Cognition, 9 (1981) 197–236

Grammatical description *versus* configurational arrangement in language acquisition: The case of relative clauses in Japanese*

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Abstract

The description of sentence complexity in terms of grammatical relations or in terms of configurational properties of their surface structure is a basic issue in developmental psycholinguistics. The problem has been investigated in English, but these studies provide little insight because of the peculiar properties of word order in the language. A series of experiments with Japanese children is reported in which the configurational demands of the sentence are shown to be the critical factor.

Sentences can be described with respect to the grammatical roles of their constituents, or in terms of the linear arrangement of the words. The extent to which the parameters specified by these alternative conceptions constrain children's language is important in determining the nature of the preparedness with which humans begin the task of language acquisition. Although the question arises in all aspects of investigation in syntactic development, it has perhaps been most explicitly asked in the study of relative clauses.

In this paper, I will first provide a general characterization of relative clause structures. This will be followed by a brief review of studies on relative clause comprehension with children in English, where it will be shown that the evidence is inconclusive on both empirical and theoretical grounds. The argument between views emphasizing grammatical description *versus* linear

*This research was supported by the Peter B. Livingston Fellowship Fund of the Harvard Medical School, NSF Grants BNS73-09150 and GSOC73-09150 to Dr. Roger Brown, and a dissertation fund from the Department of Psychology and Social Relations, Harvard University. I would like to thank Roger Brown, Jill and Peter de Villiers, Haj Ross, Helen Tager-Flusberg, Steven Pinker, and two anonymous reviewers for helpful comments and discussion. Even more, I would like to thank my mother, Emiko Hakuta, for assistance in collecting the data and for general wisdom. Finally, thanks are due to Mr. Yokoyama, Ms. Asami, Ms. Toi, Ms. Abe, and other staff of the day care center where this research was conducted.

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arrangement is best resolved in languages where word order is flexible, one such language being Japanese. Thus, a series of experiments with Japanese children will be reported in which the two variables are independently manipulated. Across all experiments, in both comprehension and production, the surface configurational properties of sentences are shown to be the critical parameter.

Logical possibilities of sentences with relative clauses

Relative clauses consist of a head noun and a relativized sentence. The head noun has a co-referent within the relativized sentence from which, linguistically speaking, it has been extracted. The head noun, placed external to the sentence, can come in two positions, either before or after the relativized sentence, sketched as follows:

(a) HEAD NOUN [RELATIVIZED SENTENCE]
(b) [RELATIVIZED SENTENCE] HEAD NOUN

Since these complex noun phrases are embedded within sentences, a description of how they interact with the matrix sentence is also called for. Greenberg (1963) has noted that an overwhelming majority of the world's languages place the subject before the object in the basic underlying order. This is a strictly statistical generalization, with exceptions such as Tagalog (Schachter, 1976), but for present purposes, we will assume it be a universal fact. This leaves us with three logically possible basic orders: Subject–Verb–Object (SVO), Subject–Object–Verb (SOV), and Verb–Subject–Object (VSO). These are in fact very common basic orders among the world's languages.

Since the matrix role of the complex noun phrase can be either Subject or Object (Subject Matrix and Object Matrix), the interaction of the language type (SVO/SOV/VSO) with the matrix role (Subject Matrix/Object Matrix) and head noun position (HN[*RS*]/[*RS*]HN) creates a variety of different sentence configurations, appearing in Table 1. The sentence configurations in which the [*RS*] element is flanked on both sides by other constituents are the center-embedded sentences, while those with [*RS*] at the beginning or the end of the string are referred to as left-branching or right-branching. As it turns out, the world's languages are not evenly distributed in the grid. The majority of SOV languages have the [*RS*]HN head noun position, while VSO languages have the HN[*RS*] position (Greenberg, 1963; Lehmann, 1973). Kuno (1974) gives an account of this universal, derived from the fact

Table 1. *Logical possibilities of sentence configurations as a function of the basic order of the language, the matrix role of the complex noun phrase, and the position of the head noun*

Basic order	Matrix role	Head noun position	
		N[*RS*]	[*RS*]N
SVO	Subject Matrix	N[*RS*]–V–N	[*RS*]N–V–N
	Object Matrix	N–V–N[*RS*]	N–V–[*RS*]N
SOV	Subject Matrix	N[*RS*]–N–V	[RS]N–N–V
	Object Matrix	N–N[*RS*]–V	N–[*RS*]N–V
VSO	Subject Matrix	V–N[RS]–N	V–[*RS*]N–N
	Object Matrix	V–N–N[RS]	V–N–[*RS*]N

Table 2. *Logical possibilities of complex noun phrase configurations as a function of the basic order of the language and the position of the head noun*

Basic order	Focus	Head noun position	
		N[*RS*]	[*RS*]N
SVO	Subject Focus	S[*VO*]	[*VO*]S
	Object Focus	O[*SV*]	[*SV*]O
SOV	Subject Focus	S[*OV*]	[*OV*]S
	Object Focus	O[*SV*]	[*SV*]O
VSO	Subject Focus	S[*VO*]	[*VO*]S
	Object Focus	O[*VS*]	[*VS*]O

that center-embedding reduces the comprehensibility of sentences (e.g., Miller, 1962; N. Chomsky, 1961). Thus, the tendency for languages is to seek the head noun position that would result in a lower probability of ending up with center-embedded structures. Antinucci *et al.* (1979) also provide a perceptually-based explanation for facts about the diachronic change in relative clause structure.

In addition to a consideration of the relative clause position in the matrix sentence, however, a thorough investigation must explore the implication of the string of elements within the relativized clause and its interaction with matrix role. Assuming that the basic order of the sentence is preserved in the relative clause, SVO, SOV and VSO will yield different configurations depending on (1) whether the subject or the object noun phrase is relativized, and (2) whether the head noun comes before or after the relativized clause. The logical possibilities resulting from this combination are outlined in Table

Table 3. *Configurations of nouns and verbs as a function of the basic order of the language, the position of the head noun, the matrix role and head noun focus*

Basic order	Sentence type	Head noun position	
		N[*RS*]	[*RS*]N
SVO	SS	N[*VN*]–V–N	[*VN*]N–V–N
	SO	N[*NV*]–V–N	[*NV*]N–V–N
	OS	N–V–N[*VN*]	N–V–[*VN*]N
	OO	N–V–N[*NV*]	N–V–[*NV*]N
SOV	SS	N[*NV*]–N–V	[*NV*]N–N–V
	SO	N[*NV*]–N–V	[*NV*]N–N–V
	OS	N–N[*NV*]–V	N–[*NV*]N–V
	OO	N–N[*NV*]–V	N–[*NV*]N–V
VSO	SS	V–N[*VN*]–N	V–[*VN*]N–N
	SO	V–N[*VN*]–N	V–[*VN*]N–N
	OS	V–N–N[*VN*]	V–N–[*VN*]N
	OO	V–N–N[*VN*]	V–N–[*VN*]N

2. There are two noteworthy interactions in Table 2. First, the order of the noun and verb within the relative clause depends on the interaction between the basic order of the language and the focus. Thus, for SVO languages, the order for subject focus is [*VN*], but it is [*NV*] for object focus. On the other hand, for SOV and VSO languages, the order remains constant: [*NV*] for SOV languages and [*VN*] for VSO languages. Second, whether the order of subject preceding the object is preserved or not depends on the interaction between focus and the position of the head noun. For all three basic language orders, the subject-before-object order is preserved in subject focus when the head noun is to the left of the relative clause. The order is preserved in object focus when the head noun is to the right of the relative clause.

Now, putting together the two logical possibilities for embeddedness as a function of the matrix role and focus, we end up with Table 3. The point of the table is that a variety of sentence configurations are possible for any given sentence type depending on the basic order of the language and the position of the head noun. It serves to place in context the present line of research to be described, which was intended to help clarify issues raised by research conducted on the four sentence configurations in the uppermost left corner of the table, representing English. The following section describes the logic underlying the studies of relative clause comprehension in English-speaking children, and the results obtained.

Relative clauses in English-speaking children

English is an SVO language, with the head noun of relative clauses on the left. The following are examples of the four logically possible sentence types in English (where the first letter refers to the grammatical role of the complex noun within the matrix sentence, and the second letter refers to the role of the head noun within the relative clause):

(SS) The duck [*that licked the frog*] bit the pig.
(SO) The duck [*that the frog licked*] bit the pig.
(OS) The duck licked the frog [*that bit the pig*].
(OO) The duck licked the frog [*that the pig bit*].

These four sentence types have been the center of some controversy recently over what the variables are that determine their psychological complexity for children.

The controversy exists at both the theoretical and empirical levels. Theoretically, the explanations that have been proposed can be divided into two distinct classes depending on their assumptions. One class bases itself on the assumption that the grammatical description of the sentences is the important variable determining their relative complexity. This view takes the grammatical role of the variables involved in these sentences, namely the matrix role and the focus, to be the determining factor. The surface representation of these sentences is seen as not relevant. The second class of explanations homes in exactly on the factors considered irrelevant by the grammatical description viewpoint, namely the configurational properties of constituents in the surface structure of sentences. Under this view, the grammatical description of a sentence is seen as a useful summary of the ingredients that go into yielding configurational features of the sentence. While theories based on grammatical descriptions would make predictions for cross-linguistic validation that are universal for the four sentence types, theories based on the configurational properties of sentences would make predictions that are based on an interaction between these grammatical descriptions and the typological characteristics of particular languages as outlined in Table 3, since this interaction determines the configurational properties of the sentences. On the empirical level as well, there has been an alarming discrepancy in the results obtained across the several studies in English. I will describe below the nature of both the theoretical and the empirical controversy and show how the issue can be resolved, naturally, through an investigation of Japanese.

Sheldon (1974), who is the major proponent of the view emphasizing grammatical description as the variable underlying complexity, has argued

that the primary determinant of complexity for these sentences is whether the grammatical functions of the two variables that define them are the same or different. Under Sheldon's Parallel Function Hypothesis, sentences are easier to comprehend when the grammatical function of the head noun within the relative clause and the grammatical function of the complex noun phrase within the matrix sentence are the same than when they are different. Thus, SS and OO sentences should be easier than OS and SO. Apparently, the theoretical motivation underlying Parallel Function is that it constitutes a significant linguistic generalization not just for relative clauses, but also for pronominal co-reference and coordination reduction (Sheldon, 1974).

Another reasonable prediction that assumes the importance of the grammatical description of the sentences is based on Keenan and Comrie's (1972) accessibility hierarchy of noun phrases from relative clauses. After surveying over 40 languages, the authors report a hierarchy in which languages allow relativization of noun phrases. The hierarchy is: Subject, Direct Object, Indirect Object, Object of Preposition, Possessive Noun Phrase, and Object of Comparative Particle. Reading this hierarchy from left to right, any language that allows accessibility of a given noun phrase in the hierarchy will also allow accessibility of all noun phrases to the left of it. Thus, if a language allows an Object of Preposition to be relativized, then it will also allow Subject, Direct Object, and Indirect Object. Some languages, such as Tagalog, only allow the Subject. This putative universal assumes an important role for developmental psycholinguistics if, as some have speculated, universal rules should appear earliest in children's language (e.g., Ross, 1973; McNeill, 1966). Keenan (1975) has expressed his own interest in the relevance of his hierarchy for adult language performance by investigating the relative frequencies of the various members of the Accessibility Hierarchy in written English. It would be a natural extension of Keenan's investigation to see if children will find relative clauses more difficult as they move down the hierarchy. With reference to the four sentence types mentioned earlier, then, the Accessibility Hypothesis would predict the Subject Focus sentences (SS, OS) to be easier than the Object Focus sentences (SO, OO).

There are several competing explanations for the relative complexity of these sentences that take into account their configurational properties to varying extents. One account (Slobin, 1973), consonant with data from spontaneous speech production and imitation of relative clauses by children, considers sentences with interruption of the main clause to be more difficult than those without interruption. Thus, the center-embedded SS and SO should be more difficult than OS and OO, which are right-branching. The difficulty with center-embedded sentences is presumably predicted owing to the heavy load placed on memory by the interruption of the main clause. As

Sheldon (1974) points out, however, most studies on center-embedded sentences with adults concerned multiple center-embedded structures, which are considerably more difficult than single center-embeddings. However, it is possible that for children, even a single center-embedding would cause difficulty. This will be called the Embeddedness Hypothesis.

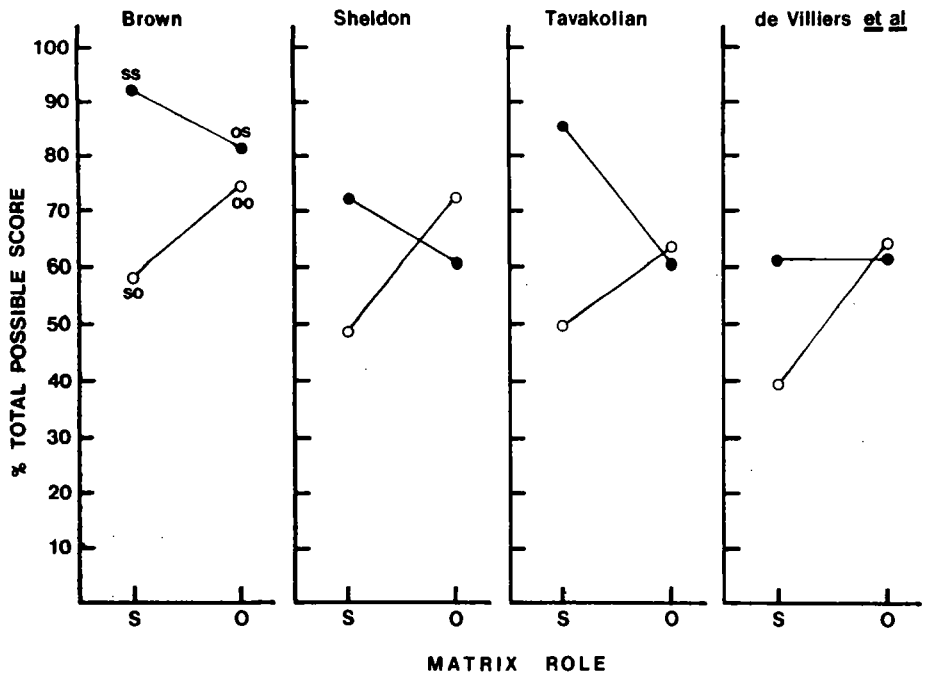
Smith (1974) proposes an explanation that is yet closer to the configurational properties of each sentence. His hypothesis is based on whether the sentences correspond to Bever's (1970) Noun–Verb–Noun (NVN) strategy, in conjunction with the Minimal Distance Principle (MDP) (C. Chomsky, 1969). The MDP was originally proposed by Chomsky to account for children's comprehension of sentences with complementizers, but can be extended to relative clauses where constituents are "missing". The MDP claims that when children find a missing noun phrase, they will assign the most recent noun phrase to its location. Smith's NVN/MDP Hypothesis predicts that OS should be easiest since NVN applies to the initial segment, and the MDP assigns the second noun of that sequence as subject of the remaining VN, yielding the correct interpretation. On the other hand, NVN correctly interprets the initial segment of SS, but MDP incorrectly assigns the second noun as the subject of the remaining VN. The NVN strategy correctly interprets the initial segment of OO sentences as well, but MDP does not apply. Since MDP mis-applies for SS and fails to apply to OO, it is not possible to predict differences between the two, but both should be more difficult than OS. And finally, the most difficult should be SO, since neither NVN nor MDP can apply.

Tavakolian (1978) proposes what I see as an even more local explanation based on the configurational properties of the sentences. She predicts that children will interpret these sentences as if they were conjoined. Her predictions work well for SS and OS, both of which have the configuration NVNVN. These configurations could be interpreted by the child as having the conjoined structure NVN-and-VN. For SS, the sentence *The iguana that bit the tortoise kissed the pigeon*, would be perceived by the child as *The iguana bit the tortoise and kissed the pigeon.* For SS, the sentence *The squirrel hit the lizard that kissed the snail* would be perceived as *The squirrel hit the lizard and kissed the snail.* A conjoined interpretation would yield the correct response for SS but would cause an erroneous interpretation of OS. Tavakolian does not make explicit the implications of conjoined clause analysis for the other two configurations SO and OO, her only claim being that the conjoined clause analysis would not apply well to these sentences.

The data relevant to the predictions outlined above can be found in studies by H.D. Brown (1971), Sheldon (1974), Tavakolian (1978) and de Villiers *et al.* (1979). With the exception of Brown's study, the studies used an

act-out comprehension procedure using toy animals. Brown used a picture-cued comprehension paradigm, where the child was asked to choose one of two possible pictures depicting the appropriate action. The results of each study are displayed in Fig. 1, with Subject and Object Focus sentences plotted separately, and the Matrix Role on the abscissa. The dependent measure is the percent of total score. For the act-out comprehension studies, since a breakdown of the response types was available in the published tables, the percentage of correct acting out of individual clauses out of the total number of clauses (two per sentence) was calculated for each sentence type. For H. D. Brown's (1971) study, the measure is what he reports, namely the percentage of correct picture choice, for which chance level is 50%.

Figure 1. *Summary of comprehension data from four English studies on SS, SO, OS and OO. Closed circles represent subject focus, open circles represent object focus. Sentence type is determined in conjunction with matrix role represented on abscissa. Measure for H. D. Brown's study is per cent of correct choice of picture, where chance is 50%. For other studies, measure is per cent of individual clauses acted out correctly. Adapted from H. D. Brown (1971), Sheldon (1974), Tavakolian (1978) and de Villiers* et al. *(1979).*



Although at first glance the results across the studies appear consistent, a close examination reveals that the only common finding is that SO is poorly comprehended. This result can be construed as evidence for all the hypotheses outlined above: it is not parallel function, it is object rather than subject focus, it is center-embedded, it is not amenable to NVN and MDP, and it cannot be interpreted as a conjoined structure! Leaving SO aside, the following observations can be made:

1. SS is easier than OS in Brown (1972), Sheldon (1974) and Tavakolian (1978), but they are equivalent in de Villiers *et al.* (1979).
2. OO is easier than OS in Sheldon, OS is easier than OO in Brown, and they are about equivalent in Tavakolian and in de Villiers *et al.*
3. SS is easier than OO in Brown and in Tavakolian, but they are equivalent in de Villiers *et al.* and in Sheldon.

The fact that such inconsistencies exist across these studies is quite disturbing, to say the least. Sheldon, Tavakolian and de Villiers *et al.* all used *identical methodology and highly similar lexical items*, in fact all used animals. The subject populations appeared comparable.

The Parallel Function Hypothesis finds strong support in Sheldon's own data, since she finds equally good comprehension of SS and OO, and poor comprehension of OS and SO. The data of Tavakolian and of de Villiers *et al.*, however, are not particularly supportive. In both these studies, there is roughly equal performance on OS as on OO. In addition, in Tavakolian's data, the discrepancy between SS and OO is very large, which Parallel Function cannot explain. H. D. Brown's data are quite contradictory to Parallel Function's predictions, where OS is better comprehended than OO.

The Embeddedness Hypothesis is embarassed by the fact that in all but the de Villiers *et al.* data, SS is better than OS. This also embarasses the NVN/MDP Hypothesis, which makes the same prediction. However, the latter's redeeming feature is that it explicitly predicts poor performance on SO. This prediction is supported by all studies.

The Conjoined Clause Hypothesis predicts successfully that SS would be better comprehended than OS, supported in Brown, Sheldon and Tavakolian. It does not make any predictions about the relative difficulties of SO and OO, however.

Given such a conflicting array of data, surely no single hypothesis will account for all the data. However, a reasonable account might be formulated from the Conjoined Clause Hypothesis, which successfully accounts for SS being superior to OS, and the NVN/MDP Hypothesis, which accounts for SO being the most poorly comprehended. The Conjoined Clause Hypothesis was

originally formulated by H. D. Brown (1971). He wrote, "the fact that [SS] was apparently easier than [OS] may be explained by the fact that in [SS] the first subject can also correctly act as the subject of the second verb, as in a sentence with a single subject and a compound verb, making it easier for the child to perceive the relationship expressed" (pp. 1931–2). Tavakolian (1978) saw the implications of this in accounting not just for good performance on SS but also for the errors in interpreting OS. The Conjoined Clause Hypothesis accounts well for the superiority of SS over OS. It might be described in more general terms as the child automatically assimilating a given input sentence into a structure that s/he already knows. It so happens that the conjoined clause is a good interpretation for a string with the structure NVNVN, for English, at least.

When it comes to OO and SO, however, the conjoined clause is not a good match with the sentence configurations, and there is no reason to expect the child to force such an interpretation on these configurations. In the case of OO, the sequence NVNNV can be interpreted as an initial NVN segment with an additional NV remaining. We would expect the child to perform quite well on this sentence because the initial NVN sequence is straightforward. For the remaining NV sequence, given that the child correctly interprets the fragment as agent-action, the chance of finding the correct patient is 50%. This is the same argument as would be made for SS and OS, except that in those cases, the missing noun phrase is the subject of a sequence VN. If there were no conjoined clause interpretation, OO should be on an equal footing with SS and OS. However, the conjoined clause interpretation pushes SS upwards and OS downwards on the scale of probability for correct responses, leaving OO in between. And finally, for SO, no existent interpretation is readily available to the child, and so we do not expect good performance.

This explanation, which we will call the Configuration Hypothesis, is a more general hypothesis of which Tavakolian's Conjoined Clause Hypothesis and Smith's NVN/MDP Hypothesis might be considered special cases. The Configuration Hypothesis essentially predicts the same results as Parallel Function, except that it distinguishes between SS and OO and between OS and SO, while Parallel Function does not. But even if the two hypotheses were not confounded in English, it would not be terribly meaningful to pursue the validity of these hypotheses with further studies until some account of why the data across the various studies are so inconsistent with each other. It is entirely possible that, had a double-blind procedure been used, we would not be worrying over the problem presently.

The Parallel Function falls under the general category of explanations that looks towards the grammatical description of the sentences as the variables

predicting sentence complexity. The Configuration Hypothesis, on the other hand, seeks to explain sentence complexity in terms of the configurational properties of the sentence, which is a function of the parameters of language described at the beginning of this section. Referring back to Table 3, it is possible to see how, by looking at other languages, the two hypotheses can be unconfounded. I am proposing to determine the correct account for English by testing the assumptions underlying the hypotheses in other languages. The study of both SOV and VSO languages is important. Taking a VSO language with the head noun to the left of the relative clause (bottommost left corner of the table), OS and OO are right-branching while SS and SO are center-embedded. Now, taking an SOV language with head noun on the right of the relative clause, SS and SO are now left-branching while OS and OO are center-embedded. Notice that the sentence type that ends up with the center-embedded configuration shifts depending on the basic order of the language. For VSO, SS and SO are center-embedded, while for SOV, OS and OO are center-embedded. Thus, if grammatical description of sentences were important in predicting sentence complexity, then cross-linguistically, sentence type should have an effect regardless of the particular configuration that the given type takes in a given language. On the other hand, if configuration were important, one expects variation of complexity for a given sentence type across languages depending on the configuration that it takes, such as center-embeddedness.

It turns out that English is a particularly bad language from the viewpoint of teasing apart the appropriateness of grammatical description and sentence configuration. There is an inherent confounding of these two descriptions because of the rigid word order required by English to signal the grammatical functions of constituents. Given a grammatical description, the configuration of the sentence is determined. The present study unconfounds these explanations by looking at an SOV language, Japanese.

Relative clauses in Japanese: experiment one

Unlike English, where word order determines the grammatical role of nouns in a sentence, Japanese signals grammatical role through postpositional particles. Thus, although the predominant, canonical order of a sentence is Subject–Object–Verb (SOV), that order is free in the sense that word order is not essential for assigning grammatical role. The major constraint on word order in Japanese is that the main verb must be sentence-final (Kuno, 1973), but even this constraint can be violated through dislocation of a constituent to the right of the verb.

Table 4. *Complex Japanese sentences with relative clauses in both SOV and OSV orders*

Sentence type	Order	
	SOV	OSV
SS	[*N-o V*] N-ga N-o V	N-o [*N-o V*] N-ga V
SO	[*N-ga V*] N-ga N-o V	N-o [*N-ga V*] N-ga V
OS	N-ga [*N-o V*] N-o V	[*N-o V*] N-o N-ga V
OO	N-ga [*N-ga V*] N-o V	[*N-ga V*] N-o N-ga V

Linguists working in Japanese have not explicitly worked out the full implications for meaning of the word order change, but in general, it is considered an optional rule analogous to extraposition in English. N. McCawley (1976) formulates the word order change in terms of Ross's (1967) "scrambling rule" for Latin, which simply interchanges the position of noun phrases under the condition that it is postcyclic. One important function of the scrambling rule in Japanese, as N. McCawley (1976) points out, is to make multiple center-embedded sentences comprehensible.

Since Japanese is a language with flexible word order, it allows for more than one configuration for each sentence with a given grammatical description. Thus, taking the middle row of the right column in Table 3 representing Japanese, each of the four sentence types which are represented in the SOV order there can take the OSV order, which yields a different configuration. Thus, within a language like Japanese, it is possible to unconfound grammatical description from sentence configuration. It is ideal when these factors can be separated out within a language rather than across languages, since languages can differ in so many ways other than the critical variable one is attempting to isolate.

The possible sentences in Japanese are listed in Table 4. The configurations on the left column are the same as those representing SOV/[*RS*] N in Table 3, with particles added. On the right column are the configurations that result when the sentences on the left column are in the OSV order. It should be pointed out that the only syntactic cue indicating relativization in Japanese is the constituent order, since there are no relative pronouns in Japanese. There is generally a slight pause following the head noun, although I am not aware of any systematic attempts to outline such prosodic cues in Japanese. The grammatical functions of the different nouns in a sentence containing a complex noun phrase are signalled, as in simple sentences, through particles. The particle on the head noun of the relative clause signals the role of the complex noun phrase within the matrix sentence. Thus, the

role of the head noun within the relative clause is signalled solely by the particle on the noun phrase within the relative clause. If that noun is marked by -ga, then the head noun is the object. If it is marked by -o, then the head noun is the subject.

The sentences in Table 4 have interesting properties that help unconfound the variables of grammatical description and sentence configuration. If grammatical description were important, one would not expect there to be any variation in performance as a function of the different configurations that each sentence type takes. On the other hand, if configurational factors were important, then we would expect differential performance for each sentence type with respect to the configuration. Specifically, OS/SOV, OO/SOV, SS/OSV and SO/OSV are center-embedded, and they all have a sentence-initial NNV sequence which mimics the simple sentence and could lead to an erroneous interpretation of the sentence. The NNV sequence for the respective sentences take the following forms:

OS/SOV	*N-ga N-o V* ...
OO/SOV	*N-ga N-ga V* ...
SS/OSV	*N-o N-o V* ...
SO/OSV	*N-o N-ga V* ...

As can be readily seen, OS/SOV mimics the SOV simple active sentence, while SO/OSV mimics the OSV simple active sentence. Previous experiments with simple sentences (Hakuta, 1977) showed that children found the SOV order easier to comprehend than OSV. Thus, the prediction was that the tendency to choose the first noun as the agent would be strongest for OS/SOV and weakest for SO/OSV. In addition, for all the sentences, it was predicted that the first two nouns would be erroneously interpreted as involved in a relationship, and that the trend would be towards interpreting the first noun as the agent in all the sentences.

The left-branching sentences, SS/SOV, SO/SOV, OS/OSV and OO/OSV do not present possibilities for such erroneous interpretations. Thus, a prediction based on considerations of configurational properties of the sentences predicts superior performance on the left-branching over the center-embedded sentences. Sheldon's Parallel Function Hypothesis would predict better performance on SS and OO over OS and SO, independent of whether they are in the SOV or OSV order. The hypothesis could tolerate a main effect for word order, but it would be embarassing to the hypothesis if there were an interaction between sentence type and the word order of the sentence. More generally, such an interaction would be problematic for any theory of complexity based on the grammatical description of the sentences.

In addition to the above predictions, it was hypothesized that there would still be a main effect for word order. SOV should overall be better comprehended than OSV, as was found for the simple sentences.

Finally, the Accessibility Hierarchy Hypothesis can be tested by assessing whether Subject Focus sentences are better comprehended than Object Focus sentences. It provides a particularly critical test of the hypothesis since in Japanese, Object Focus takes the [SV] O order while the Subject Focus takes the [OV] S order.

Subjects

Subjects were 12 children between the ages 5;3 and 6;2. In all experiments reported in this paper, they were in a public day care center in Tokyo, Japan.

Materials and procedure

Sixteen sentences were constructed from factorial combinations of two levels of Matrix Role (Subject/Object), two levels of Focus (Subject/Object), two levels of Word Order (SOV/OSV), and two replications. The nouns were all animals (e.g., alligator, gorilla, camel, panda) randomly assigned to sentence frames. Verbs were ones which required distinct actions (e.g., kicked [ketta], hit [butta], licked [nameta]).

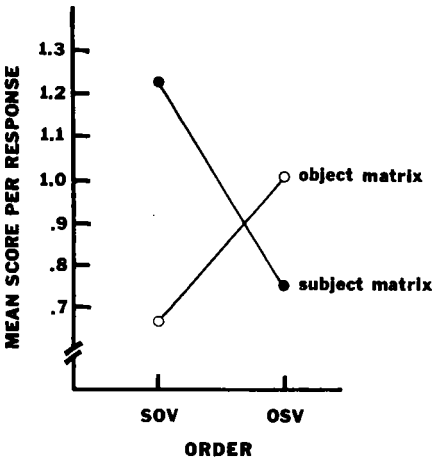
For each sentence, the child was asked to act out the actions on a stage on which the animals were placed. The experimenter read the sentences at a slow, natural speed with short pauses following both the subject and the object of the matrix sentence. The experimenter, my mother, was blind to the hypotheses of the study, to the extent that mothers can be expected to remain blind to the devious schemes of their children.

Results and discussion

Overall analysis was conducted by a 4-way ANOVA with Subjects crossed with the repeated measures factor, Sentence, nested within a cross of Matrix Role (Subject/Object) by Focus (Subject/Object) by Word Order (SOV/OSV)[1]. None of the main effects proved significant (for Word Order, $F' < 1$; for Matrix Role, $F'[1, 2] = 1.960, p > 0.10$; for Focus, $F'[1, 8] = 1.744$,

[1] Following Clark's (1973) suggestion, both subjects and sentences are treated as random effects, using procedures outlined in Winer (1971). Quasi-*F*-ratios (F') are reported for ANOVAs, and individual comparisons are made through t'. Whenever means are reported, there are two standard deviations. S_1 refers to the variability across subjects, while S_2 refers to variability across sentences.

Figure 2. *Significant Matrix Role by Word Order interaction.*



$p > 0.10$). There was a highly significant Matrix Role by Word Order interaction ($F'[1, 5] = 31.492, p < 0.005$). The 3-way interaction of Matrix Role by Focus by Word Order ($F'[1,2] = 3.109$) approached the alpha level of 0.10, for which the critical value is 3.78.

The significant Matrix Role by Word Order interaction is shown in Figure 2. Since sentences with Matrix Role Subject are left-branching when in the SOV order but center-embedded when in the OSV order, and the reverse is the case for Matrix Role Object sentences, the interaction indicates that Japanese children find center-embedded sentences more difficult to process than left-branching sentences. This result is a rather embarassing fact for any theory which subscribes solely to the grammatical description of sentences as predictors of sentence complexity. Thus, the Parallel Function Hypothesis, without major modification in which sentence configuration is incorporated, is untenable.

Analysis of individual responses revealed that poor performance on the center-embedded sentences was mostly due to the erroneous interpretation of the initial NNV sequence as a simple sentence, as was predicted. Table 5 shows the breakdown of the frequency of responses involving the first two nouns for each of the four sentence forms. When the response involved the first noun being the agent of the action, it was coded as "1–2", and appears as such in the Table. When the second noun was the agent, it was coded as "2–1". Since there were two responses for each sentence form per child, each cell has a possible total of 24. Looking at the column totals, it is evident that most responses across the sentence forms involved interpreting the NNV

Table 5. *Frequencies of responses involving the first two nouns in the center-embedded sentences*

Response	*N-ga N-o V...* OS/SOV	*N-ga N-ga V...* OO/SOV	*N-o N-o V...* SS/OSV	*N-o N-ga V...* SO/OSV
1–2	23	14	15	14
2–1	1	8	7	6
Total	24	22	22	20

"1–2" refers to responses where first noun is the agent, "2–1" to where second noun is the agent.

Table 6. *Distribution of responses on the subordinate clause in left-branching sentences*

Response	Subject focus		Object focus	
	SS/SOV	OS/OSV	SO/SOV	OO/OSV
1–2	11	11	16*	18*
2–1	11*	11*	4	2
Total	22	22	20	20

Response type "1–2" refers to the first noun being the agent, "2–1" where the second noun is the agent. Correct responses are marked by an asterisk (*).

sequence as a sentence. Within each sentence form, children appear to overwhelmingly use the 1–2 response in OS/SOV, since the sequence exactly mimics a simple SOV sentence. There was no tendency for children to prefer the 2–1 response in SO/OSV which mimics a simple OSV sentence, but this is not surprising given that children were shown in the previous experiment to have difficulty in comprehending the OSV order. Thus, these errors indicate that children have a tendency to interpret the first noun as the agent, and this is enhanced for the sequence which exactly mimics the canonical SOV simple sentence.

Since Japanese children mis-segment the center-embedded sentences, these sentences do not constitute an appropriate test of the effect of Focus and of Word Order, since the relative clause is not properly parsed in these sentences. One can make specific tests of these effects in the left-branching sentences. The question of whether Subject Focus or Object Focus relative clauses are easier to comprehend can be answered by inspection of the number of correct responses in the subordinate clause for SS/SOV and OS/OSV,

Table 7. *Frequencies of responses on the main clause of left-branching sentences*

Response	Subject–Object–Verb		Object–Subject–Verb	
	SS/SOV	SO/SOV	OS/OSV	OO/OSV
2–3	15*	17*	7	8
3–2	6	2	10*	11*
Total	21	19	17	19

"2–3" refers to responses where the second noun of the sentence is the agent, "3–2" where the third noun is the agent. Asterisk (*) indicates correct response.

which are Subject Focus, and comparing this with SO/SOV and OO/OSV, which are Object Focus. Response type "2–1" is correct for Subject Focus, and "1–2" is correct for Object Focus. The Accessibility Hierarchy Hypothesis predicts Subject Focus to be better comprehended than Object Focus. Based on our earlier experiments with comprehension of simple sentences, however, an explanation based on the order of the subject and object predicts Object Focus to be easier, since it takes the SVO order. A breakdown of the number of the response types with respect to the sentence forms appears in Table 6. As can be readily seen, there were more correct responses on the Object Focus than on Subject Focus. This suggests that the order of constituents is the major factor.

The effect of Word Order can best be assessed through comparison of SS/SOV and SO/SOV with OS/OSV and OO/OSV on the number of correct main clauses acted out, since these sentences are all left-branching. Table 7 displays the breakdown of the number of correct and reversed interpretations of the main clause for each sentence form. As can be seen, there were more correct responses on the SOV order than on the OSV order, suggesting the operation of the SOV Constraint. The effects of Word Order and of Focus will be tested explicitly in the next experiment.

A study by Harada *et al.* (1976) confirms the main findings of this experiment. The researchers tested act-out comprehension of SS, SO, OS and OO in the SOV order in one group of children, and in OSV in a different group of children. Thus, Word Order as a main effect was a between-subjects variable, while the other variables of Matrix Role and Focus were repeated measures. The researchers do not report statistical tests performed on their data, but their subjects, ranging in age from 3 to 10, clearly found center-embedded sentences to be more difficult than left-branching sentences within the SOV and within the OSV group. It is of interest to note that even at age

10, children have difficulty with center-embedded sentences, with less than 50% of the responses being correct.

Summary

This experiment tested children between 5;3 and 6;2 in their comprehension of SS, SO, OS and OO sentences in the SOV and OSV orders. The results show an interaction between the Matrix Role of the complex noun phrase and the Word Order of the sentence. Left-branching sentences were better comprehended than center-embedded sentences. Thus, the grammatical description of the sentences did not account for the differential performance of children on the various sentence types as a function of whether they were in the SOV or OSV order. This result is a major embarassment to theories, such as Parallel Function, that predict the psychological complexity of these sentences in terms of their grammatical description. It appears that the configurational properties of the sentences constitute the variables to be considered in accounting for comprehension of these sentences. There was a marginal effect for Word Order within the left-branching sentences, where the SOV sentences were easier than the OSV sentences. In addition, relative clauses whose head noun role was the object tended to be easier than those with subject head noun. However, even for the older age group, these sentences were inordinately difficult, and younger children were not tested.

Experiment two

The previous experiment demonstrated that 5 and 6 year old children find left-branching sentences easier to comprehend than center-embedded sentences. Thus, SS and SO types were easier when they were in the SOV order, but OS and OO were easier when they were in the OSV order. However, even for these children, the sentences proved quite difficult and the sentences required modification if younger children were to be tested.

The modification chosen for this experiment was to change one of the clauses into an intransitive action, such as cry. When the intransitive action is the subordinate clause, only the SS and OS types are possible, and since the main clause is transitive, both these types can be either in the SOV or OSV orders. Thus, for these sentences, it is posssible to test the effect of Sentence Type (SS or OS) and the effect of Word Order (SOV or OSV). The four sentence configurations are:

SS/SOV [*CRIED*] *AGENT-ga PATIENT-o KICKED.*
SS/OSV *PATIENT-o* [*CRIED*] *AGENT-ga KICKED.*

OS/SOV *AGENT-ga [CRIED] PATIENT-o KICKED.*
OS/OSV *[CRIED] PATIENT-o AGENT-ga KICKED.*

As in the previous experiment, a main effect for Sentence Type would indicate the importance of the grammatical description, while an interaction between Sentence Type and Word Order would indicate the importance of sentence configuration. A main effect for Word Order, with SOV better than OSV, would indicate an extension of the SOV Constraint operating on simple active sentences.

When the main clause is the intransitive action, it yields two sentence types: SS and SO. The effect of Word Order and its interaction with Sentence Type cannot be tested with these sentences since word order change can apply only to transitive actions, and the main verb in these sentences is intransitive. However, with these sentences, we can test the effect of Focus, since that parameter now varies. Thus, these sentences present a critical test of the Accessibility Hypothesis. The two sentences are:

SS *[PATIENT-o KICKED] AGENT-ga CRIED.*
SO *[AGENT-ga KICKED] PATIENT-ga CRIED.*

If Keenan and Comrie's accessibility hierarchy has any implications for processing difficulty of sentences in children, we would expect to find the effect here, with better performance on SS than on SO. On the other hand, if comprehension of relative clauses were dependent on the linear order of elements, then we would expect superior performance on SO over SS, since SO follows the Subject–Verb–Object order, while SS has the Object–Verb–Subject order.

Subjects

Subjects were 36 children divided evenly into three age groups: Group II: 3;3–4;2, Group III: 4;3–5;2, and Group IV: 5;3–6;2.

Materials and procedure

The six structures described above were each replicated twice, creating a total of 12 sentences for presentation to each child. The pool of words from which the nouns and transitive verbs were selected was the same as in the previous experiments. The intransitive verbs were: cried (naita), yawned (akubi-shita), coughed (kushami-shita), and laughed (waratta). A second set of sentences was created with the same intransitive verb but with the nouns interchanged. The procedure was identical to that of previous experiments.

Scoring

A two-point scoring system was used, with one point given for correct performance on the transitive action and one on the intransitive action. Thus, for each sentence, a score of 0, 1, or 2 was possible.

Results and discussion

The data were analyzed separately for the four structures in which the subordinate clause was intransitive and the two structures in which the main clause was intransitive. The two analyses will be reported sequentially.

For the structures in which the subordinate clause was intransitive, a 3-way ANOVA was performed, with Subjects nested within Age and the repeated measures factor, Sentence, nested within a cross of Type (SS/OS) by Order (SOV/OSV). Age did not turn out to be significant ($F'[2,9] = 1.763$), nor did it interact significantly with any of the repeated measures factors. The only significant repeated measures factor was the interaction of Type by Word Order ($F'[1,2] = 221.457$, $p < 0.005$). The means involved in the 2-way interaction appear in Table 8. Inspection of the table reveals that the interaction was due to good performance on SS/SOV and OS/OSV, and poor performance on SS/OSV and OS/SOV. This result strongly supports the view that predicts sentence complexity on the basis of sentence configuration. Japanese children find center-embedded sentences difficult to comprehend. That there was no main effect for Type (respective means for SS and OS were 1.334 and 1.389) shows that the grammatical description of the sentences was not a good predictor of complexity. In addition, the fact that there was no main effect for Word Order (respective means for

Table 8. *Means and standard deviations for Type by Word Order interaction*

Type	Order	
	SOV	OSV
SS	$\bar{X} = 1.639$	$\bar{X} = 1.028$
	$s.d._1 = 0.407$	$s.d._1 = 0.358$
	$s.d._2 = 0.039$	$s.d._2 = 0.039$
OS	$\bar{X} = 1.069$	$\bar{X} = 1.708$
	$s.d._1 = 0.381$	$s.d._1 = 0.453$
	$s.d._2 = 0.059$	$s.d._2 = 0.059$

Table 9. *Breakdown of frequency of response types for SS/SOV, SS/OSV, OS/SOV and OS/OSV*

SS/SOV: [V_i] N-ga N-o V

Transitive	Intransitive		Total
	+	–	
+	47*	6	53*
–	13	0	13
Total	60*	6	66

SS/OSV: N-o [V_i] N-ga V

Transitive	Intransitive		Total
	+	–	
+	13*	36	49*
–	10	10	20
Total	23*	46	69

OS/SOV: N-ga [V_i] N-o V

Transitive	Intransitive		Total
	+	–	
+	12*	47	59*
–	0	4	4
Total	12*	51	63

OS/OSV: [V_i] N-o N-ga V

Transitive	Intransitive		Total
	+	–	
+	55*	6	61*
–	6	1	7
Total	61*	7	68

The subordinate clauses are intransitive. "+" indicates correct response, "–" indicates error. Correct responses are marked by an asterisk (*).

SOV and OSV were 1.354 and 1.368) suggests that the SOV Constraint may not be operative for complex sentences. This will be discussed further after an analysis of the errors.

A breakdown of the responses into how well the children comprehended the transitive and intransitive components of the sentences is revealing. This analysis excludes those responses for which only one clause was acted out, although there were very few such cases. Responses can be classified into four categories:

(1) Transitive correct, intransitive correct;
(2) Transitive correct, intransitive error;
(3) Transitive error, intransitive correct;
(4) Transitive error, intransitive error.

Table 9 gives the frequency of the four types of response for each of the structures. As can be seen from the column and row marginals, there was very little difference across the structures with regard to the transitive clause,

the major difference being with respect to the intransitive action. The left-branching sentences, SS/SOV and OS/OSV, showed good comprehension of the intransitive clause, but there were more errors than correct responses for the center-embedded structures SS/OSV and OS/SOV. The fact that the intransitive clause was center-embedded caused the children to erroneously assign the first noun of the sentence as the subject of the intransitive verb. This result is exactly what a left-to-right sentence processing model, such as the Augmented Transition Network (e.g., Kaplan, 1975) would predict in the form of "garden path" sentences (Wanner *et al.*, 1974).

The fact that there is no apparent preference for SOV over OSV in the comprehension of these sentences is not surprising once we realize that Word Order for these sentences refers to the order of subject and object in the matrix sentence. Consider the left-branching sentences with the configuration V_iNNV, where V_i is the intransitive verb. As can be seen in Table 9, most responses for SS/SOV and OS/OSV correctly assigned the first noun to the V_i. Thus, the first noun is indeed the subject, although not of the action of the main clause. In addition, if we assume that the noun assigned to the V_i is no longer the "first noun" for the processing of the remainder of the sentence, there is no reason why SS/SOV should be easier than OS/OSV. In fact, one would expect the OSV order to be easier since the second noun of the entire sentence in effect becomes the "first noun" with respect to the main verb. When the first noun is removed, the sequence *SOV* ends up as *OV* while *OSV* ends up as *SV*. A different line of experiments explicitly testing this possibility shows superior performance on OSV over SOV orders (Hakuta, 1978), but that is beyond our current scope. The major point of relevance for our present purpose is to show that in comprehending these sentences, children appear to process the sentences quite locally. The SOV Constraint may be applicable only when it is locally relevant, as in simple sentences, at least for comprehension. In the case of the center-embedded sentences, as Table 9 reveals, children almost unanimously chose the first noun as the agent of V_i, erroneously. Thus once again, the first noun is the subject of the subordinate action. The SOV Constraint is not readily apparent in the context of their performance on the entire sentence because children process the sentences locally.

Turning now to the SS and SO sentences in which the main clause was the intransitive action, the results were analyzed by a 2-way ANOVA with Subjects nested within Age and crossed with the repeated measures factor, Sentence, nested within Type (SS/SO). Once again, Age was not significant ($F'[2,2] = 3.094$), nor was its interaction with Type. There was a significant main effect for Type ($F'[1,5] = 9.568$, $p < 0.05$), and inspection of the means revealed that children found the SO structure ($\bar{X} = 1.722$, s.d.$_1$ =

Table 10. *Breakdown of frequency of response types for SS and SO*

SS: [N-o V] N-ga V_i

Transitive	Intransitive		Total
	+	-	
+	32*	6	38*
–	29	3	32
Total	61*	9	70

SO: [N-ga V] N-ga V_i

Transitive	Intransitive		Total
	+	–	
+	55*	13	68*
–	5	3	8
Total	60*	16	76

The main clause is intransitive and the subordinate clause is transitive. "+" indicates correct response, "–" indicates error. Correct responses are marked by an asterisk (*).

0.438, s.d.$_2$ = 0.039) easier than SS ($\bar{X}$ = 1.403, s.d.$_1$ = 0.428, s.d.$_2$ = 0.098). A breakdown of the responses into the four types as was done for the other structures earlier, presented in Table 10, shows that the difference was mostly due to differential performance on the transitive action, namely the subordinate clause. This result does not support the hypothesis that Keenan and Comrie's accessibility hierarchy would have implications for children's sentence processing. It is more consistent with the view that the local order of elements within the complex noun phrase determines its ease of comprehension. The fact that subject focus is easier than object focus in English is best explained by the fact that the head noun in English is located to the left of the relative clause, and thus a subject focus sentence results in an S[VO] configuration while an object focus sentence results in an O[SV] configuration. Since the head noun is on the right of the relative clause in Japanese, subject focus results in an [OV]S order while object focus results in an [SV]O configuration. We can derive a law which will predict ease of comprehension of subject and object focus in all languages:

> *In languages where the head noun is on the left of the relative clause, subject focus will be easier than object focus, whereas in languages where the head noun is on the right of the relative clause, object focus will be easier, all other things being equal.*

Summary

This experiment simplified the sentences tested in the previous experiment by making one of the clauses intransitive. This reduced the number of sentence types tested. SS and OS were tested in SOV and OSV orders with the

subordinate clause being intransitive, and SS and SO with the main clause intransitive. Subjects were between ages 3;3 and 6;2. A comparison of SS and OS in both word orders strongly confirmed the interaction between Matrix Role and Word Order found in the earlier experiment. Sentences were much easier to comprehend when they were left-branching than when they were center-embedded. In the center-embedded sentences, most children made the error of interpreting the initial NV_i ... sequence as a unit. There was no main effect for Word Order, and thus the SOV Constraint does not appear in the context of the entire sentence. It was argued that children process the sentences at the local level. A comparison of SS and SO showed that Japanese children find the relative clauses with subject focus more difficult than those with object focus, contrary to the Accessibility Hierarchy Hypothesis. The superior performance on object focus is attributable to an extension of the SOV Constraint to the NVN sequence.

Experiment three

Up until this point, we have been using the terms "center-embedded" and "left-branching" as convenient labels to capture the configurational properties of the sentences. This experiment will pursue the question of whether it is center-embeddedness *per se* that causes difficulty in understanding a sentence, or whether the resultant configuration is the important variable. In formulating the critical test, we will take advantage of the right-dislocated structure frequently found in colloquial Japanese. In these sentences, a noun phrase is placed to the right of the main verb of the sentence. Thus, a sentence with the canonical form *AGENT-ga PATIENT-o BIT* can be right-dislocated as *AGENT-ga BIT, PATIENT-o* or as *PATIENT-o BIT, AGENT-ga*. The main verb is marked in these structures by a terminal contour and, in this experiment, it was decided to mark the verb with the dimunitive - no, which is frequently used in child speech and speech to children at the end of verbs. Table 11 shows how right dislocation affects SS/SOV, SS/OSV, OS/SOV and OS/OSV sentences. Although it is possible to dislocate the first or the second noun phrase, in order to preserve the word order of the subject and object, the second noun of each sentence was right-dislocated. To maintain consistency in notation, although the right-dislocated sentences are now in the SVO and OVS orders, I will refer to them as SOV and OSV. The original sentences in Table 11, under the left column labelled "Matrix NNV", are the common SOV and OSV forms. Thus, SS/SOV and OS/OSV are left-branching while SS/OSV and OS/SOV are center-embedded and there is a stacking of nouns. Under the right column labelled "Matrix NVN" appear

Table 11. *Illustration of how right dislocation affects sentence configuration*

Type/Order	Matrix NNV	Matrix NVN
SS/SOV	[*N-o V*] N-ga N-o V	[*N-o V*] N-ga V, N-o
SS/OSV	N-o [*N-o V*] N-ga V	N-o V, [*N-o V*] N-ga
OS/SOV	N-ga [*N-ga V*] N-o V	N-ga V, [*N-ga V*] N-o
OS/OSV	[*N-ga V*] N-o N-ga V	[*N-ga V*] N-o V, N-ga

Configurations under "Matrix NNV" are the standard order. Configurations under "Matrix NVN" are right-dislocated structures. Terminal contour at the end of the main verb is indicated by a comma (,).

the right-dislocated sentences. Since Japanese places the relative clause to the left of the head noun, the center-embedded sentences under Matrix NNV still remain center-embedded under Matrix NVN. However, in these sentences, the nouns are unstacked such that there is no longer any local mimicking of a simple sentence at the beginning of the sentences. In fact, under Matrix NVN, the four sentences have the identical configuration, NVNVN. Thus, the Matrix NVN sentences allow us to test whether center-embeddedness or configuration is the critical variable.

If center-embeddedness presents difficulty to the child, then there should be a similar interaction between Sentence Type and Word Order in the Matrix NVN sentences as there would be in the Matrix NNV sentences. On the other hand, if the configuration of the sentence is important, there should be no interaction between Type and Word Order in the Matrix NVN sentences.

Subjects

Subjects were eight children between ages 5;4 and 6;3.

Materials and procedure

Sentences with both the main and subordinate clauses reversible were used for this experiment. Forty-eight sentences were constructed from a factorial combination of two levels of Sentence Type (SS/OS), two levels of Word Order (SOV/OSV), two levels of Matrix Form (Matrix NNV/Matrix NVN), and four replications. In order to accommodate this large number of sentences, the pool of animals was increased. Sentences were grouped into four blocks, with each block having one example of each sentence. In addition, animals were also divided up according to these blocks. Presentation of

blocks as well as of sentences within each block was randomized for each child. The animals in each block were introduced to the child immediately prior to the presentation of that block. This procedure helped maintain the child's interest through 48 sentences, and is highly recommended to other researchers wishing to present large numbers of sentences to young children. The entire procedure lasted about 30 minutes.

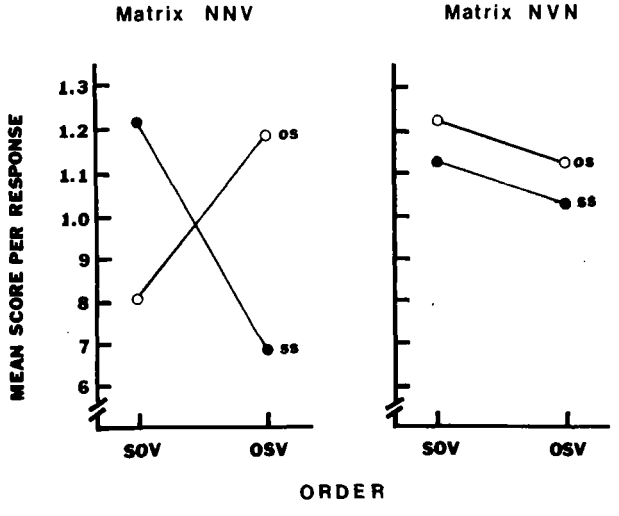
Scoring

Responses were scored 1 point for each clause correct, resulting in a total possible score of 2 for each sentence.

Results and discussion

Overall analysis was conducted by a 4-way ANOVA, in which Subjects were crossed with the repeated measures factor, Sentence, nested within a cross of Type (SS/OS) by Word Order (SOV/OSV) by Matrix Form (NNV/NVN). Main effects for Type and for Word Order were not significant ($F' < 1$), as well as the main effect for Matrix Form ($F'[1,9] = 1.597, p < 0.25$). The 2-way interaction between Type and Word Order was significant ($F'[1,7] = 7.859, p < 0.05$), as was the 3-way interaction of Type by Word Order by Matrix Form ($F'[1,8] = 6.704, p < 0.05$). The means, plotted in Figure 3,

Figure 3. *Three-way interaction between Matrix Order by Type by Word Order.*



reveal that the 2-way interaction was due entirely to the interaction of Type by Word Order within Matrix NNV, which also accounts for the 3-way interaction. In fact, when separate ANOVAs were performed by Matrix NNV and Matrix NVN, the 2-way Type by Word Order interaction was significant for Matrix NNV ($F'[1,5] = 13.327$, $p < 0.05$), and the mean square for Type by Word Order in Matrix NVN was zero. It appears that the 3-way interaction was due to better comprehension of OS/SOV and SS/OSV, the center-embedded structures, in the Matrix NVN form, than in the Matrix NNV form.

Since the predictions concern the variable of embeddedness (center-embedded or left-branching) and its relationship with the Matrix Form, the two sentence configurations representing each level of embeddedness within each Matrix Form were pooled. Thus, within the Matrix NNV structures, SS/SOV and OS/OSV were pooled since they are both left-branching, and SS/OSV and OS/SOV were pooled since they are both center-embedded. The same pairs were pooled within the Matrix NVN. Pooling of these data is justified on the grounds that it was planned *a priori* and, in addition, t'-tests comparing each pair of means to be pooled did not produce any differences that were even marginally significant.

The pooling of the data resulted in four means: LB(left-branching)/NNV ($\bar{X} = 1.203$, s.d.$_1 = 0.347$, s.d.$_2 = 0.291$); CE(center-embedded)/NNV ($\bar{X} = 0.750$, s.d.$_1 = 0.189$, s.d.$_2 = 0.259$); LB/NVN ($\bar{X} = 1.125$, s.d.$_1 = 0.320$, s.d.$_2 = 0.211$); CE/NVN ($\bar{X} = 1.125$, s.d.$_1 = 0.284$, s.d.$_2 = 0.259$). Comparison of these means through t'-tests showed that although LB was easier than CE within Matrix NNV ($t'[4] = 4.231$, $p < 0.02$), there was no difference between LB and CE within the Matrix NVN ($t' < 1$). Thus, there is no difference between LB and CE when we control for sentence configuration. In addition, the lack of difference between LB and CE within Matrix NVN is due to CE sentences being easier in the Matrix NVN than in the Matrix NNV form, as opposed to the other possibility, that LB might be more difficult in Matrix NVN than in Matrix NNV. This is demonstrated by the fact that while LB did not differ with respect to the two levels of Matrix Form, CE sentences were significantly easier in Matrix NVN than in Matrix NNV ($t'[5] = 3.487$, $p < 0.02$).

Individual analysis of the responses showed that seven out of the eight children had better comprehension of CE when it was in Matrix NVN than Matrix NNV. Performance was better on Matrix NVN because of an increased comprehension of the subordinate clause, with a concommitant decrease in the garden-path type errors involving the first two nouns of CE/Matrix NNV sentences. The reader will recall that children erroneously segment the initial NNV ... sequence as a sentence in these structures. An "improvement score"

was calculated for the subordinate and main clauses for the two CE sentences, which consisted of the number of correct responses for a given clause in Matrix NVN minus the corresponding number in Matrix NNV. For SS/OSV, the improvement score for the subordinate clause was +12, while for the main clause it was −1. There was a reduction by 11 of the garden-path type errors. For OS/SOV, the improvement score for the subordinate clause was +11, while for the main clause it was +2. The reduction in garden-path type errors was 12.

The results of this experiment show that the difficulty of center-embedded sentences in the Matrix NNV form can be removed through right dislocation, which prevents the stacking of nouns that results in garden-path errors. Center-embeddedness *per se* is not the critical variable in comprehension in children. The center-embedded sentences in the Matrix NVN form were no more difficult to comprehend than left-branching sentences. I claim that center-embedded sentences tend to be difficult because they frequently cause stacking of nouns and verbs which need to be re-ordered before the sentence can be interpreted. Such is the case in the English SO form, such as *The donkey that the man kicked licked the mule.* Center-embedded sentences are not difficult when the nouns are stacked such that they are separated out by verbs, as in the English SS: *The donkey that licked the man kicked the mule.* In Japanese as well, center-embedded sentences are difficult when the stacking causes an erroneous assignment of nouns to verbs, as in the sentences with the NNVNV configuration. They are no more difficult than left-branching sentences, however, when the stacking is "neatly" done, as in NVNVN. It is possible that the obligatory terminal contour at the end of the main verb in right-dislocated sentences will cause them to be perceived as two left-branching sentences rather than as a center-embedded structure. Nevertheless, since the transitive action of the main verb involves both the noun to its left and the complex noun phrase to its right, they are still best considered as center-embedded.

Summary

This experiment tested the hypothesis that center-embeddedness increases difficulty of sentences, which we have assumed so far, against the proposal that the stacking of nouns in such a way that they are interpreted erroneously would cause difficulty in comprehension. The second matrix noun of center-embedded sentences OS/SOV and SS/OSV and left-branching sentences SS/SOV and OS/OSV were right-dislocated, yielding a uniform unstacked configuration for both the left-branching and center-embedded sentences. Children between ages 5;4 and 6;3 were tested on comprehension of

reversible sentences created in this manner. The results show that center-embedded sentences are no more difficult than left-branching sentences when the nouns are unstacked. Thus, it is not center-embeddedness *per se* that causes processing difficulty, but rather its frequently concommitant stacking of constituents.

Experiment four

The results from the studies in comprehension of complex sentences showed that Japanese children have difficulty with sentence forms that take the configuration NNVNV. For this finding to be of any generality, it is important to ask the question as to whether similar difficulties are manifested with the configuration in other linguistic tasks. The present study looks at children's immediate imitation and delayed production of these sentences. In immediate imitation, the prediction is that the NNVNV configuration should be more difficult to imitate than the NVNNV configuration, since the former is stacked and the latter is unstacked. In delayed production, the children will produce sentences in the NVNNV configuration and avoid the NNVNV configuration.

The immediate imitation and delayed production data were obtained in the same task. Sentences in the immediate imitation phase were paired with pictures depicting the action. The same pictures were used to cue the delayed production of the sentences. The pictures were constructed such that they depicted actions described by SS and OS sentence types. In the SS-picture, the agent of a transitive action is shown performing another action, while in the OS-picture, the patient of a transitive action is shown performing another action.

In the immediate imitation phase, the model sentences came in either the SOV or OSV order for each of the pictured types. Thus, there were four model sentence forms: SS/SOV, SS/OSV, OS/SOV, and OS/OSV. The assumptions underlying the immediate imitation task are that sentences which are easier for the child will be more correctly imitated, and that errors will reflect changes towards their preferred form of the sentences.

In the delayed production phase of the task, within the rough constraint of producing sentences with relative clauses, the child should change the order of the sentences to the preferred form.

The prediction is that if children find the NNVNV configuration difficult to produce, given that they have the choice of producing any given sentence in the SOV or OSV order, for the two pictured meanings SS and OS, they should choose the order which takes the configuration NVNNV, which is

unstacked. Thus, for the SS-picture, there should be a tendency to produce the SOV order, while for the OS-picture, the OSV order should be preferred. However, since SOV is dominant in Japanese, there may be a tendency for children to produce stacked structures for OS, since it preserves the basic word order. Although word order did not appear as a main effect in the comprehension results, I argued that this was due to the fact that children processed the sentences locally. For this task, to the extent that children process the matrix sentence, one might expect an effect for word order in imitation and in delayed production.

Subjects

Subjects were 36 children divided into three age groups: Group II: 3;9–4;8, Group III: 4;9–5;8, and Group IV: 5;9–6;8.

Materials and procedure

The pictures used as cues for the sentences contained three animals, of which two were identical. Two identical animals were pictured so that there was a natural reason for using relative clauses, highlighting their restrictive function. The third animal will be referred to as the unique animal. One of the identical animals was pictured performing either an intransitive (crying or yawning) or a transitive (eating an apple or holding a balloon) action. This action corresponds to the relative clause. For the SS-pictures, this animal was pictured as the agent of a transitive action (hitting, kicking or pushing) with the unique animal. For the OS-picture, the animal was the patient of the transitive action. The SS-pictures and the OS-pictures were balanced to evenly represent the relative clause actions. Two replications of each of the resulting eight combinations were created, using different animals. This produced a total of 16 pictures. An additional counterbalancing procedure involved an equal placement of the transitive action on the right and left part of the picture. The pictures were individually mounted on 8″ × 11″ construction paper.

From each picture type, half of the pictures were chosen to be paired with a model sentence in the SOV order, and the other half in the OSV order. Within each order, half contained a relative clause with the intransitive verb and the other half with the transitive verb. A second set of sentences was created reversing the order of the sentences paired with each picture. Children were assigned randomly to either set. For each child, order of presentation of the picture/sentence pairs was randomized.

Each child was introduced to the pictures, which were bound together with ring binders and made to resemble a story book, and informed that

s/he was to help tell stories to a puppet. The child was told to repeat the story just like the experimenter, always my mother, tells it. There were four warm-up pictures of simple actions. If s/he did not repeat the sentences verbatim, the child was instructed through modelling by the two experimenters, an example of mother and child interaction. Children encountered no difficulty with the task, with the exception of one child who insisted on telling her own story about the pictures. She was not included in the experiment. The immediate imitation phase of the experiment immediately followed. This part of the experiment lasted about 15 minutes. Following completion of this phase, the child was told that it was now his/her turn to tell the story, and that the experimenter would not say anything. Children in general readily took to this task. The pictures were shown in the same order as in the immediate imitation phase. The delayed production phase also lasted about 15 minutes. No child failed to complete the task, and in fact many wanted to do more. Thus, the task was intrinsically interesting to the children. The entire session was recorded on a cassette tape recorder and subsequently transcribed.

Scoring

The response on the immediate imitation phase was coded as correct (1) or incorrect(0), and in addition, errors were coded if the wrong particle was used, and if there was a transposition of word order.

The delayed production data were recorded as being in the SOV or OSV order if they contained a relative clause. If there was an error in the use of particles, this was separately noted. In addition, a separate category was created for those responses in which the child produced a conjoined sentence involving the two actions.

Results and discussion

Since separate analyses were conducted for the immediate imitation and the delayed production phases of this experiment, the results will be reported separately.

Immediate imitation

Overall analysis for the immediate imitation data was conducted by a 4-way ANOVA, with Subjects nested within Age, crossed with repeated measures factor, Sentence, nested within a cross of Type (SS/OS) by Word Order (SOV/OSV) by Verb Type (Transitive/Intransitive). Age was significant as a

Table 12. *Means and standard deviations of means in Type by Word Order interaction in immediate imitation task*

Type	Order	
	SOV	OSV
SS	$\bar{X}$ = 0.944	$\bar{X}$ = 0.375
	s.d.$_1$ = 0.135	s.d.$_1$ = 0.330
	s.d.$_2$ = 0.051	s.d.$_2$ = 0.086
OS	$\bar{X}$ = 0.660	$\bar{X}$ = 0.660
	s.d.$_1$ = 0.317	s.d.$_1$ = 0.317
	s.d.$_2$ = 0.105	s.d.$_2$ = 0.070

main effect ($F'[2,26] = 8.712$, $p < 0.01$), indicating overall better performance in older children.

The means for the four sentence forms summing across the age groups are shown in Table 12. In the overall ANOVA, Type was not significant ($F' < 1$), but there were significant effects for Word Order ($F'[1,10] = 68.269$, $p < 0.001$) and for the Type by Word Order interaction ($F'[1,10] = 10.145$, $p < 0.01$). Since there was no difference between the means for OS/SOV and OS/OSV, these significant effects can be completely accounted for by the large difference between SS/SOV and SS/OSV. In more ordinary language, this means that while there was no difference whether an OS sentence was in the SOV or OSV order, it made a large difference for SS, which was much easier when it was SOV than when it was OSV. This is not totally in accord with the comprehension results, which would predict that OS in the OSV order should be easier since it is unstacked. But the result is not surprising when one considers the possibility that there could have been a trade-off between the Stacking Constraint and the SOV Constraint, since the unstacked configuration for OS is in the OSV order. This account of the data is supported by the errors made by the children in imitation, and will be discussed shortly. It appears that in this imitation task, perhaps because of the cue to meaning provided by the pictures, children processed the main verb to the extent that the effects of the SOV Constraint were observed.

There were significant interactions of the repeated measures factors with Age that were of interest. Age interacted with Type (Age × Type, $F'[2,11] = 4.116$, $p < 0.05$) and with Type by Word Order (Age × Type × Word Order, $F'[2,14] = 4.901$, $p < 0.05$). However, these interactions can be explained by the fact that even the youngest children performed close to optimum on the SS/SOV sentences, while there was improvement with age on all the other sentence types.

Table 13. *Frequency of (a) particle errors and (b) order transposition errors in immediate imitation task*

(a) Particle errors

Type	Order		Total
	SOV	OSV	
SS	3	41	44
OS	6	38	44
Total	9	79	88

(b) Order transposition errors

Type	Order		Total
	SOV	OSV	
SS	0	24	24
OS	11	0	11
Total	11	24	35

The remaining main effect, for Verb, also turned out significant ($F'[1,3] = 22.795$, $p < 0.02$), with better performance on the sentences with intransitive verbs then transitive verbs. This is easily accounted for by the fact that the sentences with intransitive verbs were shorter. In fact, the interaction of Age by Verb is significant at the alpha level of 0.10 ($F'[2,6] = 4.138$), and inspection of the means reveals that while sentences with the intransitive verbs are easier for Groups II and III, the difference disappears by Group IV.

An analysis of the distribution of error types with respect to the four sentence forms is highly revealing as to where the children encountered difficulty in imitation. The number of errors on each sentence form appear in Table 13. Table 13(a) gives the frequency of particle errors. For both sentence types, the particle errors appear almost entirely in the OSV order. This consisted of changing the particle on the first noun, -o, to -ga. This error reflects the general preference, found also in simple sentences, for the SOV order. Table 13(b) gives the frequency of transposition errors, where the order of the constituents was switched. Transposition errors occurred exclusively for sentences in which constituents were stacked, namely SS/OSV and OS/SOV. This error reflects the tendency to create unstacked NVNNV sequences out of stacked ones.

Delayed production

The delayed production data were analyzed in three separate ANOVAs, each using a different measure since there is no "correct" performance on this phase of the experiment. ANOVA 1 used the SOV order as the measure. Each sentence in the SOV order was given a value of 1, with all other forms assigned a value of 0. Subjects were nested within Age, crossed with repeated measures factor Sentence nested in a cross of Type (SS/OS) by Model (SOV/OSV), where model referred to the original word order in which the sentence was presented in the immediate imitation phase of this experiment. Model was not expected to have a significant effect. ANOVA 2 used the OSV order as its measure. Each sentence in the OSV order was assigned a value of 1, and all others 0. The structure of ANOVA 2 was identical to ANOVA 1. In ANOVA 3, the measure was sentences in the stacked configuration, where a value of 1 was assigned to each sentence in the NNVNV configuration, namely, OSV for SS and SOV for OS, and all other forms were assigned a value of 0. Since the effect of Model was already tested in ANOVAs 1 and 2, this ANOVA consisted of Subjects within Age crossed with Sentence within Type (SS/OS).

The predictions were that there should be significant effects for Type in ANOVAs 1 and 2, but in opposite directions. In ANOVA 1, since the measure was SOV, a higher score was expected for SS than OS. For ANOVA 2, where the measure was OSV, a higher score for OS was expected. These predictions were based on the assumption that stacked sentences will tend to be avoided in delayed production. ANOVA 3 tested the prediction that when stacked configurations are produced, they tend to be produced in the SOV order, reflecting the trade-off between the preference for the SOV order and avoidance of stacked configurations. Thus a main effect for Type was expected, with a higher score for SS since it is in the SOV order, while the OS is in the OSV order. And finally, while an overall main effect for Age was expected, this effect was considered uninteresting since it was also expected that older children would tend to produce more relative clauses in their production overall, and the main effect would simply reflect this fact. While an Age by Type interaction was not predicted, this would be a theoretically more interesting effect open to interpretations.

The results of ANOVA 1 showed significant main effects for Age (F' [2,27] = 6.612, $p < 0.005$) and for Type (F'[1,29] = 72.119, $p < 0.001$). The direction of the effect for Type was in the predicted direction, with a higher score on SS ($\bar{X} = 0.764$, s.d.$_1$ = 0.286, s.d.$_2$ = 0.053) than on OS ($\bar{X}$ = 0.205, s.d.$_1$ = 0.262, s.d.$_2$ = 0.066). The Age by Type interaction was not significant ($F' < 1$). The results of ANOVA 2 showed Type once again signi-

ficant as a main effect ($F'[1,26] = 91.704$, $p < 0.001$), and Age was approaching significance ($F'[2,20] = 3.026$, $p < 0.10$). The direction of the effect for Type was again in the predicted direction, with a higher score on OS ($\bar{X} = 0.622$, s.d.$_1 = 0.284$, s.d.$_2 = 0.070$) than on SS ($\bar{X} = 0.056$, s.d.$_1 = 0.132$, s.d.$_2 = 0.039$). The Age by Type interaction was not significant ($F' < 1$). An unexpected result consistent across both ANOVAs was the marginally significant effect for Model. For ANOVA 1, $F'(1,12) = 3.533$, $p < 0.10$, and for ANOVA 2, $F'(1,10) = 3.392$, $p < 0.10$. In both cases, the effects were in the direction predicted if children retained the word order of the sentence as it was originally presented. Inspection of individual sentences and subject responses did not reveal any outliers or biases on particular items, and thus it must be concluded that there was a marginal retention of sentence form. This does not influence the interpretation of the other results, however, since Model did not interact significantly with any of the other factors in either of the ANOVAs. The results strongly indicate that children overwhelmingly prefer to produce sentences that are unstacked.

The results of ANOVA 3, however, indicate that there is also a significant trend to produce stacked sentences in the SOV order. This is indicated by a main effect for Type ($F'[1,27] = 13.957$, $p < 0.001$). Thus, there was a higher value for OS/SOV ($\bar{X} = 0.205$, s.d.$_1 = 0.262$, s.d.$_2 = 0.066$) than for SS/OSV ($\bar{X} = 0.056$, s.d.$_1 = 0.132$, s.d.$_2 = 0.039$). The effects for Age ($F'[2,34] = 1.327$, $p > 0.10$) and the Age by Type interaction ($F'[1,27] = 1.365$, $p > 0.10$) were not significant.

For the reader's convenience, the relative frequencies of the four sentence forms, SS/SOV, SS/OSV, OS/SOV and OS/OSV, are displayed in Table 14, where a score of 1 is given to each occurrence of the sentence form. The results from the delayed production phase of this experiment show that there are two constraints operating on the child in the production of sentences containing relative clauses. The first constraint is that they will tend to produce sentences with unstacked configurations rather than stacked configurations, the Stacking Constraint. The second constraint, the SOV Constraint, is that they will tend to produce sentences in the SOV order. Thus, stacked sentences are produced for the reason that they fulfill the tugging demands of this latter constraint. This conclusion is supported by inspection of the data from individual children. Out of the 36 children in this experiment, 21 produced at least one stacked OS sentence (which is in the SOV order), with 6 of them producing four or more. But only 8 children produced any stacked SS sentences.

An inspection of the distribution of errors involving particles reveals a similarity to particle errors in the immediate imitation phase of this experiment. Table 15 gives a breakdown of the error rates for each of the four

Table 14. *Relative frequencies of the four sentence forms produced in the delayed production task*

Type	Order	
	SOV	OSV
SS	$\bar{X}$ = 0.764 s.d.$_1$ = 0.286 s.d.$_2$ = 0.053	$\bar{X}$ = 0.056 s.d.$_1$ = 0.132 s.d.$_2$ = 0.039
OS	$\bar{X}$ = 0.205 s.d.$_1$ = 0.262 s.d.$_2$ = 0.066	$\bar{X}$ = 0.622 s.d.$_1$ = 0.284 s.d.$_2$ = 0.070

Numbers represent average per response, where a score of 1 is given for each instance of a given form produced.

Table 15. *Percentage of particle errors in sentence forms produced in the delayed production task*

Type	Order	
	SOV	OSV
SS	7% (16/220)	50% (8/16)
OS	2% (1/59)	25% (44/179)

sentence forms. As can be readily seen, particle errors are clustered around the OSV order. Most of these errors, as in the immediate imitation phase, involved marking the first noun of the sentence with -ga. This is yet another manifestation of the toll taken by the SOV Constraint when the sentences were produced in the OSV order, in particular for the OS/OSV, since its appearance in the OSV order is the result of the Stacking Constraint.

Coordination provides an alternative way of describing the pictured events. Fourteen children produced 58 coordinated sentences in all, of which 39 were produced by the youngest age group (Group II), and 6 and 13 by Groups III and IV respectively. Thus, younger children tended to produce coordinate structures. There were no strong trends towards producing more coordinations with respect to either picture type. There were 32 coordinations for OS-pictures, as compared to 26 for SS-pictures. One consistent trend was for the children to mention the action corresponding to the sub-

ordinate clause first. This is not terribly surprising since the subordinate clause actions were quite distinct from the main clause actions, and the subordinate clause always preceded the main clause verb in the modelled sentences.

In order to ensure that the results of this study were not a function of the pictured meanings *per se*, but rather resulted from the processing constraints inherent in the sentences required for their description, a control group of 14 children between 3;8 and 6;8 was set up. The procedure was identical to the experiment just described, except that simple sentences were paired with the pictures, without making reference to the subordinate clause action.

In this control experiment, children overwhelmingly preferred the SOV order for simple sentences in both the immediate and delayed imitation phase of the task. Most importantly for our present purposes, the effect of the picture Type was tested in order to determine whether the pictures meaning might have influenced the results obtained in the main experiment. Neither the main effect for Type, nor its interaction with Model, was significant ($F' < 1$). Thus, the results obtained using complex sentences cannot be attributed to the possibility that Japanese children generally prefer the SOV order for SS-pictures and OSV order for OS-pictures.

Summary

This experiment used an immediate imitation and delayed production paradigm to test whether children showed the SOV Constraint and the Stacking Constraint in their production. Subjects were between 3;9 and 6;8. Children found SS sentences much easier to imitate correctly when they were in the SOV order than when they were in the OSV order, while no strong preference for word order was found for the OS sentences. Overall, both the Stacking Constraint and the SOV Constraint contributed to the results obtained. Errors in imitation strongly supported this conclusion. The delayed production results also pointed to the contribution of both constraints. Children had a strong preference for producing both SS and OS in their unstacked word order, but the tendency to produce stacked sentences was stronger for OS than for SS because the former is in the SOV order. A control condition showed that the results obtained were not a function of the pictured meanings inherent in SS and OS.

Summary and conclusion

The confused state of the art in the investigation of the comprehension of complex sentences containing relative clauses in English was a primary moti-

vation underlying the investigation of complex sentences in Japanese children. The hypotheses that had been advanced to account for the English data were classified into two classes depending on their underlying assumptions. One class assumes that the grammatical description of the sentences is the appropriate basis from which to predict sentence complexity for children. The other class of hypotheses assumes the configurational properties of the sentences to be the important predictors of sentence complexity. It is impossible to unconfound these two classes of explanations in English for the simple reason that it is a language where the grammatical description determines the sentence configuration, since it has a rigid word order. It is therefore necessary to look at other languages. Japanese is an ideal language because of its variable word order, thus making it possible to unconfound the relative contributions of grammatical description and sentence configuration towards predicting sentence complexity. The data from Japanese children unequivocally point to sentence configuration as the appropriate variable. Whenever stacking of constituents occurs in a sentence such that there is local mimicking of simple sentences, children appear to find the *simple sentence interpretation* irresistible. When such stacking does not occur, even center-embedded sentences are not particularly difficult. These results allow us to reject the Parallel Function Hypothesis and the Accessibility Hierarchy Hypothesis for any language unless they are re-stated in such a way that they interact with the configurational demands of particular languages. In fact, any hypothesis stated purely in terms of the grammatical description of sentences is challenged by these results.

The question arises as to the generality of these findings in Japanese to other SOV languages as well as to VSO languages. The results reported in this paper suggest a somewhat secondary role for particles in the processing of complex sentences, with a greater reliance on the configurational patterns of constituents. There is, however, another variable that may need to be taken into account in looking at differences within SOV and within VSO languages. Within these two rough categories of languages, there are different patterns of correlations between particles and their expected position within sentences. For example, in the case of Japanese simple sentences, there is a predominant SOV order such that the subject-marking particle -ga most frequently appears on the first noun of the sentence. This correlational property has been observed to have a significant effect on the comprehension of simple sentences in Japanese children (Hakuta, 1977). Slobin (1978) reports data on similar simple sentences from Serbo-Croatian and Turkish, both SOV languages but with different patterns of correlation between inflections and word order. Serbo-Croatian, like Japanese, is apparently a language where word order is relatively free but not quite as free as Turkish in which inflec-

tions are highly regular and obligatory. Slobin reports that the Turkish children had little difficulty with varying word orders, relying primarily on particles for comprehending sentences. The Serbo-Croatian children, on the other hand, reportedly "require normal marking in terms of both word order and inflection for comprehension" (p. 24). It is thus possible that the pattern of evidence for relative clauses within SOV languages may show interesting variation depending on the extent to which the inflectional system and word order interact. Future reports on relative clauses from Slobin's project on Serbo-Croatian and Turkish promise to shed light on the nature of this variation.

The fact that stacked sentences that would ordinarily cause perceptual difficulty can be simplified through word order variation suggests the possibility that flexible word order might itself be a device invented by languages that are plagued by such structures. Antinucci *et al.* (1979) suggest that SOV languages have such difficulty, which may cause the diachronic change from SOV to SVO. It may be the case, however, that SOV languages might as a consequence evolve flexible word order, which would either delay or obviate the need for change into SVO. Independent linguistic analysis should reveal the distribution of the extent of word order variation allowed by languages across different basic underlying structures.

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Résumé

Le choix d'une description de la complexité des phrases en termes de relations grammaticales ou en termes des propriétés configurationnelles de la structure de surface est un point fondamental des psycholinguistiques du développement. Ce problème a fait l'objet de recherches en anglais mais les études, étant donné les propriétés particulières de l'ordre des mots dans cette langue, n'ont pas éclairé la question. Une série d'expériences menées avec des enfants japonais a permis de montrer que les exigences configurationnelles de la phrase représentent le facteur critique.