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# Sentence coordination in Japanese and English*

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ABSTRACT

Structural and contextual constraints on coordination in child speech are discussed. An elicited production study with English- and Japanese-speaking children in which these constraints were manipulated is reported. Results show referential context to be an important determinant of conjunction structure. In addition, structural parameters also influenced the extent to which redundancy is expressed in utterances. A preliminary model of coordination production based on a conjunction rule is proposed.

## INTRODUCTION

The development of coordination in children's language has been investigated from the perspective of structural constraints (e.g. Lust 1977, Lust & Mervis 1980, de Villiers, Tager-Flusberg & Hakuta 1977, Ardery 1979, 1980) and from the perspective of contextual constraints (e.g. Jeruchimowicz-Jeremy 1978, Greenfield & Dent 1979). The structural viewpoint emphasizes the role of linguistic parameters such as sentential versus phrasal coordination and the direction of deletion of redundant elements. On the other hand, the contextual constraint emphasizes non-linguistic parameters, such as temporal sequence of action and physical proximity. In this paper, we will first examine claims made from the structural viewpoint, and argue that the data are

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inconclusive as to the relative roles of the two types of constraints. We will then report an elicited production study with English-speaking and Japanese children in which both structural and contextual parameters are manipulated. Finally, a preliminary model for the production of coordinations will be proposed that accounts for the patterns of data reflecting structural constraints in both English and Japanese.

In a recent series of papers, Lust (1977, Lust & Mervis 1980) claims that coordination in language development is constrained by some properties of universal grammar. Specifically, she first argues that children's language shows evidence for the psychological reality of conjunction reduction, whereby redundant elements in a fully sentential coordination are deleted. In addition, Lust argues that there is a constraint imposed by the direction of deletion (Ross 1970), where children find forward deletion easier than backward deletion. This fact parallels some proposals (e.g. Harries 1978) that the forward deletion pattern is a universal property of language, and that backward forms should be treated as a case of forward deletion followed by a re-grouping of constituents. While details of the two properties are available in Lust's papers and in the linguistic treatments cited above, the following examples should serve to clarify the basic differences between forward and backward, and sentential and phrasal coordinations.

Forward sentential:

(1) Holly loves pistachios and Holly loves anchovies.

Forward phrasal:

(2) Holly loves pistachios and anchovies.

Backward sentential:

(3) Holly adores whales and Jemima adores whales.

Backward phrasal:

(4) Holly and Jemima adore whales.

The imitation data reported by Lust (1977) for English with 2- to 3-year-old children offer some support for the hypotheses of primacy of sentential coordinations over phrasal coordinations, and primacy of forward over backward deletions, although not across all types of sentences. However, recent attempts to replicate her findings have not met with much success (de Villiers, Tager-Flusberg & Hakuta 1977, Tager-Flusberg, de Villiers & Hakuta, in press). Phrasal coordinations were no more difficult to imitate than sentential coordinations, using similar sentences and procedures. In addition, using an act-out comprehension procedure, Tager-Flusberg *et al.* found no effects for conjunction structure nor for directionality. An interesting finding from the contextual perspective was that children appeared to interpret sentences differently depending on whether it was in sentential or phrasal form. Specifically, in sentences such as (5) and (6) –

(5) The giraffe licked the elephant and the tiger licked the elephant.

(6) The giraffe and the tiger licked the elephant. –





while children were equally successful in acting out these sentences, there was a very strong tendency for them to act out sentence (5) in sequence, where the giraffe licks the elephant first, followed by the tiger. On the other hand, for sentence (6), the two actions were performed simultaneously. Thus sentential and phrasal coordinations might be open to different interpretations.

In supporting the conjunction reduction and directionality constraints, Lust & Mervis (1980) also offered evidence from spontaneous speech from a cross-sectional sample of 32 children between the ages of 2;0 and 3;1. From the spontaneous speech samples of these children, Lust & Mervis extracted 68 instances in total of coordinations that they considered relevant to the issue of conjunction structure and directionality. They were classified into phrasal and sentential forms, and a majority (40 out of 68) of these utterances were sentential.

Unfortunately, the examples of the sentences provided in the paper make the case for primacy of sentential coordinations difficult to argue. They include anaphoric reference, where the referent is not identical in constituent structure as the anaphor (*Some brown on my shirt and it was an accident*), which is impossible to produce in the corresponding phrasal form. In addition, there are several meaningless utterances in which, apparently, the child was simply repeating himself (*He sitting up and he sitting up*). Perhaps most problematic of all is the inclusion of sentences in which the child uses the same term (i.e. there is redundancy and therefore apparent potential for reduction), but for two different referents (*That's a mama and that's a daddy*; *There is a bigger boat and there's a truck*). While Lust & Mervis claim that they did not have enough contextual information to decide on the issue of co-reference in such examples, it is highly likely that the child in these cases was pointing to two different things. A phrasal coordination would be inappropriate in such circumstances, so it is inappropriate to present these sententials as an argument for the primacy of sententials over phrasals.

Our analysis of the spontaneous speech samples of Adam, Eve and Sarah (de Villiers *et al.* 1977, Tager-Flusberg *et al.* in press) suggests that the order of emergence of sentential and phrasal coordinations might be the opposite of that suggested by Lust & Mervis. In our longitudinal analysis of the three children up through MLU of 4·25, we found a total of 360 utterances that could be classified as sentential or phrasal coordinations. We found a primacy of phrasal coordinations over sententials overall. Furthermore, viewed over time, the children almost exclusively used forward phrasal forms in the early months when coordination was emerging, backward phrasal forms being infrequent.

Bloom, Lahey, Hood, Lifter & Fiess (1980) reported the development of syntactic connectives in four children studied longitudinally, and found that phrasal coordinations emerged at the same time as sentential coordination for

three of the children, and earlier for the fourth subject. At this point, from the naturalistic data, it seems most prudent to conclude that the evidence for the primacy of sentential coordination over phrasal coordination is shaky at best.

In light of the uncertain nature of the evidence regarding the psychological status of the structural constraints governing coordination, where do we proceed in the investigation of coordination in language acquisition? It appears that the issue of context can never be safely excluded even in studies that only look at the structural parameters. With regard to methodology, imitation is not advisable as a sole method for investigating any aspect of language development. For example, Lust's finding that children were better at imitating sentential rather than phrasal coordinations might easily have been due to the fact that sentential coordinations by necessity have redundant items, and repeated items in any memory task show a marked advantage. More importantly, perhaps, it appears to us that it would be impossible to prevent subjects from constructing a context for the sentences they are imitating, which in turn might have an effect on the success of recall. Another methodology, spontaneous speech samples, is good only to the extent that contextual notes are carefully recorded, a fact that makes the comparison across studies quite difficult, as we have discussed above. In addition, in spontaneous speech, there is no control over the types of utterances children use. For example, across the studies, coordinations that have backward deletion (or, from the other perspective, sentences in which the subjects are conjoined) are quite infrequent. This could very well be due to the difficulty in producing (via backward deletion or otherwise) these forms, or it could simply be that in the natural world there are fewer opportunities to produce these utterances.

We have been experimenting with a paradigm for eliciting coordinations from children through a picture description task, thereby attempting to control the opportunities for the different types of coordinate structures. In addition, this procedure allows contextual manipulations, so that the non-linguistic effects may be simultaneously evaluated. In the course of these investigations, and especially through cross-linguistic comparisons of English and Japanese, we have been attempting to formulate a process model for the production of coordination in children.

*A study of elicited production*

Setting aside the problem of definite and indefinite reference, let us consider some sentences in which redundancy or words might be found:

(7) *Cat* is licking boy and *cat* is biting girl.
(8) Cat is licking *boy* and dog is biting *boy*.
(9) *Cat is licking* boy and *cat is licking* girl.
(10) Cat is *licking boy* and dog is *licking boy*.





If we were to find such sentences with redundancy in children's utterances, we can appeal to at least two sources of explanaton: either it is a REFERENTIALLY MOTIVATED REDUNDANCY, or it is a STRUCTURALLY MOTIVATED REDUNDANCY. If the redundant items are in fact referring to separate entities, such as two different cats in sentence (7) or two different boys in sentence (8), the motivation for the apparent redundancy in the sentence is to keep the identities of the referents separate, a referentially motivated redundancy. On the other hand, if the redundant elements in fact refer to the same entity, and in particular if we find that the pattern of occurrence of redundancy varies according to the structural parameter of the redundant element, then we have to appeal to a structural motivation for the redundancy. As noted in the above discussion of studies of spontaneous speech protocols, there is often insufficient evidence to decide whether the redundancies observed in coordination, such as sentential coordinations, might be referentially or structurally motivated.

*Coordination in Japanese*

Before proceeding with a description of the study, a brief description of coordination in Japanese is in order. Japanese is a language whose basic order is Subject–Object–Verb, with an alternative Object–Subject–Verb order. Nouns are marked by postposed particles for grammatical role. The major constraint on word order is that the verb must appear in sentence-final position (see Kuno 1973). Unlike English, there are several different morphemes that correspond to *and*. The largest distinction is between marking conjunction in nouns and verbs. Noun conjuncton is achieved primarily through the particle *-to*, such as *saru-to-tanuki* ('monkey and raccoon'). The entire conjoined noun phrase is marked at the end by a particle for its grammatical role, e.g.

| | | | | |
|---|---|---|---|---|
| (11) | *saru-to* | *tanuki-ga* | *onigiri-o* | *tabeta* |
| | monkey-and | raccoon-subj | riceball-obj. | ate |

Conjunction of verbs, verb phrases, and sentences is achieved primarily through adding *-te* at the end of the verb, although the variety of forms available is considerable (see Kuno 1973).

With respect to direction of deletion, unlike English where subject conjunction involves backward deletion and object conjunction forward deletion, both types of conjunction in Japanese involve a backward component because of the verb-final constraint:

Subject conjunction: S Ø V+S O V
Object conjunction: S O V+S O V

However, as can be seen above, object conjunction involves forward reduction as well.

## METHOD

### *Subjects*

The American sample came from lower to middle class day care centres in the greater Boston area and several from a day care centre in Minneapolis. There were 52 *S*s, grouped into three ages: three-year-olds (Group I, $N = 18$); four-year-olds (Group II, $N = 17$) and five-year-olds (Group III, $N = 17$). There was an equal number of boys and girls across the age groups. The Japanese sample came from a lower to middle class public day care centre in Tokyo. There was a total of 36 *S*s, evenly divided into three age groups that corresponded to the age ranges in the classrooms that were tested: 3;6–4;5 (Group I, $N = 12$); 4;6–5;5 (Group II, $N = 12$) and 5;6–6;5 (Group III, $N = 12$), balanced with respect to sex.

### *Materials and Procedure*

Each child was shown a series of 26 pictures on a portable slide viewer and asked to describe what they saw. There were 3 warm-up pictures, during

TABLE 1. *Types of pictures used in elicited production task*

| Redundant element | Conjoined constituent | Example |
|---|---|---|
| S–V | O | (1) Single: A rabbit holding an umbrella and the same rabbit holding a balloon. |
| | | (2) Double: A rabbit holding an umbrella and another rabbit holding a balloon. |
| O–V | S | (3) Single: A frog watching television and a turtle watching the same television. |
| | | (4) Double: A frog watching television and a turtle watching another television. |
| S | O–V | (5) Single: A rabbit riding a bike and the same rabbit flying a kite. |
| | | (6) Double: A rabbit riding a bike and another rabbit flying a kite. |
| O | S–V | (7) Single: A fox pulling a wagon and a cat pushing the same wagon. |
| | | (8) Double: A fox pulling a wagon and a cat pushing another wagon. |
| V | S–O | (9) Single: A horse eating a banana and a cow eating an apple. |
| S–O | V | (10) Single: A cat painting a car and the same cat driving the same car. |
| | | (11) Double 1: A cat painting a car and the same cat driving another car. |
| | | (12) Double 2: A cat painting a car and another cat driving the same car. |
| | | (13) Double 3: A cat driving a car and another cat painting another car. |





which children were explicitly told that they were the only ones who could see the pictures.

The slides consisted of two replications of thirteen different types of pictures. An example of the picture types can be found in Table 1. There were two types of contexts, which are referred to as SINGLE and DOUBLE referential contexts. The distinction is best explained through examples. A single referential context might be a picture of a rabbit holding an umbrella and at the same time holding a balloon. It is called a single referential context because the 'same' term across the two propositions, i.e. the rabbit, is a single referent. A double referential context counterpart to the same two propositions would be a picture with one rabbit holding an umbrella and another rabbit holding a balloon, i.e. rabbit is a double referent. In addition, the pictures can be described from the linguistic viewpoint, that is, the elements of the actions that are the same across the two propositions. In the above example, the same element was Subject–Verb. They could also be Object-Verb, Subject, Object, Verb, and Subject–Object. Each of these types of pictures, except for the Verb-same picture, can appear in both single and double referential contexts. For the picture in which the Subject–Object are the same, in fact, there are three different possible versions of double referential context, as can be seen in examples (11)–(13) in Table 1.

Two sets of 26 pictures were created in order to minimize the effects of individual pictures. Basically, for any set of characters and actions, both single and double referential context pictures were drawn, and these pairs were divided between the two sets. *S*s were randomly assigned to view either set.

The order of presentation was randomized across subjects. The responses were recorded on a cassette tape recorder and subsequently transcribed.

## RESULTS AND DISCUSSION

The procedure was quite successful in eliciting coordinations targeted in the pictures, with about half of all the utterances across both the Japanese and English samples corresponding to the target. Some pictures were more successful than others, as will become apparent in the discussion. In analysing the data, we calculated the percentage of phrasal coordinations produced over the total number of coordinations (phrasal plus sentential coordinations) rather than over the total number of utterances, since it is the relative proportions of phrasal and sentential coordinations that are of primary interest here.

Referential context had an important effect in determining whether a sentential or a phrasal form of coordination was produced. The percentage of phrasals produced in the two referential contexts across all the pictures appears on Table 2. In the English data across age groups, 73% (112/154) of the utterances in single referential contexts were phrasal. In contrast, in

the double referential contexts, only 13% (22/175) were phrasal, the remainder being sentential. For Japanese as well, in single referential contexts, 88% (141/161) were phrasal, while 40% (53/134) were phrasal in the double referential contexts. This overall difference between single and double referential contexts is taken as evidence that children are extremely sensitive to the referential context in determining whether phrasal or sentential forms should be used. In addition, it suggests that sentential coordinations

TABLE 2. *Percentage of phrasal coordinations produced for single and double referential contexts for English and Japanese samples*[a]

| Language | Referential context | Age group I | Age group II | Age group III | Total |
|---|---|---|---|---|---|
| | | % | % | % | % |
| English | Single | 67 (26/39) | 74 (37/50) | 75 (49/65) | 73 (112/154) |
| | Double | 27 (12/44) | 8 (4/53) | 8 (6/78) | 13 (22/175) |
| Japanese | Single | 90 (38/42) | 92 (45/49) | 83 (58/70) | 88 (141/161) |
| | Double | 80 (24/30) | 42 (20/48) | 16 (9/56) | 40 (53/134) |

[a] For English sample, Age Group I = 3;0–3;11, Age Group II = 4;0–4;11, Age Group III = 5;0–5;11. For Japanese sample, Age Group I = 3;6–4;5, Age Group II = 4;6–5;5, Age Group III = 5;6–6;5.

with redundancy found in spontaneous speech of children might very well be the result of referential context, much like the type of context we created in the stimuli for this study.

While there is no interesting age trend in the single referential context for both language samples, there is a trend for the double referential contexts. Particularly for Japanese, the younger age groups show a higher likelihood of describing the pictures using phrasal coordinations. A look at Table 3, which presents the data collapsed across age and broken down by some of the picture types, suggests another interesting pattern. Comparing the Subject–Conjoined and the Object–Conjoined sentences in double referential contexts, for both languages, there is a higher proportion of phrasal coordinations produced for the Subject–Conjoined than the Object–Conjoined sentences. We appeal to a psychological rather than linguistic explanation for this effect. Our pictures by necessity had animate subjects, and mostly inanimate objects. A Subject–Conjoined, double referential picture shows, for example, a pig painting an apple and a raccoon painting another apple. An Object-Conjoined picture shows, by contrast, a gorilla eating an apple and another gorilla eating a banana. Assuming that children see the distinction between animate beings as more psychologically important than the distinction between inanimate objects, such as apples, they would be more likely to collapse inanimate objects into a single, generic term of reference, resulting in a phrasal form.





TABLE 3. *Percentage of phrasal coordinations produced by different picture types in single and double referential contexts*

| | Japanese | | English | |
|---|---|---|---|---|
| | Referential context | | Referential context | |
| | Single | Double | Single | Double |
| | % | % | % | % |
| Subject-Conjoined[1] | 96 (49/51) | 75 (36/48) | 75 (30/40) | 27 (13/48) |
| Object-Conjoined[2] | 94 (51/54) | 24 (8/33) | 95 (55/58) | 11 (6/57) |
| Subject-Verb-Conjoined[3] | 0 (0/15) | 0 (0/12) | 7 (2/27) | 3 (1/31) |
| Object-Verb Conjoined[4] | 100 (41/41) | 25 (9/36) | 86 (25/29) | 5 (2/39) |

[1] Equivalent to pictures (3) and (4) in Table 1.
[2] Equivalent to pictures (1) and (2) in Table 1.
[3] Equivalent to pictures (7) and (8) in Table 1.
[4] Equivalent to pictures (5) and (6) in Table 1.

As children become older, their description of the pictures becomes more careful and detailed, and by the oldest age group they carefully differentiate even the inanimate objects.

While a large percentage of the utterances in single referential contexts are phrasal for both Japanese and English, there are differences among the different types of pictures, a fact that must be explained through appeal to structural motivations for expressing redundancies in sentences. As can be seen in Table 3, there is an extremely low proportion of phrasal coordinations produced when the Subject–Verb is conjoined (Picture 7 in Table 1). In fact, these sentences accounted for 75% of the total number of sentential forms produced in single referential contexts for Japanese, and 60% of those for English. Phrasal description of these pictures for both English and Japanese are either ungrammatical or marginally acceptable, as in the examples below:

(12) A cow is licking and a pig is patting a donkey.

(13) Ushi-ga uma-o namete-te buta-ga nadeteru.

Phrasal versions of these sentences can be made perfectly grammatical through passivization in the case of English, and word order scrambling in the case of Japanese, and therefore cannot be attributed to the semantics involved in such sentences.

(14) A horse is being licked by a cow and patted by a pig.

(15) Uma-o ushi-ga namete-te buta-ga nadeteru.

It is interesting to note that none of the children in our sample produced such sentences; they all opted for the sentential forms.

There was another set of pictures, not included in Table 3, which produced a consistent pattern of sentential coordinations. These were sentences where only the verb is redundant (picture 9 in Table 1). The phrasal version of these sentences would be:

(16) A horse is eating a banana and a cow an apple.

(17) Uma-ga banana-o, shoshite ushi-ga ringo-o tabeteru.

These are 'gapped' sentences (Ross 1970), and a model of coordination through deletion of redundant elements, such as Lust's, would predict the phrasal forms to be easy. In the English sample, of the 54 sentences elicited, only 2 were of the gapped, phrasal form, while the remainder were sentential, with a redundant verb. Similarly for Japanese, of 23 sentences conforming to the target, none was phrasal in form. This pattern of data must be taken into account by any model of sentence coordination.

For the English-speaking children, there was a difference between the Subject-Conjoined and Object-Conjoined sentences. While 95% of the Object-Conjoined sentences were phrasal, there was a slightly smaller proportion of phrasals produced for the Subject-Conjoined pictures (75%). There was no such trend in the Japanese sample, with an equally high proportion of phrasal forms produced for both pictures.

While the Japanese data showed no difference in the Subject–Conjoined and Object–Conjoined sentences with respect to percentage of phrasals produced, a more detailed inspection of the data reveals an interesting form of redundancy to be found in the Object–Conjoined forms. Of the total of 54 utterances in the Object–Conjoined pictures, 51 were classified as being phrasal. However, of these there were 13, or 25%, that were produced in the form SOV + OV, where the verb was repeated. When a similar analysis was performed on the English data to see if the phrasal coordinations might have taken the comparable SVO + VO form where the verb was redundant, only 3 out of 55 instances (4%) were in that form. Thus, there appears to be a structurally motivated redundancy for Japanese children to repeat the verb. We believe that it reflects the properties of a production system operating in real time, where a decision to conjoin constituents must be made. If the constituent to be conjoined is in the final position of the sentence, as the object is in the case of English, then the redundancy in the verb need not be expressed. On the other hand, as in the case of Japanese, if the constituent to be conjoined is in the middle of the sentence, then an effort must be made to conjoin the constituent before the final element in the sentence is processed. If the decision is not made in time, it appears that the conjunction then must occur at the next higher constituent level, namely the verb phrase, and the verb becomes redundantly expressed.

We can look at the mirror image of this problem, where redundancy is predicted for English but not for Japanese. This can be found in the case where the verb is the conjoined constituent. Since Japanese is verb-final, the conjoined constituent is in the terminal element of the sentence. On the other hand, it is in the middle of the sentence in English. One predicts that redundancy would be expressed in the case of English, but not in Japanese. Although pictures with verb conjunction as the target were used (picture 10,





Table 1), these were the least successful in eliciting the target utterances. However, the data are highly consistent with the above hypothesis. In the English data, there were 7 sentences that took the form SVO + VO, where the object was redundant. In addition, there were 6 sentences where the object itself was not repeated, but where there was an anaphoric pronoun, thus taking the form SVO + VPro. Finally, there were only 3 instances of complete phrasal forms with no redundancy, of the form SV + VO. The data can be summarized by saying that 19% (3/16) of the phrasals showed no redundancy, while the remainder (81%) contained redundancy, reflecting a similar type of constraint found in the Japanese SOV + OV form, with verb redundant. In contrast, while there were only 7 relevant sentences in the Japanese data (primarily because the particular lexical items chosen by the children did not correspond well to our target), 6 involved no repetition of the object, and thus took the form SOV + V, with no redundancy. These data thus complement the cross-language comparison for Object-Conjoined sentences described previously.

*A model for the production of coordinations*

The following model is sketchy, and is meant to serve as a working hypothesis which can be modified as relevant data are collected. It is, needless to say, tailored to suit the characteristics of the Japanese and the English data described above. In the paragraphs below, we will first give a bare-boned outline of the model, which will be followed by a somewhat more elaborate justification.

The model assumes knowledge of the sentence constituents NP and VP immediately dominated by S, and V and NP immediately dominated by VP. The basic operation for sentence conjunction can be represented by the rule

$$X_i \rightarrow X_i + X_{i+1},$$

where X is a variable that can represent any constituent, NP, VP, V or S.

The generation of a coordinated sentence begins by first generating a canonical simple sentence, containing a subject, object and verb. As the sentence is being generated, elements of the event being described that are not included in the canonical sentence are identified, and the constituent in the canonical sentence to which the additional elements correspond must be identified. The conjunction rule applies to this constituent. If only one addition is made corresponding to either a subject, object or verb, then ideally the conjunction rule would apply to that constituent. However, if more than one addition is to be made, such as an addition corresponding to a subject and a verb, the conjunction rule must apply to the lowest node that includes the additions. Thus, in the above case of subject and verb, the lowest node that immediately dominates the two constituents is the S-node.

As the canonical sentence is processed in a left-to-right manner, it is logical

that the potential for the conjunction rule to apply to any particular constituent must also keep pace with this process. Once the processing of a particular constituent has been superseded by a subsequent constituent, it is assumed that the conjunction rule can no longer apply to the former constituent. Thus, the point at which the constituent for the conjunction rule is selected is critical to the final form that the sentence takes. For example, in object conjunctions in Japanese, if the processing of the canonical sentence SOV goes beyond O into V, the conjunction rule is blocked from applying to O. It must then apply to the next node up and encompass the constituent currently being processed. In the case of this particular example, instead of resulting in S(O+O)V if the conjunction rule had applied to the object, the resulting structure would be S(OV+OV). This left-to-right constraint can be formalized as follows: the node for the application of the conjunction rule must be the next lowest node that includes the constituent at which point the decision to apply the rule was made.

There are some pieces of evidence to support the model's assumption that coordination production consists of building on to a canonical simple sentence through the conjunction rule. First, many of the earliest child descriptions of the pictures either involved simple sentences without conjunction, or the simple conjoining of nouns, such as *A 'brella and a balloon* or *TV and the other one* for English, and *buta-to...inu* or *kaeru-to rakuda* in Japanese. In addition, such elementary forms of conjoining words were the earliest forms of observed coordination in the spontaneous speech protocols of Adam, Eve and Sarah (de Villiers, Tager-Flusberg & Hakuta 1977). The simple sentence and the conjoining of words are, of course, the primitives on which this model is built.

There is further evidence from the Japanese data to suggest the reality of this parameter of the model when we contrast the coordination data with embedded sentences investigated in another study (Hakuta 1979). Using a picture-cued delayed imitation paradigm, 4- to 6-year-old children were made to produce sentences containing relative clauses, such as

(18) [*Fuusen-o motteiru kangaruu*]-*ga buta-o kette-imasu*
[balloon-obj holding kangaroo]-subj pig-obj kicking

The sentences were manipulated so that the relative clause could be on either the subject or the object of the main clause. The children were free to produce sentences in either the SOV or the OSV order, and the data showed that the children strongly preferred the SOV order when the relative clause was on the subject, but the OSV order when the relative clause was on the object. Since the standard order is SOV, this deviation from the standard order when the object is a complex noun phrase is structurally motivated. In the case of the coordination data, there were no cases in which (O+O)SV was produced. They were always in the SOV order. This fact is consistent with a model that builds on the canonical SOV sentence through conjunction.





The claim of the model that the conjunction rule is a psychologically unitary routine in the sentence processing mechanism can be tested with hesitation data in Japanese. Japanese has a distinct form of hesitation, *-ne*, which serves a function similar to *you know* in English. It has great potential for the researcher because in informal dialogue, *-ne*s are ubiquitous. It can appear in most positions in the sentence, such as in

(19) *kame-to-ne, kaeru-ga-ne, terebi-o-ne, miteruno.*

The actual relative frequency of *-ne* can vary considerably depending on the position in the sentence. Common observation suggests that they are most frequent after the first noun phrase of the sentence. While position in the sentence might influence the frequency of *-ne*, if the conjunction rule is a routine with its own properties, the frequency of *-ne* WITHIN THE CONJOINED PHRASE, should not vary with regard to its position within the sentence. That is exactly what our data show. While there was no difference in the rate of interruption within the conjoined noun phrase whether it was the subject or the object of the sentence, the same data showed substantial variability in the rate at which *-ne* appeared following the subject or the object noun phrase. Subject–conjoined noun phrases were followed by *ne* 51% of the time, while object–noun phrases were followed in only 10% of the instances. Thus the conjunction routine is an independent process that is not sensitive to its location within the canonical sentence once the routine is initiated.

The constraint that the conjunction rule must apply to the constituent under the lowest node that includes the additional elements to be conjoined finds support in sentences where sentential coordinations were produced. It will be recalled that there were two types of sentences in which sentential coordinations were produced with high frequency in both English and Japanese: where the subject and verb were conjoined, such as a fox pulling a cart and a rabbit pushing the same cart, and where the subject and the object were 'conjoined', such as a horse eating a banana and a cow eating an apple. In both cases, the lowest node that dominates the constituents to be conjoined is the sentence node itself. In addition, this property of the model accounts for the fact that in most other instances the coordinations produced were phrasal with no redundancy. The cases where redundancy was found provide the motivation for the next feature of the model, namely its left-to-right properties.

The left-to-right, real time constraint was introduced in the following form: the node for the application of the conjunction rule must be the next lowest node that includes the constituent at which point the decision to apply the rule is made. This process accounts well for the redundancy found in the Object-Conjoined sentences in Japanese, where 25% of the utterances took the form S(OV+OV), where the verb was redundant. In addition, it accounts for the identical pattern of redundancy found for the Verb-Conjoined sentences in English, in which the majority took the form S(VO+VO), where

in this case the object was redundant. Finally, this constraint also accounts for why there were some instances of sentential coordinations produced in Subject-Conjoined sentences in the English data, although it is unclear why there was no similar pattern for the subject conjunctions in the Japanese data. The latter may in fact be a more phrasal-oriented language, as also reflected in the extent to which Japanese children more than the English children produced phrasal coordinations even in cases of referentially redundant sentences.

## CONCLUSION

The data from the elicited production study show that both Japanese and English-speaking children are sensitive to referential contexts in determining the form of their coordinative utterances. In addition, there appear to be a number of structural constraints that influence whether redundancies appear in the coordinations of children. While the data in general suggest that the earliest forms of coordination in child speech are phrasal rather than sentential in nature, it would perhaps be more fruitful to attempt to formulate an explicit production model for coordination rather than to simply argue for abstract constraints on observed productions, as most researchers have done in the past. That is the approach taken in the present paper. The wrinkles in the data from our elicited production task were used as a basis from which to formulate a process model for production. The production model can now be tested in several specific ways. For example, since the model postulates a real time component that constrains the amount of time available to search for additional elements in a given situation, it would be possible to manipulate the amount of time allotted between observation of the picture and the description of the picture. The model predicts that the longer the amount of 'study time' allowed, the less redundancy there would be in the utterance.

One major component of our model is the conjunction rule. Further research into its viability as an independent routine, as was done with the hesitation data on Japanese, would be critical in establishing that component. In the end, our hope is that even if the empirical status of the model proves to be dead wrong, the spirit of attempting to formulate a process model would be preserved in future research on coordination, giving rise in turn to clever methods of experimentally tapping the sentence production system in young children.

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