L1 ACQUISITION OF JAPANESE VERB ARGUMENT STRUCTURE: HOW DO CHILDREN ACQUIRE GRAMMAR IN THE ABSENCE OF CLEAR EVIDENCE?

by

Nozomi Tanaka

BA, Chiba University, 2009

Submitted to the Graduate Faculty of

Arts and Sciences in partial fulfillment

of the requirements for the degree of

Master of Arts

University of Pittsburgh

2011

UNIVERSITY OF PITTSBURGH

SCHOOL OF ARTS AND SCIENCES

This thesis was presented

by

Nozomi Tanaka

It was defended on

April 15, 2011

and approved by

Yasuhiro Shirai, Ph.D., Professor of Linguistics

Brian MacWhinney, Ph.D., Professor of Psychology

Na-Rae Han, Ph.D., Lecturer and Director of Robert Henderson Language Media Center

Thesis Director: Yasuhiro Shirai, Ph.D., Professor of Linguistics

L1 ACQUISITION OF JAPANESE VERB ARGUMENT STRUCTURE: HOW DO CHILDREN ACQUIRE GRAMMAR IN THE ABSENCE OF CLEAR EVIDENCE?

Nozomi Tanaka, M.A.

University of Pittsburgh, 2011

L1 ACQUISITION OF JAPANESE VERB ARGUMENT STRUCTURE: HOW DO CHILDREN ACQUIRE GRAMMAR IN THE ABSENCE OF CLEAR EVIDENCE?

Nozomi Tanaka, M.A.

University of Pittsburgh, 2011

The Japanese language allows flexible word order (Shibatani, 1990) and allows missing noun constituents (Shibatani, 1990). The case-marking is realized with postpositional particles, e.g. the subject marker –*ga* and the direct object marker -*o*. However, these case markers are often omitted (Aida, 1993; Miyata, 2008; Rispoli, 1989). While Bates and MacWhinney (1989) and Sasaki and MacWhinney (2006) view case marking as the strongest cue in Japanese and animacy contrast as the second reliable cue, Ito, Tahara, and Park (1993) and Rispoli (1987) claim that Japanese children produce case markers with errors because they do not process them. It has not been clear how Japanese children acquire verb argument structure when there is little structural information in their input.

The current study aims to account for first language acquisition of Japanese verb argument structure by means of corpus analysis. We hypothesize that, while case markers are often omitted, both mothers' production and children's production initially follow the canonical pattern where the word order cue and the animacy contrast cue form a coalition (Bates & MacWhinney, 1989; Sasaki & MacWhinney, 2006), which aids children to identify the grammatical relations of the verb arguments.

The results indicated that the coalition we proposed is reliable information when the two nouns were realized. While both mothers and children produced the non-canonical form frequently even at the earliest age contrary to our prediction, children start from the canonical vs. non-canonical ratio that is similar to the maternal speech and then develop their own distribution

as they get older. Moreover, we suggest that animacy contrast cue in Japanese is more important for children than it has been suggested in the past. The animacy contrast is almost always present in the utterances and it is the information the speakers and the listeners use to specify the grammatical relations of the noun arguments when the sentence involves the reordering of the constituents or includes only one noun. On the other hand, the case-marking cue only appeared in a redundant context, which makes it hard for Japanese children to acquire case-marking.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

I thank my advisor Dr. Yasuhiro Shirai for everything, including his advice, supervision, patience, encouragement, and continuous support throughout these two years. I would also like to thank my two other committee members, Dr. Brian MacWhinney, who provided me with essential information about the theory and data interpretation, and Dr. Na-Rae Han, who has helped me learn the necessary skill to analyze the data.

I would also like to acknowledge my mentors who have been tremendously cooperative, helpful, and supportive about me pursuing my master's degree in the United States: Dr. Yasuharu Den, Dr. Syun Tutiya, Dr. Toshihiko Matsuka, Dr. Kazuo Otaka at Chiba University, Dr. Dennis Jaehne at San Jose State University, and Dr. Seiko Fujii at the University of Tokyo. Without them, I would have not made it to this country.

I am also grateful for all the training and assistance I received from the faculty members at the Department of Linguistics at the University of Pittsburgh, as well as the support from fellow graduate students and my friends. Last but not the least, I would like to thank my family, especially my parents, for their love, understanding, and support toward what I chose as my career path.

1.0   INTRODUCTION

The acquisition of verb involves the discovery of agent-patient relations. The major determiners are word order (Dryer, 2005), inflectional morphology including case-marking (Comrie, 2005) and various forms of verb agreement (Siewierska, 2005). Animacy is also considered to be helpful information, and many researchers claim that very young children favor animate agents and inanimate patients (Bowerman, 1973; Brown, 1970; Brown, Cazden, & Bellugi, 1968; Chapman & Miller, 1975; de Villiers & de Villiers, 1974; Kail, 1989; Slobin, 1968). These elements bear different weight depending on the language. For example, Bates and MacWhinney (1989) provide the importance of cues to actor assignment in 13 different languages based on the results of their experiments on sentence comprehension in adult native speakers. In the case of English, although there is a slight difference depending on the age, speakers generally rely on word order the most heavily, followed by animacy and agreement. On the other hand, Chinese uses animacy as the strongest cue and word order as the second strongest cue. Japanese, on the other hand, uses case-marking as the most important cue, animacy as the second most important, and SOV word order as the least important cue (Bates & MacWhinney, 1989; Sasaki & MacWhinney, 2006). That is, native speakers rely on the animacy contrast cue when the case marker is absent (Kilborn & Ito, 1989), but do not pay attention to word order until both case-marking and animacy contrasts are missing. Similar to Japanese, Korean speakers also rely on case markers (Kilborn & Ito, 1989).

1

1.1 THEORIES ON VERB ACQUISITION

How do children use these elements of linguistic information in order to acquire the grammar of verbs? Scholars have sought to provide accounts for the verb acquisition from different perspectives.

Pinker (1982, 1984) proposed the mechanism that is referred to as the "semantic bootstrapping", in which the children initially decode semantic notions (i.e. thematic roles such as agent and patient) in events in the world and assumes that grammatical entities (i.e. syntactic roles such as subject and object) have a canonical relationship to the thematic roles. For example, one of the simple examples of the proposed principles is to associate the agent with the subject and the patient with the object. According to Pinker (1984), the lexical entry of canonical verbs involves this kind of "Canonical Mapping" (Pinker, 1984), where children recover "thematic roles inherent in the described action" (Pinker, 1984, p. 297) and learn to use the verbs productively. However, non-canonical verbs are learned in a piecemeal fashion based on the "direct learning from positive evidence" (pp. 294-296). Because children need to collect enough information for a specific lexical rule, these non-canonical verbs are claimed to be learned later in the development. Rispoli (1987) referred to this approach as "lexicalist approach".

Contrast to the lexicalist view is the constructionist/usage-based explanations. Tomasello's (1992) Verb Island hypothesis suggests that children initially learn verb-specific constructions, such that English transitive verb *hit* has "hitter" before the verb and "hittee" after the verb. Casenhiser and Goldberg (2005), on the other hand, discussed more abstract and larger unit of construction. They demonstrate in their experiments that, when children learn novel words, they associate the meaning with word order, i.e., the structure of the arguments.

According to them, morphological information facilitates the learning but is not necessary to learn the novel verbs.

Although they define the role of input differently, there seems to be an agreement in these previous studies that children learn grammar based on what they hear in their input. The Japanese language, however, is a problematic case when considering the role of input, which is discussed in detail in the next section.

1.2   PROBLEMS WITH JAPANESE

These previous views on verb acquisition do not well-account for first language (L1) acquisition of Japanese verbs because Japanese speech often lack of information that tells the listeners about the structure of the language.

First of all, Japanese is a SOV language, but allows reordering of major constituents. That is, it exhibits the phenomenon often referred to as "scrambling" (Shibatani, 1990). Thus, the SOV sentence in (1) and OSV sentence in (2) are both grammatical.

(1) Hanako-ga   Taroo-o   Nagut-ta.

   Hanako -NOM   Taroo-ACC   hit-PAST

   "Hanako hit John."

(2) Taroo-o   Hanako -ga   Nagut-ta

   Taroo-ACC   Hanako -NOM   hit-PAST

   "Hanako hit Taroo."

Secondly, Japanese is a pro-drop language (Shibatani, 1990), and therefore allows missing constituents unlike English, where constituents such as subject NPs and direct object

NPs are required in sentences. The sentences in (3)-(7) are missing one or more constituents compared to (3), but in fact they are all grammatical (Tsujimura, 2007, p. 212).

(3) Taroo-ga   Hanako-ni   hon-o   ni-satu   age-ta.

Taroo-NOM   Hanako -DAT book-ACC   two-CLF   give-PAST.

"Taroo gave two books to Hanako."

(4) Hanako-ni   hon-o   ni-satu   age-ta.

Hanako-DAT   book-ACC   two-CLF   give-PAST

"(I/You/He/She) gave two books to Hanako."

(5) Hon-o   ni-satu   age-ta.

book-ACC   two-CLF   give-PAST

"(I/You/He/She) gave two books to (you/him/her)."

(6) Ni-satu   ageta.

two-CLF   give-PAST

"(I/You/He/She) gave two (bound objects) to (you/him/her)."

(7) Ageta.

give-PAST

"(I/You/He/She) gave (it) to (you/him/her)."

The unexpressed constituents are referred to as "null anaphora" and they are understood by means of contextual information (Kuroda, 1965; Tsujimura, 2007)

Lastly, there is a problem of the omission of case markers. The Japanese case-marking system is realized in terms of postpositional particles and follows the nominative-accusative pattern, with the subjects of both transitive and intransitive clauses being marked by the nominative particle -*ga*, which we refer to as the subject marker in the present study, and the

object of a transitive clause by the accusative *–o*, which will be referred to as the object marker. The other examples of case particles include the topic marker *–wa*, the focus marker *–mo*, the dative marker *–ni*, and the genitive marker *–no*; however, these case markers are optional and allow ellipsis, especially in a casual speech situation (Tsujimura, 2007), and child-directed speech is not an exception (Aida, 1993; Miyata, 2008; Rispoli, 1989)[1]. According to Shibatani (1990), it is more common not to mark the direct object at all. Examples of the omission of case markers are found as follows:

(8) Watashi(-ga)   ringo(-o)   tabeta.

   I(-NOM)   apple(-ACC)   eat-PAST

   "I ate an apple."

(9) Ame(-ga)   hut-te-ir-u.

   rain(-NOM)   fall-CONN-be-PRES

   "It's raining."

(10) Mado(-o)   wat-ta.

   Window(-ACC)   break(trans.)-PAST

   "(I/You/He/She) broke the window."

The characteristics of Japanese, where it involves flexible word order, optional case-marking, and ellipsis of noun phrase arguments, make the input sentences indeterminate unlike

---

[1] Although subjects and objects are claimed to be marked by default, sometimes it is more natural not to mark these arguments at all. However, there has not been any comprehensive study done on the nature of the case-marking omission in Japanese.

languages like English, where the verb is heard in a sentence with unambiguous indication of the syntactic role played by the thematic role (Rispoli, 1989). This issue have evoked a great deal of discussion about what kind of information is used in the children's comprehension of sentences and how Japanese children acquire verbs (Hakuta, 1982; Ito, et al., 1993; Miyazaki, 1979; Noji, 1985; Rispoli, 1987, 1989; Suzuki, 2005).

While Bates and MacWhinney (1989) and others (e.g. Kilborn & Ito, 1989) viewed case-marking as the major cue to sentence interpretation for adult native speakers of Japanese, studies on child language acquisition of Japanese found different results. For example, Miyazaki (1979) and Noji (1985) stated that Japanese children do not produce the subject marking –*ga* correctly until at least the age of three. Ito, Tahara, and Park (1993) further examined children's acquisition of case-marking by conducting an experiment where the participants listened to auditory stimuli and then were asked to demonstrate what they heard by using toys and dolls. The results show that they they do not show adult-like comprehension the subject marking –*ga* until the age of 10, and of the object marking –*o* until the age of 7. According to Suzuki (2005), Japanese children start understanding single-argument sentences with case markers –*ga* and –*o* (e.g. *Koara-gaoshi-mashi-ta.* 'Koala-NOM push-POL-PAST') around the age of four, but their performance does not reach adult-like level until around the age of 5 to 6. He also showed that the context plays a great role in children's comprehension of single-argument sentences, although younger children (age 3-4) did not make as good use of the context as the older children (age 5-6).

Rispoli (1987) also claimed that Japanese children classify transitive and intransitive verbs based on the semantics and that this classification is done without the benefit of a case-marking system or syntactic configuration of the noun arguments. He collected data of children's

6

production from the conversations between two Japanese children from 22 to 24 months of age and their caretakers, which was made into a corpus of sentences that include action verbs, i.e., verbs that refer to events of change in the physical state of objects or the bodies of animate beings. The cluster analyses of 9 to 10 most frequent action verbs in each children's production showed that the children use two kinds of semantic information, the planned nature of an action and the animacy of theme referents, in order to classfy verbs into transitive verbs and intransitive verbs. He concluded that, Japanese children separate transitive and intransitive verbs based on the semantics and do not use case-marking to guide their comprehension. That is, they learn verbs without syntactic specification of verb arguments. Rispoli (1989) further conducted a corpus analysis on the distribution of 300 action verbs in the speech of six caretakers of four Japanese children from 22 to 24 months of age. He concludes that 2year-old children use the intentionality (i.e. roughly corresponding to animacy in our framework) of the figure-patient referent and the expression of intentional, planned action realized as verb suffixes, auxiliaries and adverbs. This information helps them assign an action verb to a semantic causal type, which ultimately leads to the classification of transitive and intransitive action verbs. The three semantic causal types Rispoli (1989) was concerned with are: self-agentive event, non-agentive event, and causal agentive event. When a figure/patient intends its own change and thus is also an agent, the event is classified as self-agentive. The figure/patient has to have intentions, and thus it should be an animate figure. When the event is unintentional or neutral, the event is non-agentive and the figure/patient can be either inanimate or animate. A causal agentive event requires an animate, intentional causer and an inanimate figure/patient. The morphemes he states as the expressions implying planned action were: verb + *te* 'request', verb + *(i) tai* 'desirative', verb + *(y)oo* 'hortatory', ver + *cha dame* 'prohibitional', verb + *te ii* 'permissive', verb + *te kure-*

'benefactive', verb + *te age-* 'benefactive', the adverbs *joozu ni* 'skillfully' and *sekkaku* 'carefully'.

On the other hand, Hakuta (1982) did experiments to test production, comprehension, imitation (i.e. delayed production) of simple sentences by children between the age of 2 to 6 and showed that Japanese children at this age do not show a strong reliance on neither word order nor on case markers alone. He claimed that Japanese children use a specific conjunction of case-marking and word order for both comprehension and reproduction.

The characteristics of Japanese, where it involves flexible word order, optional case-marking, and ellipsis of noun phrase arguments, allow the input sentences to be indeterminate unlike languages like English, where the verb is heard in a sentence with unambiguous indication of the syntactic role played by the thematic role (Rispoli, 1989).

Overall, there are conflicting opinions about Japanese L1 acquisition of verbs. Whereas adults use case-marking as the strongest cue as suggested in Bates and MacWhinney (1989) and Kilborn and Ito (1989), Rispoli (1987, 1989) stated that Japanese children do not use case-marking to learn verbs and that instead they use semantic information like animacy. Ito, et al. (1993), Hakuta (1982), and Suzuki (2005) shared the similar view with Rispoli (1987, 1989), although Suzuki (2005) indicated that children at the age of 3-4 show that they start understanding the role of case markers. The study by Hakuta (1982) suggests that, while children do not process case markers as themselves, they comprehend sentences using the information from both word order and case-marking.

The current study aims to offer a comprehensive account for the nature of Japanese L1 acquisition of verbs by means of corpus analysis. We analyze the data of mother's and children's

production and examine the interaction between the available cues based on the concept proposed in the competition model (Bates & MacWhinney, 1989).

1.3   THE COMPETITION MODEL

The Competition Model seeks to integrate the traditions of L1 acquisition, L2 acquisition, and adult processing research from the emergentist perspective invoked from functional linguistics and cognitive psychology (Sasaki & MacWhinney, 2006). The model tries to capture language in two-level structure, with a functional level concerned with meanings, and a formal level concerned with surface forms (Bates & MacWhinney, 1989). Therefore, language learning is viewed as a process of acquiring coalitions of form-function mappings.

There are four core concepts in this model: cue strength, cue validity, conflict validity, and coalition between forms and functions. Under ideal conditions, the value of cue strength converges on the value of cue validity (Bates & MacWhinney, 1989). Therefore, cue validity is the major predictive construct in the Competition Model. Cue validity refers to the information value of a given linguistic device as a cue to an underlying meaning and can be analyzed into three components (MacWhinney, 1978; MacWhinney, Pléh, & Bates, 1985; McDonald, 1989): availability, reliability, and conflict validity. Cue availability is the extent to which a cue is present when needed, cue reliability is the degree to which a cue leads to the correct interpretation when you count on it, and conflict validity is the number of cases in which the cue leads to a correct interpretation when two or more cues conflict. "Overall validity" is the product of cue availability by cue reliability.

Whereas cue validity and cue strength are mainly concerned with the relationship between a single cue and a single function or meaning, such one-to-one mappings are not common in natural languages. The subsystems comprised of many-to-many mappings are referred to as coalitions (Bates & MacWhinney, 1989; Sasaki & MacWhinney, 2006). For example, Chan, Lieven, and Tomasello (2009) examined children's comprehension of word order and animacy contrasts as cues to the agent-patient relations in the transitive sentences, and showed that the children comprehend transitive sentences better when agent and patient were cued redundantly by both word order and animacy contrast. They analyzed the cue availability, reliability, and validity of the word order cue and the animacy contrast cue in child-directed speech in Cantonese, German, and English, followed by an experiment targeting monolingual Cantonese-, German-, and English-speaking children. In the experiment, the examiners orally presented the sentence stimuli and the participants were asked to demonstrate what the sentences meant using the apparatus. Based on the results, they conclude that the children comprehend prototypical transitive sentences where the word order cue and the animacy contrast cue formed a coalition.

Conflict validity is another important concept in the Competition Model. In order to estimate conflict validity, it is necessary to look at those cases where two or more cues conflict (Bates & MacWhinney, 1989). For example, in case of English, word order is a reliable cue when it is in SVO order and animacy cue is reliable when there is an animacy contrast between animate subject and inanimate object. In a sentence such as "The apple ate the man.", these two cues conflict, because while SVO word order indicates "the apple" is the subject and "him" as the object, the animacy of the nouns tell us that "the man" is more likely to be a subject/agent of the sentence because it is an animate entity. The conflict validity measures the extent to which

the cue leads to a correct interpretation in the competition situations that cue participates. In the English example above, word order is the stronger cue because this sentence is interpreted as personification and 'the apple" is interpreted as the agent.

The concept of conflict validity is essential in order to understand the language acquisition because, while children initially respond primarily on the basis of overall validity, the development is controlled primarily by reliability in the first years of language learning (McDonald, 1989). In the course of mapping between forms (i.e. cues) and functions (i.e. meaning), the strengths of the same function increase when the cues agree. However, the strengths of cues are distributed to different functions when cues disagree, and later on, the functions that has obtained the most strength is chosen. This kind of learning-on-error mechanism promotes the process by which cues are acquired and strength is altered with continued exposure to the negative evidence (McDonald, 1989).

While there are studies of cue strength of each cue in Japanese in both adult comprehension and child comprehension (Bates & MacWhinney, 1989; Ito, et al., 1993), there has not been a study that examines the coalition of these cues inside the framework of the Competition Model. As mentioned above, Hakuta (1982) indicates that Japanese children from the age of 2 to 6 understand sentences using the conjunction of word order and case-marking. On the other hand, Rispoli (1987, 1989) stressed the importance of animacy and argued that Japanese verb acquisition is done without syntactic specification of noun arguments, but he did not take word order, which is a syntactic concept, into consideration. Therfore, it is necessary to examine every combination of these three cues. Moreover, we also need to examine the role of single cues, particularly the role of case markers, because researchers disagree with what is the strongest cue for children in Japanese (Bates & MacWhinney, 1989; Hakuta, 1982; Ito, et al.,

11

1993; Rispoli, 1987, 1989; Suzuki, 2005), while the consensus seems to be that case markers are strongest cue for adult speakers (Bates & MacWhinney, 1989; Kilborn & Ito, 1989). The problem here is that different researchers looked at different cues separately and argued which information is important or not. The purpose of this study is to provide a comprehensive explanation for Japanese verb acquisition by taking all cues investigated so far (i.e. word order, case-marking, and animacy) into account.

In addition, most of these previous studies except Hakuta (1982) and Rispoli (1987) only looked at children's comprehension, that is, how children interpret their input. In the current study, we will investigate how these cues are used in children's input as well as the output in order to better understand how children learn from their input and establish their linguistic knowledge about argument structure in order to be able to use it in their output.

2.0   THE STUDY

2.1   PURPOSE

The purpose of the present study is to examine how Japanese children acquire verb argument structure. More specifically, it investigates what kind of cue distribution they are exposed to, how children learn the relevant cues from their input, and how they use the information in their own production. In order to answer these questions, we analyzed the transcribed data of the conversation between child Japanese L1 speakers and their caretakers. The speech produced by the caretakers was essential to discuss the importance of the input in children's first language acquisition. We also analyzed children's production in order to examine what children actually learn from the input and how they manipulate the information in their own speech output.

2.2   RESEARCH QUESTIONS AND HYPOTHESES

Our prediction is that children use the coalition of the multiple cues to help their acquisition instead of obtaining information from single cues. In the current study, we followed the operation in the study by Chan et al. (2009) and focused on a coalition formed with the word order cue and the animacy contrast cue. When SOV word order and animacy contrast successfully form a coalition, we state such cases as the "canonical forms" that aid children to

identify the grammatical relations of the noun phrase arguments. We pose three questions as our research questions:

1. How much of the caretaker speech (input for children) is in the canonical form?

2. How much of the children's production (output for children) is in the canonical form?

3. Does the rate of the canonical form change along the development of children?

Based on the previous research, we hypothesize that case-marking is not part of the coalition because the previous studies from Ito, Tahara, and Park (1993) indicate that Japanese children do not acquire the subject and object case markers until the age of 7-10, and because Rispoli's (1987) study indicates that Japanese children do not rely on case markers when acquiring transitive verbs. We hypothesize that (a) case markers are often dropped in both input and output for children and thus do not play a critical role in acquisition of Japanese verb argument structure and instead, (b) word order and animacy contrast form a coalition and help children learn Japanese verb argument structure. We also hypothesize that (c) canonical forms are dominant in the early production of both mothers and children, and (d) non-canonical forms in the input and output increase as the children grow older.

2.3   METHOD

2.3.1   Data

This study investigates the previously mentioned research questions by means of corpus analysis. The data were taken from Child Language Data Exchange System (CHILDES) database, which contains transcripts and media data collected from conversations between young children, their

playmates and caretakers (MacWhinney, 2000; Oshima-Takane, MacWhinney, Sirai, Miyata, & Naka, 1998).

2.3.1.1 Selection of the files

We conducted the analysis using the corpus of a Japanese girl, Arika (Nisisawa & Miyata, 2010a) and a Japanese boy, Asato (Nisisawa & Miyata, 2010b). In this study, we chose the data from the age of 3;0, 4;0, and 5;0 for both children because the Arika corpus was available from the age of 3;0.02 to the age of 5;1.19 and the Asato corpus was available from the age of 3;0.01 to the age of 5;0.27. The data we analyzed for Asato corpus were at 3;0.01 (Mean Length of Utterances 2.66), 3;0.19 (MLU 2.53), 4;0.24 (MLU 3.31), and 5;0.27 (MLU 2.75). The data analyzed for Arika corpus were at 3;0.02 (MLU 3.38), 3;0.21 (MLU 2.63), 4;0.09 (MLU 4.41), 4;0.16 (MLU 4.00), 4;0.19 (MLU 4.10), 5;0.04 (MLU 3.51), and 5;00.25 (MLU 3.87). We analyzed the utterances that contained transitive verbs in the children's speech and the speech of their caretakers, which were their mothers in both cases. Table 1 shows the total clauses analyzed in the current study.

Table 1. Number of clause analyzed for each speaker at each age and MLU

	3;0	4;0	5;0
Asato	96 (2.60)	41 (4.41)	21 (4.00)
Asato's mother	323	59	87
Arika	131 (3.00)	250 (4.17)	196 (3.69)
Arika's mother	137	281	124

Note. MLU-morph (ratio of morphemes over utterances) in parentheses. When multiple files were analyzed for the month, we calculated the mean of MLU of each file.

2.3.2 Analysis

In the current analysis, we only focused on transitive verbs, and did not analyze intransitive verbs. This is because, in order for the word order cue and the animacy contrast cue to be present, it is necessary for the verb to have two noun arguments. This is discussed further below.

The transitive verbs analyzed include the potential forms of the verbs as well as the first verb of serial verb constructions, except the cases when the second verbs add the intransitive meaning to the entire construction. The example of such cases can be seen the following sentence:

(11) hora   midori-san   tte   kai-te   ar-u   koko-ni.

    INTJ   noun-HON   COMP   write-CONN   exist-PRES   here-LOC

    "Look, it is written 'midori-san' here."   (Arika, 3;0)

We also excluded when the transitive verbs were in passive forms because the required arguments are different in passive forms. When there was a relative clause in the sentence, we treated the whole clause as a noun phrase and evaluated the grammatical relations and animacy of the noun phrase. There were cases the relative clause contained transitive verbs, but we did not include these verbs in our analysis, since the formation of a relative clause alters the word order.

We coded the following:

i.   word order and case markers of the nouns

        (e.g. SOV, OSV, SgaOV, SOoV, SgaOoV, OwaSV, etc.)

ii.   animacy of each noun phrase

        (e.g. animate subject, inanimate subject, animate object, inanimate object)

16

iii.   animacy contrast of the two nouns

(e.g. present, absent)

Grammatical relations of the nouns were annotated only when the nouns were realized in the sentence. When the verbs were in the imperative forms and question sentences, sometimes the agent or patient nouns were present as vocatives. [2] In the present analysis, we coded the vocatives as subjects, since they were merely the topic of the sentence and were still bearing thematic roles. If not frequently (2 out of 77 tokens), some of them were also case-marked.

In order to annotate the animacy of the nouns, we retrieved the unrealized nouns from the context and evaluated the animacy based on the retrieved nouns. [3] Animation characters, dolls, toys and pictures of animate entities were interpreted as animate nouns based on the context. However, when the pictures of animate entities were the objects of the verb *kak-* 'draw' and when the toys of animate entities were the objects of the verb *tsukur-* 'make', these objects were interpreted as inanimate objects, because the verbs are directly related to the inanimate objects such as pictures or toys. When we were not able to retrieve the nouns from the context because of the lack of information, the animacy was coded as "indeterminate" and these data were excluded from the analysis.

---

[2] Vocatives were 0-2.5% in Asato's mother's speech, 1.8-8.0% in Arika's mother's speech, 0-3.1% in Asato's speech, and 6.9-7.1% in Arika's speech.

[3] This is because, while word order and case marking are linguistic notion, animacy is real-world knowledge which is often obvious from what is available in the setting where the conversation between children and their mothers takes place, especially because such conversations tend to talk about "here and now" (Bloom, 1970; Brown & Bellugi, 1964; Sachs, 1983). If we exclude the sentences where he had to retrieve the animacy from the context, the animacy contrast rate was 87.5-100% in mothers' speech and was 85.7-100% in children's speech, which are very similar to the animacy contrast rate presented in the results section below.

We also excluded the cases where the verb in the sentence (e.g. *iw-* 'say', *wakar-* 'understand', *omow-* 'think') took a proposition as its argument because propositions were dependent clauses and not noun phrases and also because propositions are not marked with case markers.

The animacy contrast was coded as present when there is a contrast in the animacy status of the two nouns, that is, when one noun is animate and the other noun is inanimate (Chan, et al., 2009). When both nouns were animate, the animacy contrast was regarded as absent, as well as when both nouns were inanimate.

2.4 RESULTS

2.4.1 Caretaker speech

2.4.1.1 Word order and noun ellipsis

Table 2 shows the frequency and percentage of different types of word order in the total number of transitive sentences in the caretaker speech. NV and VN sentences indicate that either the subject or the object was unrealized, and V sentences indicate that both the subject and the object were unexpressed in the sentence.

Table 2. Frequency and percentage of each word order in the caretaker speech

		Asato's mother						Arika's mother					
		3;0		4;0		5;0		3;0		4;0		5;0	
		($N = 323$)		($N = 60$)		($N = 87$)		($N = 137$)		($N = 281$)		($N = 124$)	
word order		freq	rate	freq	rate	freq	rate	freq	rate	freq	rate	freq	rate
NNV	SOV	25	7.7%	3	5.1%	3	3.5%	8	5.8%	6	2.1%	8	6.4%
NNV	OSV	1	0.3%	1	1.7%	0	0.0%	0	0.0%	1	0.4%	0	0.0%
NVN	SVO	1	0.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NVN	OVS	0	0.0%	0	0.0%	1	1.2%	2	1.5%	1	0.4%	0	0.0%
VNN	VSO	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.4%	0	0.0%
VNN	VOS	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NV	SV	25	7.7%	4	6.7%	5	5.8%	11	8.0%	22	7.8%	12	9.7%
NV	OV	135	41.8%	21	35.0%	34	39.1%	43	31.4%	118	42.0%	42	33.9%
VN	VS	3	0.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.8%
VN	VO	6	1.9%	2	3.3%	0	0.0%	2	1.5%	2	0.7%	1	0.8%
V	V	127	39.3%	28	46.7%	44	50.6%	71	51.8%	130	46.3%	60	48.4%

Based on the data in Table 2, we calculated the availability, reliability, and validity of word order cue (see Table 3). We used the criteria used to evaluate German word-order cue by Chan, et al. (2009) and Kempe and MacWhinney (1998): "relative ordering of the subject and object regardless of the verb position" (Chan, et al., 2009, p. 272).[4] This is because German permits SOV, OVS, OSV, VOS, and VSO in addition to the basic SVO order, which is similar to Japanese. The word order cue was counted as present when both the subject and the object were expressed in a sentence. In the case of NV, VN, and V sentences, the word order cue was

---

[4] Chan, et al. (2009) use another criteria which was not used in the present study: pre-verbal slot (Bates, McNew, MacWhinney, Devescovi, & Smith, 1982). This criteria was appropriate for SVO languages like English, however, pre-verbal slot cannot be a cue for SOV languages like Japanese. This, in addition to the frequent omission of the noun arguments, make the word order cue in Japanese low by default.

counted as absent, because two nouns are required in order to decide the relative order of the subject and the object. The availability of the word order cue was calculated as the ratio of sentences in which the word order cue was available divided by the number of sentences analyzed.

The word order cue was counted as reliable when the first noun in the sentence was the subject (agent). The reliability of the word order cue was computed as the ratio of sentences where the word order cue was reliable divided by the number of sentences where the word order cue was available.

Cue validity was calculated by multiplying the availability and reliability.

Table 3. The word order cue in the caretaker speech

	Asato's mother			Arika's mother		
	3;0	4;0	5;0	3;0	4;0	5;0
Cue availability	8.3%	6.8%	4.7%	7.9%	3.3%	6.4%
Cue reliability	92.6%	75.0%	75.0%	80.0%	66.7%	100%
Cue validity	7.7%	5.1%	3.5%	6.3%	2.2%	6.4%

In both mothers' speech, the rate of the occurrences of sentences with two nouns (i.e. in NNV, NVN and VNN sentences) was low. That is, the word order cue availability was low (3.3-8.4%). Both mothers dropped one or both of the noun arguments frequently, and 39.3-51.8% of the sentences contained neither subject nor object. The low availability results in the low reliability of the word order cue.

However, if we only look at the cue reliability, canonical SOV word order was the most frequent word order when both of the noun arguments were present in a sentence. That is, when the word order cue was available, its reliability was fairly high (66.7-100%).

20

When the sentence contained only one noun involiving null arguments (e.g., NV and VN frames), the overt argument was more likely to be the object of the sentence than the subject in both NV and VN frames. OV and VO sentences make up 38.3-43.7% in Asato's mother's speech and 32.9-42.7% in Arika's mother's speech, while SV and VS sentences account for 5.8-8.6% in Asato's mother's speech and 7.8-10.5% in Arika's mother's speech. The higher ratio of null-subject is probably because the referents of the subjects were too obvious from the context, that is, either the mother or the child was usually the subject, while object is oftentimes new information (Allen & Schröder, 2003; Clancy, 1993, 2003, 2004; Du Bois, 1987; Du Bois, Kumpf, & Ashby, 2003). Because there were only a few sentences where the nouns were in the post-verbal position (0.0-3.3%), we can say that the sentences without one of the noun arguments also partially followed the canonical word order.

We could not see linear increase or decrease of either canonical or non-canonical word order in both mothers' productions.

2.4.1.2 Animacy

The animacy contrast rate in Asato's mother's speech and Arika's mother's speech is shown in Table 4.

Table 4. The animacy contrast rate in the caretaker speech

Asato's mother						Arika's mother					
3;0 ($N = 323$)		4;0 ($N = 59$)		5;0 ($N = 87$)		3;0 ($N = 137$)		4;0 ($N = 281$)		5;0 ($N = 124$)	
Freq	Rate	Freq	rate	freq	rate	freq	rate	freq	rate	freq	rate
293	90.7%	54	91.5%	84	96.6%	128	93.4%	265	94.3%	121	97.6%

As seen from the table, animacy was contrasted 90.4-97.6% of the time. Animacy contrasts were seen mostly between animate subjects and inanimate objects. There were only 2 instances in

21

Asato's mother's speech at 3;0 where the animacy contrast was due to inanimate subject and animate object:

(12) kondo-wa   Kakka-o   nosete   doko   ik-u-n   da-roo

next-TOP   mother-ACC   load-CONN   where   go-PRES-Q   da-VOL

"(lit.) Next, it loads mom, and where does it go?"

Where does [the bus] go next with mom on it?"   (Asato's mother, 3;0)

(13) mikan-ga   yattsuke-ru   no   hebi-o ?

tangerine-NOM   defeat-PRES   Q   snake-ACC

"Does the tangerine defeat the snake?"   (Asato's mother, 3;0)

The sentences in (12) and (13) are both taken from Asato's mother's utterances when the child was at 3;0. In the sentence (12), because the child and the mother were talking about riding a bus right before this utterance, the null subject was interpreted as "a bus", which is an inanimate entity (though it can also be interpreted as pseudoanimate, to be discussed below). In (13), both arguments were expressed and the animacy of both nouns is determinate.

Table 5 shows the availability, reliability, and validity of the animacy contrast cue. Based on Kempe and MacWhinney (1998) and Chan et al. (2009), the animacy contrast cue was counted as present when there is a contrast in the animacy of the two nouns, that is, when one noun is animate and the other noun is inanimate. The cue was counted as absent in a sentence where both nouns were animate or in a sentence where both nouns were inanimate. The availability of the animacy contrast cue was calculated as the ratio of sentences in which the animacy contrast cue was available divided by the number of sentences analyzed.

The animacy contrast cue was counted as reliable when the animate noun is the subject (agent) and the inanimate noun is the object (patient/experiencer) in the sentence. The animacy

cue was counted as unreliable in a sentence where the inanimate noun is the subject and the animate noun is the object. The reliability of the animacy contrast cue was computed as the ratio of sentences where the animacy contrast cue was reliable divided by the number of sentences where the animacy contrast cue was available.

Cue validity was again calculated by multiplying the availability and reliability.

Table 5. The animacy contrast cue in the caretaker speech

	Asato's mother			Arika's mother		
	3;0	4;0	5;0	3;0	4;0	5;0
Cue availability	90.7%	91.5%	96.6%	93.4%	94.3%	97.6%
Cue reliability	99.3%	100%	100%	100%	100%	100%
Cue validity	90.0%	91.5%	96.6%	93.4%	94.3%	97.6%

Unlike the word order cue, both availability and reliability of the animacy contrast cue were high (availability 90.7-97.6%; reliability 99.3-100%) in both mothers' speech, which results in the high cue validity (90.0-97.6%).

When there was no animacy contrast, it was largely because the subject and object were both animate, and this happens with particular kinds of verbs such as *home-* 'praise', *mamor-* 'protect', *mat-* 'wait', *mi-* 'see', *tabe-* 'eat', *tasuke-* 'help', and *yattsuke-* 'defeat'. 33 sentences in Asato's mother's speech and 28 sentences in Arika's mother's speech had animate subjects and objects. (14) and (15) are the examples of such sentences.

(14) nekosan-wa hiyokosan tabe-chau kamoshirenai

cat-TOP chick eat-COMPL-PRES possible

"Cats might eat the chicks." (Asato's mother, 3;0)

23

(15)　mamot-te　　　　　ageru　　　　Kakka-ga

　　　protect-CONNgive-PRES　　mom-NOM

　　　"Mom will protect [the cat]."　　　　　　　　　　　(Asato's mother, 3;0)

Both (14) and (15) are from Asato's mother's speech when Asato was at 3;0.

On the other hand, there were only 8 sentences in the maternal speech where both the subject and the object were inanimate, and they were all from Asato's mother's speech. Verbs in such sentences include *otos-* 'drop', *mot-* 'have/hold', *hakob-* 'carry', and *ire-* 'put in'. The examples of sentences that contain such words are as follows:

(16)　daijiko　　　　dayo　tankuroori-ga tanku　otos-ite

　　　big accident　is　　tanker-NOM　tank　drop-CONT

　　　"It is a big accident, the tanker drops the tank."　　　(Asato's mother, 3;0)

(17)　hako(b)-nde　kuru　　　　　no

　　　carry-CONN　come-PRES　FIN

　　　"[The tanker] carries [the gas]."　　　　　　　　(Asato's mother, 3;0)

(18)　kore-ga　　　　　　mot-te　　　　kuru　no

　　　this-NOM　　　　　bring-CONN　come　FIN

　　　"This (= the tanker) brings [the gas]."　　　　　(Asato's mother, 3;0)

The sentences in (16)-(18) were all Asato's mother's speech taken from the same part of the conversation where the Asato (3;0) and his mother were talking about a tanker and how it brings gas to a gas station. Note that these also involve pseudoanimate nouns, which is to be discussed below.

24

2.4.1.3 Case-marking

Table 6 shows the total drop rate of the subject marker –*ga* and the object marker -*o* in Asato's mother's speech and Arika's mother's speech. As the previous research indicated (Shibatani, 1990), both the subject marker and the object marker were frequently dropped in the maternal speech (35.5-87.3%), while the object marker was dropped more frequently (55.0-87.3%) than the subject marker (35.5-77.8%).

Table 6. Overall drop rate of subject and object markers in the maternal speech

	Asato's mother						Arika's mother					
	3;0		4;0		5;0		3;0		4;0		5;0	
subject marker	($N = 64$)		($N = 8$)		($N = 9$)		($N = 21$)		($N = 31$)		($N = 21$)	
drop	freq	rate	freq	rate	freq	Rate	freq	Rate	freq	Rate	freq	rate
	42	65.6%	3	37.5%	7	77.8%	13	61.9%	11	35.5%	13	61.9%
object marker drop	($N = 168$)		($N = 28$)		($N = 38$)		($N = 55$)		($N = 129$)		($N = 51$)	
	freq	rate	freq	rate	freq	Rate	freq	Rate	freq	rate	freq	rate
	122	72.6%	23	82.1%	33	86.8%	48	87.3%	71	55.0%	40	78.4%

The availability, reliability, and validity of the case-marking cue were calculated based on the number of sentences with both arguments (see Table 8). The case-marking cue was counted as available when either the subject or the object was marked, because if one of the nouns is marked with either the subject marker or the object marker, it also cues the grammatical relation of the other noun. Some of these sentences contained nouns marked with non-canonical case markers (such as the topic marker –*wa* and a few kinds of focus markers including –*mo*). However, the case-marking cue was not counted as available in these sentences unless the other noun was marked with either –*ga* or -*o*, because these markers mark both subjects and objects and do not contribute as a cue to specify the grammatical relation of the nouns. The availability

25

of the animacy contrast cue was computed as the ratio of sentences where the case-marking cue was counted as present divided by the number of sentences with both arguments.

The case-marking cue was counted as reliable when –*ga* marked the subject or –*o* marked the object. The reliability of the case-marking cue was computed as the ratio of sentences where the case-marking cue was reliable divided by the number of sentences where the case-marking cue was available. Cue validity was again calculated by multiplying the availability and reliability.

Table 7. The case-marking cue in the caretaker speech

	Asato's mother			Arika's mother		
	3;0	4;0	5;0	3;0	4;0	5;0
	($N = 28$)	($N = 4$)	($N = 4$)	($N = 10$)	($N = 9$)	($N = 8$)
Cue availability	25.0%	25.0%	0.0%	0.0%	33.3%	0.0%
Cue reliability	100%	100%	-	-	100%	-
Cue validity	25.0%	25.0%	-	-	33.3%	-

From Table 8, we can see that the availability of the case-marking cue was very low (0-33.3%). However, when the case-marking is available, it was always reliable (100%) and led to the correct interpretation of the grammatical relation of the nouns.

2.4.1.4 Cue coalition

2.4.2.4.1 Two-argument sentences

Table 9 and Table 10 show the frequency and percentage of the cases where three, two, one, or none of the three cues were reliable. As previously mentioned, according to Chan et al. (2009), the word order cue is only available when the two nouns were present. Therefore, Table 9 does not include sentences with NV and VN frames, which will be discussed separately below.

Coaltion here means the cases when SOV word order and the animacy contrast were present and the case markers were not present. The data show that 64.3-75.0% of the sentences with two nouns in Asato's mother's speech and 55.5-87.5% of the sentences with two nouns in Arika's mother's speech contained the coalition of the word order cue and the case-marking cue. This percentage is higher than the coalition of all three cues (Asato's mother 0.0-17.9%; Arika's mother 0.0-11.1%), the coalition of the animacy contrast and case-marking (Asato's mother 3.6-15.0%; Arika's mother 11.1%), the coalition of the word order and case-marking (Asato's mother 3.6%; Arika's mother 0.0%), and the cases where there was no redundancy of cues (Asato's mother 2.7%; Arika's mother 11.1-20.0%).

Table 8. The coalition of the word order cue (WO), the animacy contrast cue (AC), and the case-marking cue (CM) in the sentences with two arguments in Asato's mother's speech

	coalition	WO	AC	CM	3;0 (N = 28)		4;0 (N = 4)		5;0 (N = 4)	
					freq	Rate	freq	Rate	freq	Rate
3 cues	WOxACxCM	SOV	✔	-ga/-o	5	17.9%	0	0%	0	0%
2 cues	WOxAC	SOV	✔	non-canonical	4	14.3%	0	0%	0	0%
2 cues	WOxAC	SOV	✔	∅	14	50.0%	3	75.0%	3	75.0%
2 cues	ACxCM	OSV	✔	-ga/-o	0	0%	1	15.0%	0	0%
2 cues	ACxCM	SVO	✔	-ga/-o	1	3.6%	0	0%	0	0%
2 cues	WOxCM	SOV		-ga/-o	1	3.6%	0	0%	0	0%
1 cue	WO	SOV		non-canonical	2	7.1%	0	0%	0	0%
1 cue	AC	OSV	✔	∅	1	2.7%	0	0%	0	0%
1 cue	AC	OVS	✔	∅	0	0%	0	0%	1	2.7%

Note. The frequency and percentage of the "canonical form" with the coalition of the word order cue and the animacy contrast cue is seen in the shaded cells. Some of these sentences contained nouns marked with non-canonical case markers (such as the topic marker *–wa* and a few kinds of focus markers including *–mo*). However, these markers mark both subjects and objects, so they do not contribute as a cue to specify the grammatical relation of the nouns.

Table 9. The coalition of the word order cue (WO), the animacy contrast cue (AC), and the case-marking cue (CM) in the sentences with two arguments in Arika's mother's speech

		WO	AC	CM	3;0 (N = 10) Freq	rate	4;0 (N = 9) Freq	rate	5;0 (N = 8) Freq	rate
3 cues	WOxACxCM	SOV	✔	*-ga/-o*	0	0%	1	11.1%	0	0%
2 cues	WOxAC	SOV	✔	non-canonical	0	0%	4	44.4%	2	25.0%
2 cues	WOxAC	SOV	✔	∅	8	80.0%	1	11.1%	5	62.5%
2 cues	ACxCM	OSV	✔	*-ga/-o*	0	0%	1	11.1%	0	0%
2 cues	ACxCM	OVS	✔	*-ga/-o*	0	0%	1	11.1%	0	0%
1 cue	WO	SOV		∅	0	0%	0	0%	1	12.5%
1 cue	AC	OVS	✔	non-canonical	2	20.0%	0	0%	0	0%
1 cue	AC	VSO	✔	∅	0	0%	1	11.1%	0	0%

Note. The frequency and percentage of the "canonical form" with the coalition of the word order cue and the animacy contrast cue is seen in the shaded cells. Some of these sentences contained nouns marked with non-canonical case markers (such as the topic marker *–wa* and a few kinds of focus markers including *–mo*). However, these markers mark both subjects and objects, so they do not contribute as a cue to specify the grammatical relation of the nouns.

Our focus is when SOV word order and the animacy contrast were present and the case markers were not present. The data show that 64.3-75.0% of the sentences with two nouns in Asato's mother's speech and 55.5-87.5% of the sentences with two nouns in Arika's mother's speech contained the coalition of the two cues. This percentage is higher than the coalition of all three cues (Asato's mother 0.0-17.9%; Arika's mother 0-11.1%), the coalition of the animacy contrast and case-marking (Asato's mother 3.6-15.0%; Arika's mother 11.1%), the coalition of the word order and case-marking (Asato's mother 3.6%; Arika's mother 0.0%), and the cases where there was no redundancy of cues (Asato's mother 2.7%; Arika's mother 11.1-20.0%). There were no sentences in which all three cues were absent. Both mothers started to use the non-canonical forms when the children were at the earlier age. Therefore, we can argue that the

coalition of the word order cue and animacy cue specify the subject and object in a sentence without the presence of the case-marking cue.

When there is no animacy contrast, the sentences always followed the SOV word order and the nouns were marked with case markers. The sentences in (19)-(22) show the examples of non-canonical sentences that lack the animacy contrast.

(19)   daijiko   dayo   tankuroori-ga tanku otos-ite

        big accident   is   tanker-NOM tank   drop-CONT

        "It is a big accident, the tanker drops the tank."   (Asato, 3;0)

(20)   nekosan-wa   hiyokosan   tabe-chau   kamoshirenai

        cat-TOP   chicken   eat-COMPL-PRES   possible

        "Cats might eat chickens."   (Asato, 3;0)

(21)   uma-wa   inu   nanka tabenai   yo

        horse-TOP   dog   NEG eat-NEG   FIN

        "Horses wouldn't eat dogs."   (Asato, 3;0)

(22)   Fuuchan   Oneechan-no koto   kan-da

        Fuuchan   sister-GEN   thing bite-PAST

        "Did Fuuchan (Arika's sister) bite her sister (Arika)?"   (Arika, 5;0)

When the sentence lacks animacy contrast, the mothers case-mark the subjects in (19)-(21) even though these sentences follow SOV word order. On the other hand, the subject in (22) is not case-marked, but in the raw transcript, *Fuuchan* is transcribed as vocative. Because the subject *Fuuchan* was realized as vocative, we can argue that it was not necessary to mark the noun with a case marker in this case.

These case markers seem to specify the grammatical relation of the noun argument because the animacy contrast was absent. However, the problem here is whether the topic marker –*wa* can serve as a subject marker. Table 10 shows the noun arguments that were marked by topic marker –*wa* in the NNV sentences in the caretaker speech.

Table 10. Noun arguments marked with the topic marker -*wa* in the NNV sentences in caretaker speech

	Asato's mother						Arika's mother					
	3;0		4;0		5;0		3;0		4;0		5;0	
	(*N* = 6)		(*N* = 0)		(*N* = 0)		(*N* = 0)		(*N* = 16)		(*N* = 2)	
	Freq	Rate	Freq	rate	freq	rate	Freq	rate	freq	rate	freq	rate
Subject	6	100%	-	-	-	-	-	-	2	100%	0	0%
Object	0	0%	-	-	-	-	-	-	0	0%	2	100%

As seen from the table, the topic marker –*wa* seems to mark both subjects and objects. However, when we look at the three instances where objects were marked with the topic marker –*wa*, the subjects were all realized as vocatives as follows:

(23) Ari-chan   saishoni   kime-ta   koto-wa   mamot-te   yo!

Ari-HON in the beginning   decide-PAST thing-TOP   obey-CONT   FIN

"Ari-chan, follow what we decided in the beginning!"   (Arika, 5;0)

(24) Ari-chan   kyoo-no   gyooza-wa   joozuni   tsukut-te   ne!

Ari-HON today-GEN   dumpling-TOP   well   make-CONT   FIN

"Ari-chan, cook today's dumpling well."   (Arika, 5;0)

Therefore, unless there was a vocative in the sentence, the topic marker –*wa* served as a subject marker in these NNV sentences. This means that, when there was no animacy contrast, the mothers marked the nouns in order to specify their grammatical relationship in the sentence.

When the the coalition was violated by the scrambled word order (OSV, OVS, and VSO), it appears that both the canonical –*ga/-o* and non-canonical markers were used by the caretakers. However, animacy contrast was also present in such sentences (i.e. such sentences falls into either ACxCM or ACin Table 8 and Table 9). In fact, we did not find any non-canonical forms where the word order and the animacy contrast were both non-canonical , i.e., there was no case where the case-marking was the only available cue, although such sentence is indeed a possibility (e.g. *Ken-o Naomi-ga mi-ta* 'Ken-ACC Naomi-NOM see-PAST'). This may suggest that case-marking is not a strong enough cue in children's input at this point in children's development, although it is available and reliable in some cases as examples (19)-(22) above show.

2.4.2.4.2 Single-argument sentences

Although the word order cue is not present when there is only noun in the sentence, we also examined if the animacy of the noun in NV sentences would be beneficial information for children to determine whether the noun is the subject or the object of the sentence. Table 11 and Table 12 show the frequency and percentage of the sentences with both, one, or none of the animacy contrast cue and the case-marking cue in both mothers' speech. We can see that, when there is only one noun realized in the sentence, animacy can be the major predictor that helps the interpretation of the noun argument (Asato's mother 76.8-84.7%; Arika's mother 62.7-80.50%). Case-marking alone is not used to specify the grammatical relation of the noun (Asato's mother 1.3%; Arika's mother 0.0%); however, case marking can be used in addition to the animacy. Both animacy and case markers were present in 15.4-18.5% of Asato's mother's production and 14.3-30.2% of Arika's mother's production.

Table 11. The animacy contrast cue and the case-marking cue in NV and VN sentences in Asato's mother's speech

		WO	AC	CM	3;0 (N = 168) Freq	rate	4;0 (N = 27) Freq	rate	5;0 (N = 39) Freq	rate
2 cues	ACxCM	SV	✔	*-ga*	2	1.2%	4	14.8%	1	2.6%
2 cues	ACxCM	OV	✔	*-o*	24	14.3%	1	3.7%	5	12.8%
2 cues	ACxCM	VS	✔	*-ga*	1	0.6%	0	0%	0	0%
2 cues	ACxCM	VO	✔	*-o*	1	0.6%	0	0%	0	0%
1 cue	AC	SV	✔	non-canonical	5	3.0%	0	0%	1	2.6%
1 cue	AC	SV	✔	∅	16	9.5%	0	0%	3	7.7%
1 cue	AC	OV	✔	non-canonical	12	7.1%	2	7.4%	0	0%
1 cue	AC	OV	✔	∅	90	53.6%	18	66.7%	29	74.4%
1 cue	AC	VS	✔	∅	2	1.2%	0	0%	0	0%
1 cue	AC	VO	✔	∅	4	2.4%	2	7.4%	0	0%
1 cue	CM	SV		*-ga*	2	1.2%	0	0%	0	0%
0 cue	-	OV		non-canonical	2	1.2%	0	0%	0	0%
0 cue	-	OV		∅	7	4.2%	0	0%	0	0%

Note. The check mark (✔) of the AC column means that the subject is animate and the object is inanimate.

Table 12. The animacy contrast cue and the case-marking cue in NV and VN sentences in Arika's mother's speech

		WO	AC	CM	3;0 (N = 56) Freq	rate	4;0 (N = 142) Freq	rate	5;0 (N = 56) Freq	rate
2 cues	ACxCM	SV	✔	*-ga*	6	10.7%	10	7.0%	7	12.5%
2 cues	ACxCM	OV	✔	*-o*	2	3.6%	32	22.5%	5	8.9%
2 cues	ACxCM	VO	✔	*-o*	0	0%	1	0.7%	0	0%
1 cue	AC	SV	✔	non-canonical	2	3.6%	4	2.8%	1	1.8%
1 cue	AC	SV	✔	∅	3	5.4%	8	5.6%	4	7.1%
1 cue	AC	OV	✔	non-canonical	3	5.4%	17	12.0%	3	5.4%
1 cue	AC	OV	✔	∅	37	66.1%	60	42.3%	34	60.7%
1 cue	AC	VS	✔	∅	0	0%	0	0%	1	1.8%
1 cue	AC	VO	✔	∅	1	1.8%	1	0.7%	1	1.8%
0 cue	-	OV		non-canonical	0	0%	2	1.4%	0	0%
0 cue	-	OV		∅	1	1.8%	5	3.5%	0	0%
0 cue	-	VO		∅	1	1.8%	0	0%	0	0%

Note. The check mark (✔) of the AC column means that the subject is animate and the object is inanimate.

2.4.2 Children's speech

2.4.2.1 Word order and noun ellipsis

Table 13 shows the frequency and percentage of different types of word order in the children's speech. NV and VN sentences indicate that either the subject or the object was unrealized, and V sentences indicate that both the subject and the object were unexpressed in the sentence.

Table 13. Frequency and percentage of each word order in the children's speech

		Asato						Arika					
		3;0		4;0		5;0		3;0		4;0		5;0	
		($N = 96$)		($N = 42$)		($N = 20$)		($N = 131$)		($N = 250$)		($N = 196$)	
word order		freq	rate	Freq	rate	freq	rate	freq	rate	freq	rate	freq	rate
NNV	SOV	11	11.5%	7	17.1%	1	5.0%	12	9.1%	11	4.4%	10	5.1%
NNV	OSV	1	1.0%	0	0.0%	0	0.0%	1	0.8%	1	0.4%	3	1.5%
NVN	SVO	1	1.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NVN	OVS	0	0.0%	0	0.0%	0	0.0%	1	0.8%	1	0.4%	1	0.5%
VNN	VSO	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.4%	0	0.0%
VNN	VOS	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NV	SV	11	11.5%	5	12.2%	2	10.0%	9	6.8%	17	6.8%	15	7.7%
NV	OV	40	41.7%	11	26.8%	8	40.0%	61	46.2%	93	37.2%	75	38.3%
VN	VS	1	1.0%	0	0.0%	0	0.0%	0	0.0%	2	0.8%	2	1.0%
VN	VO	0	0.0%	1	2.4%	0	0.0%	1	0.8%	7	2.8%	2	1.0%
V	V	31	32.3%	17	41.5%	9	40.0%	47	35.6%	118	47.2%	88	44.9%

Based on the data in Table 13, we calculated the availability, reliability, and validity of word order cue (see Table 14). The availability, reliability, and validity of the word order cue were computed using the same criteria as the maternal speech.

Table 14. The word order cue in the child speech

	Asato			Arika		
	3;0	4;0	5;0	3;0	4;0	5;0
Cue availability	13.5%	17.1%	5.0%	10.7%	5.6%	7.1%
Cue reliability	84.6%	100%	100%	85.7%	73.3%	71.0%
Cue validity	11.4%	17.1%	5.0%	9.2%	4.1%	5.1%

Similar to their mothers, the children also dropped one or both of the noun arguments frequently, and 32.3-47.2% of the sentences contained neither subject nor object. However, compared to the maternal speech (3.3-8.4%), the availability of the word order cue was higher (5.0-17.1%). The reliability of the word order cue was as high as the caretaker speech (71.0-100%). This indicates that children, although following trend in maternal speech, are using more canonical pattern.

When the sentence contained only one noun (e.g. in case of NV and VN frames), the noun was more likely to be the object of the sentence than the subject in both NV and VN frames, which is similar to the caretaker speech. OV and VO sentences make up 29.2-41.7% in Asato's speech and 39.3-47.0% in Arika's speech, while SV/VS sentences account for 10.0-12.5% in Asato's speech and 6.8-8.7% in Arika's speech. This follows the pattern seen in the maternal speech, where the subject of the sentence was frequently omitted because it was obvious from the context. Because there were only a few sentences where the nouns were in the post-verbal position (0.0-3.6%), we can say that the sentences without one of the noun arguments also partially followed the canonical word order.

We did not observe linear increase or decrease of either canonical or non-canonical word order in both mothers' productions.

2.4.2.2 Animacy

Table 15 shows the animacy contrast rate in Asato's speech and Arika's speech. Similar to the maternal speech, animacy was contrasted about 85.4-100% of the time.

Table 15. The animacy contrast rate in the children's speech

Asato						Arika					
3;0		4;0		5;0		3;0		4;0		5;0	
($N = 96$)		($N = 42$)		($N = 21$)		($N = 132$)		($N = 250$)		($N = 196$)	
freq	rate	freq	Rate	freq	rate	freq	rate	Freq	rate	freq	rate
88	91.6%	35	85.4%	21	100.0%	122	92.4%	237	94.8%	180	91.8%

Table 16 shows the availability, reliability, and validity of the animacy contrast cue computed based on the same criteria as the maternal speech. In all cases, animacy was contrasted between the animate subject and the inanimate object, which resulted in 100% reliability of the animacy cue, which was almost identical to the maternal speech (99.3-100%). The validity of the animacy contrast cue (85.4-100%). was as high as the caretaker speech (90.4-97.4%).

Table 16. The animacy contrast cue in the children's speech

	Asato			Arika		
	3;0	4;0	5;0	3;0	4;0	5;0
Cue availability	91.6%	85.4%	100%	92.4%	94.8%	91.8%
Cue reliability	100%	100%	100%	100%	100%	100%
Cue validity	91.6%	85.4%	100%	92.4%	94.8%	91.8%

When there was no animacy contrast, it was largely because the subject and the object were both animate. There was only one instance in Asato's speech (at 3;0) where both the subject and the object were inanimate, as in (25), and none in Arika's speech.

(25) kore-ga   mot-te   kuru   no

      this-NOM   bring-CONN   come   FIN

      "This (= the tanker) brings [the gas]."   (Asato, 3;0)

On the other hand, 13 sentences in Asato's speech and 43 sentences in Arika's speech had animate subjects and objects. Verbs contained in such examples were *mi-* 'see', *mat-* 'wait', *tabe-* 'eat' and *yattsuke-* 'defeat'.

(26) onaka   sui-ta   kara   kitsune   tabe-ta

      stomach   empty-PAST   CAUSAL   fox   eat-PAST

      "I was hungry so I ate the fox."   (Asato, 3;0)

(27) Kakka   mat-te-(i)ru   kara

      mom   wait-CONN-be   CAUSAL

      "Because mom is waiting"   (Asato, 3;0)

2.4.2.3 Case-marking

Table 17 shows the total drop rate of the subject marker *–ga* and the object marker *-o* in Asato's speech and Arika's speech. Both the subject marker and the object marker are frequently dropped in the children's production like the maternal speech. Similar to their input from the mothers, the object marker is more dropped than the subject marker (subject marker 52.0-87.1%; object marker 66.4-92.1%).

Table 17. Overall drop rate of subject and object markers in the children's speech

	Asato			Arika		
	3;0	4;0	5;0	3;0	4;0	5;0
subject marker –*ga* drop	(*N* = 25)	(*N* = 11)	(*N* = 3)	(*N* =23)	(*N* =32)	(*N* =31)
	13 52.0%	7 63.6%	2 66.7%	18 78.3%	23 71.9%	27 87.1%
object marker –*o* drop	(*N* = 53)	(*N* = 20)	(*N* = 10)	(*N* = 76)	(*N* = 113)	(*N* = 91)
	47 88.7%	14 70.0%	7 70.0%	70 92.1%	75 66.4%	74 81.3%

The availability, reliability, and validity of the animacy contrast cue were computed using the same criteria as the maternal speech (see Table 18). Like the maternal speech (0.0-33.3%), the availability of the case-marking cue was low (0.0-28.6%). However, when the case-marking is available, it was always reliable (100%) and led to the correct interpretation of the grammatical relations of the nouns.

Table 18. The case-marking cue in the children's speech

	Asato			Arika		
	3;0	4;0	5;0	3;0	4;0	5;0
	(*N* = 13)	(*N* = 7)	(*N* = 1)	(*N* = 14)	(*N* = 13)	(*N* = 14)
Cue availability	15.4%	28.6%	0%	7.1%	23.1%	21.4%
Cue reliability	100.00%	100.00%	-	100.00%	100.00%	100.00%
Cue validity	15.4%	28.6%	-	7.1%	23.1%	21.4%

2.4.2.4 Cue coalition

2.4.2.4.1 Two-argument sentences

Table 19 and Table 20 show the frequency and percentage of the cases where three, two, one, or none of the three cues were reliable.

The data show that 57.2-100% of the sentences with two nouns in Asato's speech and 64.2-85.7% of the sentences with two nouns in Arika's speech contained the coalition of the word order cue and the case-marking cue. This percentage is higher than the coalition of all three cues (Asato 7.7-28.6%; Arika 7.1-15.4%), the coalition of the animacy contrast and case-marking (Asato 7.7%; Arika 7.1-7.7%), the coalition of the word order and case-marking (Asato 7.7-14.3%; Arika 0%), and the cases where there was no redundancy of cues (Asato 7.7%; Arika 7.1-21.4%). There were no sentences in which all three cues were absent. This overall pattern mirrors maternal speech.

Table 19. The coalition of the word order cue (WO), the animacy contrast cue (AC), and the case-marking cue (CM) in the sentences with two arguments in Asato's speech

					3;0 (N = 13)		4;0 (N = 7)		5;0 (N = 1)	
	coalition	WO	AC	CM	freq	Rate	Freq	rate	Freq	rate
3 cues	WOxACxCM	SOV	✔	*-ga/-o*	1	7.7%	2	28.6%	0	0%
2 cues	WOxAC	SOV	✔	non-canonical	3	23.1%	1	14.3%	0	0%
2 cues	WOxAC	SOV	✔	∅	7	53.8%	3	42.9%	1	100%
2 cues	ACxCM	OSV	✔	*-ga/-o*	1	7.7%	0	0%	0	0%
1 cue	WO	SOV		∅	0	0%	1	14.3%	0	0%
1 cue	AC	SVO	✔	∅	1	7.7%	0	0%	0	0%

Note. The frequency and percentage of the "canonical form" with the coalition of the word order cue and the animacy contrast cue is seen in the shaded cells. Some of these sentences contained nouns marked with non-canonical case markers (such as the topic marker *–wa* and a few kinds of focus markers including *–mo*). However, these markers mark both subjects and objects, so they do not contirubte as a cue to specify the grammatical relation of the nouns.

Table 20. The coalition of the word order cue (WO), the animacy contrast cue (AC), and the case-marking cue (CM) in the sentences with two arguments in Arika's speech

	coalition	WO	AC	CM	3;0 (N = 14)		4;0 (N = 13)		5;0 (N = 14)	
					freq	Rate	Freq	rate	Freq	rate
3 cues	WOxACxCM	SOV	✔	-ga/-o	0	0%	2	15.4%	1	7.1%
2 cues	WOxAC	SOV	✔	non-canonical	1	7.1%	2	15.4%	0	0%
2 cues	WOxAC	SOV	✔	errors	2	14.3%	0	0%	1	7.1%
2 cues	WOxAC	SOV	✔	∅	9	64.3%	7	53.8%	8	57.1%
2 cues	ACxCM	OSV	✔	-ga/-o	1	7.1%	1	7.7%	0	0%
1 cue	AC	OSV	✔	∅	0	0%	0	0%	3	21.4%
1 cue	AC	OVS	✔	∅	1	7.1%	1	7.7%	1	7.1%

Note. The frequency and percentage of the coalition of the "canonical form" with the word order cue and the animacy contrast cue is seen in the shaded cells. Some of these sentences contained nouns marked with non-canonical case markers (such as the topic marker –*wa* and a few kinds of focus markers including –*mo*) and/or misusage of the markers (e.g. an subject marked with –*de* and an object marked with -*ni*). However, these markers mark both subjects and objects, so they do not contribute as a cue to specify the grammatical relation of the nouns.

Therefore, the results show that the coalition of the word order and animacy cues specify the subject and object in a sentence without the presence of the case-marking cue. When there is no animacy contrast, the sentences always followed the SOV word order and sometimes the nouns were also marked with the case markers. It appears that children also use the case-markers when there is a violation of the coalition (i.e. the word order was scrambled) even if there was animacy contrast, although the percentage is lower (7.1-7.7%) than the maternal speech (11.1-20%). The case markers were also used when animacy and word order were both present (0.0-28.6%), which is slightly higher than the maternal speech (0.0-17.9%). However, we could not find any non-canonical forms where the word order and the animacy contrast were both non-canonical, i.e., where the case-marking was the only available cue, while some sentences contained only the word-order cue (0.0-14.3%) or only the animacy contrast cue (7.1-21.4%).

2.4.2.4.2 Single-argument sentences

Contrary to our prediction, both children started to use the non-canonical forms when the children were at the earlier age. The canonical and non-canonical production in the maternal speech and children's speech will be discussed in 2.4.2.5.   There was only one instance where animacy contrast was absent. Unlike the maternal speech (see examples (14)-(18) discussed in section 2.4.1.2), this sentence in (28) does not have case markers:

(28) ore   Riidaa   yattsuke-te   kuru .

I   Riidaa   defeat-CONN   come-PRES

"I will defeat Riidaa."   (Asato, 4;0)

When the word order was scrambled and the coalition was violated, like the maternal speech, animacy contrast was always present. The case markers were also used, but the case-marking cue was never available alone. This, along with the results with the maternal speech, indicates that case-marking in children's speech is redundant and not a strong cue at this point in children's development.

Let us turn to NV and VN sentences (see Table 21 and Table 22). It appears that the animacy of the noun in NV sentences can be a determiner of the grammatical relation of the noun argument in the sentence (Asato 72.7-82.4%; Arika 75.6-90.4%). Case-marking alone is not used to specify the grammatical relation of the noun, since no more than 5.9% of the children's speech contains only the case-marking information. However, similar to the maternal speech, case-marking can be used in addition to animacy. Both animacy and case markers were present in 6.4-21.0% of Asato's production and 5.9-27.3% of Arika's production.

Table 21. The animacy contrast cue and the case-marking cue in Asato's NV and VN sentences

		WO	AC	CM	3;0 (N = 52) Freq	rate	4;0 (N = 17) Freq	rate	5;0 (N = 11) Freq	rate
2 cues	ACxCM	SV	✔	*-ga*	3	5.8%	0	0%	1	9.1%
2 cues	ACxCM	OV	✔	*-o*	2	3.8%	1	5.9%	2	18.2%
1 cue	AC	SV	✔	non-canonical	3	5.8%	2	11.8%	0	0%
1 cue	AC	SV	✔	∅	4	7.7%	3	17.6%	1	9.1%
1 cue	AC	OV	✔	non-canonical	3	5.8%	1	5.9%	1	9.1%
1 cue	AC	OV	✔	∅	29	55.8%	7	41.2%	6	54.5%
1 cue	AC	VS	✔	∅	1	1.9%	0	0%	0	0%
1 cue	AC	VO	✔	∅	0	0%	1	5.9%	0	0%
1 cue	CM	OV		*-o*	0	0%	1	5.9%	0	0%
0 cue	-	OV		∅	6	11.5%	1	5.9%	0	0%

Note. The check mark (✔) of the AC column means that the subject is animate and the object is inanimate.

Table 22. The animacy contrast cue and the case-marking cue in Arika's NV and VN sentences

		WO	AC	CM	3;0 (N = 70) Freq	rate	4;0 (N = 119) Freq	rate	5;0 (N = 94) Freq	rate
2 cues	ACxCM	SV	✔	*-ga*	2	2.9%	6	5.0%	1	1.1%
2 cues	ACxCM	OV	✔	*-o*	4	5.7%	19	16.0%	5	5.3%
1 cue	AC	SV	✔	∅	7	10.0%	11	9.2%	14	14.9%
1 cue	AC	OV	✔	non-canonical	1	1.4%	10	8.4%	8	8.5%
1 cue	AC	OV	✔	errors	0	0%	4	3.4%	2	2.1%
1 cue	AC	OV	✔	∅	52	72.9%	57	47.9%	58	61.7%
1 cue	AC	VS	✔	∅	0	0%	2	1.7%	1	1.1%
1 cue	AC	VO	✔	∅	1	1.4%	6	5.0%	2	2.1%
1 cue	CM	VS	✔	non-canonical	0	0%	0	0%	1	1.1%
0 cue	-	OV		non-canonical	0	0%	1	0.8%	0	0%
0 cue	-	OV		∅	3	5.7%	2	1.7%	2	2.1%
0 cue	-	VO		∅	0	0%	1	0.8%	0	0%

Note. The check mark (✔) of the AC column means that the subject is animate and the object is inanimate. Errors include subject marked with *–ni* and object marked with *–ga* and *–de*.

2.4.2.5 Relation between the caretaker speech and the children's speech

Another question is whether children reflect what they hear in the input into their own production and how it changes over time. Figure 1 and Figure 2 show the rate of canonical (SOV sentences with animacy contrast) and non-canonical production of Asato and his mother as well as Arika and her mother.
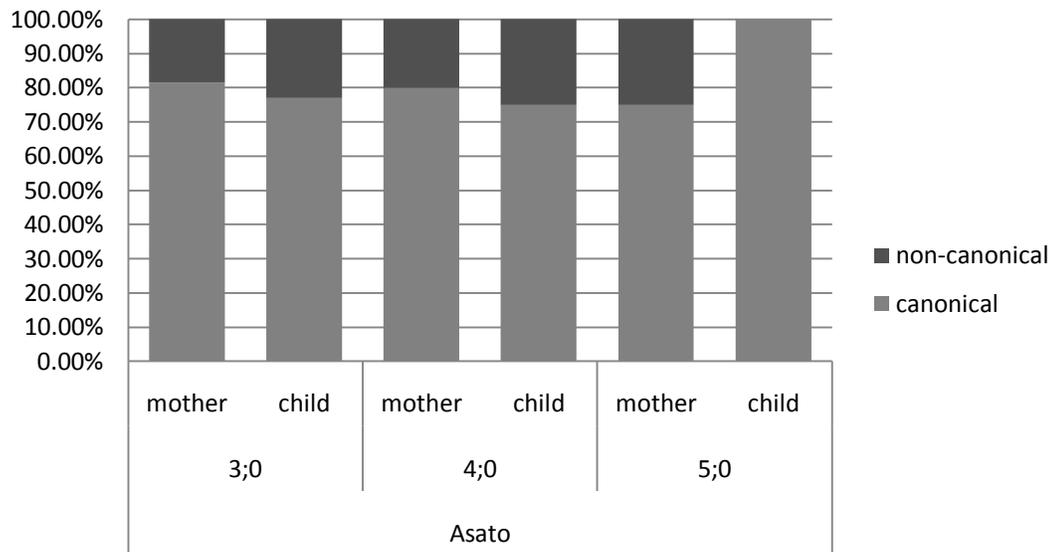
**Figure 1.** Asato and his mother's production rate of canonical and non-canonical forms
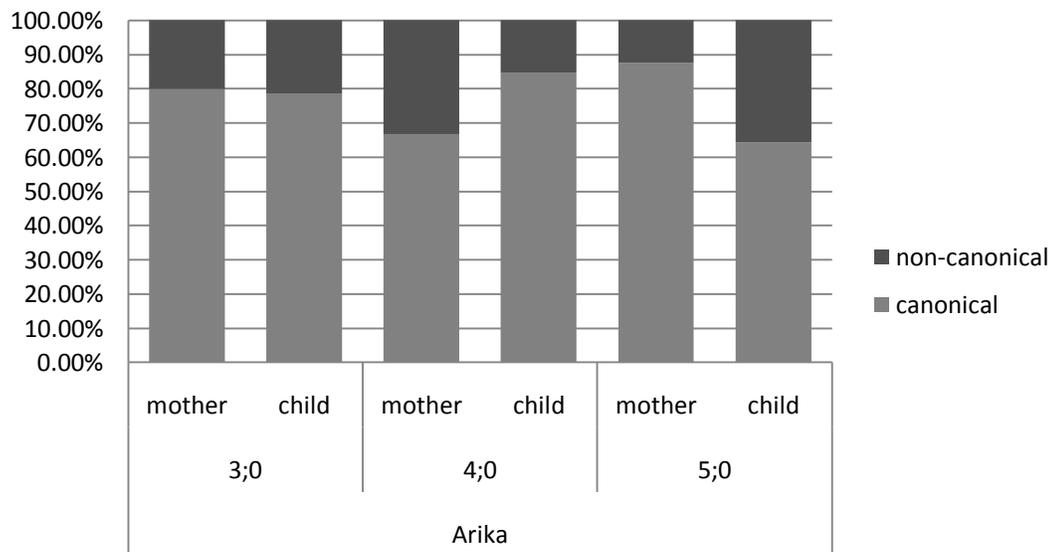
Figure 2. Arika and her mother's production rate of canonical and non-canonical forms

42

The proportion of the canonical form vs. non-canonical in children's production is similar to that of their mothers. We could not observe any linear progression across the different stages of development as we hypothesized. However, in Figure 3 where the percentage of canonical forms is plotted for each speaker, children's production initially seems to show the similar canonical vs. non-canonical ratio with each of their mothers' speech, but eventually their canonical vs. non-canonical ratio grow apart from their mothers'. That is, although their pattern of production at 3;0 is very similar to their mothers, at 5;0, Asato produced more canonical sentences than his mother, while Arika produced less canonical sentences than her mother.
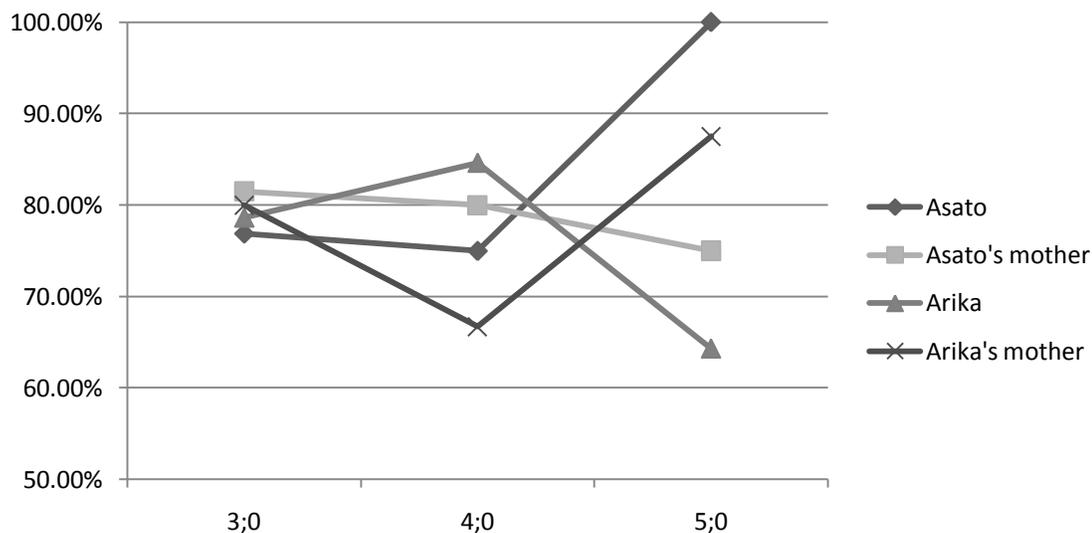
Figure 3. Percentage of the canonical forms in the production of each speaker.

However, the problem here is that the sample size is extremely small for Asato (*N*=1) and his mother's speech (*N*=4) at age 5;0. In order to examine this tendency more carefully, we analyzed Asato and his mother's speech from 4;8 (Asato *N*=7; Asato's mother *N*=2) and 4;11

(Asato *N*=3; Asato's mother *N*=2) so that Asato's and his mother's token will be comparable to Arika's and her mother's. These additional tokens were added to the data of 5;0 and plotted in Figure 4. In Figure 4, Asato seems to follow his mother's pattern compared to Arika.
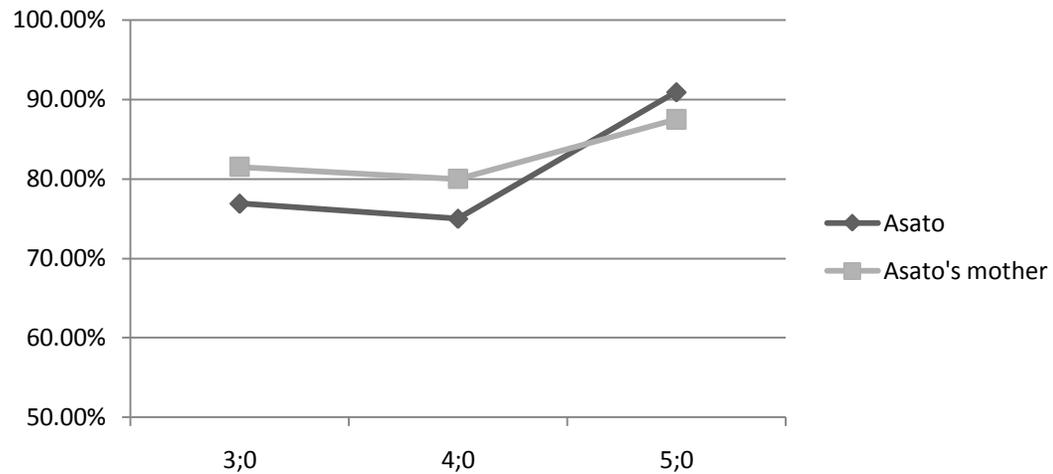
Figure 4. Percentage of the canonical forms in the production of Asato.

2.5   DISCUSSION

The frequency of the sentences with two arguments was extremely low in both the maternal speech (i.e. the input for the children) and the children's speech (i.e. the children's output). However, when both noun arguments were present, the sentence almost always (input 55.5-87.5%; output 57.2-100%) followed the canonical word order SOV and had the animacy contrast. While we also saw the coalition between the animacy contrast cue and the case-marking cue, the animacy contrast cue and the word order cue coalesce much more frequently. This supports our hypothesis that the coalition of the word order cue and the animacy contrast is available for children to use when they are learning the grammar of the verbs.

44

What do children do when the coalition is not successfully formed? When there were two nouns in the sentence that had no animacy contrast, the mothers case-marked one of the noun arguments (specifically, subjects) in order to specify the grammatical relation of the nouns. However, children did not show such a tendency. This is understandable because Japanese children have a hard time acquiring case-marking, as indicated by the previous studies by Ito, et al. (1993) and Suzuki (2005). Although adults have full control of case markers and can use it when other cues are not present, young children, at least till age 5, cannot use case marker as cues, either in comprehension or production.

Whereas there were sentences with the word order cue alone and sentences with the animacy cue alone, neither the mothers nor the children produced sentences that only had the case-marking cue such as *Inu-o Neko-ga kan-da* 'dog-ACC cat-NOM bite-PAST'. The case-marking cue had a high cue reliablity (100%) but was only used in a redundant context, including where all three cues were available, which suggests why it is hard for Japanese children to acquire case-marking.

However, although the frequency was low and although they were produced more frequently in a redundant context, children did produce case-markers when animacy cue was present and word order was scrambled (0.0-7.7%) as well as when both animacy cue and word order cue were present (0.0-28.6%). Children produced case markers even at the age of 3;0 (0.0-7.7%). Moreover, while Arika produced errors in case-marking (9 out of 67 case markers used), Asato did not produce such errors (0 out of 27). Our analysis supported Ito, et al. (1993) and Suzuki (2005) and suggested that children may start learning case-marking around the age of 3-4, although their knowledge about case-marking is still very limited.

Based on the results of our analysis and the previous studies (Hakuta, 1982; Ito, et al., 1993; Rispoli, 1987; Suzuki, 2005), we posit a hypothesis on case-marking acquisition that children do not use the information of case markers in comprehension until at least the age of 2 (Rispoli, 1987) and then start acquiring case-marking around the age of 3-4 (Suzuki, 2005), although they do not reach adult level until the age of 5-6 (Suzuki, 2005) or even later (Ito, et al., 1993). However, in the case of production, children seems to take more time. Although we cannot predict when they start producing adult-like case-marking from the current analysis, children from 3;0 to 5;0 did not produce case markers often and if they did, it was only used in the redundant context where other cues are available. While mothers case-marked nouns, specifically subjects, in the sentences without animacy contrast, children did not show such a pattern. In the future, it is necessary to experimentally examine whether children can produce case markers in a necessary situation, such as when the other cues are missing or when there are conflicting cues.

On the other hand, animacy is the strongest information in Japanese that contributes to the acquisition of verbs, given that it is the most available (90.7-100%) and reliable (99.3-100%) information in the input children are exposed to, stronger than word worder both in terms of availability (3.3-8.3%) and reliability (66.7-100%). Moreover, the animacy contrast was always present when the word order was scrambled, that is, when there was no word order cue in the two-argument sentences. While both the maternal speech and the children's speech made use of the flexibility of Japanese word order and contained non-canonical word order from the early age, which contradicts our prediction that non-canonical forms are not found in the earlier conversation between the children and the mothers, the animacy contrast was always present in such cases. Furthermore, the animacy of the noun argument leads to the correct specification of

the noun argument in one-argument sentences. This indicates that, children rely more on animacy contrast and word order than case-marking.

Based on the discussion about the cue strength of case-marking, animacy, and word order cues above, we propose the following order of cue strength for Japanese children's sentence comprehension:

(29) Animacy > Word order (SOV) > Case

Since word order cue appeared as a single cue in two-argument sentences and case-marking cue did not, we determined that the word order is a stronger cue than case-marking. The suggested order of imporantance of cues in (29) differ from the order of cue strength for Japanese adults as proposed by Bates and MacWhinney (1989), which is shown in (30) :

(30) Case > Animacy > Word order (SOV)

Whereas case-marking is the strongest cue in adult sentence comprehension as seen in (30), it is not a strong cue for children. Instead, children use animacy contrast as the strongest cue as indicated in (29). We cannot tell from the current analysis when the cue strength order in (29) alters into the one in (30). This also needs to be experimentally examined.

The unanswered question here is what motivated the children to use the case markers. There does not seem to be any circumstance that required the case-marking, since all of their case markers were produced in redundant contexts, while their mothers used case markers to mark the nouns when there was no animacy contrast between two nouns. Children used case markers when animacy contrast cue was present (0.0-7.7%) and also when word order and animacy cues were both present (0.0-28.6%)., although the latter case is more frequent. It is necessary to address what kind of roles case markers play in children's production.

Because the previous question is unexplained, we are also unable to account for how Japanese speakers manage to learn case markers when they are not an available cue in the input. Rounds and Kanagy (1998), who investigated English-speaking children's sensitivity to word order cue, case-marking cue, and animacy cue for identifying agent in an immersion school environment, pointed out the possibility that case marking is explicitly focused on at school even in L1 development. They analyzed the naturally occurring classroom discourse at the immersion school, and found no occurrences of noncanonically casemarked sentences in the production by the teachers (Rounds & Kanagy, 1998). The experience of formal education and the development of literacy might be necessary for the acquisition of Japanese case-marking.

The results of the current study indicated that animacy is the strongest information in Japanese that contributes to the acquisition of verbs, given that it is the most available (90.7-100%) and reliable (99.3-100%) information in the input children are exposed to, stronger than word worder both in terms of availability (3.3-8.3%) and reliability (66.7-100%). Furthermore, animacy cue may be available even in the cases that we coded as unavailable. Although we coded the noun either as animate or inanimate, animacy is a hierarchical notion rather than a binary one (Silverstein, 1976). For example, in the following sentence, we coded the tanker as an inanimate object.

(31)   daijiko   dayo   tankuroori-ga tanku otos-ite

         big accident   is   tanker-NOM   tank   drop-CONT

          "It is a big accident, the tanker drops the tank."

However, automobiles can be interpreted as pseudoanimate objects since they have drivers and have self-mobility (Matsumoto, 2007). Therefore, strictly speaking, there is animacy contrast between the tanker and the tank. Rispoli (1989) also argued that animacy has three levels: true

48

animate beings, animate surrogates, and inanimate objects. Animate surrogates include dolls and pictures of animate, and they may represent true animates in fantasy play, or may be treated as inanimate. If we adopt the animacy hierarchy when evaluating the animacy contrast, we would find contrast between two nouns where we cannot see contrast if we only use the animate/inanimate dichotomy. This, however, will not provide explanation to how children learn verbs which can take two animate nouns as arguments, such as *mat-* 'wait', *mi-* 'see', *tasuke-* 'help', and *yattsuke-* 'defeat'. These verbs might be acquired through developing item-based constructions, because such variety of the verbs is relatively specific.

3.0   CONCLUSION

3.1   SUMMARY OF FINDINGS

We stated our hypotheses as follows:

(a) Case markers are often dropped in children's input and output and thus do not play a critical role in acquisition of Japanese verb argument structure

(b) Word order and animacy contrast form a coalition and help children learn Japanese verb argument structure.

(c) Canonical forms are dominant in the early production of both mothers and children.

(d) Non-canonical forms in the input and output increase as the children grow older.

Among these hypotheses, the results of the present study support hypothesis (a). The subject and object markers were dropped frequently in both the mothers' speech and the children's speech at all ages, and therefore the cue validity of the case-marking cue was low. Also, while mothers used case markers to mark the nouns when there was no animacy contrast between two nouns, children do not follow such a maternal pattern. However, there was some evidence of the usage of the case markers in children's production, as suggested by Ito, et al. (1993) and Suzuki (2005); therefore, it appears that children are starting to learn case marking. This conflicts with Rispoli's (1987) claim but we suggest that this is due to the age difference between the target population of each study. Our prediction is that children do not use the information of case-

marking until around the age of 2 (Rispoli, 1987), but start acquiring case-marking around the age of 3 (Suzuki, 2005), and finally reach adult level around the age of 5 for single-argument sentences (Suzuki, 2005) or age 7-10 for two-argument sentences (Ito, et al., 1993)

The results also support hypothesis (b). Although neither children nor mother produced a large amount of sentences that contained two nouns, the coalition was available in 61.9-90.4% of the sentences where the two nouns were present. Moreover, the word order was always SOV when there was no animacy contrast in both the caretaker speech and the children's speech, and the information of animacy was always present when the word order was reordered or when the sentence lacks one of the noun arguments. The animacy contrast appears to have the highest cue availability, reliability, and validity in Japanese language for children, followed by word order and case-marking, the order of which differs from what has been claimed in the previous studies (Bates & MacWhinney, 1989; Kilborn & Ito, 1989).

Contrary to our hypotheses, there does not seem to be a big change over the different stages of development at least between the age of 3 and 5. Both mothers and children produced non-canonical forms at the earliest age in our analysis; therefore, we were unable to obtain the results that support hypotheses (c) and (d). Nevertheless, we can answer the first two of our research questions: How much of the caretaker speech (input for children) was in the canonical form and how much of the children's production (output for children) was in the canonical form. We found that 61.9-90.4% of both mother's production and children's production included the canonical forms. Both Arika and Asato showed the proportion of canonical forms that is similar to their mothers' at 3;0. While Arika produced less canonical sentences than her mother at age 5;0, Asato mirrored the canonical rate of his mother's speech throughout the two years. This might be due to individual differences or gender differences. It is necessary to analyze the

51

discourse between children and their mothers more closely in order to examine what kind of conversation they are engaged in.

3.2   FUTURE RESEARCH

In the future research, we need to investigate the following issues that were not fully addressed in this study.

First, we need to include intransitive sentences into analysis. This is because, children's production is initially dominated by intransitive verbs (Nomura & Shirai, 1997), which means that children's verb acquisition starts with the acquisition of intransitive verbs.

Second, although we excluded transitive verbs in relative clauses from current analysis, this also needs to be analzyed in the future research. Because relative clauses involves obligatory contexts for nominative –ga marking, it provides important information on how children acquire case marking.

Third, we only did corpus analysis in the present study, but we also needed to obtain experimental evidence in order to examine the finding of the current analysis. We proposed in the discussion that experiments need to be done in order to find out if children can produce case markers in non-redundant or conflict contexts. We also suggested that we should experimentally investigate when children start to use the adult-like order of the cue strength, where case-marking is the strongest cue unlike in the order of cue strength for children.

Fourth, it is also necessary to evaluate each cue in more details. For example, the coding of animacy might require more careful consideration. If we adopt the hierarchical structure of animacy (Matsumoto, 2007; Rispoli, 1989; Silverstein, 1976) in the evaluation of the animacy

contrast, we might get different results about the importance of the animacy contrast cue. In addition, case-marking is used differently in different types of sentences, such as question sentences. In question sentences, *wh*-words cannot be marked with the topic marker *–wa* and thus always case-marked with the subject marker *–ga* or the object marker *-o*. Therefore, separate analysis of case-marking in question sentences is desirable. Overall, we ultimately need to account for what motivates children to learn case markers and how they are learned when they only appear in redundant contexts.

It is also important to include the cues that we did not investigate in the present study. The cue coming from the verb form is the case in point. Unlike English where the same form can be either intransitive or transitive, Japanese has separate forms for intransitive and transitive verbs (Morikawa, 1997; Rispoli, 1987), which clearly indicate who the agent is. This functions as a strong cue for agent identification at least for adult native speakers. Although how this cue can help in the acquisition of argument structure is not clear, such cues can be either lerned verb-by-verb basis, or more productively through morphological forms. Nomura and Shirai (1997) discuss the latter possibility, suggesting that the verb ending of transitive and intransitive verbs can be a salient cue in Japanese. There are morphologically related pairs of transitive and intransitive verbs such as *ak-* 'open' (intransitive) and *ake-* 'open' (transitive) based on which Shibatani (1990) suggested subregularity (See Appendix for details) while Jacobsen (1992) claims there is no rule that can capture the formation of transitive from intransitive or vice versa. Nevertheless, according to Nomura and Shirai's (1997) analysis based on Jacobsen's (1992) list of the transitive-intransitive pairs, almost half of the transitive verbs have the same ending *-su*, which no intransitive verbs have. Therefore, the *–su* ending of the verbs might inform the children that these verbs are transitive and not intransitive. In order to take verb forms into

consideration, however, we need to find a way to quantify the verb forms so that we can compute the cue availability, reliability, and validity.

In addition to L1 verb acquisition, the possible future research is to look at the production data of L2 Japanese learners with different L1s (English, Chinese, and Korean) to reveal the difference between L1 and L2 acquisition. For example, VanPatten (1996, 2004, 2007) proposes First Noun Principle (FNP), which states that L2 learners generally tend to process the first noun or pronoun they encounter as the subject/agent. However, most of his study was done on English native speakers, which brings up the question whether L2 learners who speak other languages as L1 also follow the FNP. In Qin (2008), Chinese learners of English followed the FNP when interpreting English passive sentences. This does seem to support VanPatten's (1996, 2004, 2007) claim, because animacy is the strongest cue in Chinese. However, this does not answer the question sufficiently, because Chinese word order is SVO like English and the word order cue is the second strongest cue in Chinese. Isabelli (2008), on the other hand, shows that L1 speakers of Italian performed better in comprehending Spanish OVS sentences compared to English speakers. Based on this, Isabelli (2008) claims that the FNP is not a universal strategy but rather a result of L1 transfer. Rounds and Kanagy (1998) also addresses L1 influence in the usage of cues in their study. They examined English-speaking children learning Japanese in an immersion school environment and found that these child learners of Japanese rely on the word order cue the most and case marking the least. They argue that this is due to the influence from their L1. There are potential discussions about whether there is a universal tendency of L2 verb acquisition, how L1 influences the L2 verb acquisition, and whether L2 learners make use of the same information as the native speakers.

APPENDIX A

TRANSITIVE/INTRANSITIVE VERB PAIRS (SHIBATANI, 1990, P. 236)

Table 23. Transitive/intransitive verb pairs (Shibatani, 1990)

	Intransitive		Transitive	
Group a	*-ar*		*-e*	
	ag-ar-u	'rise'	*ag-er-u*	'rise'
	atum-ar-u	'gather'	*atum-er-u*	'gather'
	tam-ar-u	'accumulate'	*tam-er-u*	'accumulate'
	tom-ar-u	'stop'	*tom-er-u*	'stop'
Group b	*-∅*		*-e*	
	ak-u	'open'	*ak-e-ru*	'open'
	itam-u	'be damaged'	*itam-e-ru*	'damage'
	ir-u	'enter'	*ir-e-ru*	'put in'
	ukab-u	'float'	*ukab-e-ru*	'float'
Group c	*-e*		*-as*	
	ar-e-ru	'be ruined'	*ar-as-u*	'ruin'
	okur-e-ru	'be late'	*okur-as-u*	'postpone'
	ta(y)-e-ru	'be extinct'	*tay-as-u*	'annihilate'
	ko(y)-e-ru	'become fat'	*koy-as-u*	'fatten'
Group d	*-∅*		*-as*	
	aw-u	'meet'	*aw-as-u*	'meet'
	kusar-u	'spoil'	*kusar-as-u*	'spoil'
	nak-u	'cry'	*nak-as-u*	'cry'
	wak-u	'boil'	*wak-as-u*	'boil'
Group e	*-e*		*-∅*	
	or-e-ru	'be broken'	*or-u*	'break'
	ur-e-ru	'be sold'	*ur-u*	'sell'
	sak-e-ru	'split'	*sak-u*	'split'
	hag-e-ru	'tear off'	*hag-u*	'tear off'

The table shows five groups of transitive-intransitive verb pairs that show a certain subregularity. In addition to these groups of pairs, there are some irregular pairs, such as *sin-u* 'die' and *koros-u* 'kill', *ot-i-ru* 'drop (intr.)' and *ot-o-su* 'drop (tr.)'.

APPENDIX B

LIST OF ABBREVIATIONS USED

ACC	accusative	LOC	locative
CLF	classifier	NOM	nominative
COMP	complementizer	PAST	past tense
CONN	continuative	POL	polite
DAT	dative case	PRES	present tense
FIN	final particle	Q	question particle
GEN	genitive	TOP	topic marker
INTJ	interjector	VOL	volitional

BIBLIOGRAPHY

Aida, M. (1993). Omission of postpositions in Japanese mothers' speech to one-year-old children. *Sophia Linguistica, 33*, 313-331.

Allen, S. E. M., & Schröder, H. (2003). Preferred Argument Structure in early Inuktitut spontaneous speech data. In J. W. Du Bois, L. E. Kumpf & W. J. Ashby (Eds.), *Preferred Argument Structure: Grammar as architecture for function*. Amsterdam: John Benjamin.

Bates, E., & MacWhinney, B. (1989). Functionalism and the competetion model. In B. MacWhinney & E. Bates (Eds.), *The cross-linguistic study of sentence processing* (pp. 3-73). New York: Cambridge University Press.

Bates, E., McNew, S., MacWhinney, B., Devescovi, A., & Smith, S. (1982). Functional constraints on sentence processing: A cross-linguistic study. *Cognition, 11*, 245-299.

Bloom, L. (1970). *Language development: Form and function in emerging grammars*. Cambridge, MA: MIT Press.

Bowerman, M. (1973). Structural relationships in children's utterances: syntactic or semantic? In T. E. Moore (Ed.), *Cognitive development and the acquisition of language.* New York: Academic.

Brown, R. (1970). The first stentences of chidl and chimpanzee. In R. Brown (Ed.), *Selected papers by Roger Brown*. New York: Free Press.

Brown, R., & Bellugi, U. (1964). Three processes in the child's acquisition of syntax. *Harvard Educational Review, 34*, 133-151.

Brown, R., Cazden, C., & Bellugi, U. (1968). The child's grammar from I to III. In J. P. Hill (Ed.), *Minnesota symposia on child development*. Minneapolis: University of Minnesota Press.

Casenhiser, D., & Goldberg, A. E. (2005). Fast mapping between a phrasal form and meaning. *Developmental Science, 8*(6), 500-508.

Chan, A., Lieven, E., & Tomasello, M. (2009). Children's understanding of the agent-patient relations in the transitive construction: Cross-linguistic comparisons between Cantonese, German, and English. *Cognitive Linguistics, 20*(2), 267-300.

Chapman, R. S., & Miller, J. F. (1975). Word order in early two- and three- word utterances: Does production precede comprehension? *Journal of Speech and Hearing Research, 18*, 355-371.

Clancy, P. M. (1993). Preferred argument structure in Korean acquisition. In E. Clark (Ed.), *Proceedings of the Twenty-fifth Child Language Research Forum* (pp. 307-314). Stanford: CSLI Publications.

Clancy, P. M. (2003). The lexicon in interaction: Developmental origins of Preferred Argument Structure in Korean. In J. W. Du Bois, L. E. Kumpf & W. J. Ashby (Eds.), *Preferred Argument Structure: Grammar as architecture for function* (pp. 81-108). Amsterdam: John Benjamin.

Clancy, P. M. (2004). The discourse basis of constructions: Some evidence from Korean acquisition. In E. Clark (Ed.), *Proceedings of the 32nd Stanford Child Language Research Forum*: http://csli-publications.stanford.edu/CLRF/2004/05-Clancy.pdf.

Comrie, B. (2005). Alignment of case marking. In M. Haspelmath, M. Dryer, D. Gil & B. Comrie (Eds.), *The World Atlas of Language Structures* (pp. 398-495). Oxford: Oxford University Press.

de Villiers, J. G., & de Villiers, P. A. (1974). Competence and performance in child language: Are children really competent to judge? *Journal of Child Language, 1*, 11-22.

Dryer, M. (2005). Order of subject, object and verb. In M. Haspelmath, M. Dryer, D. Gil & B. Comrie (Eds.), *The World Atlas of Language Structures* (pp. 330-333). Oxford: Oxford University Press.

Du Bois, J. W. (1987). The discourse basis of ergativity. *Language, 63*, 805-855.

Du Bois, J. W., Kumpf, L. E., & Ashby, W. J. (2003). *Preferred Argument Structure: Grammar as architecture for function*. Amsterdam: John Benjamin.

Hakuta, K. (1982). Interaction between particles and word order in the comprehension and production of simple sentences in Japanese children. *Developmental Psychology, 18*(62-75).

Isabelli, C. A. (2008). First noun principle or L1 transfer principle in SLA? *Hispania, 91*(2), 463-476.

Ito, T., Tahara, T., & Park, W. (1993). *Bun no rikai ni hatasu joshi no yakuwari [The role of particles on sentence comprehension]*. Tokyo: Kazama.

Jacobsen, W. M. (1992). *The transitive structure of events in Japanese*. Tokyo: Kuroshio.

Kail, M. (1989). Cue validity, cue cost, and processing types in sentence comprehension in French and Spanish. In B. MacWhinney & E. Bates (Eds.), *The cross-linguistic study of sentence processing* (pp. 77-117). New York: Cambridge University Press.

Kempe, V., & MacWhinney, B. (1998). The acquisition of case-marking by adult learners of Russian and German. *Studies in Second Language Acquisition, 20*, 543-587.

Kilborn, K., & Ito, T. (1989). Sentence processing strategies in adult bilinguals. In B. MacWhinney & E. Bates (Eds.), *The crosslinguistic study of sentence processing* (pp. 257-291). New York: Cambridge University Press.

Kuroda, S.-Y. (1965). *Generative Grammatical Studies in the Japanese Language.* Ph.D. Dissertation, Massachusetts Institute of Technology, Cambridge, MA.

MacWhinney, B. (1978). The acquisition of morphology. *Monographs of the society for research in child development, 43*, 1.

MacWhinney, B. (2000). *The CHILDES project: Tools for analyzing talk* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

MacWhinney, B., Pléh, C., & Bates, E. (1985). The development of sentence interpretation in Hungarian. *Cognitive Psychology, 17*, 178-209.

Matsumoto, Y. (2007). Interaction of Multiple Factors in Relative Clause Construal and Acquisition. *Studies in Second Language Acquisition, 29*, 367-374.

McDonald, J. (1989). The acquisition of cue-category mappings. In B. MacWhinney & E. Bates (Eds.), *The cross-linguistic study of entence processing*. New York: Cambridge University Press.

Miyata, S. (2008). Input Frequency and Case Acquisition in Japanese. *Journal of Medical Welfare, 4*, 108-117.

Miyazaki, M. (1979). *The acquisition of the particles wa and ga in Japanese: A comparative study of L1 acquisition and L2 acquisition.* Unpublished manuscript. University of Souther California.

Morikawa, H. (1997). *Acquisition of case marking and argument structures in Japanese.* Tokyo: Kuroshio.

Nisisawa, H. Y., & Miyata, S. (2010a). *Japanese: ArikaM Corpus.* Pittsburgh, PA: TalkBank.

Nisisawa, H. Y., & Miyata, S. (2010b). *Japanese: Asato Corpus.* Pittsburgh, PA: TalkBank.

Noji, J. (1985). *Yohjiki no gengo seikatsu no jittai [The language development of a child], Vols 1-4.* Hiroshima: Bunka Hyoron.

Nomura, M., & Shirai, Y. (1997). Overextension of intransitive verbs in the acquisition of Japanese. In E. Clark (Ed.), *Proceedings of the Twenty-Eighth Annual Child Language Research Forum* (pp. 233-242). Stanford, CA: Center for the Study of Language and Information.

Oshima-Takane, Y., MacWhinney, B., Sirai, H., Miyata, S., & Naka, N. (Eds.). (1998). *CHILDES for Japanese. Second Edition.* The JCHAT Project Nagoya: Chukyo University.

Pinker, S. (1982). A theory of the acquisition of lexical interpretive grammars. In J. Besnan (Ed.), *The mental representation of grammatical relations.* Cambridge, MA: MIT Press.

Pinker, S. (1984). *Language Learnability and Language Development.* Cambridge, MA: Harvard University Press.

Qin, J. (2008). The effect of processing instruction and dictogloss tasks on acquisition of the English passive voice. *Language Teaching Research, 12*, 61-82.

Rispoli, M. (1987). The acquisition of the transitive and intransitive action verb categories in Japanese. *First Language, 7*(21), 183-200.

Rispoli, M. (1989). Encounters with Japanese verbs: caregiver sentences and the categorization of transitive and intransitive action verbs. *First Language, 9*(25), 57-80.

Rounds, P. L., & Kanagy, R. (1998). Acquiring linguistic cues to identify agent: Evidence from children learning Japanese as a second language. *Studies in Second Language Acquisition, 20*, 509-542.

Sachs, J. (1983). Talking about there and then: The emergence of displaced reference in parent-child discourse. In K. E. Nelson (Ed.), *Children's language* (Vol. 4, pp. 1-28). Hillsdale, NJ: Erlbaum.

Sasaki, Y., & MacWhinney, B. (2006). Language acquisition research based on the competition model. In M. Nakayama, R. Mazuka & Y. Shirai (Eds.), *The handbook of East Asian psycholinguistics Volume II: Japanese* (pp. 307-314). Cambridge: Cambridge University Press.

Shibatani, M. (1990). *The languages of Japan.* New York: Cambridge University Press.

Siewierska, A. (2005). Alignment of verbal person marking. In M. Haspelmath, M. Dryer, D. Gil & B. Comrie (Eds.), *The World Atlas of Language Structures* (pp. 406-409). Oxford: Oxford University Press.

Silverstein, M. (1976). Hierarchy of features and ergativity. In R. M. W. Dixon (Ed.), *Grammatical caregories in Australian languages.* (pp. 112-171). New Jersey: Humanities Press.

Slobin, D. I. (1968). Recall of full and truncated passive sentences in connected discourse. *Journal of Verbal Learning and Verbal Behavior, 7*, 876-881.

Suzuki, T. (2005). Tan-itsu koobun no rikai kara saguru yooji no kakujoshi hattatsu [The development of Japanese case-markers observed through children's comprehension of single-argument sentences]. *Gengo Kenkyu, 132*, 55-76.

Tomasello, M. (1992). *First verbs: a case study of early grammatical development*. Cambridge: Cambridge University Press.

Tsujimura, N. (2007). *An Introduction to Japanese Linguistics*. Malden, MA: Blackwell.

VanPatten, B. (1996). *Input processing and grammar instruction: Theory and research*. Norwood, NJ: Ablex.

VanPatten, B. (2004). Input processing in second language acquisition. In B. VanPatten (Ed.), *Theory, research, and commentary* (pp. 5-31). Mahwah, NJ: Lawrence Erlbaum and Associates.

VanPatten, B. (2007). Input processing in adult second language acquisition. In B. VanPatten & J. Williams (Eds.), *Theories in second language acquisition.* (pp. 115-135). Mahwah, NJ: Lawrence Erlbaum and Associates.