

On the Acquisition of Recursive Locative PPs*

Inada, Shun'ichiro

University of Tokyo

Inokuma, Sakumi

Jissen Women's University

1. Introduction

Recursion is enjoying a central role in current minimalist theorizing (Chomsky 2004, 2005, 2008, 2013, Hauser et al. 2002). Many of the apparently language-specific properties have been shown to find fundamental, language-independent bases in their core aspects. Under this program, which has come to be called “minimalist,” or more recently “biolinguistic,” recursive merge is held to be one property of human language which seems to be irreducible to other factors.

In the history of generative grammar, Recursion has taken various formulations. To take a recent characterization, Chomsky (2014) defines Recursion in general as below.

For our purposes, we can think of recursion as enumeration of a set of discrete objects by a computable finitary procedure, one that can be programmed for an ordinary digital computer that has access to unlimited memory and time. Taking the recursive procedure P to be a function on the integers, its range $R = \{P(n)\}$, the set of objects enumerated by P . In the interesting cases, R is infinite, but it could be finite (or null). (Chomsky 2014: 1-2)

Chomsky goes on to define the operation Merge, which must be presupposed in virtually any approach to hierarchical objects like human language.

A finitary computational procedure P will have buried in it in some form an operation –call it *Merge* – that takes objects already constructed and forms from them a new object, beginning with a set of atomic objects (which may have internal structure). To first approximation, we can take the atomic objects to be lexical items drawn from the lexicon, though this is not an innocent move. We can therefore think of P as having available a work space consisting of the lexicon (or some subpart extracted from it for the purpose of the computation) and objects that have already been formed by P . The optimal assumption is that Merge takes the simplest form: a binary operation that applies to X, Y , forming $Z = \{X, Y\}$, with X and Y unchanged by the operation (the No-tampering Condition NTC), and also unordered. (Chomsky 2014: 7)

In essence, human language is a computational system that maps hierarchical structure constructed by recursive operation of Merge to two interfaces: the sound (externalization) system on the one hand, and the meaning (conceptual-intentional) system on the other.

We are concerned with a special case of recursive procedures, generative grammar G_i , each of which enumerates a set of hierarchically structured expressions, assigning to each a symbolic representation at two interfaces, the sensorimotor interface SM for externalization ER and the conceptual-intentional interface CI for what is loosely termed *thought*: interpreting experience, reflection, inference, planning, imaging, etc. In this respect each G_i

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can be regarded as an instantiation of the traditional Aristotelian conception of language as sound with meaning (though sound is now known to be only a special case of ER). (Chomsky 2014: 2)

Various aspects of Recursion is under intense investigation. The present article is one of the attempts, from the perspective of children's language acquisition. Based on the experimental results reported in Terunuma & Nakato-Miyashita (2013) and Nakajima et al. (2014), we will provide an analysis toward an apparently puzzling behavior that Japanese children exhibit with respect to "Recursive" structure. Our goal is two-fold: (i) to explain the different behavior observed in English-speaking and Japanese-speaking children, and (ii) to explain asymmetric patterns that Japanese children (unlike English children) exhibit towards possessive expressions and locative expressions.

The article is organized as follows. In section 2, we will briefly introduce the hypotheses as to the acquisition of Recursion proposed by Roeper (2011), and experimental results conducted so far under the general framework of Roeper. Terunuma & Nakato-Miyashita (2013) is one of them, focusing on Japanese children's acquisition path of multiple possessive expressions. Roeper's (2011) hypothesis predicts the same path will be observed in other multiple embedding configurations. With this general perspective, Nakajima et al. (2014) conducted an experiment on Japanese 4- to 5-year-old children, this time focusing on multiple locative expressions, as surveyed in Section 3. The result of Nakajima et al. (2014) does not pattern with the result obtained with multiple possessives by Terunuma & Nakato-Miyashita (2013), and in this sense looks inconsistent with the general prediction of Roeper's approach. Specifically, Nakajima et al.'s (2014) result shows (i) that Japanese children show a complex pattern compared to English children, and (ii) that among Japanese children, multiple locative expressions exhibit a complex pattern compared to multiple possessive expressions. Section 4 discusses a possible analysis that can capture these two puzzles, the crucial key being the morphologically ambiguous status of Japanese *-no*. Section 5 concludes.

2. Acquisition of Recursion in English

It is well-known that the structure like (1b), which involves two possessive expressions, resists children's proper understanding in their early stage of acquisition (Roeper (2011), Gentile (2003)).

- (1) a. Cookie Monster's sister
- b. Cookie Monster's sister's picture

Notice that (1b) employs one individual (*Cookie Monster*) that functions as a possessor of another individual denoted by *sister*, which in turn functions as a possessor of an entity denoted by *picture*. In this sense, noun phrases like (1b) involve "recursive" embedding of possessive expressions.

Gentile (2003) performed an experiment, in which children are shown three pictures (2A-2C), and are asked to choose the one with Cookie Monster's sister: "Can you show me Cookie Monster's sister's picture?"

- (2) A. Picture of Cookie Monster
- B. Picture of Cookie Monster and his sister
- C. Picture of his sister

The result is roughly as follows: a third of the children chose (2B), although children at around five years old correctly chose (2C).

Hollebrandse and Roeper (2014) report a general tendency found in English-speaking children that they have difficulty in dealing with recursive structure like (1b). Their examples include recursion of attributive adjectives and locative prepositional phrases, and complex sentences.

Hollebrandse and Roeper (2014) go on to argue that this sort of restriction on recursion can be explained by assuming

two subtypes of recursion: namely, Conjoined (Direct) Recursion and Embedded (Indirect) Recursion (cf. Roeper (2011)).

- (3) i. Conjoined (Direct) Recursion:
the father and son and friend came.
- ii. Embedded (Indirect) Recursion:
the father's son's friend came. (Hollebrandse and Roeper (2014: 180))

They claim that children at the early stage of syntactic development only have access to Conjoined Recursion (3-i), but not Embedded Recursion (3-ii), which explains why many children mistakenly chose the picture (2B) in Gentile's experiment. Hollebrandse and Roeper add that children around five years old acquire Embedded Recursion, displaying adult-like behavior in this type of experiment.

All things being equal, the restriction of this sort on the acquisition of recursive structure, if the biolinguistic perspective is on the right track, will be observed universally across languages. In the next section, we will look into the acquisitional data of Japanese children, using the expressions (presumably) corresponding to the English counterparts.¹

3. Acquisition of Recursion in Japanese

With the above concerns in mind, this section turns to experimental results of acquisition of recursive constructions by Japanese children. As reported below, the results at first glance suggest even more complicated patterns than those in English.

This section first summarizes basic properties of adnominal possessives and locative phrases in adult Japanese, with special reference to *-no*, which expresses various relations between the head noun and the elements within the nominal phrase it heads. Against this background, we go on to a short report of the experiment conducted by Nakajima et al. (2014), with discussion on the theoretical problems it raises.

3.1. *-No* in Adnominal Possessives and Locative Phrases

First, consider the difference of the four occurrences of *-no* in (4).

- (4) a. [DP <_{Loc} benchi-no ue-no > neko]
<_{Loc} bench-*no* on-*no*> cat
'a/the cat on the bench'
- b. [DP <_{Loc} kooen-no benchi-no > neko]
<_{Loc} park-*no* bench-*no*> cat
'a/the cat on the bench in the park'

Among the four instances of *-no*, all but the first instance in (4a) can be replaced by an existential predicate *aru/iru* 'to exist_{animate}/exist_{animate},' as shown in (5-6).

- (5) a. * [DP <_{Loc} benchi-ni aru/iru ue-no > neko]
<_{Loc} bench-at exist on-*no*> cat

¹ It is worth noticing here that as we will discuss in section 3, we can say the restriction on Embedded Recursion is operative both in English-speaking and Japanese-speaking children, although the restriction loses its entire effect at the later stage in Japanese than in English, as observed in Nakajima et al. (2014). Why the acquisitional cue is given at different times in English and Japanese remains mystery and needs to be explored in the future research.

follows nouns and postpositions, but not verbs and adjectives.

- (10) [DP [PP Tokyo kara-no] denwa] ni-wa Hanako-ga deta.
 [DP [PP Tokyo from-Link] call] to-Top Hanako-Nom answered
 ‘Hanako answered the call from Tokyo.’

If we assume that *ue* in the examples above has nominality to some extent, while being on the functional layer of complex locative phrases, the use of *no* directly preceding it can be taken as instances of the Linker *no*.³

3.2. Experimental Results of Nakajima et al. (2014)

Nakajima et al. (2014) conducted an acquisitional experiment that examines three types of *no*, illustrated in (11), and obtained an intriguing fact with regard to the acquisition of recursion in Japanese children.⁴

- (11) a. Taroo-no neko
 Taro-POSS cat
 ‘Taro’s cat’
 b. Kooen-no naka-no neko
 park-Link inside-at cat
 ‘a/the cat in the park’
 c. Kooen-no neko
 park-at cat
 ‘a/the cat in the park’

No in (11a) denotes a possessor. In an ordinary context, *Taroo-no* is interpreted as a possessor of the cat. In (11b, c), in contrast, *kooen(-no naka)-no* is interpreted as the location where the cat exists (again, in an ordinary context). As discussed above, the first *no* in (11b) is a Linker, and the latter *no* is a postposition.

A first question is whether Japanese children distinguish these three types of *no* in the earliest stage of acquisition. If they do, it is predicted that the course of acquisition reflects the distinction at issue. In this light, Nakajima et al. (2014) first tested children’s reactions to expressions corresponding to (12a-c).

- (12) a. [PossP [PossP kukkiimonstaa-no] imouto-no] e
 Cookie.Monster-POSS sister-POSS picture
 b. [LocP [LocP kooen-no] benchi-no] neko
 park-LOC bench-LOC cat
 c. [LocP benchi-no ue-no] neko
 bench-LINK top-LOC cat

³ It is interesting to note that the Linker *no* can be left unpronounced after relational nouns discussed here, with a systematic change in pronunciation. This is presumably because *ue* is in fact the functional head on the extended prepositional layer, not *bona fide* nouns.

- (i) a. benchi % (no-) ue-no neko
 b. benchi (*no-) joo-no neko
 bench (Link-) top-at cat
 a/the cat on the bench

Here we see a sharp contrast with the other, postpositional, *no*.

- (ii) benchi joo*(-no) neko
 bench top(-at) cat

⁴ Subjects are 4- to 5-year-old Japanese-speaking children.

At first sight, (12a) includes recursion of possessive expressions, and (12b) includes recursion of locative expressions. Thus it is predicted that if children have not acquired recursion, they will fail to assign appropriate interpretation to these constructions. In contrast, since (12c) contains only one locative expression, with no recursion, children will have no difficulty interpreting it, with respect to recursion.

The result is somewhat surprising, given in (13).

(13) Nakajima et al. (2014): Experiment 1

	2 POSS (12a)	2 LOC (12b)	1 LINK + 1 LOC (12c)
% of correct responses	30.6%	58.3%	69.4%

The low score for multiple possessor construction (12a) is as expected. The score for multiple locative expressions, (12b), should be as low as (12a), if the key was multiple occurrence of the same category, whether it is possessors or locatives. The prediction is not, however, borne out; children's reaction to the expressions like (12b) is remarkably better than their reaction to the expressions like (12a).

Nakajima et al. (2014) goes on to examine the reaction by the same group of children to examples like (14).

(14) [_{LocP}[_{LocP} zoo-no ue-no] ushi-no ue-no] wani
elephant-LINK top-LOC cow-LINK top-LOC crocodile

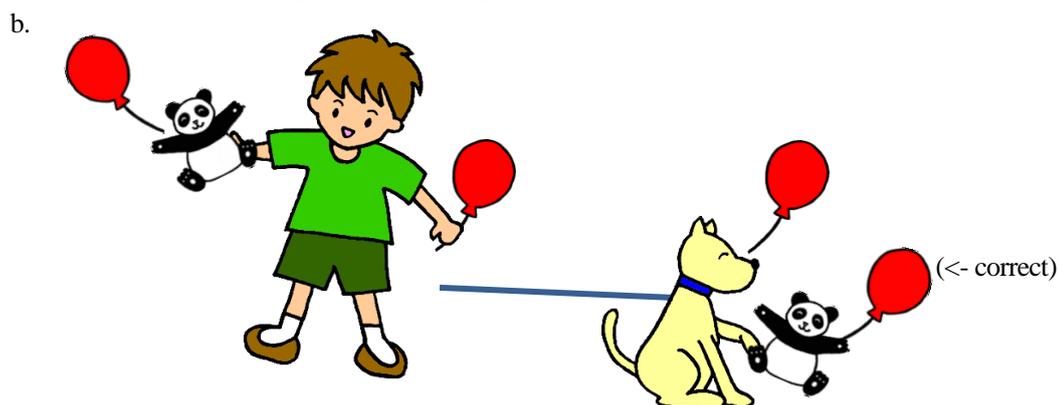
The result is given in (15).

(15) Nakajima et al. (2014): Experiment 2-i

	2 [LINK + LOC] (14a)
% of correct responses	16.7%

If (the number of) multiple occurrence of the same category was the key, examples like (14) should score to the level corresponding to (12b), since both involve two locative expressions, with the only difference being complexity of the locative PPs. Nakajima et al. also examines the reaction to the examples like (16) that contain three possessive *-nos*.

(16) a. [_{PossP}[_{PossP}[_{PossP} otokonoko-no] inu-no] panda-no] huusen
boy-POSS dog-POSS panda-POSS balloon



The low score for multiple possessor construction (16) is, again, observed. The children of the same group experienced the most serious difficulty in selecting the correct balloon in (16b).

(17) Nakajima et al. (2014): Experiment 2-ii

	3 POSS (14b)
% of correct responses	11.1%

How could we explain these complicated patterns Japanese children exhibit with regard to “recursive” structures?

3.3. Discussion: Lexical distinction of *no* and acquisition of “recursion”

Let us summarize the result of Nakajima et al. (2014). Firstly, many Japanese children can interpret (18a) and (18b), but not (18c).

- (18) a. [DP <LOC1 benchi-no ue-no> neko]
bench-LINK top-LOC cat
- b. [DP <LOC1 kooen-no> <LOC2 benchi-no> neko]
park-LOC bench-LOC cat
- c. [DP <LOC1 kooen-no naka-no> <LOC2 benchi-no ue-no> neko]
park-LINK inside-LOC bench-LINK top-LOC cat

Pretheoretically, (18a) and (18b) involve two instances of *no*, and (18c) involves four. If we focus on the locative postposition, according to the classification of *no* above, (18a) involves one, while (18b) and (18c) involve two. That is, structurally speaking, (18a) has only one instance of a locative phrase, whereas (18b) and (18c) have two instances.

The contrast observed in (18) might seem to simply reflect the number of the instances of *no*: the more, the harder. That it is not the (only) factor, however, is evident from the result regarding possessor expressions. Consider (19).

- (19) [DP <POSS1 Taroo-no> <POSS2 ane-no> neko]
Taroo-POSS elder.sister-POSS cat

(19) involves two instances of *no*, both of which presumably denote possession. In this respect, (19) is parallel to (18b). Nevertheless, Japanese children fail to assign an appropriate interpretation to (19), unlike (18b).

So it can be said that on the one hand, Japanese children are like English children, in that they have difficulty dealing with multiple possessor cases (19) and complex locative cases (16c); on the other hand, Japanese children are unlike English children, in that they fare well with multiple simplex locative cases (18b) and single locative cases, whether they are simplex or complex (18a). Of particular interest here is the fact that Japanese children do quite well with (18b); cf. 58.3% accuracy in interpreting (12b). On one account, this expression can have a multiple locative structure, with the interpretation in which *neko* ‘cat’ is modified by a locative expression *benchi-no* ‘on the bench,’ which in turn is modified by another locative expression *kooen-no* ‘in the park.’ If so, we would have to say expressions like (18b) do involve “recursion of locative expression.”

- (20) [DP [LocP [DP [LocP [DP kooen] no_{PLoc}] benchi] no_{PLoc}] [NP neko]]
 park LOC bench LOC cat

On this account, we might be led to the conclusion that Japanese children can assign an appropriate interpretation to structures that involve Embedded Recursion. This conclusion at face value conflicts with the experimental result obtained with English children.

If, on the other hand, children interpreted these instances as involving Conjoined Recursion, then the syntactic structure would look like (21).⁵

- (21) a. [DP [LocP [DP kooen] no_{PLoc}] [LocP [DP benchi] no_{PLoc}] [NP neko]]
 park LOC bench LOC cat
- b. [DP [LocP [DP kooen-no] naka-no_{PLoc}] [LocP [DP benchi-no] ue-no_{PLoc}] [NP neko]]
 park-LINK inside-LOC bench-LINK top-LOC cat

World knowledge will exclude the possibility of interpreting the two locative expressions as referring to two physically independent spots, since it is hard to imagine an object (*neko* ‘cat’ in these examples) occupies two distinct places (in a park and on a bench *not* in the park) at same time. Pragmatic consideration of this sort will naturally invite children to relating the two locations, effectively providing them with apparently “recursive” interpretation. Thus children’s relatively high score on “recursive simplex locatives” could be explained away with Conjoined Recursion analysis, too. However, Conjoined Recursion analysis brings about a problematic consequence. If children in fact assign an apparently correct interpretation to (18b) via Conjoined Recursion structure, with a help of their world knowledge, then they should also be able to assign the same interpretation to (18c), contrary to the experimental findings (cf. 16.7% correct response to (14)). We take this to indicate that the better performance in (18b) is not due to the way around with Conjoined Recursion structure.

4. Syntactic Structure and Acquisition of Recursive Locative Phrases

4.1. Recursion of Locative Expressions in Adult English

A further argument against Conjoined Recursion approach to Japanese children’s behavior discussed in Section 3.3 comes from the facts found in adult grammar. Consider the English examples in (22), which involve multiple instance of locative expressions.

- (22) a. A Martian grzch lumbered down the street toward the frightened garbage collector.
 b. A drunken bassoonist staggered into the smoky room from out of the cold.

(Jackendoff (1973))

In principle, these constructions have two analytical possibilities: one is that the two PPs form a single constituent, i.e., a PP, with one PP modifying another PP; the other is that the two PPs independently adjoin to VP (Jackendoff 1973). The former corresponds to what Hollebrandse & Roeper (2014) call Embedded Recursion, and the latter to Conjoined Recursion. The availability of Embedded Recursion structure is confirmed by locative inversion (23a) and focalization

⁵ Whether the two locative expressions have Conjunction (coordination) structure or constitute two independent adjuncts to the head noun is irrelevant to the present discussion. In either case, the attained interpretation is conjunctive modification.

(23b).

- (23) a. Down the street toward the frightened garbage collector lumbered a Martian grzch.
b. It wasn't down the street toward Harpo that the garbage collector ran.

(Jackendoff (1973))

In these cases, we can say that the lower locative PP (e.g., *toward the frightened garbage collector*) is adjoined somewhere inside the layered structure of the higher locative PP (e.g., *down the street*).

Jackendoff (1973) also observes that it is possible to prepose only the first PP, or to insert a manner adverb between the two PPs.

- (24) a. Down the street lumbered a Martian grzch toward the frightened garbage collector.
b. A fearsome grzch lumbered down the street noisily(,) toward the frightened garbage collector.

(Jackendoff (1973))

These patterns show that, besides Embedded Recursion structure, Conjoined Recursion structure is also available.

Nakamura (1984) and Maruta & Hirata (2001) also examine sequences of two locative PPs in inclusion relation, and conclude that these sequences form a single PP.

- (25) a. I saw John at Kanda in Tokyo. (Nakamura (1984))
b. At Kanda in Tokyo I saw John.
b'. [_{PP}At Kanda in Tokyo] I saw John.

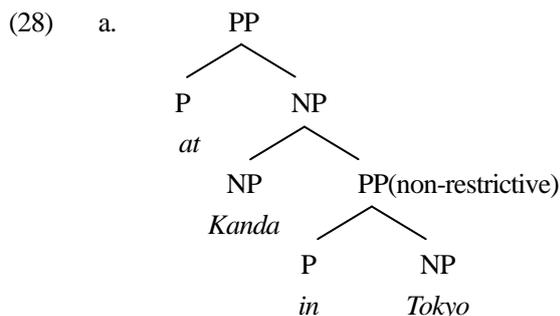
- (26) a. John sat in the park under a tree on a bench. (Nakamura (1984))
b. In the park under a tree on a bench John sat down.
b'. [_{PP}In the park under a tree on a bench] John sat down.

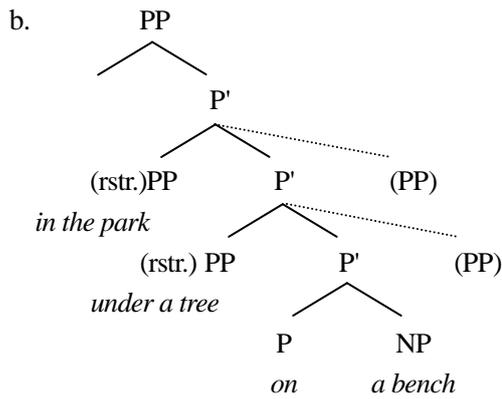
Maruta & Hirata (2001) further propose the following two subtypes of Embedded Recursion structure of locative PPs. One type, represented by (26), tolerates inverted orderings of locative PPs (27b), but the other type, represented by (25), does not (27a).

- (27) a. * I saw John [_{PP}in Tokyo at Kanda].
b. John sat [_{PP}on a bench under a tree in the park].

(Maruta & Hirata (2001: 133))

Maruta & Hirata (2001) conclude that in (25), a locative PP *in Tokyo* functions as a non-restrictive modifier of a location noun *Kanda* as illustrated in (28a), while in (26), the two locative PPs do not have such a structure as illustrated in (29b).





Maruta & Hirata (2001), in an attempt to explain the flexible ordering of locative PPs in (26), exploit the X'-theoretic assumption that X'-adjunct can occur in either the left-hand or the right-hand of its sister node. The general X'-theoretic restriction also provides a reason why examples like (29) are impossible: the ban on the extraction of X'-level constituents.

(29) * [_P On a bench] John sat in the park under a tree. (Maruta & Hirata (2001))

To sum up, according to Jackendoff (1973) and Maruta & Hirata (2001), multiple locative PPs can have Embedded Recursion structure (where one PP contains another PP), or Conjoined Recursion (where two or more PPs independently adjoin to the category they modify). Embedded Recursion structure is further divided into two types: one in which the lower PP acts as a non-restrictive modifier to the higher noun, and one in which the lower PP is adjoined to the higher PP.

4.2. Recursion of Locative Expressions in Adult Japanese

In Japanese, multiple occurrence of adverbial locative expressions is excluded in some cases (Tsujioka (2002)).⁶

(30) a. * Taro_o-wa [_{LocP} Tokyo-ni_{PLoc}] [_{LocP} Setagaya-ni_{PLoc}] ie-ga aru.
 Taro_o-TOP Tokyo-LOC_{ADV} Setagaya-LOC_{ADV} house-NOM possess
 (Tsujioka (2002: 65))

b. * [_{LocP} 3g_{oo}-kan-ni_{PLoc}] [_{LocP} kenkyuushitsu-ni_{PLoc}] Tanaka sensei-ga iru.
 No3-building-LOC_{ADV} office-LOC_{ADV} Tanaka professor-NOM exist

While recursion of adverbial locative expressions is not allowed in (30a) and (30b) above, it is sometimes allowed in the example like (31) below.⁷

(31) a. [_{LocP} Depaato-ni_{PLoc}] [_{LocP} okujoo-ni_{PLoc}] Biagaaden-ga aru.
 department.store-LOC_{ADV} rooftop-LOC_{ADV} outdoor.beer.hall-Nom exist
 b. [_{LocP} Ekimae-ni_{PLoc}] [_{LocP} shootengai-ni_{PLoc}] kombini-ga aru.
 front.of.station-LOC_{ADV} shopping.avenue-LOC_{ADV} CVS-Nom exist

⁶ Tsujioka (2002), building upon the acceptability contrast in (i) and (30a) below, shows that *Taroo-ni* in (i) must be interpreted as a possessor, not as a (extended) location.

(i) Taro_o-ni Tokyo-ni ie-ga aru.
 Taro_o-NI Tokyo-LOC_{ADV} house-NOM possess

As discussed below in the text, in both examples each of the two *-ni*-phrases restricts the denotation of *ie* 'house.'

⁷ One of the anonymous reviewers suggests that the examples presented in (31) is unacceptable. We believe that the contrast is real; what makes certain speakers judge the examples unacceptable must be examined in the future research, however.

Notice that (31) involves Conjoined Recursion, where two locative PPs independently modify the existential predicate *aru* since both of them have the adverbial ending. Thus Japanese has a syntactic means of modifying locative predicates with two (or more) distinct PPs. Nevertheless, (30a) and (30b) are unacceptable, which implies that some semantic/pragmatic factors are at work here, restricting the eligibility of Conjoined Recursion structure.

Interestingly, the contrast of the sort observed in (30)-(31) is absent in multiple adnominal locative expressions. All of the examples in (32), each corresponding to the examples in (30)-(31), are perfectly fine.

- (32) a. <LOC Tokyo-no_{PLoc}> <LOC Setagaya-no_{PLoc}> ie
Tokyo-LOC_{ADN} Setagaya-LOC_{ADN} house
- b. <LOC 3goo-kan-no_{PLoc}> <LOC kenkyuushitst-no_{PLoc}> Tanaka sensei
No3-building-LOC_{ADN} office-LOC_{ADN} Tanaka professor
- c. <LOC depaato-no_{PLoc}> <LOC okujoo-no_{PLoc}> biagaaden
department.store-LOC_{ADN} rooftop-LOC_{ADN} outdoor.beer.hall
- d. <LOC ekimae-no_{PLoc}> <LOC shootengai-no_{PLoc}> kombini
front.of.station-LOC_{ADN} shopping.avenue-LOC_{ADN} CVS

If Japanese has a semantic/pragmatic constraint on multiple restriction/specification by locative expressions (which is presumably category-neutral), and if the examples in (32) employ Conjoined Recursion structure, then the same kind of eligibility effect as found in (31) should also be observed in (32), contrary to fact. Hence, the adnominal modification instances in (32) do *not* involve Conjoined Recursion.

In fact, the examples in (31) become acceptable when we replace *-ni* in the first locative expression with *-no*, as shown in (33).

- (33) a. Taroo-wa [_{LocP} Tokyo-no_{PLoc}] Setagaya-ni_{PLoc} ie-ga aru.
Taroo-TOP Tokyo-LOC_{ADN} Setagaya-LOC_{ADV} house-NOM possess
- b. Tanaka sensei-wa [_{LocP} 3goo-kan-no_{PLoc}] kenkyuushitsu-ni_{PLoc} iru.
Tanaka professor-TOP No3-building-LOC_{ADN} office-LOC_{ADV} exist
- c. Biagaaden-wa [_{LocP} depaat-no_{PLoc}] okujoo-ni_{PLoc} aru.
outdoor.beer.hall-TOP department.store-LOC_{ADN} rooftop-LOC_{ADV} exist
- b. Kombini-wa [_{LocP} ekimae-no_{PLoc}] shootengai-ni_{PLoc} aru.
CVS-Top front.of.station-LOC_{ADN} shopping.avenue-LOC_{ADV} exist

If we follow the analysis of Maruta & Hirata (2001), the phrases introduced by *-no* in (33a, b) function as a non-restrictive modifier to *Setagaya* and *kenkyuushitsu* ‘office,’ respectively, and the adjunct phrase as a whole takes Embedded Recursion structure.

- (34) a. Taroo-wa [_{LocP} [DP[_{LocP} Tokyo-no_{PLoc}] Setagaya]-ni_{PLoc}] ie-ga aru.
Taroo-TOP Tokyo-LOC_{ADN} Setagaya-LOC_{ADV} house-NOM possess
- b. Tanaka sensei-wa [_{LocP} [DP[_{LocP} 3goo-kan-no_{PLoc}] kenkyuushitsu]-ni_{PLoc}] iru.
Tanaka professor-TOP No3-building-LOC_{ADN} office-LOC_{ADV} exist

The examples (33c-d) have Embedded Recursion structure, in which *depaato-no* or *ekimae-no* adjoins to a locative PP *okujoo-ni* or *shootengai-ni*, respectively. As expected, this configuration tolerates the same type of inversion as its English counterpart in (26).⁸

⁸ The preposition *-ni* in (32-33) is in the adverbial form so that they may function as the modifier of the (larger) locative PP, or

- (35) a. * [_{LocP} [_{LocP} Setagaya-ni_{PLoc}] Tokyo-ni_{PLoc}] ie-ga aru.
 b. [_{LocP} [_{LocP} okujoo-ni_{PLoc}] depaato-ni_{PLoc}] Biagaaden-ga aru.
- (36) a. Atami-ni-wa [_{PP} [_{PP} [furui hoteru]-ni] [_{PP} kasoukai-ni] [_P yamagawa-ni]]
 Atami-Loc-Top old hotel-LOC low.rise.floors-LOC mount.side-LOC
 mada kuushitsu-ga aru.
 still empty.rooms-NOM exist.
 b. Atami-ni-wa [yamagawa-ni kasoukai-ni frui hoteru-ni] mada kuushitsu-ga aru.
 c. [yamagawa-no kasoukai-no frui hoteru-no] kuushitsu

4.3. Embedded Recursion of Locative Expressions and Language Acquisition: A Reanalysis

Now let us go back to the primary puzzle. Why can Japanese children do well with multiple occurrence of simplex locative expressions such as (12b)/(18b), apparently analyzable only in terms of Embedded Recursion structure, which is hard for English children? The key to this puzzle lies, we contend, in the categorially ambiguous status of Japanese *-no*; examples like (32) can have a syntactic structure other than Embedded Recursion. More specifically, the first instance of *-no* in (32) is analyzed as possessive *-no*, rather than as locative postposition *-no* (which has an alternative adverbial form *-ni*).^{9,10}

- (37) [_{DP} [_{LocP} [_{DP} [_{PossP} Tokyo-no_{Poss}] Setagaya] -no_{PLoc}] [_{NP} ie] D]

On this account, the possessive phrase *Tokyo-no* modifies a location noun *Setagaya*, by virtue of semantic/pragmatic relatedness (or aboutness) which Japanese *-no_{Poss}* denotes.¹¹ The location noun *Setagaya* in turn combines with postpositional *no_{PLoc}*. The resulting phrase forms an adnominal (simplex) locative expression. What is crucial here is that in this structure no “recursion,” in the sense of embedding of the same category, is exploited. We have one possessive phrase occurring in one locative phrase.

Examples like (38) add further support for the present claim, in that the possessive phrase (*Tokyo-no* in this case), despite its “locative-like” appearance, can occur within a DP, rather than within a locative PP.

- (38) a. Sakunen Taroo-wa [_{PP} [_{DP} Tokyo-no shinseki]-ni] ai-ni itta.
 last.year Taroo-TOP Tokyo-POSS relative -DAT see-to go.past
 ‘Last year, Taroo went to see the relatives who live in Tokyo.’
 b. Sakunen [_{DP} Tokyo-no shinseki-ga] ai-ni kita.
 last.year Tokyo-POSS relative-NOM see-to come.past
 ‘Last year, the relative who lives in Tokyo came to see us.’

In (38b), *Tokyo-no* is clearly a DP-internal constituent. Then it is not unwarranted to assign the DP-internal status to

of the verb *aru*. In the latter case, the configuration is of the Conjoined Recursion, which also tolerates the inversion.

⁹ It might be more appropriate to state that these expressions become acceptable only when *-no* at issue can be analyzed as a possessive. We will reserve any detailed analysis of their syntactic behavior for future research. The goal of the present article is rather modest: to submit a possible line of explanation to different acquisitional patterns observed in Japanese and English children with regard to recursive occurrence of the same category, locative expressions in this case. Terunuma & Nakato-Miyashita (2013) is the one discussing the trigger that makes the recursive possessor expressions available for Japanese-speaking children.

¹⁰ The experimental results in Nakajima et al. (2014) also indicate that there are 4 to 5-year-old children who do not utilize this “reanalysis” strategy. Unfortunately, however, we cannot find any statistical connection, or statistical anomaly, among those children who experienced difficulty when they are confronted with the examples like (37).

¹¹ We do not go into detail as to the precise characterization of the notion “semantic/pragmatic relatedness.”

Tokyo-no in (37) as well.

Pereltsvaig & Lyutikova (2014) point out that, through observation of two types of possessive expressions in Tatar, the possessive expression which is structurally lower (i.e., closer to the head noun) can assume various interpretations: the lower the possessor is, the more abstract (and varied) its interpretation becomes with regard to the head noun.

- (39) a. bala-lar kitab-1
child-PL book-3
'a book belonging to some children or a book designed for children'
- b. bala-lar-nij kitab-1
child-PL-GEN book-3
'a book belonging to some children' (Pereltsvaig & Lyutikova (2014: 207))

The locative-like possessors in Japanese might be structurally characterized in terms of Pereltsvaig & Lyutikova's (2014) theory of two types of possessive expressions.

Finally, the present approach also provides an account for the fact that Japanese children cannot give an appropriate interpretation to multiple complex locative expressions like (39) (recall 16.7% accuracy of (14)).

- (40) [DP kooen-no naka-no benchi-no ue-no neko]
park-LINK inside-P_{LOC} bench-LINK top-P_{LOC} cat

The two instances of *-no*, one following *naka* and the other following *ue*, are unambiguously locative postpositional heads. They thus can never be analyzed by children as possessor expressions (in the extended sense above). Consequently, instances like (40) have no way around to avoid *bona fide* Embedded Recursion structure.¹² Besides its lengthiness, which presumably plays a role in children's perception, children have no recourse to Conjoined Recursion or morphological "reanalysis," hence the helplessly low score (16.7%) obtains.¹³

5. Summary

The experimental result by Nakajima et al. (2014) at first looks like a mystery: on the one hand, Japanese children, like English children, seem to have difficulty dealing with Embedded Recursion of possessive expressions (cf. Terunuma & Nakano-Miyashita 2013), while on the other hand, Japanese children, *unlike* English children, seem to do fairly well with Embedded Recursion of simplex locative expressions. This result may appear to suggest that there is cross-linguistic variation with regard to the "process of Recursion," which is (at least at face value) unexpected in light of the current biolinguistic perspective. The present article has pointed out, however, that the apparent puzzles can be explained away by taking into consideration morphological factors peculiar to Japanese, namely, the categorial ambiguity of the element *-no* in this language. Embedded Recursion structure is unavailable uniformly to English and Japanese children. An apparent counterexample found in Japanese children is, in fact, not a counterexample, in that it does *not* involve Embedded Recursion. The relevant examples are analyzable as combination of one (extended) possessive expression and one locative expression; hence no "recursion" of the same category. If the analysis of the present paper is correct, the

¹² As for adult Japanese, Embedded Recursion structure of locative expressions causes no problem, except for perceptual difficulty due to its lengthiness.

¹³ Japanese-speaking children must have already been allowed to use the possessive morpheme *-no*, which follows the possessor expression with the same sound of the locative attributive postposition. They would be clever enough to avoid the Embedded Recursion structure, if possible, because they are not equipped to (re-)produce the structure at the stage. For the first *-no* in the example (37), the possessive *-no* must be hit on both in the production and the parsing process as the first choice, not as the complement to the locative preposition *-no*, even if the adult in front of them pronounces the morpheme with the locative flavor.

apparent cross-linguistic variation with regard to the “acquisition of Recursion” just fades away: it’s simply reduced to a matter of lexical/ morphological properties.

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