that in morphology should be considered to be independent.

The second question is whether there is any default setting of the Head Parameter or whether it is an open parameter. If the default setting of this parameter is 'Righthand,' children would have more difficulty in acquiring languages with 'the Lefthand Head Rule (henceforth, LHR)' than in acquiring those with the RHR, because only the former involves the process of parameter-resetting. Look at Table 1 once again. If Italian children's acquisition of the LHR is later than Japanese/English children's acquisition of the RHR, the results would support the assumption that this parameter originally has a default value. If they acquire their respective rules at roughly the same time, then we can say it must be an open parameter.

1.3. Various Kinds of Compounds

As we have mentioned in 1.1., the Head Parameter in phrase structure concerns the position of the head and its complement. In the Head Parameter in compounding word structure, not only the relative order of the head and its complement but also the relative order of the head and its adjunct is defined. Let us take the English expressions in (7a) and (7b) as the examples.

(7) a. doghouse
b. nutcracker

This language is a morphologically head-final language and thus the righthand element of a compound is necessarily the head of the compound. On the other hand, the lefthand element of the compound can be either a complement or an adjunct of the head element. In (7a), the lefthand element *dog* modifies the head *house* in that *dog* describes what sort of house

doghouse is; this modifier is not an argument but an adjunct of the head, while in (7b), the lefthand element *nut* functions as the object of the verb *crack* and thus the complement of the derived noun *cracker.*

The compounds in (7a) and (7b) are of different types. Compounds such as *doghouse* are called primary compounds which consist of only simple words. A secondary compound is a compound in which a derived word appears. *Nutcracker* is a secondary compound because the head *cracker* is an expression which is derived from the verb *crack.*

Primary compounds are classified into three categorical groups: N-N primary compounds such as *doghouse*, A-N primary compounds such as *darkroom* and P-N primary compounds like *afterthought.* As pointed out in Namiki (1985), primary N-N compounds are more varied in meaning than secondary N-N compounds, so they should be further classified by meanings, as well as by category. For example, the compound *doorknob* is classified as an '[N_1 has N_2] type compound' because the semantic relation of the two elements *door* and *knob* can be translated as something like 'the door has a knob.' *Doghouse* can be classified as an '[N_2 is for N_1] type compound' because a doghouse is 'a house which is for a dog,' *catfish* is an '[N_2 is like N_1] type compound' for it refers to 'a fish which is like a cat,' *drummer boy* is an '[N_2 is N_1] type compound' as it means a boy who is a drummer, and so on. Although they all have the same word structure, N-N, where the first N is some kind of adjunct of the latter N, the semantic relation between their constituents varies widely item by item.

When we examine the children's ability to produce or interpret compounds, this primary/secondary distinction and the semantic variation among primary N-N compounds will provide some interesting viewpoints.

1.4. Aims of This Study

One main aim of this paper is to discuss whether Japanese-speaking young children know that the head of a compound is necessarily located in its right.[5] We have seen in 1.2. that we have to examine how early children acquire the RHR/LHR in various languages and compare the data in order to investigate into two questions: the question of whether the value of the Head Parameter in phrase structure affects the value of the Head Parameter in word structure or not, and the question of whether we can assume the default value of the Head Parameter in word structure to be 'Righthand.' Our experimental study will be the first step in investigating these important topics. To obtain reliable data, we revise the experiments used in previous studies and carry out a new experiment using novel reversible compounds, which appropriately reveals whether children have the proper knowledge of the RHR.

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[5] The necessity of such a study has been suggested by Namiki (1993, 1995), and at his summer lecture at the University of Tokyo (2001).

It is cross-linguistically reported that children as young as age two can correctly produce some novel primary N-N compounds such as *lion-box* (a box that looks like a lion) (Clark (1993)) in their spontaneous speech. We cannot decisively conclude from this fact, however, that they have the proper knowledge of the RHR. As there are many compounds with righthand heads in their input, it is quite natural that children can make a compound merely by imitating them. To ensure their knowledge of the RHR, it is necessary to show that they know that the righthand element of a compound must be the head and thus other elements cannot be. To achieve this point, we propose in the following sections a new method of experimental study.

Along with this main point, we would like to discuss whether there is any difference in acquiring different types of compounds, which we have mentioned in 1.3. Do children acquire all kinds of compounds roughly at the same time, or do they have more difficulty in using certain types of compounds than others? Although we study only primary N-N compounds in our experiment, in which we use reversible compounds in order to obtain reliable results, a closer look at the data shows that children have more difficulty in comprehending compounds which have secondary-compound-like properties than in comprehending genuine primary compounds.

This paper is organized as follows. In section 2, we propose our experimental design by making some modifications on the previous experiments conducted by Clark et al. (1985) and Sugisaki and Isobe (2000). In section 3, we present the results of our revised experiments for Japanese-speaking children. In section 4, based on the results of our experiment in 3.2, we show that children cannot interpret a certain type of compound correctly, using the distinction between various compounds mentioned in 1.3. Section 5 provides concluding remarks.

2. Previous Studies

There are previous studies which examine children's ability to coin new compounds or to interpret novel compounds correctly. We introduce three of these studies and consider how we can modify the experiments employed there in order to apply them to the study of the RHR.

2.1. Clark et al.'s (1985) Production Task

When children productively coin novel N-N compounds, do they put the head element of the compound in the correct position? Concerning this, Clark et al. (1985) show that English-speaking children at the age of three can make new compounds correctly if the experimenter gives an example compound beforehand.

Their experimental method is as follows. The experimenter holds up a card between her and the subject. Three pictures are on the card and they describe three N-N compounds with

the same head noun. One of them is painted on the experimenter's side and the other two are painted on the child's side. For example, a '*balloon-tree*' (a tree which bears balloons) is painted on the experimenter's side, and a '*pencil-tree*' and a '*cup-tree*' are on the other side. The experimenter says "I have a *balloon-tree*," and she asks the subject to tell her what is painted on his/her side. In this experiment, children can produce compounds like '*pencil-tree*' or '*cup-tree*' rather easily. Children know that 'a tree which bears pencils' can be named '*pencil-tree*,' using the form of a compound.

However, the results cannot be taken as evidence that children know that the head of the compound must always be the right element, because the example compound always has the same head as the two target compounds. The child hears the word '*balloon-tree*' beforehand and then names his/her picture '*pencil-tree*.' He/she may be just imitating the form 'N-*tree*,' because his/her picture also contains some kind of tree.

What if the head noun of the example compound is different from that of the target word? If the experimenter says, for example, "I have a *tree-balloon*," we can then see what the child calls the picture of 'a tree which bears pencils.' If he/she is just imitating the form of the experimenter's compound, that is, '*tree*-N,' he/she will reply "I have a *tree-pencil*," and if he/she knows the RHR, he/she will reply correctly. Otherwise we should not give any example compounds beforehand. We must conduct such an experiment to examine children's ability to use the RHR productively.

2.2. Sugisaki and Isobe's (2000) Production Task

As for Japanese-speaking children, Sugisaki and Isobe (2000) have conducted an experiment as in (8) to see children's ability to produce novel compounds, where many young children seem to have succeeded in forming compounds correctly, putting their heads on the right. The result, however, says nothing about whether children have the actual knowledge of the RHR. They have conducted their experiment in the following way.

(8) E(xperimenter): (showing a picture of a bear)
kore wa nani?
'What is this?'
S(ubject): **kuma**.
'bear'
E: (showing a picture of a clock)
kore wa nani?
'What is this?'
S: **tokei**.
'clock'

E: (showing a picture of a clock shaped a bear)
jaa, **kuma**-no katati-o si-ta **tokei**-wa nante iu?
then bear-Gen shape-Acc do-Past clock-Top what call
'Then, what do you call a clock which is shaped like a bear?
S: **kuma-dokei**. (expected answer)
'bear-clock'

In this experiment, the two words used to compose a compound are presented to children in the order expected in the compound. To put it concretely, in (8), the two words *kuma* (bear) and *tokei* (clock) that form a compound '*kuma-dokei* (bear-clock)' are presented in the linear order in which the compound is formed. They are included in the NP *kuma-no katati-o sita tokei* (a clock which is shaped like a bear) that consists of a relative clause and a noun. Thus we cannot reject the possibility that those who passed this type of experiment may simply combine the two words mechanically, only making use of the given linear order or syntactic structure. To resolve this situation and examine children's knowledge of the RHR, we also have to use other types of input sentences as in (9) in which the two words are presented in the reverse order.

(9) a. E: (showing a picture of a rabbit that lives in a railroad station)
jaa, **usagi**-de **eki** ni sun-deru no-wa?
then rabbit railroad station in living pronoun-TOP?
'Then, what do you call a rabbit that lives in a railroad station?'
S: **eki-usagi**. (expected answer)
railroad station-rabbit
b. E: (showing a picture of a crab that lives in the mountain)
kono **kani**-wa **yama** ni sun-deru yo.
this crab-Top mountain in living
'This crab lives in the mountain.'
(pointing to the picture of the crab that lives in the mountain)
kore nan-te iu?
'What do you call this?'
S: **yama-gani**. (expected answer)
'mountain-crab'

2.3. Clark et al.'s (1985) Comprehension Task

Along with the experiment cited in 2.1., Clark et al. (1985) have conducted another experiment to show that most 3-year-old children can correctly interpret the meaning of novel

N-N compounds in English. However, their methods do not suffice to show that children have the knowledge that the last element in a compound always works as its head, although their results indicate that young children can make guesses about what a novel compound means.

The experiment is divided into two parts. In the first half of the experiment, they present a novel compound to the subject and ask him/her to choose one picture which represents the meaning of the compound. The child is presented (a) a knife (b) an apple, (c) another thing related to apples, and (d) another thing related to knives and is asked to choose an '*apple-knife.*' In most cases, he/she chooses (a). Clark et al. (1985) conclude from the result that the child has the knowledge that the latter element is the head of the compound; an '*apple-knife*' is a kind of knife rather than a kind of apple. In the second half of the experiment, the child is presented (a) a hat, (b) a mouse, (c) a hat on a mouse, and (d) a hat on a fish for a '*mouse-hat,*' and he/she correctly chooses (c). So they argue that the child does not ignore the first element but knows that the head element is modified by the first element.

These results do not necessarily indicate that young children have the knowledge of the RHR. As is obvious from the result of the '*mouse-hat*' question, children understand that a '*mouse-hat*' is different from a mere hat or a mere mouse, and that it has something to do with both a hat and a mouse. But it might be the case that children actually do not understand which is the head of the compound, and choose (c) just because only this picture illustrates both a hat and a mouse. They might choose not only (c) but also 'a mouse with a hat,' where the head element is meant to be *mouse*, as the right picture for a '*mouse-hat.*' What is problematic about the second half of the experiment is that, among the choices, only one picture contains the concepts of both *mouse* and *hat*.

As for their first half, children choose (a) a knife rather than (b) an apple as an '*apple-knife.*' But can this be the evidence for the acquisition of the RHR? Children know that an '*apple-knife*' is somewhat different from a mere knife as seen from above, but there are not any appropriate choices that include both the notion of *apple* and that of *knife*. Children will try to imagine which picture is more capable of containing both of the notions. In this respect, we see from our pragmatic knowledge that it is more probable that *knife* is modified by *apple* than that *apple* is modified by *knife*. In other words, the word *knife* is apt to be modified by *apple*, a word which refers to food, because the definition of *knife* is 'a tool to cut food or other things, like plants, thread, plasterboard, etc.' On the other hand, *apple* is not apt to be modified by *knife*; an apple is not necessarily something to be cut. To be more concrete, when we hear the word '*apple-knife,*' we can easily imagine that it means 'a knife to cut apples,' while the word '*knife-apple*' is totally nonsense and hard to figure out for many of us. This is a stipulation but it may be the case that when the child hears the word '*apple-knife,*' he/she interprets *knife* as its head just because this interpretation is pragmatically more probable than the interpretation in which *knife* somehow modifies *apple*. In this way, the child can correctly answer the question without using the knowledge of the RHR. Other examples in this

experiment, such as '*banana-box*,' also have the same problem.

To avoid these problems, we claim that we should use reversible compounds such as (4) as test items. The examples in (4) are existing reversible compounds, but we can also coin novel reversible compounds when the two compounds are both pragmatically probable. For example, '*mouse-hat*' and '*hat-mouse*' seem to be equally pragmatically possible; we can imagine that the former is 'a hat for mice,' and the latter means 'a mouse wearing a hat,' for instance. If we use two pictures illustrating each of such reversible compounds, we can make it clear which of the two nouns the subject interprets as the head.

The first advantage of using a pair of reversible compounds is that we can prepare two pictures involving both the notion of *hat* and the notion of *mouse*: 'a hat for mice,' and 'a mouse wearing a hat.' For children who do not understand which noun is the head of the compound, the pair of reversible compounds would be ambiguous. They would choose both pictures when they hear '*mouse-hat*.'

The second advantage is that, as mentioned, the reversed interpretations are both pragmatically possible. When the subject actually sees both the picture of a '*mouse-hat*' and the picture of a '*hat-mouse*,' both interpretations become imaginable for him/her. In this situation, if the subject hears the word '*mouse-hat*' and he/she chooses the picture of 'a hat on a mouse' but not the picture of 'a mouse with a hat,' then we can safely conclude that the child has the appropriate knowledge of the RHR.[6] (For the procedure for this experiment, see section 3.)

2.4. Summary

In this section, we have pointed out that the results of the three previous experiments: two with a production task and one with a comprehension task, do not necessarily indicate children's knowledge of the RHR, and proposed a revised design for each experiment. In the next section, we present a design and result of the revised experiment with a comprehension task proposed in 2.3. The reason why we choose the comprehension task is that the task is easier for children to adapt to: children have only to choose correct pictures without producing novel compounds themselves, while many young children have difficulty in producing compounds themselves as reported by Sugisaki and Isobe (2000).[7] Thus, it is expected that this task makes it possible for us to examine younger children's knowledge of

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6 In this example, it may be rather difficult to differentiate the picture 'a hat on a mouse' from the picture of 'a mouse with a hat,' so we have to use other examples in the actual experiment which are easy to describe with pictures. See 3.1. about this point.

7 Actually, we have also carried out an experiment with production task of the type proposed in 2.2. and face the very problem. Many children have avoided coining compounds and responded with phrases instead, so we have got no significant results. We will somehow revise the method and try it again in future research.

the RHR.

3. Experiment

We conducted the experiment which we proposed in the previous section to see whether children can interpret an unfamiliar compound correctly, that is, whether they can correctly take the righthand element of the compound as its head or not. By using reversible compounds, the problems found with previous experiments (pointed out in chapter 2) are resolved.

Eighteen children participated in the experiment carried out at Hutaba-Kusunoki Kindergarten in Tokyo, on October 19, 2001. They ranged in age from 4;1 to 6;4: three early four-year-olds, three late four-year-olds, six early five-year-olds, three late five-year-olds and three early six-year-olds. All of them are monolingual Japanese-speaking children.

3.1. Methods

For our picture-identification task, we prepared four novel reversible compounds: '*tyoko-mikan* (chocolate-orange)' '*neko-doroboo* (cat-thief),' '*pantu-zaru* (briefs-monkey)' and '*neko-bana* (cat-flower)' as in (10)-(13) in order to see whether children can interpret new compounds productively using the knowledge of the RHR. We have chosen the target words carefully so that both interpretations of the reversible compounds are unambiguously expressed in each picture.

As for the typology of the compounds discussed in 1.3., all the compounds employed in the experiment are primary N-N compounds. This is because A-N primary compounds, P-N primary compounds, and most secondary compounds are not reversible. The intended semantic structures of these novel compounds are as follows: '*tyoko-mikan*' refers to an orange which is coated with chocolate and it is an '[N_2 has N_1] type compound,' '*neko-doroboo*' refers to a thief who steals cats and it is an '[N_2 steals N_1] type compound,' '*pantu-zaru*' refers to a monkey which is wearing briefs and it is an '[N_2 has N_1] type compound,' and '*neko-bana*' refers to a flower which is like a cat and it is an '[N_2 is like N_1] type compound.' The experiment proceeded as follows.

(10) a. Pictures:[8] A banana coated with chocolate (10-A), an orange coated with chocolate (10-B), a chocolate bar flavored with banana (10-C), and a chocolate bar flavored with orange (10-D).

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[8] See Appendix for pictures used in the experiment.

b. E: (pointing to picture (10-A))
Kore-wa **tyoko**-ga kakatta **banana** da-ne.
this-Top chocolate-Nom coated banana is
'This is a banana coated with chocolate.'
(pointing to picture (10-B))
Kore-wa **tyoko**-ga kakatta **mikan** da-ne.
this-Top chocolate-Nom coated orange is
'This is an orange coated with chocolate.'
(pointing to picture (10-C))
Kore-wa **banana**-no aji-ga suru **tyoko** da-ne.
this-Top banana-Nom flavor-Nom do chocokate is
'This is a chocolate bar flavored with banana.'
(pointing to picture (10-D))
Kore-wa **mikan**-no aji-ga suru **tyoko** da-ne.
this-Top orange-Nom flavor-Nom do chocokate is
'This is a chocolate bar flavored with orange.'

c. E: Which is a '*tyoko-mikan* (chocolate-orange)' among these?
S: (pointing to the orange coated with chocolate (10-C)) This one.
E: (pointing to the chocolate bar flavored with orange (10-D)) How about this one?
S: No. (It's a '*mikan-tyoko* (orange-chocolate)'.)

(11) a. Pictures: A person stealing a monkey (11-A), a monkey stealing a banana (11-B), a person stealing a cat(11-C), and a cat stealing a fish (11-D).

b. E: (no explanation about the pictures)

c. E: Which is a '*neko-doroboo* (cat-thief)' among these?
S: (pointing to the person stealing a cat (11-C)) This one.
E: (pointing to the cat stealing a fish (11-D)) How about this one?
S: No. (It's a '*doroboo-neko* (thief-cat)'.)

(12) a. Pictures: Briefs printed with a painting of a monkey (12-A), briefs printed with a painting of a fox (12-B), a monkey wearing briefs (12-C), and a fox wearing briefs (12-D).

b. E: (no explanation about the pictures)

c. E: Which is a '*pantu-zaru* (briefs-monkey)' among these?[9]
S: (pointing to the monkey wearing briefs (12-C)) This one.

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[9] In Japanese, there is no overt distinction between singular nouns and plural nouns. So whether the given word is singular or plural (for example, the word *briefs* is inherently plural in English) does not affect the children's responses.

E: (pointing to the briefs printed with a painting of a monkey (12-A)) How about this one?

S: No. (It's a '*saru-pantu* (monkey-briefs)'.)

(13) a. Pictures: A cat which has flowers on it (13-A), a dog which has flowers on it (13-B), a flower which looks like a cat (13-C), and a flower which looks like a dog (13-D).

b. E: (pointing to picture (13-A))
Kore-wa **neko** da-ne. **Hana**-ga tuiteru-ne.
this-Top cat is flower-Nom attached
'This is a cat. It has flowers on it.'
(pointing to picture (13-B))
Kore-wa **inu** da-ne. **Hana**-ga tuiteru-ne.
this-Top dog is flower-Nom attached
'This is a dog. It has flowers on it.'
(pointing to picture (13-C))
Kore-wa **hana** da-ne. **Neko** mitai da-ne.
this-Top flower is cat look-like is
'This is a flower. It looks like a cat.'
(pointing to picture (13-D))
Kore-wa **hana** da-ne. **Inu** mitai da-ne.
this-Top flower is dog look-like is
'This is a flower. It looks like a dog.'

c. E: Which is a '*neko-bana* (cat-flower)' among these?

S: (pointing to the flower which looks like a cat (13-C)) This one.

E: (pointing to the cat which has flowers on it (13-A)) How about this one?

S: No. (It's a '*hana-neko* (flower-cat)'.)

We first explained what each of the pictures illustrates only in (10) and (13) ((10b) and (13b)) because we think that the subjects might misinterpret these pictures. For example, children might misinterpret 'a banana coated with chocolate' as 'a chocolate in the shape of a banana,' whose head element is different from what we expect. In (10b), we used relative clauses as in (8) where the expected head noun precedes the other noun, while we presented the two nouns in the reverse order in (13b). Thus we maintained a balance so that the word order in the input sentences should not affect the results. (The conceivable effect of the word order in the input sentences, see 2.2.) In (11) and (12), we gave no explanation about the pictures because they unambiguously represent the compounds we have coined.

The examples of subjects' responses above (represented with 'S') are the predicted responses of the child who has the knowledge of the RHR. If the child chooses the right

picture first, we ask about the picture with the reversed interpretation in order to make sure that he/she can correctly reject it.[10]

3.2. Results

We classify the patterns of the children's responses into three groups: PERFECT, PREFER, and FAIL. PERFECT is the case where the subject chooses only the right answer first and, when he/she is asked "How about this one?," he/she can correctly deny it. PREFER means that although the subject can choose the correct picture first, when he/she is asked about another picture, he/she answers "It is 'Yes', too," or "I don't know." Other patterns fall into FAIL cases. (Choosing the wrong pictures first, choosing both the right picture and one of the wrong pictures at the same time, etc.)

PERFECT children have the knowledge of the RHR perfectly. PREFER children prefer the right picture to wrong ones, although they cannot reject the wrong one. So, although imperfectly, they also have the knowledge of the RHR. So we classify both PERFECT and PREFER answers as GOOD. Here are the percentages of the PERFECT answers and the GOOD answers.

(14) Overall Results

PERFECT:	33/70	(47.1%)
GOOD:	44/70	(62.9%)

At first sight, it seems that not many children have the RHR, because fewer than half of the subjects are PERFECT. However, when we look more closely at the data, we see that

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[10] We carried out the following training before the main experiment.

(i) Pictures: An apple, a potato, a tulip, and an elephant.
E: This is an apple. This is a potato. This is a tulip. This is an elephant. Which is a fruit among these?
S: (pointing the apple) This one.
E: (pointing the potato) How about this one?
S: No. It's a vegetable.

(ii) Pictures: A train, a bus, a table, and a TV.
E: (no explanation about the pictures) Which is a vehicle among these?
S: (pointing the train and the bus) This one and this one.

This training is intended not only to accustom subjects to the task, but also to let them notice the possibility of having more than one right answers (Training (ii)), although we have only one right answer for each of the test questions. If the child were convinced that the right answer is necessarily only one, we would not know whether he/she can correctly exclude other pictures even when he/she chooses only the right picture first.

many children actually show knowledge of the RHR.

(15) Results by items

	PERFECT	GOOD
'*tyoko-mikan* (chocolate-orange)'	8/17 (47.1%)	12/17 (70.6%)
'*neko-doroboo* (cat-thief)'	**5/17 (29.4%)**	**7/17 (41.2%)**
'*pantu-zaru* (briefs-monkey)'	11/18 (61.1%)	14/18 (77.8%)
'*neko-bana* (cat-flower)'	9/18 (50.0%)	11/18 (61.1%)

The results of '*neko-doroboo* (cat-thief)' are obviously worse than those of the other three novel compounds. As will be discussed in section 4, we assume that this is due to some extra factor other than the RHR. Concretely, we consider that the semantic type of this compound is responsible. So we exclude '*neko-doroboo* (cat-thief)' from the calculations below. As for the other three, there is not any significant difference between '[N_2 has N_1] type compounds' ('*tyoko-mikan* (chocolate-orange)' and '*pantu-zaru* (briefs-monkey)') and '[N_2 is like N_1] type compound' ('*neko-bana* (cat-flower)').

We can also conclude from (15) that the word order in the input sentences does not have much influence on the children's interpretation of the compounds, because the results of '*tyoko-mikan*,' where we have given the input sentences in (10b), and the results of '*neko-bana*,' where the input sentences in (13b) have been given, are not significantly different.

(14') Overall Results excluding '*neko-doroboo* (cat-thief)'

PERFECT:	28/53	(52.8%)
GOOD:	37/53	(69.8%)

Thus, the number of the PERFECT answers holds a majority. The percentage of the GOOD answers rises to about 70%.

Next, look at the results by subject summarized in (16). We exclude '*neko-doroboo* (cat-thief)' also in the list below.

(16) Results by subjects

	number of the children	(age)
3 items PERFECT:	3	(4;9, 5;1, 5;8)
2 items PERFECT:	9	(4;4, 4;5, 4;11, 5;0, 5;2, 5;3, 6;1, 6;3, 6;4)
1 item PERFECT:	1	(5;8)
0 item PERFECT:	5	(4;1, 4;7, 5;1, 5;5, 5;8)
3 items GOOD:	7	(4;7, 4;9, 5;1, 5;2, 5;3, 5;8, 6;3)
2 items GOOD:	7	(4;4, 4;5, 4;11, 5;0, 5;8, 6;1, 6;4)
1 item GOOD:	2	(4;1, 5;8)
0 item GOOD:	2	(5;1, 5;5)

We regard as PASSERS those who are PERFECT in at least 2 questions out of 3. By this measure, we see that 12 children out of 18 have knowledge of the RHR. The percentage is as high as 67%. It should also be noted that even among the 4-year-old children, 5 out of 6 children are PASSERS. The timing of acquisition of the rule in Japanese seems to be rather early.

4. Discussion

We have seen from the results of our experiment that children interpret only certain compounds such as '*neko-doroboo* (cat-thief)' in a different way from adults. In the adult grammar, '*neko-doroboo*' necessarily means 'a thief who steals cats' and thus is a kind of thief. It is not a kind of cat because *doroboo* (thief) is the head of the compound. However, many children choose the picture of 'a cat which steals fish' (11-D), which we intended as a '*doroboo-neko* (thief-cat),' as '*neko-doroboo*' (and some other children choose both this picture and the correct one), even though most of them choose only the correct picture in the cases of other novel compounds. We argue in this section that this difference has something to do with the typology of compounds we have seen in 1.3.: the distinction between primary compounds and secondary compounds, along with semantic variation among primary N-N compounds.

When we consider why the result of the compound '*neko-doroboo* (cat-thief)' was worse than other compounds, it should be noted that among the four N-N compounds used in the experiment, this compound differs from the other three compounds in one respect. In the cases of the other three compounds, the picture of a '*tyoko-mikan* (chocolate-orange)' illustrates obviously a sort of orange but not a sort of chocolate, the picture of a '*neko-bana* (cat-flower)' obviously a sort of flower but not a sort of cat, and so on. However, the wrong picture (11-D) for this compound illustrates 'a cat who is a thief,' and this picture may also be

described as 'a thief who is a cat,' where the head of the compound is *doroboo* (thief) and the compound is of '[N_2 is N_1] type' just like *drummer boy*. If the children take this picture that way, it is also the right picture for '*neko-doroboo* (cat-thief),' according to their knowledge of the RHR. Then, why isn't this interpretation allowed in adult grammar?

Here, recall the discussion about the sorts of compounds in 1.3. Also in Japanese N-N compounds, there is a clear distinction between primary compounds and secondary compounds. Let us give several examples. If the head noun of the compound is a noun such as *tomodati* (friend), the first element behaves as an adjunct; *onna-tomodati* (girl-friend) means a 'friend who is female.' This is an example of a primary compound, whose semantic type is '[N_2 is N_1] type.' On the other hand, if the head noun is a derived nominal such as *taiji* (defeat), the first element of the compound behaves as the complement of the derived nominal and the formed compound is a secondary compound; *oni-taiji* (ogre-defeat) means 'to defeat ogres' and not 'for ogres to defeat someone.'

The examples where the head element is *doroboo* (thief) show a mixed property. We have tentatively classified '*neko-doroboo*' in adult usage as a regular primary compound whose semantic type is '[N_2 steals N_1] type' in 3.1., but closer inspection of the noun *doroboo* reveals that its semantic structure is rather similar to that of a secondary compound. *Doroboo* (thief) means a 'person who steals something.' It is true that *doroboo* is a simple word which is not derived from the verb *steal*. At the same time, however, it is close to derived nominals such as *cracker* (See 1.3.) and *taiji*, which are derived from verbs, in that it has a property of a predicate; it requires an object. Such a noun can make a compound both with an adjunct noun and with a complement noun as seen in (17) and (18).

(17) a. gaikokujin-doroboo (adjunct)
foreigner-thief
'a thief who is a foreigner'

b. houseki-doroboo (complement)
jewel-thief
'a thief who steals jewels'

(18) a. onna-kyoosi (adjunct)
woman-teacher
'a teacher who is female'

b. suugaku-kyoosi (complement)
math-teacher
'a teacher who teaches math'

Even if *doroboo* and *kyoosi* are not derived from a verb, (17b) and (18b) are like secondary compounds in that they have argument structure within them, while (17a) and (18a) are

genuine primary compounds like *onna-tomodati* (girl-friend). Let us tentatively call compounds like (17b) and (18b) 'quasi-secondary compounds' and distinguish them from regular primary compounds of '[N_2 steals N_1] type.'

If we make these assumptions, those children who choose 'a cat stealing something' (11-D) as a '*neko-doroboo*' can be argued to interpret *neko* (cat) in '*neko-doroboo*' as a genuine primary compound in the same way as (17a) and (18a), while adults interpret it as a 'quasi-secondary compound' as (17b) and (18b).

Let us return to the question why adults do not allow the interpretation of this compound as a genuine primary compound. On the basis of the fact that examples (17a) and (18a) are fully acceptable as genuine primary compounds in the adult grammar, we may conclude that the interpretation of '*neko-doroboo*' as a primary compound is not allowed just because of our pragmatic knowledge concerning the lexical properties of the words *neko* and *doroboo*. Unlike examples in (17) and (18), both 'a thief who steals cats' and 'a thief who is a cat' are pragmatically imaginable. Nevertheless, adult grammar allows only the former interpretation. Thus, we stipulate that the Japanese adult grammar has a pragmatic rule that prefers the argument interpretation to the adjunct interpretation; we must always interpret the first element of an N-N compound as an argument as long as it is pragmatically possible. If we assume in this way, even if children choose the picture (11-D), this does not indicate that they are lacking in the competence for the RHR. They are just misinterpreting *neko* in '*neko-doroboo*' as an adjunct, lacking the pragmatic rule mentioned above.

If the argument above is on the right track, what is important is that, although our pragmatic rule prefers the 'quasi-secondary compound' interpretation, children are apt to interpret it as a genuine primary compound. This may be because even among so-called primary compounds, children have more difficulty in comprehending 'quasi-secondary compounds,' than comprehending genuine primary compounds.

How about the difference between the acquisition of primary compounds and that of secondary compounds? Concerning this, the data indicate that children spontaneously produce primary N-N compounds very early but have difficulty in using secondary N-N compounds. As mentioned in 1.4., children spontaneously produce primary N-N compounds such as *lion-box* from as young as age two. By contrast, Clark et al. (1986) claim that English-speaking children rarely use secondary N-N compounds spontaneously before age three. They show that secondary compounds that children use are often different from adult usage: *cracking-nut* (2;6) for *nut-cracker* or *cutter-grass* (4;0) for *lawn-mower*.

Given that children have difficulty also in acquiring primary N-N compounds in which argument structure is involved, as discussed above, we can generalize from these data that compounds with argument structure in general are more difficult for children to acquire than other compounds. On the other hand, it is widely held that the value of the Head Parameter in phrase structure is set at a very early stage of language acquisition; children rarely have

difficulty in constructing argument structure syntactically. Thus, our stipulation is that when children determine the value of the Head Parameter in phrase structure earlier, and get accustomed to representing argument structure using syntactic knowledge, they have no need to devise another representation of the same argument structure making use of the morphological method, which leads to the late acquisition of secondary/'quasi-secondary' compounds. We would like to investigate into the acquisition of other kinds of compounds, say, Japanese secondary compounds, in order to see whether this stipulation is on the right track.

5. Concluding Remarks

As is evident from the results of our experiment, it has been revealed that many Japanese 4-year-old children have the full knowledge of the RHR. In order to specify the age at which children acquire the RHR, we have to conduct the same experiment for younger children. Also, this revised experiment should be conducted with children acquiring English, Italian, and so on. By comparing the results, we can see whether the setting of the value of the Head Parameter in word structure is independent of that in phrase structure, and whether the Head Parameter has a default value.

In addition, our experiment has revealed that the results greatly differ depending on the semantic relation of the two elements in each compound; among so-called primary compounds, genuine primary compounds are easier for children to interpret than primary compounds involving argument structure within them. We consider that the existence of argument structure might be responsible for the late acquisition also in the case of secondary N-N compounds. Although we have focused on the data concerning N-N compounds in this paper, we would like to verify this point by employing various types of compounds in the experiment in future research.

References

Clark, Eve V. (1993) *The Lexicon in Acquisition*, Cambridge University Press, Cambridge.

Clark, Eve V, Susan A. Gelman and Nancy M. Lane (1985) "Compound Nouns and Category Structure in Young Children," *Child Development* 56, 84-94.

Clark, Eve V., Barbara Frant Hecht and Randa C. Mulford (1986) "Coining Complex Compounds in English: Affixes and Word Order in Acquisition," *Linguistic Inquiry* 24, 7-29.

Di Sciullo, Anna-Maria and Edwin Williams (1987) *On the Definition of Word*, MIT Press, Cambridge, Mass.

Downing, Pamela (1977) "On the Creation and Use of English Compound Nouns," *Language*

53, 810-842.

Goodluck, Helen (1991) *Language Acquisition: A Linguistic Introduction*, Blackwell, Oxford and Cambridge, Mass.

Kizu, Hiromi (1986) *A Developmental Study on the Creation and Use of Compound Nouns*, B.A. thesis, Ochanomizu University.

Lieber, Rochelle (1992) *Deconstructing Morphology*, The University of Chicago Press, Chicago.

Namiki, Takayasu (1985) *Gokeisei*, Taishukan, Tokyo.

Namiki, Takayasu (1993) "Morpho-Syntactic Studies of Compound Adjectives in English: Toward Universalities of Compounding," *A Report of a Grant-in-aid for Scientific Research (C)*.

Namiki, Takayasu (1995) "Keitairon," *Nintisinrigaku*, ed. by Yukio Otsu, 37-41, Tokyo Daigaku Shuppankai, Tokyo.

Namiki, Takayasu (2001) "Further Evidence in Support of the Righthand Head Rule in Japanese," *Issues in Japanese Phonology and Morphology*, ed. by Jeroen van de Weijer and Tetsuo Nishihara, 277-297, Mouton de Gruyter, Berlin/New York.

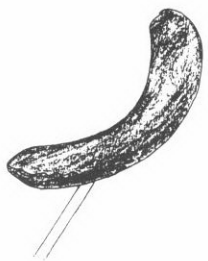
Scalise, Sergio (1992) "Compounding in Italian," *Rivista di Linguistica* 4.1, 175-199.

Sugisaki, Koji and Miwa Isobe (2000) "Resultatives Result from the Compounding Parameter: On the Acquisitional Correlation between Resultatives and N-N Compounds in Japanese," *WCCFL* 19, 493-506.

Williams, Edwin (1981) "On the Notions 'Lexically Related' and 'Head of a Word'," *Linguistic Inquiry* 12, 245-274.

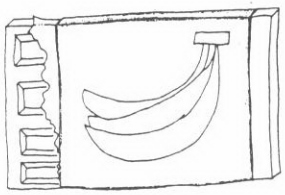
Appendix: Pictures used in the experiment

(10-A)



(10-B)

(10-C)



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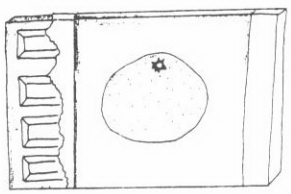
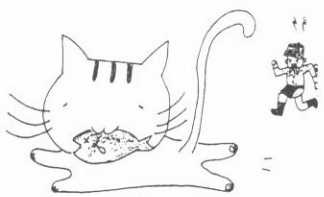


(11-A)

(11-B)

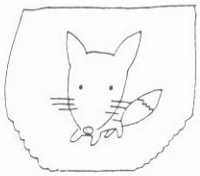
(11-C)

(11-D)



(12-A)

(12-B)



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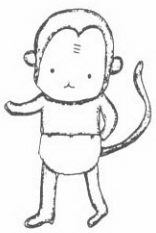

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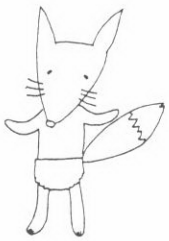

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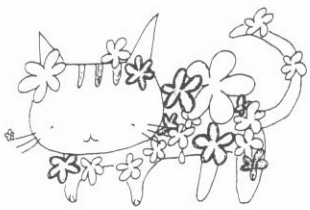

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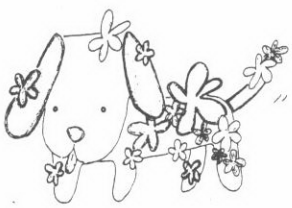

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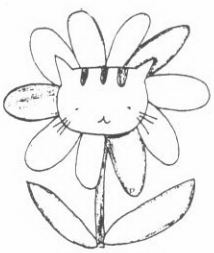

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