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ACQUIRING LINGUISTIC CUES TO IDENTIFY AGENT

Evidence from Children Learning Japanese as a Second Language

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This study investigates children's changing sensitivity to processing cues for identifying agent (word order, case marking, and animacy) as a function of proficiency in a second language. English-speaking learners of Japanese need to appropriately adjust cue strengths in moving from a rigid SVO language to one in which SOV word order is a good general processing strategy, but case marking must ultimately be relied on if it conflicts with this order. English-speaking children in grades K–7 in an immersion school were asked to identify the agent for a set of audiotaped sentences in English and Japanese. The children in this study learned to use SOV word order, lexical semantics, and canonical case marking, but they do not provide evidence of appropriately exploiting noncanonical case marking. We suggest that these results might be accounted for by the context in which input is processed in immersion school classrooms.

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Although bilingualism or even multilingualism is the norm in many parts of the world, in most of North America monolingualism has been the historic norm for public education. More recently, owing to the promotion of the ideals of multiculturalism throughout school districts in the United States, to the legislation of bilingualism as a national policy in Canada, and to a recognition that knowledge of additional languages may be economically beneficial, school curricula have been designed that have the development of bilingual children as a unifying goal. These children receive all or part of their subject-matter education in the target language for as many as 12 years. Although there is no question that immersion-educated children perform at grade level in the content areas, their linguistic performance has not been found to be nativelike, especially in the areas of syntax and morphology (Harley, Allen, Cummins, & Swain, 1990; Swain, 1985).

But what do such findings mean for children who are learning a language? As one sits in small chairs at the back of immersion school classrooms watching the students and teachers go about the business of learning and teaching about the world in, for example, Japanese, one cannot help but be struck by how nonplussed everyone seems to be about this odd enterprise. One wonders what is going on in the heads of the children who are experiencing their first contact with an educational institution, who are being asked to perform in accordance with a completely new set of rules, and who are being directed to do all of this in a language they had never heard until they came into the school setting. An excerpt from Igarashi's (1997, pp. 47–48) study of early oral production by immersion kindergartners vividly illustrates what children experience on the first day of school:

> The kindergarten classroom was full of noise. New kindergartners arrived at the classroom with their parents or guardians, who reassured the children that they would be OK. Two Japanese teachers and the assistant in the room were busy giving each child a name card on which his or her name was written both in Japanese and English. The teachers used only Japanese when talking to the children. Some children, appearing to be confused, asked the adults what to do. One child even came up to the researcher and asked, "What are they (the Japanese teachers) saying?" . . . By the end of the first day, the children seemed to understand that they sometimes had to imitate not only the teacher's physical movement but also the sounds she made. Besides the morning greeting, the children produced many other L2 sounds by imitating the teacher . . . some were short words such as *neko* (cat) and *inu* (dog), but the others were rather complex, long expressions such as *toire ni ittemo ii desu ka* (May I go to the bathroom?).

How do the children know that the set of alien sounds the teacher is making has meaning for them? How do they come to understand what that meaning is? This study set out to understand how it is that children who are "merely exposed" to language come to understand language. In other words, how do

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they come to acquire the system that makes the sounds they hear eventually yield meaning?

A first place to start understanding language acquisition is by asking how children learn the means that the language uses to keep track of who is doing what or, in other words, who the agent of an action is. This would enable them, for example, to know whether a dog bites a man or a man bites a dog. In the so-called real world, it is clear that dogs more often bite men than vice versa, and certainly this kind of pragmatic information can help language learners decode sets of lexical items they are presented with. Of course, dog bites man. But language provides ways to express more than the merely commonplace, so a system must provide for the expression of the rare but plausible possibility that man bites dog. The commonplace can generally be decoded off even a reduced or pidginized version of language, but it is the fully grammaticalized linguistic system that facilitates the communication of a less common message. The route and rate of acquisition of the fully grammaticalized system is the research area that this paper explores.

The research paradigm exploited in the service of this goal is the Competition Model (Bates & MacWhinney, 1989). This model of language acquisition provides an experimental paradigm that allows the researcher to manipulate the linguistic cues that are available to languages for identifying the function of agent so as to make it possible to determine the relative strength of each cue for listeners. This paradigm is particularly well suited for examining the question posed herein: How do immersion-educated children develop the ability to decode spoken Japanese and come to appropriately weight the linguistic cues of word order, case marking, and animacy as means of identifying the doer of the action, or agent, in simple transitive sentences? Once we have information about the second language learners, we may consider whether the path they take toward acquisition of the system is similar to the path native speakers take. Further, we consider whether the path the children take bears any resemblance to that taken by adult second language learners who are taught about language.

BACKGROUND

As indicated above, this research was carried out in the context of the Competition Model (Bates & MacWhinney, 1989). This model of language acquisition is based on a functionalist theory of grammar that has as its goal describing the relationship between underlying meaning and intentions, and their expression in language (Givón, 1979a). Languages rely on various surface cues—for example, word order, case marking particles, stress, inflectional morphology—to signal the roles of the various participants in an utterance. In real-time processing, these cues may converge or compete to express a particular intended meaning. Hence, the task for the listener is to determine which form is aligned with which function. Consider, for example, the following sentence:

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(1) *The girl pushes the table.*

Native speakers of English can exploit many cues to determine who or what performs the action of the verb. In active declarative sentences, the first noun phrase is typically the subject of the sentence and typically fills the actor role.[1] Secondly, the morphology or subject-verb agreement also militates for a convergence on *the girl* as the subject of the sentence because the singularity of *the girl* requires a singular marked verb. Finally, there is an animacy contrast between the nouns *the girl* and *the table*, favoring the former; it is more likely that girls push tables than that tables push girls. In this case, all cues cooperate, or form a coalition, on the same assignment of relationships. However, form-to-function mappings are often inconsistent and a particular cue may not always be reliable. Thus, in the sentence

(2) *The table pushes the girl.*

there is again an animacy contrast, but it favors the second, post-verbal noun in the string. Bates and MacWhinney (1981, 1989, & elsewhere) propose that in sentences like (2) the cues of word order (i.e., first noun phrase is subject) and morphology (i.e., subject-verb agreement) compete with the cue of animacy, thus the term "Competition Model." Sentences that evidence this kind of competition are called conflict sentences, and in such sentences this interpretive problem can be resolved by postulating a weighting of the information value of the various cues; that is, by a consideration of cue strength (Bates & MacWhinney, 1987). In sentence (2) above, English listeners would assign the surface subject slot and agenthood to *the table* because word order has the greatest weighting in English, overriding all other possible factors. However, Italian speakers asked to identify the doer in a word-for-word translation of sentence (2) in Italian would name *the girl*, because Italian speakers rely more strongly on the cue of animacy (Bates & MacWhinney, 1981).

Thus, in the Competition Model, language learning is viewed as "a process of acquiring coalitions of form-function mappings, and adjusting the weight of each mapping until it provides an optimal fit to the processing environment" (Bates & MacWhinney, 1989, p. 59). These mappings, or cues, are the source of information used by the learner to decide which function is meant to be expressed by a given form. An important feature of the model for second language researchers is that it allows them to investigate the partial language systems of learners by examining their changing sensitivity to cue distribution in the target grammar and to trace the learners' development as it becomes congruent to native speaker performance, as opposed to simply determining whether or not a learner has acquired some discrete rule-based principle. Notice that in the Competition Model no a priori distinction regarding the contributing roles of the individual cues to comprehension is made. In particular, it should be noted that syntax is not accorded privileged status as a cue to comprehension, and on this point the Competition Model differentiates itself

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from most other models. Rather, all cues are treated as equipotential regarding possible effect on processing outcomes, and empirical evidence must determine our eventual understanding of the contribution of the various factors in any particular language. In the Model, the strength of a cue is based on its validity, which MacWhinney (1987) and MacWhinney, Pléh, and Bates (1985) defined as a product of cue applicability and reliability. In English, preverbal word order is very consistently applicable because English sentences rarely omit a preverbal noun. It is also a highly reliable cue because the preverbal noun is almost always the actor with few exceptions (most notably, passive sentences). Animacy, on the other hand, is less reliable and applicable. For example, McDonald (1987) pointed out that in sentences such as *The lightning struck the tree*, there is no animacy contrast to facilitate decoding and in sentences such as *The lightning struck the golfer*, the inanimate rather than the animate noun is the actor.

McDonald (1986) found that cue acquisition is affected by two types of cue validity. The first type, *overall validity*, is a measure of how often the cue is provided in the input and it determines the order of acquisition of cues by native speakers. The second type of cue validity, *conflict validity*, is a measure based solely on conflict sentences (e.g., sentences such as (2) above) and reflects how strongly a cue is relied on by adult native speakers of a language. Numerous studies have provided strong evidence for the role of cue validity in determining the order in which grammatical devices are acquired. Studies of children learning their first language, for example, have indicated that even very young learners (age $2\frac{1}{2}$) are sensitive to the information values of the cues in the language(s) to which they are exposed. For example, children exposed to English have shown a strong effect for word order at this age, but children exposed to Italian rely on animacy (Bates, MacWhinney, Caselli, Devescovi, Natale, & Venza, 1984). Children who are exposed to a language that freely exploits variable word order and case marking, such as Turkish, learn to rely on case marking for interpretation at the earliest ages (Slobin, 1981; Slobin & Bever, 1982).

In the case of L2 learning, when the relative strength of lexical semantic, morphological, and syntactic cues differs from their strength in the first language, learners must adjust the strength of the various target language cues; in doing so they develop comprehension strategies that are possibly distinct from those they rely on in their first language. For example, Gass (1987), in a cross-linguistic study of English and Italian learners, found that syntactic (word order) cues were stronger than semantic (animacy) cues for English L1 learners of Italian but that Italians learning English relied on semantic cues over syntactic cues. In the terms of the Competition Model, both sets of learners must eventually acquire new cue strengths. The English L1 speakers need to weight the cue of semantics more heavily when decoding Italian than English; the Italian L1 speakers need to weight the cue of word order more heavily when decoding English than Italian.

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Acquisition of Japanese

We turn now to work done specifically on the acquisition of cue strength in native speakers and second language learners of Japanese. Unlike English, in which word order rigidly determines the grammatical roles of nouns in a sentence, in Japanese the placement of noun phrases in a clause is relatively flexible because postpositional case markers (or particles) signal the grammatical role of nouns. However, Japanese is relatively rigid regarding the clause-final position of the verb (Givón, 1984). Canonical or pragmatically neutral SOV order is often found in Japanese discourse and is the preferred order when case markers are omitted, as occurs in colloquial speech (Martin, 1975); SV and OV sentences are also possible in Japanese simple declarative clauses. Noncanonical, or OSV, word order is much less frequent but not uncommon (Kuno, 1973). Japanese also differs from English in the range of semantic roles it allows in the subject role of a transitive sentence, permitting only human beings or higher animals (Kuno, 1973).[2] On the basis of this linguistic analysis, we can predict that the cue of word order would have overall validity for speakers of Japanese but that the cue of case-marking would have high conflict validity because Japanese speakers must ultimately rely on it for proper interpretation of the grammatical roles of the various nouns that could appear in a sentence. The animacy cue would appear to be stronger in Japanese than in English because it affects what can be an acceptable subject of a transitive verb. These issues are taken up in more depth below.

A number of studies have investigated the acquisition of case, animacy, and word order cues by native Japanese children and adults on the one hand and by adult Japanese as Second or Foreign Language (JFL) learners on the other. From studies on the early oral output of Japanese children, it is apparent that acquisition of the case-marking system proceeds at different rates in different environments (canonical SOV vs. noncanonical OSV; Clancy, 1985; Hakuta, 1982; Ito, Tahara, & Park, 1989, 1991). The first case markers appear around age 2, consisting of *-wa* (topic marker) in questions and *-mo* ("also") in noun-plus-case strings (Clancy, 1985). As object (*-o*) and subject (*-ga*) case markers emerge, they are overused by children in positions in which they would be elided in adult speech. As well, children initially overgeneralize *-ga*, consistently using it to mark the first argument even in OSV sentences, in which the first noun should take *-o* (Clancy, 1985). It has been claimed that this multifunctional nature of *-ga*, which generally marks subject but marks patient[3] with stative predicates, results in a lack of clear one-to-one form-to-function mapping, which weakens the cue validity of *-ga* as opposed to *-o* (Ito, Tahara, & Park, 1989). Overall, Japanese children appear to have difficulty acquiring the means for grammatical expression of the full range of case relationships and exhibit many errors until after age 3 (Ito, Tahara, & Park, 1991).

As children begin comprehending and producing longer sentences, how does case marking interact with other cues in signaling meaning? Hakuta's (1982) investigation of the degree to which Japanese children, ages 2–6, rely

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on grammar (word order and case marking) versus semantics (animacy) in processing sentences reveals that in comprehension, production, and imitation of simple sentences, children exhibit strong dependence on neither word order nor case markers alone; rather, they demonstrate a strong preference for a match between case markers and their positions in sentences. In an experiment formally exploiting the Competition Model, Ito, Tahara, and Park (1991) tested the understanding of agency by 80 Japanese speakers, age 5 to college age, by having subjects act out 27 stimulus sentences containing nouns marked with either *-o* (object) or *-ga* (subject) in different animacy and word order (SOV vs. OSV) combinations. Their results show a clear developmental sequence in the acquisition of word order and case-marking in canonical (SOV) and noncanonical (OSV) positions by native-speakers: For 5-year-olds, noun animacy is the strongest cue, but in first grade *-o* overtakes animacy as the dominant cue in canonical position; however, in noncanonical positions, *-o* does not become a reliable cue until third grade. As for *-ga*, when it is in canonical position, it overpowers animacy as a cue by fifth grade, but in noncanonical sentences it does not gain cue strength over animacy until the seventh grade. Ito, Tahara, and Park (1991) concluded that the case marker *-o* surpasses word order as a reliable cue by third grade but *-ga* is not acquired in all positions (SOV and OSV) until seventh grade. These results clearly indicate that Japanese children's ability to interpret case marking is age dependent and that multifunctional cues such as *-ga* take longer to acquire than cues with one-to-one form-to-function mapping, such as the object marker *-o*. As children get older, the cue validity of case in choosing agency increases and the tendency to select the first noun as agent (word-order dependence) in noncanonical strings decreases; complete command takes up to 7 years of formal schooling. Recall that Turkish children are reported to acquire the single-function object suffix by age 2 (Slobin & Bever, 1982). By contrast, Japanese children acquire case markers as a processing cue relatively late.

As case marking gains cue strength in older children and adults, how important do syntactic and semantic cues continue to be? In a cross-linguistic study, Ito, Tahara, and Park (1989) compared Japanese and Korean adults' reliance on object markers (*-o* in Japanese; *-eul* or *-reul* in Korean) in processing sentences. In both language groups, case was found to be the strongest cue; however, differences emerged in terms of the strength of word order and animacy cues: case marker > animacy > word order for Japanese, and case marker > word order > animacy for Koreans. In another cross-linguistic study (Harrington, 1987), Japanese adults exhibited L1 animacy biases when processing L2 English, with some dependence on English canonical word order, although to a lesser degree than native English speakers, with no evidence of noncanonical or second-noun strategy.[4] In two cross-linguistic studies that included English-speaking adults learning Japanese, Sasaki (1991) found that intermediate and advanced L2 Japanese learners depended more on animacy cues than word order in interpreting non-case-marked NNV strings. In a later study targeting comprehension of case-marked NNV sentences in Japanese,

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Sasaki (1994) obtained results showing that adult learners relied increasingly on case-marking cues as a function of their proficiency but that animacy still explained a greater amount of variance. Sasaki (1994) concluded that, in transfer situations between L1 English and L2 Japanese, cue strength conforms to the following order (p. 66): lexical semantics (animacy) > case marking > canonical word order. Recall that Ito, Tahara, and Park (1989) reported that native Japanese adults follow the cue strength order of: (object) case marker > animacy > word order. Sasaki (1994) claimed that word order effects accounted for so little of the variance in his subjects' performance because the canonical word order of English and Japanese is so different (SVO vs. SOV). Kilborn and Ito (1989), however, noted that it is not necessary for exact surface order to be transferred from one language to another to claim an effect for the word-order cue in comprehension. They proposed a process of metatransfer of word order, in which learners apply the strength of the core strategy of their L1 (viz., "use word order") to process Japanese sentences but do not rely on the exact SVO canonical word order of English. Their novice learners relied heavily on this strategy; advanced learners, however, were found to ignore word order and attend to case-marker cues as did native Japanese subjects (Kilborn & Ito, 1989).

Notice that these studies investigate adult second language learning. Is the course of acquisition for children similar? Children learning Japanese in an immersion school are learning their second language under very different but, we would suggest, much more naturalistic conditions than is usually the case for adults (Igarashi, 1997). We believe that the language-learning history of the adults in Sasaki's (1991, 1994) and Kilborn and Ito's (1989) studies would almost certainly differ from the immersion-school children, who receive none of the explicit rule instruction that is central to formal language instruction in high school or university classrooms. In particular, the function of the various case-marking particles is not isolated and explicated for the children (cf. Kanagy & Igarashi, 1997) as it is in most adult JFL classrooms. One might suppose that putting adults on the alert to "notice" (Schmidt, 1990) case-marker forms and associate them with their functions gives adult learners an advantage in processing subsequent material in which they occur, thus hastening acquisition. Explicitly pointing out these form-to-function relationships might disturb the natural course of cross-linguistic development, which in the model considered herein entails a process of cue strength adjustment completely dependent on the validities of the various cues in naturally occurring discourse.

Furthermore, Japanese is still a less-commonly taught language in our schools and universities. It is likely that many of the JFL learners who are the adult subjects in previous studies had explicit instruction in another language before beginning study of Japanese. These students have a history as language learners and would approach second or foreign language learning knowing some ways in which other language systems can differ from their native languages. This knowledge could make them unusually attuned to a linguistic phenomenon such as case marking, which is a relatively weak cue in English,

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and it may contribute to a crucial difference between the observed course of second language acquisition of adults and children.

In this study we are primarily interested in investigating the natural course of development that English-speaking children follow in acquiring the appropriate Japanese cue strengths while in an immersion education setting in the U.S. We also ask whether what the children do mirrors what has been attested for English-speaking adults learning Japanese. It is of further interest to ask whether there is any interaction between young children's first and second language cue strength settings. For example, Liu, Bates, and Li (1992) find evidence for "backward transfer" (i.e., transfer of cue strengths) from the second language into the first language for Chinese learners of English who are first exposed at very early ages (before age 4) or at adolescence (around age 12). In particular, we are curious to find out if the acquisition of the canonical SOV word order cue in Japanese affects the children's interpretation of noncanonical (NNV) sentences in English. In prior studies (e.g., Bates & MacWhinney, 1981), English L1 subjects have been found to identify the agent in sentences such as *Chris Pat kissed* as the second noun (in this case, *Pat*), yielding an OSV interpretation.

In sum, the research questions for the present study investigate the following areas:

1. Word order effects: (a) How do Japanese immersion students interpret non-case-marked NNV sequences in Japanese? (b) How do child JL2 learners interpret NNV strings in English? (c) Are child JL2 learners' English NNV sentence interpretation strategies affected by their Japanese NNV sentence interpretation strategies?
2. Case-marking effects: How does case marking affect child JL2 interpretation of canonically and noncanonically case-marked sentences?
3. Semantic effects: How does lexical semantics affect child JL2 interpretation of case-marked and non-case-marked sentences?

METHOD

Participants

A total of 89 native English-speaking children in kindergarten through seventh grade[5] of a Japanese immersion school in the U.S. participated in the present study. Subjects in the K–5 pool were nominated by their teachers on the basis of being in the top half of each grade level. All students in sixth and seventh grades who were present on the day of testing were included; these students are presumed to represent a comparable achievement group to the elementary top half because they had made a successful transition from the elementary to middle-school program. All students were from native English-speaking households.

In this type of partial-immersion program, 5-year-olds attend kindergarten 2.5 days per week receiving 90% of their instruction in Japanese and 10% in English (for a detailed study of the first year of immersion, see Igarashi, 1997;

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Kanagy, 1997; Kanagy & Igarashi, 1997). Children in first through fifth grades are instructed in English half the day and Japanese half the day (2.5 hours per session); there is also a computer-based bridge class in which students use both languages. Teachers follow an integrated syllabus, meaning that instruction in all the traditional subject areas is integrated, so there is no delimitation of the L2 to specified content area. There is no deliberate or planned repetition of content delivered in the L2 at some later point in the L1; students must learn the content in whatever language it is offered. All students are performing in conformance to standardized-test expectations. In the middle-school program, instruction in Japanese is reduced to 2.5 hours on alternate days and was restricted to math and science teaching at the time of the testing procedure. In the present study, proficiency in Japanese is linked to years of exposure, with the second graders having 2 years of exposure, the third graders having 3 years of exposure, and so on. The exception is the first graders. They were the first cohort to attend the Japanese immersion kindergarten, and so they had 2 years of exposure at the time of testing; however, the kindergarten year is less intensive than the normal first grade, so these children are still considered to represent a degree of exposure somewhere between that of kindergartners and that of second graders.[6]

During the 7 years that this immersion school has been in existence, there has been a certain amount of staff change. However, all the teachers of Japanese who have ever worked there have been female native speakers trained as elementary school teachers in Japan. It has been noted that the teaching practice on the Japanese side of the immersion school is very similar to what might be observed in a typical elementary school classroom in Japan (Falsgraf, 1994; Falsgraf & Majors, 1995).

Procedure

The experimental protocol consisted of an English version and a Japanese version. The elementary students completed both protocols; the middle-school students completed only the Japanese version because analysis of the English protocol for the younger children showed a strong ceiling effect. The two tests were administered 1 week apart, the Japanese version being administered first to all students. Students were tested in groups of 6–12.

In each version of the protocol, the students listened to a series of active sentences or strings consisting of two nouns plus a verb recorded on audiotape. For each sentence, they were directed to choose the one of three pictures from a test booklet that best matched what they had just heard on the tape.[7] In the oral directions, they were additionally directed to focus on "who or what is doing the action." Two of the three pictures in each set showed the same two actors, but in one picture a particular actor (e.g., *boy*) was the agent and in the other it was the patient. In the third picture (a distractor), one of the actors was different—that is, if two of the pictures included a boy and a grandfather, the third picture might have a grandfather and car. Students indi-

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cated their choice by marking an "X" in the box corresponding to their picture choice. They had 8 seconds to respond after hearing the sentence or string; no student appeared to be rushed and the students had ample time to deliberate over their responses if necessary. We felt this optimized their opportunities to reflect and reconsider their answers if necessary and ensure the highest degree of accuracy possible.

Stimulus Sentences

Manipulated cues. Two types of cues were experimentally manipulated: case marking and lexical semantics (viz., noun animacy).[8] By considering performance when these cues were neutralized (either the case markers were omitted or there was no animacy contrast), we could also obtain a measure of how strong the word-order cue was. Consistent and noncontrastive stress was used throughout the test tape.

For the Japanese protocol, only NNV sequences were presented.[9] Case marking was manipulated in the following ways: non-case-marked NNV strings (no case marking); canonical case marking (first noun marked nominative *-wa* or *-ga*;[10] second noun marked accusative *-o*); and noncanonical case marking (first noun marked accusative *-o*; second noun marked nominative *-wa* or *-ga*). The presentation of non-case-marked strings would allow us to determine the learners' basic word-order strategy because case marking would not be an issue in interpretation. Animacy also was controlled. A combination of animate (A) and inanimate (I) nouns produced three types of semantic bias: a first-noun bias (AI); a second-noun bias (IA), and a reversible condition (AA). There were 48 test sentences and the number of sentences in each category was as follows: non-case-marked sentences: AI = 3, IA = 3, AA = 6; canonically case-marked: AI = 3, IA = 3, AA = 12; noncanonically case-marked: AI = 6, IA = 6, AA = 6. All Japanese sentences were presented with the direct form of the verb.[11] Sentences (3a–d) illustrate some of the combinations presented.

(3) a. NNV strings (No case markers; first noun animate, second noun inanimate)
onnanoko ki miru
girl tree sees
"girl sees tree"

b. NNV (Cooperating cues: case marked for canonical word order; first noun animate, second noun inanimate)
onnanoko-ga ki-o miru
girl-NOM tree-ACC sees
"The girl sees the tree."

c. NNV (Competing cues: case marked for noncanonical word order; first noun animate, second noun inanimate)
onnanoko-o ki-ga miru
girl-ACC tree-NOM sees
"The tree sees the girl."

d. NNV (Reversible cues: case marked for canonical word order; first noun animate, second noun animate)

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onnanoko-ga *obaasan-o* *miru*
girl-NOM grandmother-ACC sees
"The girl sees the grandmother."

For the Japanese version of the protocol, there were two kinds of distractors. The first kind was passive sentences involving the same set of nouns and verbs. In this version, students were also asked to match a picture with a single presented noun (e.g., *flower*, *shoe*, *horse*); we felt that this would help them remember that the goal of the test was to match what they heard with the best picture. There were 69 test items in total.

For the English version, word-order cues were manipulated by presentation of canonical NVN and noncanonical NNV and VNN strings. Lexical semantics was manipulated in a manner parallel to the Japanese version. There were 36 test sentences and the number of sentences in each category was as follows: canonical NVN: AI = 3, IA = 3, AA = 6; noncanonical NNV: AI = 3, IA = 3, AA = 6; noncanonical VNN: AI = 3, IA = 3, AA = 6. The English version employed the same nouns and verbs as the Japanese version. All nouns were presented in the singular and preceded by the definite article; verbs were presented in the simple present tense with third-person-singular conjugation. Sentences (4a–c) illustrate the combinations presented.

(4) a. NVN (canonical word order; first noun animate, second noun inanimate)
the girl *pushes* *the desk*
b. VNN (noncanonical word order; first noun animate, second noun inanimate)
pushes *the girl* *the desk*
c. NNV (noncanonical word order; first noun animate, second noun inanimate)
the girl *the desk* *pushes*

As in the Japanese version, 12 passive sentences involving the same set of nouns and verbs served as distractors, yielding a total of 48 test items. For both versions, the test items were randomized and all students received the same version of each test.

Lexical items. To ensure that all students would understand the lexical items, a small inventory of words was chosen from the First Grade Japanese workbook. The list was cross-checked for learner comprehensibility by all the teachers. Any lexical combinations that resulted in test items that we predicted would be semantically inappropriate for the students were eliminated from the test item pool (see Appendix A for a list of the lexical items).[12]

Analyses

Research employing the Competition Model paradigm has traditionally employed a number of mathematical analyses to characterize subjects' response

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patterns. Several of these techniques are used to interpret the present data. Following early Competition Model studies, a mean and sometimes the percent of first-noun choice are provided in conjunction with the hypotheses proposed. It should be noted that this represents an accuracy score for the canonically case-marked sentences in Japanese but not for the noncanonically case-marked sentences. For non-case-marked Japanese strings, we present the discussion in terms of the percentage of strings in which the first noun in the two-noun-plus-verb series is chosen as agent. As needed, *t* tests against chance are performed. Also, following Ito, Tahara, and Park (1989), a percent use of meaning or case (i.e., PUMS or PUCS) is reported to express the strength of semantic or case-marking cues. This index is derived from the difference in first-noun choice ratio when semantics (PUMS) or case (PUCS) favor the first noun versus when one or the other favors the second noun. An example of when PUCS would offer useful information is in contrasting the effect of canonical and noncanonical case marking on first-noun choice. These indices provide a straightforward depiction of the students' decoding behavior.

Prior research on the acquisition of Japanese as both a first and a second language allowed us to propose a series of fairly specific a priori hypotheses related to the acquisition of various cue strengths. When we report on each a priori hypothesis, we describe each statistical analysis procedure in detail, but in general we measured the effect of cue strength using repeated measures analysis of variance (RM ANOVA) tests. Follow-up post-hoc Tukey's (HSD) tests were performed to highlight the locus of the effects observed in the ANOVAs. The level of significance was set at alpha = .05.

Because of various organizational factors and innovations related to the school in which this research was carried out, we decided to collapse our data set into four grade groups, which correspond to increasing duration of exposure. As noted above, the kindergarten year was a recent addition to the immersion program and had been in place for 2 years at the time of testing. This meant that the first-grade students and the second-grade students had both had 2 years of exposure at the time of testing, but these years of exposure entailed different linguistic experience because the kindergarten curriculum does not focus on literacy skills and academic content to the extent that the rest of the school program does. We felt that there was some justification to separate the children who had experienced kindergarten in Japanese from the rest of the subject pool. At the other end of the immersion program, the middle-school children (sixth and seventh grades) receive much less intensive exposure to Japanese because the program is reduced to just 2.5 hours on alternating days; thus we decided to group them together as well. These decisions suggested that the remaining grade levels should also be grouped in 2-year increments, yielding the four grade groups used as a variable for the RM ANOVA tests: Group K/1 (kindergarten and first grade: $n = 18$), Group 2/3 (second and third grades: $n = 24$), Group 4/5 (fourth and fifth grades: $n = 21$) and Group 6/7 (sixth and seventh grades: $n = 26$).

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RESULTS

Cross-Linguistic Word-Order Processing Strategies

Our first research area centered on determining if the JL2 children utilized any identifiable dependence on word order to distinguish agent in sequences consisting of two nouns and a verb. In Japanese, if the children relied on a canonical interpretation of such sequences, they would identify the first noun as agent. Recall also (see discussion above) that NNV sequences are possible in English—although they are relatively uncommon—and that Bates and MacWhinney (1982) have found that English native speakers choose the second noun as agent in English NNV sequences. Thus, the JL2 child learners are confronted with NNV sequences that ought to be interpreted using two distinct language-specific word-order patterns. It is of interest to ask how strong these patterns are and whether there is any interaction between them for these children.

Prior research on adults (Ito, Tahara, & Park, 1993; Kilborn & Ito, 1989; Sasaki, 1991, 1994) has shown that adult language learners employ distinct strategies for processing strings in Japanese (viz., animacy dependence) and English L1 (viz., word order). To avoid any effect of an animacy contrast in interpreting NNV strings, then, we only examined sequences in which both nouns are animate, because these strings are considered reversible—that is, either noun could reasonably perform the action. For example, in the string *the boy the grandfather pushes*, either the boy or the grandfather could conceivably perform the action *push*.

The questions we pose are: How do Japanese immersion students interpret non-case-marked NNV sequences in Japanese; that is, which noun do they identify as the agent? Similarly, how do child JL2 learners interpret noncanonical NNV sentences in English? And, finally, is there any evidence that the child JL2 learners' English NNV interpretation strategy is affected by their Japanese NNV interpretation strategy? Thus, as a starting point we formulated the following hypothesis:

> Hypothesis 1: JL2 children will maintain different processing strategies for NNV word strings in their L1 and their L2. That is, they will process Japanese strings consisting of two animate nouns and a verb (AAV) as SOV, but they will process English strings consisting of two animate nouns and a verb (AAV) as OSV.

To test Hypothesis 1,[13] a 3×2 RM ANOVA was run, with the three grade groups (K/1, 2/3, 4/5) and two stimulus languages (Japanese, English) as independent variables and the ratio of choosing the first noun as the subject to the total number of responses as the dependent variable. Both language and grade group had a significant main effect on the choice ratio.

There was a main effect of language, $F(1, 56) = 122.67$, $p < .001$. For the non-case-marked AAV strings presented in Japanese, the JL2 children as a group

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Table 1. Percent first-noun choice in Japanese non-case-marked reversible animacy (AAV) strings and in English reversible animacy noncanonical (AAV) strings

	Language			
	Japanese		English	
Grade group	*M*	*SD*	*M*	*SD*
K/1	.604	.242	.260	.227
2/3	.780	.214	.311	.288
4/5	.865	.167	.167	.274
All groups	.763	.232	.246	.270

chose the first noun as agent 76% of the time, indicating a strong general first-noun-as-subject or SOV strategy (see Table 1). In contrast and as expected, for AAV strings presented in English, the same JL2 children as a group chose the first noun 25% of the time (see Table 1). These findings suggest that there are language-specific word order effects.

In addition to the main effect of language there was a significant interaction for the language variable among grade groups, $F(2, 56) = 5.10$, $p < .05$. Follow-up analyses revealed that the K/1 group chose the first noun in Japanese AAV strings less often than the other groups (Tukey's HSD, $p < .05$) (see Table 1 and Figure 1). Specifically, for AAV strings presented in Japanese, the children in the K/1 group chose the first noun as subject only 60% of the time, whereas children in the older grade groups chose the first noun an average of 82% (78% for grade group 2/3 and 87% for grade group 4/5). Another way of characterizing these findings is in relation to chance. A series of exploratory *t* tests (alpha = .001) suggests that the K/1 group chose between the first and second nouns randomly when presented with AAV strings in Japanese. By contrast, all of the other groups picked the first noun at levels that were well above chance. We interpret these results as suggesting that, after the first grade, children come to rely strongly on a first-noun-as-agent strategy for Japanese strings even when, according to the animacy cue, either noun could fill this role. They manage to accomplish this in spite of the fact that when similar (AAV) strings were presented in their native language they relied on a different strategy, namely, second-noun-as-agent. Thus, we conclude that JL2 children utilized distinct and language-appropriate strategies for interpreting non-case-marked AAV sequences presented in Japanese and presented in English.

Effect of Case Marking

Our second research question asked if case marking affects child JL2 learners' interpretation of simple active sentences in Japanese. Given prior research indicating that the ability to exploit the information coded in case markers improves as a function of proficiency for both native speakers of Japanese and

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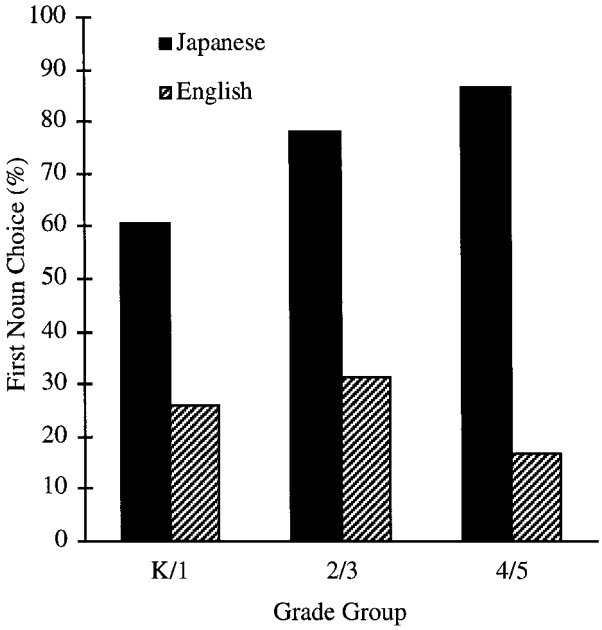


Figure 1. Percent first-noun choice in non-case-marked reversible animacy Japanese AAV strings and in reversible animacy English noncanonical AAV strings presented by grade group.

for adult JL2 learners (Hakuta, 1982; Ito, Tahara, & Park, 1993; Sasaki, 1994), two hypotheses were tested:

> Hypothesis 2: Child JL2 learners will choose the first noun as agent in canonically case-marked sentences more often than they choose the first noun as agent in non-case-marked strings. The effects of canonical case marking will become more pronounced relative to no case marking over time.

> Hypothesis 3: Child JL2 learners will choose the first noun as agent in noncanonically case-marked sentences less often than they choose the first noun as agent in non-case-marked strings. The effects of noncanonical case marking will become more pronounced relative to no case marking over time.

To test for significant effects of the case marking variable a 4×3 RM ANOVA was run, with the four grade groups (K/1, 2/3, 4/5, 6/7) and three case levels (canonical, noncanonical, non-case-marked) as independent variables and the ratio of choosing the first noun as the subject to the total number of responses as the dependent variable. Again, only performance on reversible

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Table 2. Effect of canonical and noncanonical case marking on percent first-noun choice for reversible animacy strings: AAV vs. A*ga*AoV vs. Ao A*ga*V

	Case condition					
	Non-case marked AAV		Canonical A*ga*AoV		Noncanonical Ao A*ga*V	
Grade group	*M*	*SD*	*M*	*SD*	*M*	*SD*
K/1	.611	.234	.804	.190	.746	.244
2/3	.770	.213	.921	.130	.923	.145
4/5	.865	.179	.961	.067	.932	.108
6/7	.814	.135	.969	.062	.951	.080
All groups	.773	.190	.921	.112	.898	.144

(A-A) sequences was examined in order to avoid any processing bias related to animacy contrasts.

When considering only combinations of two animate nouns, there was a significant main effect for the case-marking type variable on first-noun choice, $F(2, 170) = 39.18$, $p < .001$. Follow-up analyses revealed that the proportion of first-noun choice when AAV strings were non-case marked was significantly less relative to when they were canonically case marked and when they were noncanonically case marked (Tukey's HSD, $p < .05$; see Table 2). Thus, both kinds of case marking significantly increased the JL2 learners' likelihood of choosing the first noun as agent.

For canonically case-marked sentences, JL2 children chose the first noun as agent 92% of the time, as compared to 77% of the time for non-case-marked strings. Overall PUCS (i.e., the effect for case marking) for canonical case marking was +15%. Interestingly, when presented with noncanonically case-marked strings, JL2 children still chose the first noun 90% of the time (although the second noun was the one that was case marked as agent; see Table 2). In fact, follow-up analyses revealed that the frequency of choosing first noun when it was marked as subject (i.e., in canonically case-marked sentences) was not significantly different from the frequency of choosing it when it was marked as object (i.e., in noncanonically case-marked sentences; Tukey's HSD, n.s.). In other words, even when the nouns were case marked so that the second noun ought to have been understood as agent, JL2 children still chose the first noun as agent.

We next turn to examine the data for any effects for exposure. The overall RM ANOVA indicated a main effect for the grade group variable, $F(3, 85) = 11.22$, $p < .001$. This is, however, essentially the finding for word-order effects we noted in the prior section. Follow-up analyses revealed that children in the K/1 group chose the first noun as agent at a significantly lower rate than all other groups (Tukey's HSD, $p < .05$;[14] see Table 3 and Figure 2). We suggest that these results indicate less decisive decoding behavior in general in the first 2 years of Japanese immersion education.

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Table 3. Percent first-noun choice summarized over all case conditions for reversible animacy strings (non-case marked and case marked: AAV, A*ga*A*o*V, and A*o*A*ga*V)

	All case conditions	
Grade group	*M*	*SD*
K/1	.600	.266
2/3	.729	.212
4/5	.780	.202
6/7	.793	.193

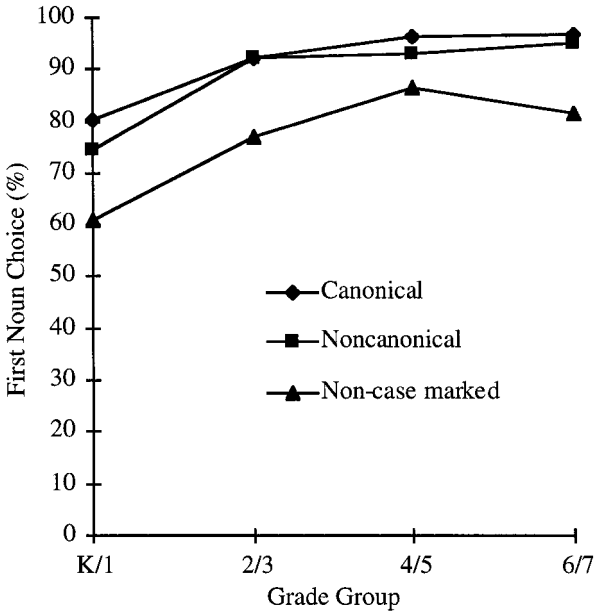


Figure 2. Effect of case-marking condition on percent first-noun choice in reversible animacy Japanese sentences: non-case marked (AAV), canonically case marked (A*ga*A*o*V), and noncanonically case marked (A*o*A*ga*V).

Finally we asked if there is any change in the learners' ability to use case-marking cues to interpret Japanese strings. The two-way interaction between the case-marking variable and the grade group variable was not significant, $F(6, 170) = 0.91$, n.s., indicating the relative effects for any kind of case marking on first-noun choice remains constant with increased exposure. As we can see in Figure 2, for all grade groups, the likelihood of interpreting first noun as

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agent for both canonically and noncanonically case-marked sentences is greater than it is relative to non-case-marked strings. Canonical case marking increased the likelihood of learners choosing the first noun as agent (PUCS) 10–19% relative to non-case-marked strings; noncanonical case marking also increased the likelihood of learners choosing the first noun as agent (PUCS) 7–15% relative to non-case-marked strings. This performance differential due to case marking is constant for all grade groups. Thus, Hypothesis 2 was partially supported.

Hypothesis 3, which examines the effect of noncanonical case marking, was not supported. We have seen that, in general, students displayed a first-noun choice strategy and that this strategy was strengthened by canonical case marking. Surprisingly, in noncanonically case-marked sentences (A*o*A*ga*V) they still chose the first noun even though—if they are exploiting the grammar—they should have chosen the second noun. Their tendency to choose the first noun as agent in these sentence types was, in fact, quite high (above 90% frequency) for children older than the K/1 grade group. We conclude that, when case marking and the students' word-order strategy conflict, noncanonical case marking still appears to function as a cue for first-noun choice. The performance differential effect of the noncanonical case marking relative to no case marking does not change. These JL2 learners show no improvement in exploiting the information coded in noncanonical case marking with exposure.

Effect of Animacy on Non-case-marked Strings

Our third research question aims to explore the effect of lexical semantics on child JL2 interpretation strategies. Given that lexical semantics provides the most transferable cue in studies carried out with adults (Gass, 1987; Sasaki, 1994), it seems reasonable to assume some animacy effect for child learners as well. Because we already know that the word-order cue gets stronger as a function of exposure, we predict that any animacy effect will correspondingly weaken. We first examine the strength of the animacy cue separately from case and look at performance in non-case-marked strings, proposing the following hypothesis:

> Hypothesis 4: Children will choose the first noun as agent in strings in which there is an animacy contrast and the contrast converges with the word order cue strategy (viz., in A-I strings) more often than when there is no animacy contrast (in reversible A-A strings) or when the animacy contrast competes with the word order cue (in I-A strings). This animacy effect will decrease as a function of amount of exposure.

To test for significant effects of the animacy variable a 4×3 RM ANOVA was run, with the four grade groups (K/1, 2/3, 4/5, 6/7) and three animacy levels (A-I, A-A, I-A) as independent variables and the ratio of choosing the first noun as the subject to the total number of responses as the dependent variable. Only performance on non-case-marked strings was considered.

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Table 4. Effect of animacy condition on percent first-noun choice in non-case-marked (NNV) strings

	Animacy condition					
	AAV		AIV		IAV	
Grade group	*M*	*SD*	*M*	*SD*	*M*	*SD*
K/1	.611	.236	.704	.300	.481	.261
2/3	.770	.213	.875	.165	.542	.257
4/5	.865	.179	.841	.171	.635	.180
6/7	.813	.135	.859	.214	.692	.229
All groups	.773	.190	.828	.213	.596	.232

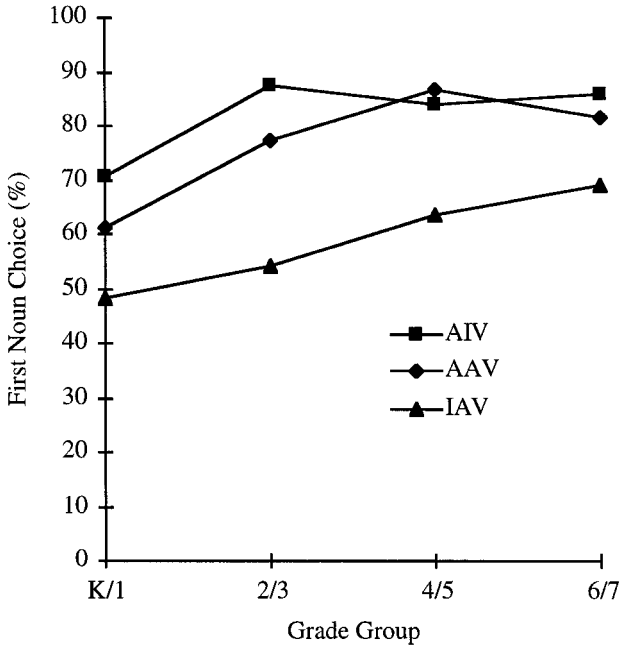


Figure 3. Effect of the controlled animacy conditions on percent first-noun choice: first noun animate, second noun inanimate (AIV); first noun animate, second noun animate (AAV); first noun inanimate, second noun animate (IAV).

Hypothesis 4 was partially supported. There was a main effect of the animacy condition variable, $F(2, 170) = 26.59$, $p < .001$. Follow-up analyses revealed that the child JL2 learners chose the first noun as agent significantly less often in the I-A condition relative to the A-I and A-A conditions (Tukey's HSD, $p < .05$; see Table 4 and Figure 3). However, there was no difference between performance in the A-A and A-I conditions (Tukey's HSD, n.s.). Overall, the great-

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est PUMS (effect for meaning) occurs when comparing IAV to AIV sequences, namely a 23% differential favoring AIV. For IAV sequences compared to AAV sequences, the differential is 18% in favor of AAV; for AIV sequences compared to AAV sequences, the differential is only 6% in favor of AIV. Thus, an animacy contrast that placed an animate noun in first position offered no advantage over the reversible animacy condition, but an animacy contrast that placed an inanimate noun in first position did have a significant effect on choice of first noun as agent. Nevertheless, collapsed across grade groups, first-noun choice in the I-A condition was above chance, $t(88) = 3.33$, $p < .05$. These findings suggest that when animacy and word order diverge—that is, in conditions in which the word-order cue favors the first noun but the animacy cue favors the second noun—these learners demonstrate a preference for the first (inanimate) noun. We conclude that an animacy contrast that favors the second noun is not a strong enough cue to overcome the cue of simple word order.

There was a main effect for the grade-group variable, $F(3, 85) = 9.45$, $p < .001$. Follow-up analyses revealed that the K/1 grade-group percent scores for choice of first noun in all animacy conditions was lower than the other grade groups (Tukey's HSD, $p < .05$; see Table 4). The two-way interaction between the animacy variable and the grade group variable was not significant, $F(6, 170) = 0.957$, n.s., indicating the effect of the different animacy conditions on first-noun choice remains constant even with increased exposure (see Figure 4). The competition of cues in the I-A configuration, with animacy favoring second-noun choice, appears to present the JL2 learners with a consistent interpretation problem when compared to the other two conditions (A-I and A-A). As an inspection of the means in Table 4 illustrates, in the latter conditions, first-noun choice increased with exposure and reached a plateau at around 80–90%. In the I-A configuration, however, first-noun choice never got higher than 70%. These data imply that although overall the JL2 children still showed a preference for first noun in spite of the adverse animacy condition, their tendency to choose it in the I-A condition was diminished relative to the other conditions.

In order to examine further the students' behavior in the I-A condition, we posed the post-hoc question of whether the performance of the children in just this condition varied as a function of exposure. For the two youngest groups, *t* tests against chance revealed that children in the K/1 and 2/3 grade groups performed at chance, $t(17) = 0.39$, n.s., and $t(23) = 0.76$, n.s.; however, children in the older groups appeared to favor first noun and perform above chance; 4/5 group: $t(20) = 3.46$, $p < .05$; 6/7 group: $t(26) = 4.27$, $p < .05$. This suggests that with exposure the effect of inanimate noun in first position on first-noun choice decreased; in other words, the children became a bit *less* Japanese-like because the strength of the contrasting animacy cue diminished.

Effect of Animacy on Canonically Case-marked Strings

We have established that for JL2 children canonical case marking has the overall effect of increasing the likelihood that they will choose first noun as

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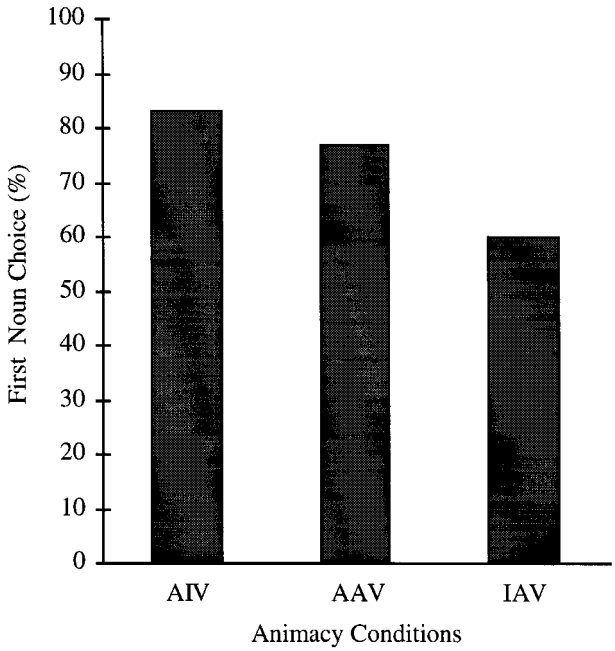


Figure 4. Effect of the controlled animacy conditions on percent first-noun choice in non-case-marked Japanese by grade groups (K/1, 2/3, 4/5, and 6/7).

agent when compared to performance on non-case-marked strings. In the previous section, we provided data showing that the animacy cue has an effect on which noun the learners choose as agent but that the differential effect of the various animacy cue conditions is similar over time. The likelihood of the learners choosing an inanimate noun as subject is greater than chance only in children older than third grade. We now turn to examine how the animacy cues interact with the word order and canonical case-marking cues. We propose the following hypothesis:

> Hypothesis 5: In canonically case-marked sentences, JL2 learners will choose the first noun as agent more often when it is an animate noun than when it is an inanimate noun.

This hypothesis examines the effect of the animacy contrast in canonically case-marked sentences, considering first-noun choice performance on A*ga*I*o*V sentences compared to first-noun choice in I*ga*A*o*V sentences. In the first condition, all possible cues—word order, case marking, and animacy contrast—converge on the choice of first noun as agent; in the latter condition, only word order and case marking converge on the choice of first noun as agent.

To test for significant effects of the animacy variable a 4×3 RM ANOVA

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Table 5. Effect of the animacy condition on percent first-noun choice in canonically case-marked (N*ga*N*o*V) strings

	Animacy condition					
	A*ga*A*o*V		A*gal o*V		I*ga*A*o*V	
Grade group	*M*	*SD*	*M*	*SD*	*M*	*SD*
K/1	.803	.190	.889	.198	.537	.364
2/3	.920	.129	.958	.113	.819	.240
4/5	.961	.068	.968	.100	.905	.239
6/7	.969	.063	.987	.065	.897	.206
All groups	.920	.113	.955	.119	.805	.262

was run, with the four grade groups (K/1, 2/3, 4/5, 6/7) and three animacy levels (A-I, A-A, I-A) as independent variables and the ratio of choosing the first noun as the subject to the total number of responses as the dependent variable.

Hypothesis 5 was supported. There were main effects for the animacy variable, $F(2, 170) = 25.177$, $p < .001$, and for the grade-group variable, $F(3, 85) = 11.51.$, $p < .001$, but these need to be interpreted in light of the significant interaction between the animacy variable and the grade-group variable, $F(6, 170) = 3.601$, $p < .005$. Follow-up analyses revealed that the K/1 grade group scores for percent first-noun choice were significantly lower for all conditions compared to the other grade groups (see Table 5).

In canonically case-marked sentences, when all cues converged on first-noun choice (i.e., in the cooperating animacy or A*gal o*V condition), the likelihood of the learners' choosing that noun as agent was very high for all grade groups (see Table 5 and Figure 5). However, the observed performance differential favoring these canonically case-marked A-I sequences over the canonically case-marked I-A sequences was greatest for the K/1 grade group. They essentially paid more attention to the competing animacy contrast cue relative to the other grade groups. An inspection of the means (see Table 5) indicates that, except for this one condition, percent first-noun choice was very high for all groups.

Effect of Animacy on Noncanonically Case-marked Strings

In addition to the findings regarding animacy noted above, we have already shown that case marking the first noun as object surprisingly results in the learners' choosing the first noun as agent as often as they do when it is marked as subject. This finding indicated that remarkably little of the information in the noncanonical case-marking cue was exploited by the learners. However, we wondered whether the combination of an animacy contrast favoring the second noun (I-A) combined with case marking the second noun (cooper-

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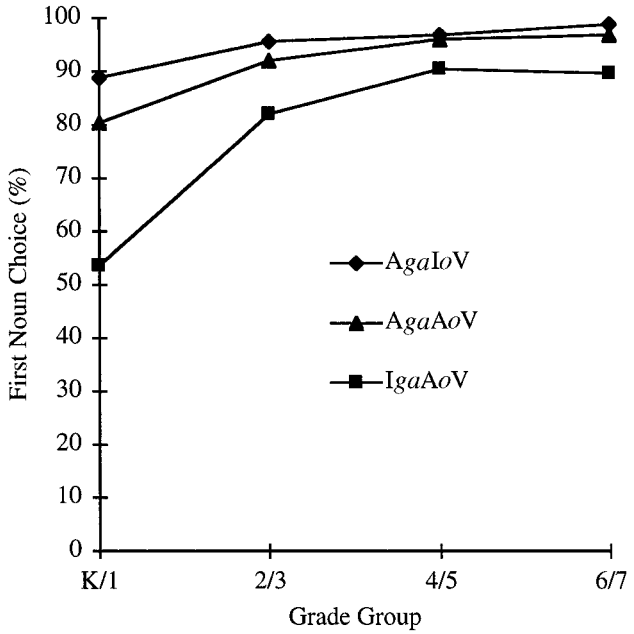


Figure 5. Effect of the animacy cue contrast on first-noun choice in canonically case-marked sentences: the cooperating animacy (A*ga*I*o*V) contrast, the reversible animacy (A*ga*A*o*V) condition, and the competing animacy (I*ga*A*o*V) contrast.

ating animacy) might at least reduce the children's reliance on the first-noun-as-agent strategy. We propose the following hypothesis:

> Hypothesis 6: In noncanonically case-marked sentences, JL2 learners will choose the first noun as agent more often when it is an animate noun than when it is an inanimate noun.

Hypothesis 6 examines the effect of the animacy contrast in noncanonically case-marked sentences, comparing percent first-noun choice when the animacy cue cooperates with the case marking (i.e., in I*o*A*ga*V sentences) to when the animacy cue competes with the case marking (i.e., in A*o*I*ga*V sentences). In the first condition, neither the animacy cue nor the case-marking cue converge on the choice of first noun; performance in this condition would test the strength of the word-order tendency in opposition to a coalescence of the other two cues. In the latter condition, the animacy contrast cue converges on the choice of first noun as agent, and the case-marking cue alone does not.

To test for significant effects of the animacy variable a 4×3 RM ANOVA was run, with the four grade groups (K/1, 2/3, 4/5, 6/7) and three animacy levels (A-I, A-A, I-A) as independent variables and the ratio of choosing the first

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Table 6. Effect of the animacy condition on first-noun choice in noncanonically case-marked (N*o*N*ga*V) strings

	Animacy condition					
	A*o*A*ga*V		A*o*I*ga*V		I*o*A*ga*V	
Grade group	*M*	*SD*	*M*	*SD*	*M*	*SD*
K/1	.746	.243	.867	.238	.467	.266
2/3	.923	.146	.925	.129	.575	.297
4/5	.932	.107	.943	.157	.676	.249
6/7	.951	.080	.938	.124	.808	.250
All groups	.897	.144	.921	.162	.645	.266

noun as the subject to the total number of responses as the dependent variable.

Hypothesis 6 was supported. There were main effects for the animacy variable, $F(2, 170) = 74.90$, $p < .001$, and for the grade-group variable, $F(3, 85) = 7.75.$, $p < .001$, but these need to be interpreted in light of the significant interaction between the animacy variable and the grade-group variable, $F(6, 170) = 3.30$, $p < .05$. Follow-up analyses revealed that the differences in performance occur in two places (see Table 6 and Figure 6). One of these differences pertains directly to the hypothesis under consideration: The oldest group of learners (grade group 6/7) chose the first noun in I*o*A*ga*V sentences more often than any other grade group (Tukey's HSD, $p < .05$). This suggests that after the fifth grade, even when the first noun is inanimate and marked as object, the learners chose it as agent significantly more often than any other grade group did. This represents a substantial move away from the expected development of ability to exploit noncanonical case marking. The other significant performance difference occurred as usual in the K/1 grade group, who chose the first noun as agent in the A-A condition significantly less often than the other grade groups did (Tukey's HSD, $p < .05$). We interpret this as further evidence of the youngest learners' not having settled on a clear first-noun-as-agent strategy, compared to the rest of the learners.

In summary, the weakest cue by far was noncanonical case marking, and it became significantly weaker over time. Even when the animacy contrast cooperated with the noncanonical case marking, the most experienced learners chose the other noun (i.e., the first noun) significantly more often than the other grade groups.

DISCUSSION

This study examined the acquisition of the relative strength of word order reliance, case-marking cues, and lexical semantic cues for the identification of agent by children learning Japanese in an immersion school environment. In

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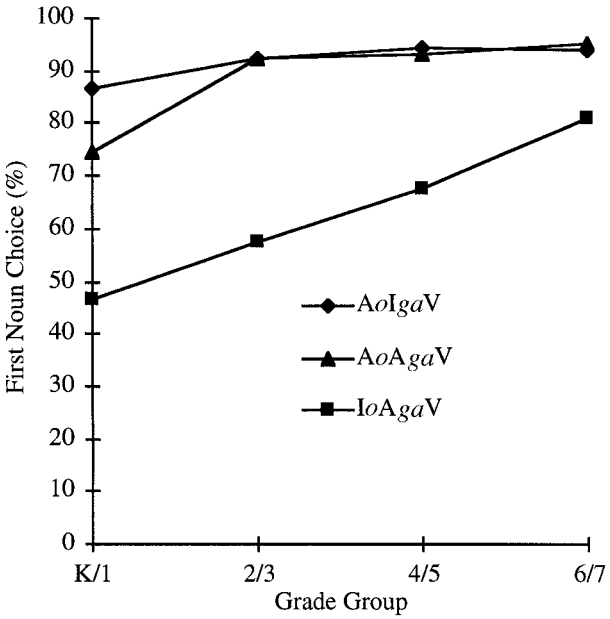


Figure 6. Effect of the animacy cue contrast on first-noun choice in noncanonically case-marked sentences: the cooperating animacy (I*o*A*ga*V) contrast, the reversible animacy (A*o*A*ga*V) condition, and the competing animacy (A*o*I*ga*V) contrast.

general we observe the overall cue hierarchy for these childern is: word order > semantics > case marking.

In the area of word-order reliance, we find that these child JL2 learners employ different strategies for interpreting reversible sequences of two nouns followed by a verb (i.e., AAV) in each of their two languages. For strings presented in Japanese they tended to choose the first noun as agent. For strings presented in English they tended to choose the second noun as agent. These results indicate that the second-noun-as-subject strategy reported for monolingual English L1 speakers (Bates & MacWhinney, 1981; Bates, McNew, MacWhinney, Devescovi, & Smith, 1982) is also robust for this population, suggesting a lack of any back transfer on their English word-order processing from Japanese. These findings are consistent with those of Liu, Bates, and Li (1992), who also found no back transfer in the highly differentiated interpretation systems for Chinese L1 children first exposed to English at around age 4. We note, for comparison, that as a group the JL2 immersion children's reliance on canonical word order in non-case-marked Japanese strings is slightly stronger (at 76%) than for adult native speakers of Japanese. The precise figure varies in the literature, but the rate of choosing first noun as agent in re-

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versible (AAV) strings has been reported as ranging from approximately 69% (Harrington, 1987; Sasaki, 1991) to approximately 47% (Kilborn & Ito, 1989) for adults.

Our findings regarding the strength of the learners' word-order dependency are consistent with prior research suggesting that learners transfer their dependence on word-order cues when interpreting L2 word strings (Kilborn & Ito, 1989; McDonald, 1987; Miao, 1981). Further, our findings support Kilborn and Ito (1989), who suggested that learners transfer a "meta-word-order" strategy because they do not employ the English L1 surface order that would assign an OSV interpretation to an NNV sequence. The learners we studied appear to transfer a general reliance on word order as an interpretive strategy, expecting that the first noun in a Japanese string will be the agent. However, it takes them approximately 2 years of exposure to rely on this interpretive strategy consistently.

The results we report for effect of case marking are somewhat unexpected. Both patterns of case marking (canonical and noncanonical) increased the likelihood of choosing the first noun as agent relative to no case marking at all. The strength of the case-marking cue achieved significance in the earliest grade group and did not change as a function of exposure. We are, however, concerned about the similarity of effect found for both patterns of case marking. The general developmental profile of increasing first-noun choice for canonically case-marked strings is consistent with our expectations for the effects of exposure for JFL learners (Sasaki, 1994) and with what is found for native-language children (Hakuta, 1982; Ito, Tahara, & Park, 1991). However, our finding that noncanonical case marking also improved first-noun choice performance was not expected. The present results are in sharp contrast to what has been found for other populations. Ito, Tahara, and Park (1991) tested Japanese L1 children on reversible animacy sentence types in which the second noun was case marked as agent but the first noun was non-case marked (i.e., AA*ga*V). As expected, the Japanese L1 children got more accurate at exploiting the information presented in noncanonical case-marked sentences over time (between first grade and seventh grade). For adult JFL learners, Sasaki (1994) reported that as their proficiency increased, they also depended increasingly on Japanese case markers that presented a noncanonical bias. Although we did not expect the JL2 immersion children to acquire the cue of noncanonical case marking at the same absolute age as native speaking children nor as quickly as adult foreign language learners, we anticipated finding some indication that their development was moving in the general direction of acquisition. We did not find it in this population.

Consistent with prior work (Gass, 1987; Sasaki, 1994), the present study found an effect for lexical semantics in Japanese. Cooperating animacy cues increased the likelihood that the child JL2 learners would choose the first noun as agent, and this effect for the animacy cue was consistent in each of the sentence types examined. When the animacy cue and the students' preferred word-order strategy cooperated (as in AIV and AAV strings), all the

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children were more likely to choose the first noun as agent than when these cues conflicted (as in IAV strings). However, the animacy cue was not strong enough to overcome the conflicting word-order cue—that is, taken as a group, the children chose the first noun as agent in IAV sequences 60% of the time. Interestingly, semantics is a stronger interpretation cue in Japanese strings than English strings. For example, in canonical IVA sentences presented in English (e.g., *The table pushed the girl*.) these same children chose the inanimate noun as agent more than 99% of the time.

Did we find any change in relative cue strengths as a function of exposure? Word order did not achieve its eventual cue strength until after first grade because these learners (i.e., the K/1 group) were significantly less sure about choosing the first noun as agent in all the sequences we tested them on. On the other hand, the JL2 learners never showed a preference for choosing the second noun in any I-A condition, which suggests that the animacy cue is never (except, perhaps, before the point at which we tested them) strong enough to overcome a reliance on the first-noun-as-agent strategy. Case marking of any type consistently across grade groups made a significant difference in the likelihood of choosing first noun. From the perspective of accuracy performance, this is problematic because it means that over time the child JL2 learners get better at interpreting canonically case-marked sentences but worse at interpreting noncanonically case-marked sentences. Therefore, in an attempt to capture this nontargetlike strength of the noncanonical case marking, we could slightly modify our hierarchy of cue strength for English speaking children learning Japanese as a second language as follows: (meta-) word order > semantics > canonical case marking > [noncanonical case marking?].

We are left with two findings to explain. First of all, this conclusion regarding the relative strength of the word order cue conflicts with Sasaki (1991, 1994) and Gass (1987), who argued that semantics is in general a stronger language interpretation strategy than syntax. In particular, for learning Japanese, Sasaki (1991) claimed that English L1 speakers are predisposed to look for the most basic sequence of words in the L2—which would be NNV—and assign a word-order–based interpretation to it, namely, SOV. This appears to be exactly what the immersion-school learners have done. He claimed, however, that "This attempt is doomed to fail in Japanese . . . , where the position of subject and object are frequently reversed" (p. 66), citing Kuno (1973), who reported an SOV : OSV ratio of 17 : 1 in Japanese newspaper articles. The argument is that this variation in word-order frequency ought to be enough to disrupt a reliance on word order. This has not happened for the immersion children. Secondly, we must attempt to account for the children's lack of development in terms of noncanonical case marking during the time frame of this study.

We suggest that an explanation for these unanticipated results can be found in how second language learners come to arrive at the appropriate weighting of cues. A wealth of studies (e.g., see Bates & MacWhinney, 1989) have suggested that for second language learners this process begins with cue

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weights in the second language that are close to those in their first language. Such findings are consistent with connectionist models of language learning that strongly rely on analogy and pattern generalization, thus predicting that all aspects in a first language that can transfer to a second language will transfer (MacWhinney, 1997). According to the model of cue strength acquisition proposed by McDonald (1987), second language learners can acquire cues not used in the first language, but this acquisition depends on the cue being frequently present and whether it "indicates the correct answer on misinterpreted sentences" (p. 411). Let us consider the first condition: frequently present. The target language input to these children is almost exclusively limited to their native-speaker teachers and to the various literacy-based materials they have available. A detailed study of their reading materials is needed, but a sampling of the naturally occurring classroom discourse at the immersion school under study indicated no occurrences of noncanonically case-marked sentences in 1460 teacher clauses. However, Sasaki (1994) argues that even if no OSV cases are provided, learners would still adjust cue strengths to account for the strength of case marking because of the high incidence of ellipsis in Japanese. Due to ellipsis, learners would be provided sufficient OV constructions to weaken the word-order processing strategy of "first noun is subject" (Sasaki, 1994, p. 67); SV strings would do the same for a "preverbal noun is object" strategy. Indeed, in the immersion-school sample, 20% of the teacher clauses contained only *-wa* or *-ga* (SV), another 5% were marked *-o* (OV), and only 2% were fully case-marked SOV.[15] Even so, the word-order processing strategy of immersion-educated learners does not appear to be weakened but strengthened.

The second condition in McDonald's model (i.e., indicating the correct answer on misinterpreted sentences) suggests the critical role of learners' misinterpretation in the adjustment of cue strength. In particular, she noted that learners provided with appropriate feedback are likely to be faster acquirers of second-language cue strengths. In immersion education, the majority of teacher input is addressed to the whole class or to small groups of students. Consequently, interpretation is often a group activity; for any one child there is bound to be a certain amount of "noise" or misconstrual of interpretation—some due to language, some due to attentional deficits, and some due to content. But rarely does correctness of on-line interpretation have critical consequences for any single individual. In these Japanese immersion classrooms, as has been noted in the French immersion classrooms (Swain, 1985), the teachers' role is primarily to instruct students in content areas. In the classes Swain reports on, in the classes observed in this immersion school, and perhaps in language classrooms in general (Pica, 1987), there are very few opportunities for students and teachers to engage in meaning-exchanging two-way interactions in the L2. Further, Pica suggests that "mutual comprehension is often built into classroom discourse" (1987, p. 12) because teachers are adept at decoding "formally imprecise or ambiguous" utterances. Thus, students are rarely in the situation of having to pay close attention to utterances di-

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rected solely to them, have few opportunities to initiate their own meaning, and therefore have few opportunities to realize that they have misinterpreted. Strategies that work for general comprehension, broadly based on lexical semantics coupled with the high probability of certain word orders, may work fine for the most part. However, children in immersion classrooms are infrequently provided with opportunities to be critically confronted by their syntactic deficits, and herein may lie the reason for their not adjusting cue strength in line with native speakers.

The behavior of the JL2 children with respect to case marking is in sharp contrast to the behavior of adult learners who have been the subjects of prior studies (Sasaki, 1994) and who have shown an increasing sensitivity to case marking as a function of proficiency. However, it should be recalled that Sasaki's subjects were university-level JFL students. In the usual high school and university-level Japanese-language curriculum, students are provided with explicit and frequent instruction on the function of case markings from a very early point (Doi & Yoshioka, 1990; Yagi, 1992). In particular, it should be noted that, although the object is unambiguously marked, exploitation of *-wa* and *-ga* involves complexities that challenge even university-level JFL learners (Tomita, 1997). These immersion students, on the other hand, had not received any explicit instruction regarding the function of these or the other Japanese particles by the end of the seventh grade, which was the highest grade in the program at the time of testing. It may be that these learners also need the assistance of attentional focus on form (although not necessarily rules) to initiate a resetting of the first-language cue strength of syntactic word order. One of the researchers (RK) notes that when she was a student in a Japanese elementary school, case marking was often corrected in compositions, suggesting that, even in native language development, case marking must be explicitly focused on; further research in this area is needed. If this should indeed be the normal situation for L1 acquirers of Japanese and, given the work of Ito, Tahara, and Park (1989, 1991, 1993), who note that even they did not fully exploit the case-marking system until seventh grade (after 12 years of exposure to Japanese), it would seem overly optimistic to assume that L2 immersion-school children who have been exposed to much less input, with far fewer personal communicative consequences, could acquire the system in the same time frame. Perhaps the time slice of this study only permits us to capture the period during which some sensitivity to animacy is active and during which the cue of case marking is being acquired but not differentiated by function.

CONCLUSION

The present study has attempted to find evidence for how learners come to sort out the players in the discourse they are exposed to. We wanted to know if, over time, they would come to appropriately exploit the semantic and syntactic information coded in their second language to determine whether "dog bites man" or "man bites dog." They passed the test only when the agent was

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in the expected place. But perhaps the bar was set too high. In any reasonably fair world we would have to agree that a more protracted period of development is needed to conquer the critical conflict validity weighting of noncanonical case marking.

Nevertheless, we might wonder if—without explicit instruction—these learners would ever come to consider the possibility that these post-positional particles function as they do in Japanese. Taking a typological perspective, English is a relatively unusual language because the word-order rule is so rigid (Bates & MacWhinney, 1981; Givón, 1979a). Further, Givón (1979b, 1985) notes that such a syntax-based system is cognitively more sophisticated because it is developmentally derived from a more "rudimentary" pragmatics-centered communicative system. Dryer (1996) has suggested that word-order languages like English have an extra rule that, in a sense, supersedes the interpretive contributions of factors like semantics and case marking. Speakers of word-order languages attempting to learn typologically different languages have to learn to cut back from this reliable syntactic rule to a dependence on developmentally basic lexical semantics or more localized morphology. The performance of the child JL2 learners seems to indicate that this "cutting back" has not occurred with up to 7 years of exposure to Japanese, and it simply may not be achievable on the basis of exposure alone.

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NOTES

1. The term "actor" represents an extension of the semantic notion "agent" to include other argument noun phrases that are not strictly agents but that pattern like agents for grammatical purposes. An actor is an argument noun phrase having the highest degree of independent action in the clause.

2. Kuno (1973) points out that a perfectly fine English transitive sentence such as *The typhoon broke the window* is ungrammatical in Japanese, which requires an intransitive verb, case marking *typhoon* as instrument and *window* as subject. This would yield a translation such as "Due to the typhoon, the window broke" (p. 31).

3. Some linguists prefer to use "theme" here instead of "patient" but this distinction is the subject of much debate. Here it is used to denote the second argument of a two-argument verb; that is, the relatively more dependent argument.

4. Second-noun strategy is the term used to refer to the tendency of native English speakers to choose the second noun as agent in noncanonical sentence configurations such as *the girl the grandfather pushes* and *pushes the girl the grandfather*. In both cases English native speakers identify the grandfather as the one who pushes.

5. At the time of testing, seventh grade was the highest grade in this immersion school. Each year the school adds a grade, so the seventh graders represent the first students to enter the program.

6. It would be preferable to have some independent measure of language proficiency that would make it possible for us to more directly compare these learners and those reported on in the adult JFL studies. Unfortunately, we do not know of the existence of any standardized test of Japanese as a second or foreign language. Neither do we know of any test that has been shown to test children and adults reliably.

7. This procedure differs from the way such studies have been carried out. Previous studies have either asked children to act out actions using small toys (e.g., Bates et al., 1984) or have asked adults to say out loud the noun they interpreted to be the subject or agent of the action described by the verb (e.g., Sasaki, 1991). Given that we were looking at eight grade levels, we needed to create a protocol that would be familiar to school children (as is a paper and pencil test), that would be suitable for children in a wide age range, and that would facilitate testing with larger numbers of

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subjects than is usual in such studies. Subsequent act-out testing with a sample of the same students (Sato, 1997) found results very similar to what is reported here, so we are confident that we have results that are comparable to previous studies.

8. We did not test for the effect of stress because we wanted to limit the length of the test, given that children have relatively short attention spans. Also, Harrington (1987) found no effect for stress for either Japanese or English speakers in their native languages.

9. We did not present other possible word-order possibilities in order to control the length of the test.

10. Normally *-ga* is the nominative case marker and *-wa* is a topic marker. Extensive observation of classes indicated that students appeared to prefer *-wa* as a subject marker. Sato (1997) found that in a production test when she used *-ga* students almost uniformly repeated her sentence inserting *-wa*. We included both forms and found that students performed identically. For exaple, of the 10 items on which the students achieved 80% accuracy performance, 6 were *-wa* marked and 4 were *-ga* marked.

11. The direct form is the simplest form of the Japanese verb and includes no politeness markers.

12. The verb *ojigisuru* "bow" was used only in non-case-marked NNV strings. (The second noun in such sentences is normally marked with *-ni* rather than *-o*; however, the task for the subjects remained the same: to identify which noun is agent.)

13. Recall that only grades K–5 took the English test. In order to do this cross-language comparison, Japanese data for four subjects had to be removed.

14. Remember that we indicated in the prior section that their performance is random for the non-case-marked strings.

15. Further analysis of the immersion-school teacher input is clearly called for. It would also be useful to know, for example, more about non-case-marked sentences, given that female speakers are more likely to delete case markers than men (Shibamoto, 1985) and that all the immersion school teachers are female.

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APPENDIX

LEXICAL ITEMS IN THE ENGLISH STRINGS (AND THEIR JAPANESE COUNTERPARTS)

Verbs	see [miru]; touch [sawaru]; push [osu]; bow [ojigisuru]
Animate Nouns	the boy [otoko no ko]; the girl [onna no ko]; the grandmother [obaasan]; the grandfather [ojiisan]; the horse [uma]; the dog [inu]; the rabbit [usagi]; the ogre [oni]
Inanimate Nouns	the tree [ki]; the desk [tsukue]; the car [kuruma]; the chair [isu]; the carrot [ninjin]

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