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ABSTRACT

The role of linguistic structure in a referential communication task was examined by comparing encoding and decoding performance of 80 five- and seven-year-old children from Japan and the United States. The linguist structure demanded by the task was the simultaneous encoding and decoding of attributes of size, color, pattern, and shape. (In English such coordination can be accomplished through prenominal adjective ordering rules--"a little brown, spotted dog." Japanese is a more agglutinative language in which the ordering of these attributes is quite flexible.) Subjects were preselected on the basis of a short term memory task. In addition to the communication task, they were given a perceptual matching test to assess the relative saliency of the four attributes. As expected, the saliency of the attributes was similar for American and Japanese children. However, Japanese children were more successful than American children in producing informative messages as well as in comprehending their own encodings and adult encodings. By age seven the American children seemed able to comprehend the linguistically coordinated manner of adult descriptions as well as did the Japanese children. (Author/RL)

Linguistic Effects on Children's Encoding and Decoding Performance in Japan and the United States

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Linguistic Effects on Children's Encoding and Decoding Performance in Japan and the United States

Referential communication research focuses on speakers' ability to describe an object well enough that a listener can pick the object from an array of similar objects. Recently studies have focused on listeners' ability to decode descriptions of objects (cf., Dickson, 1981). This investigation examines encoding and decoding in a referential communication task as a function of specific linguistic rules for coordinating features in an informative description. As these rules vary in complexity and acquisition rate across languages, one expects differences in encoding and in decoding. Languages chosen were Japanese and English. They afford a clear contrast in linguistic character that would not be availagle among Indo-European languages and we study them here in cultures relatively similar in industrial and educational development - Japan and the United States.

A linguistic rule found to influence communication performance of young English-speaking children is the prenominal adjective ordering rule (Bever, 1970; Freedle and Hall, 1973; Ford and Olson, 1975; Foorman, 1975; Richards, 1979). This rule rigidly orders adjectives which describe attributes of size, color, pattern, and shape. For example, we say a little, yellow, spotted dog but not *a spotted, yellow, little dog, unless the pragmatic context permits the emphatic "It is the spotted little yellow dog I like" (cf., G. Lakoff's 1972 discussion of topicalization in "Egg creams I like"). Linguists attribute this rule to syntactic notions of transformations (Vendler, 1968) or to semantic notions of "sets" (Quirk, et al, 1972), class membership (Hill, 1958; Strang, 1968; Crystal, 1971), or "denotative definiteness" (Martin, 1969 a, b). Psycholinguistics, on the other hand, stress the informativeness of a message within a communicative interaction (Danks and Glucksberg, 1971; Schwenk and Danks, 1974; Bacharach and Maisto, 1974). Thus, we might say "a little, yellow, spotted dog" because this ordering aids its fever comprehension. Or, perhaps, if our listeners are not deemed competent or as speakers our processing span is overloaded, we unpack our prenominally ordered encoding into embedded clauses or separate utterances (e.g., "a little yellow dog with spots" or "It's yellow and little" and "It's a dog that's spotted".).

Previous research (Foorman, Arias-Godinez, & Gonzalez, in press; Foorman, 1981, Note 1) found that the linguistic rules for coordinating attributes of size, color, pattern, and shape in English, Spanish, and Japanese varied in acquisition rate and congruence with perceptual saliency. Working class five and seven year olds from the United States, Mexico, and Japan, preselected on the basis of a short-term memory task, found shape and then pattern to be more salient than color or size on a perceptual matching task. However, when encodings were compared in informativeness and linguistic coordination, significant language group differences were found. Both American and Japanese children produced more relevant attributes in initial encodings than Mexican children. However, after feedback the Mexicans produced more relevant attributes than the Japanese who, in turn, produced more relevant attributes than the Americans.

Moreover, the Mexican and Japanese encodings were more coordinated than the American in that they contained a greater number of attributes conjoined within single nominative-predicative constructions acceptable to native speakers. The interesting point here is that the linguistic rules of Spanish and Japanese allow the salient attribute shape to be mentioned first (e.g., un perrito amarillo con bolitas in Spanish). If we order shape first in English we must resort to embedded clauses or the use of "and" or separate utterances. In this "spewing out" strategy processing time must be extended, thereby taxing young children's limited capacities.

The present investigation further examines the relationship between adjective ordering rules and referential communication performance by focusing on decoding as well as encoding ability. As before, five and seven year old American and Japanese children were asked to play a perceptual matching game and then to encode objects that varied in size, color, pattern, and shape so that an adult listener of the same linguistic and cultural background could identify them. We attempted to separate the effects of culture from linguistic structure by including a group of Japanese children who were living in the United States and attended the same school as the English-speaking American children. However, this investigation differed from the previous one in that a Spanish-speaking sample was not included and in that the Japanese and American children were from a higher socio-economic background and participated in a decoding as well as an encoding task. The decoding task consisted of children's self-encodings as well as adult encodings. The obvious research question was: If Japanese five and seven year olds' encodings are superior to American five and seven year olds' with respect to informativeness and linguistic coordination, then are the Japanese children also better at decoding their own encodings and adult encodings? One might suspect that American five year olds are still at the acquisition stage of <u>producing</u> prenominal adjective ordering rules so that they would have real difficulty <u>comprehending</u> their own descriptions as well as informative, coordinated adult descriptions. However, by age seven the American children may have sufficiently mastered the prenominal adjective ordering rule that they can correctly decode adult messages even though their own productions are still inferior to the Japanese.

Method

<u>Subjects</u>. Forty Japanese-speaking kindergartners and second graders from a public elementary school in Urawa, Japan and forty English-speaking (Caucausian) kindergartners and second graders from a public elementary school in Spring Branch, Texas, half boys and half girls at each grade level, were preselected on the basis of a short-term memory test. A sample of five Japanese-dominant kindergartners and ten Japanese-dominant second graders from the same school in Spring Branch and another near-by elementary school were included in an attempt to separate out the influence of culture on language performance. This "control" sample was necessarily small because the Japanese community in Houston is small, comprised mostly of temporary residents. All children in this investigation came from upper-middle class homes where great value is placed on educational attainment. The Japanese school, located in a commuter-suburb of Tokyo, is

a laboratory school affiliated with Saitama University, but open to the public on the basis of entrance examinations. The Spring Branch schools are also located in a commuter suburb. Although there are no entrance examinations, families move to this expensive suburb because of the quality of the schooling.

Mean age levels for the kindergarten and second grade children from Japan and the United States were similar: 5;6 and 7;7 for Japan and 5;6 and 7;6 for the United States.

Procedure

Each child was individually tested in his or her native language by an adult of the same language and cultural group on a set of three tasks: (1) a short-term memory task called Mr. Cucui (Diaz, 1974); (2) a perceptual matching task (Toki, 1974, Note 2); and (3) a referential communication task (Foorman, 1975 and Foorman et al, in press). The Cucui test consists of outlines of a potatoman with various parts of his body colored. In the version of the test used here the number of spots of color on a particular page varied from one spot to four spots, with each color level represented on five pages. Scoring procedures consisted of assigning one point if four out of five pages in a level were "passed" and an additional one-fifth of a point for subsequent pages "passed". Subjects whose Cucui scores fell into ranges predicted by Pascual-Leone's Theory of Constructive Operators (1.6 to 2.6 for children at age 5-6 and 2.8 to 3.6 for children at ages 7-8; cf., Pascual-Leone, 1970, and Foorman, 1977, Note 3) participated in the perceptual and communication tasks. Distributions of Cucui scores were similar for the Japanese and American children.

In the perceptual matching test (Toki, 1974, Note 2) children matched three-dimensional wooden attribute blocks in color, size, shape, and pattern. There were five trials, each with an array of four blocks and one target block. For example, in one trial the array consisted of: (1) a small, blue plain circle; (2) a large, green, striped triangle; (3) a large, yellow, plain diamond; and (4) a large, red, plain square. The experimenter handed the target block--a small, yellow, striped square--and said, "find me one like this one", pointed to the target block and then to the array. The child might point to the first block in the array on the basis of shape, the second on the basis of color, the third on the basis of pattern, and the fourth on the basis of size. In each trial the child was encouraged to make as many matchings as possible, with the range of matches being 0-4. After the final trial, the child was asked to justify matches on that trial.

The referential communication task (Foorman, 1975; Foorman et al, in press) consisted of identical arrays of wooden animals which varied in shape (camel, dog), color (yellow, brown), size (large, small), and pattern (stripes, spots). Task-relevant vocabulary was assessed pre-experimentally by showing each child cards depicting the attributes and asking questions such as "What color is this?" Responses which distinguished the binary values of each attribute (e.g., "orange" for "yellow") were accepted. If a child did not know the answer to a question, the experimenter offered one (e.g., "Could it be a camel?"). For the one or two children in each language group who needed such help, the response was immediate agreement.

Consequently, no child was dropped from the study because of inadequate vocabulary.

The referential communication game had this procedure. While the adult experimenter hid her eyes the child was told to choose one of the animals and put it in a box, keeping the lid ajar so that the animal was visible to the child but not to the experimenter. Once the animal was selected and hidden, the experimenter asked the child to "tell me how it looks so that I can try to find it from my set of animals". Since each set of animals constituted a fully crossed matrix of four attributes with binary values, the adult could look at the child's array and deduce the values of the hidden animal. This deduction, then, provided feedback if the child's description did not include all four values. For example, suppose the child had picked out a big, brown, spotted camel but only said, "It's brown". The adult would pick a brown animal maximally different on all other attributes--a little, brown, striped dog. The adult would show this animal to the child, saying "Could this be the one? It's brown". Children, almost invariably, say "No" and add further relevant information, such as "It's a camel and has spots". Three relevant attributes have been mentioned--color, pattern, and shape. Size is then elicited by showing the child a little, brown, spotted camel. Thus, range of feedback on any one trial was 0-4 (even if all four attributes had not been produced by the fourth contrast). Once the adult has located the correct animal, the child is asked to again "say how the animal looks--putting everything you told me together--so that I can write it down". This final encoding can be compared with the initial encoding as an indication of the effectiveness of feedback and of the instruction "put everything you told me together".

Linguistic coordination of initial and final encodings was scored according to a three-point scale: one point for two coordinated relevant features, two points for three coordinated relevant features, and three points for four relevant coordinated features. Zero points were assigned to encodings which contained no relevant features or only partially coordinated ones. Inter-rater reliability coefficients of .90 to .92 were obtained on the American and Japanese experimenters' use of these criteria (as well as their agreement in feedback procedures). The following examples in English and Japanese are given to illustrate the scoring of linguistics coordination. (A more detailed description of the scoring system may be obtained by writing the senior author):

0 points: No relevant attributes, only one relevant attribute or several relevant attributes which are not conjoined within single nominative-predicative constructions (e.g., "It's a dog. I like it"; "Inu. Suki desu".)

1 point: Two relevant attributes which are conjoined in a single nominative-predicative construction by "and" or "with" or by linguistically acceptable compacting--prenominal adjective ordering or relative clauses in English or by

the particles "de" or "no" in Japanese ("(It's) a camel with spots"; "potsu potsu de inu (desu)" or "potsu potsu ga atte inu (desu)").

2 points: Three relevant attributes conjoined in a single nominative-predicative construction by "and" or "with" or by the kinds of linguistically acceptable compacting cited above (e.g., "a little, brown dog"; "chiisakute chairokute inu").

3 points: Four relevant attributes conjoined in a single nominative-predicative construction by "and" or "with" or by the kinds of linguistically acceptable compacting cited above (e.g., "a big, striped camel that's yellow"; "kiiroi rakuda de sen ga tsuite soshite okii").

To examine possible transfer effects of the feedback procedure to subsequent spontaneous encodings, five trials were included in the referential communication task, each with the identical procedure. Audiotapes of the referential communication task were made and immediately transcribed so that the decoding task could be arranged. The third and fourth trials were found to be the peak trials for the American and Japanese children in terms of the number of relevant attributes produced in final encodings. Consequently, these trials were selected as the self-encodings to be given to each subject. In other words, if an American child said in trial three "It's a dog" in response to the experimenter's request to "say how the animal looks--putting everything you told me together--so that I can write it down" then that description would be given to the child in the context of the array of wooden animals to see if the child could pick out the correct animal. Obviously the probability of a correct choice is small given the minimal description of "It's a dog". Moreover, chance is a big factor when an encoding contains three out of four of the relevant attributes.

Two adult-encodings were also given as part of the decoding task. The adult-encodings were selected as the two most frequent descriptions produced during the same referential communication task by two child development classes of fifteen female adults at Saitama University in Urawa, Japan and University of Houston in Houston, Texas. These descriptions were: (1) A big, yellow camel with stripes (Kiiro de shima moyō no okii rakuda) and (2) A small, brown, spotted dog (chairo no inu de ten ten moyō de chiisai no).

In sum, about two weeks after the referential communication task was administered the child was given two of his or her own encodings to decode as well as two adult encodings. Decoding ability was scored by correct or incorrect choices.

Results

The table of means for the perceptual and communication task measures and the intercorrelations of communication task measures and the Cucui test are presented in Tables 1 and 2. Because the correlations

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Insert Tables 1 and 2 about here

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suggest different patterns for the Japanese and the American children, separate analyses of variance were conducted for the dependent variables of the communication task: the number of relevant attributes in initial and final encodings and the degree of linguistic coordination in these encodings, the number of steps of listener feedback, and the number of accurate decodings. An additional analysis examined the number of relevant attributes matched in the perceptual task. Main effects for these analyses were language group, sex, age level (refined by ranges on the Cucui test), and trials. Significant results of these analyses are reported in Table 3.

Insert Table 3 about here

Table 3 shows that the Japanese children exceed the American children in performance on the perceptual task and in decoding, linguistic coordination, and relevant attributes produced in final encodings of the communication task. Age level differences favor the older children and interactions with age reveal the Japanese children to be significantly improving from age five to age seven whereas the American children are not. These results will now be presented in greater detail.

Perceptual Matching Task

The Japanese children made more perceptual matches than the American children ($F_{1,72} = 14.85$, $p < .001$). However, the sheer quantity of matches is not particularly meaningful because many of the matches may be random. Consequently, attention will be focused on the order of the matches and the reasons given for the matches made in the final trial. The attribute of shape was matched first 55% of the time by American children and 65% of the time by Japanese children. However, seven year

Just as saliency of attributes appeared similar for the two language groups, so did the reasons given for the matches in the final trial. The majority of explanations given by all children referred to the value of the attribute (e.g., "yellow") rather than to the category of the attribute (e.g., "color"). However, there was one noticeable difference between the reasons given by the Japanese and American children. That is, the Japanese children gave more irrelevant reasons for their matches than the American children--zero and 8% among American five and seven year olds respectively compared to 14% and 36% among Japanese five and seven year olds. The majority of these irrelevant reasons concerned perceptual detail and mental rotations of the geometric shapes. Examples of seven-year-olds' explanations are: "If you make this oblique it will become the same shape" and "If you cut the four corners it will be a circle". Five-year-olds' explanations include: "If we make this four-sided, these will be the same"; "if you stretch this it will be four-sided"; "if you put two triangles together, it will be four-sided"; "if we make this oblique it will be the same".

Similar verbal transformations of perceptual arrangement were evidenced in previous research with Japanese five and seven year olds from a rural village in Hokkaido (Foorman, 1981, Note 1). What appears to be going on is that the words for "diamond" and "triangle" are not in the vocabulary of young Japanese children. Instead, the words used to categorize these shapes are typically "four-sided shaped figure" and "three-sided shaped figure". Consequently, when young Japanese children are asked to explain why they matched the target block, a little, yellow, striped square, with the big, yellow diamond and the big, green, striped triangle, they want to specify the perceptual differences between shapes categorized similarly by their language.

Referential Communication Task

As we saw from the ANOVA results presented in Table 3 the Japanese and American children differ significantly in many aspects of their encoding and decoding performance in the referential communication task. First let us consider encoding performance.

Encoding. With respect to initial encodings, prior to listener feedback, the Japanese children showed a significant increase from age five to age seven in the number of relevant attributes produced ($F_{1,72}$ = 4.21, $p < .05$). See Figure 1.

Insert Figure 1 about here

Given that there was no language group difference in the number of relevant attributes produced initially, it is not surprising that there was no language group difference in the number of steps of listener feedback required by Japanese and American children before an informative message was produced.

There was, however, a significant language group difference favoring the Japanese in the number of relevant attributes produced after feedback, when the adult asked the child to say again what the animal looked like so that the adult could write it down ($F_{1,72} = 3.72$, $p < .05$). Moreover, Japanese encodings given before and after feedback were linguistically more coordinated than the American ($F_{1,72} = 49.80$, $p < .001$) and demonstrated a significant increase in coordination with age ($F_{1,72} = 13.28$, $p < .001$). Finally, the significant language group by sex interaction in the analysis of linguist coordination ($F_{1,72} = 4.32$, $p < .05$) is due to the superior performance of Japanese females in contrast to the superior performance of American males.

In addition to the quantitative differences between Japanese and American encodings, we can see qualitative differences in the contents of the encodings. Table 4 provides the frequencies with which categories of relevant and irrelevant attributes were produced.

Insert Table 4 about here

The most striking part of Table 4 is on the righthand side where the proportion of relevant and irrelevant attributes are given. 40% and 46% of American five-year-olds' initial and final encodings were irrelevant to the listener's task of picking out the correct animal. These proportions drop among the seven-ye r-olds to 19% and 23%. However, these proportions stand in marked contrast to the small proportion of irrelevant attributes produced by the Japanese children: 7% and 5% in five-year-olds' initial and final encodings compared to 4% and 2% in seven-year-olds' encodings. The kinds of non-informative attributes that the American children were producing fall predominantly into the subcategory entitled irrelevant. This subcategory includes such personal or universal information about the dogs and camels as "I've seen it before" or "it has four legs and runs fast".

The pattern of relevant attributes diaplayed in Table 4 reveals many language group similarities. Pattern was the attribute encoded most frequently by both Japanese and American children, with shape and color close behind. In addition, both language groups increased their production of the attribute size from age five to age seven. Now let us turn to differences in decoding performance.

Decoding. In Table 3 we saw the significant results of the ANOVA on decoding performance. Significant differences between language groups favored the Japanese ($F_{1,72} = 7.26$, $p < .01$). Differences in age favored the older children ($F_{1,72} = 49.06$, $p < .001$). Differences between decoding of self-encodings and adult-encodings (represented as repeated trials) favored the adult-encodings ($F_{1,72} = 54.28$, $p < .001$). Interactions of age with decodings ($F_{1,72} = 9.97$, $p < .01$) was due to greater improvement with age in the decoding of self-encodings compared to adult-encodings.

The remaining significant result is the language group by age by decodings interaction ($F_{1,72} = 13.57$, $p < .001$). This interaction is depicted in Figure 2.

Insert Figure 2 about here

We can see in Figure 2 that the Japanese children at age five and seven were at ceiling on their decoding of the two adult-encodings. In contrast, the American children did not hit ceiling until age seven. Furthermore, the Japanese children demonstrated a large gain in the average number of self-encodings correctly decoded from age five to age seven. The gain for the American children is not nearly so dramatic.

Discussion

The purpose of the present investigation was to examine the effect of specific linguistic rules for coordinating attributes on encoding and decoding performance in a referential communication task. Based on previous research that focused on the encodings of lower socio-economic children from Japan, Mexico, and the United States (Foorman et al, in press; Foorman, 1981, Note 1) there was reason to suspect that Japanese children in the present higher "SES" study would produce more informative and coordinated encodings than the American children. But the question was would they also comprehend correctly more self- and adult-encodings than American children?

The answer to this question was yes. In initial encodings there was no overall language group difference in the number of relevant attributes produced but the Japanese children did significantly increase production with age whereas the American children did not (see Figure 1). Moreover, the Japanese encodings, both initial and final, were more coordinated than the American and there was an overall language group difference favoring the Japanese in final encodings. Likewise, in terms of overall decoding performance, the Japanese children were better than the American children at decoding their own encodings as well as adult encodings. But by age seven the American children were able to decode the adult encodings with almost perfect accuracy.

In sum, with mental processing capacity refining the notion of age across the two language groups, Japanese and American children did perform differently in the communication task. Although both groups found shape and pattern perceptually salient on the perceptual matching task and frequently chose pattern, color, and shape as the first attributes to be linguistically encoded in the communication task, the quantity and quality of their encodings and decodings differed.

As a relatively agglutinative language Japanese provides more flexibility in the linguistic means of coordinating four attributes than English does as a word-order language. In Japanese shape, color, size, and pattern can be coordinated by a combination of the following constructions: the gerund of verbal adjectives or, "-te" form (e.g., chairokute okikute); nouns conjoined by the modifying participle "no" and "de" (e.g., inu no katachi de); and gerunds (e.g., shima ga tsuitete inu) (cf., Niya and Matsuda, 1968). Of twenty-four possible orderings of these four attributes, Japanese adults exhibited eleven orderings, with shape never occurring first and size and color occurring first an equal number of times. Such flexibility in the linguistic means of packaging information in Japanese would seem to reduce processing demands compared to the rigid, prenominal rules for ordering in English. But the fact that shape, a salient attribute for young children, was the one attribute that adults never ordered first suggests that Japanese children could still have some difficulty with linguistic production, even by age seven. Indeed, the results of this investigation (see means of Table 1) reveal the Japanese children to be producing on the average about two relevant attributes at age five and three relevant attributes at age seven. The American five year olds are not very different from the Japanese five year olds in the number of attributes produced but the American seven year olds are less successful than the Japanese seven year olds in producing three relevant attributes. Differences in linguistic coordination ability are suggested here as the major reason for these production differences, although cultural differences are also a possible explanation. First, support for the role of linguistic structure will be offered, then cultural differences will be considered.

Linguistic structure does not appear as crucial to a discussion of production differences at age five as it does at age seven. Both Japanese and American five year olds produced two relevant attributes; the two produced by the Japanese were coordinated while the two produced by American five year olds were not. But by age seven the Japanese were adding another relevant attribute and tending to coordinate it, while the Americans were still producing two uncoordinated attributes. Consequently, it appears that a "spewing out" strategy works-up to the point at which mental processing capacity is strained. American five and seven year olds alkie produced descriptions such as "It's yellow and it's a dog." Those who did add a third attribute, primarily seven year olds, managed to coordinate two of them and then tack on the third (e.g., "It's a brown camel and it has spots"). Some managed to avoid prenominal adjective ordering rules and complex embeddings, while still producing a coordinated message by the use of pauses. For example, "It's a big dog... brown stripes."

Although the American seven year olds appeared to be struggling with linguistic coordination in terms of <u>production</u> they had little difficulty in <u>comprehension</u>. Their performance, like the Japanese five and seven year olds, was at ceiling on adult encodings (see Figure 2). An enticing conclusion is that the American five year olds were not at ceiling on adult-encodings because they lacked sufficient mental processing capacity to comprehend the highly compacted descriptions of adults. Some support for this conclusion is provided by the weak to moderate correlation between Cucui scores and adult-encodings for the Americans ($r=.35$, $p<.05$). In other words, for Americans an increase in Cucui scores tended to go along with improved decoding of adult descriptions. Since the performance of the Japanese in this area was at ceiling, there is no significant correlation ($r=.18$, $p>.05$). In contrast, the Japanese Cucui scores do correlate significantly and strongly with decoding of self-encodings ($r=.78$, $p<.001$) while the American scores do not ($r=.25$, $p>.05$). The point to be made here is that increasing mental processing capacity was not as useful to American children as Japanese children in comprehending their own encodings because the American encodings did not contain as much relevant information as the Japanese encodings did. In order to better understand this complex relationship between mental processing capacity and linguistic production and comprehension further research is needed where measures such as the Cucui test are used predictively, not merely as controls.

The role of cultural factors in referential communication performance is obviously important. The present investigation has highlighted the role of linguistic structure by constructing a stimulus array that demands the cognitive coordination of binary values for four relevant attributes. Dickson Miyake, and Muto's (1977) research with Japanese and American children utilizing the Krauss and Glucksberg ambiguous figures (cf.. Glucksberg _et al_, 1975) has emphasized referential relativity by pointing out the culture-boundedness of the analytic and metaphoric encodings. One concludes that task-related variables are of critical importance to understanding the complex relationship between language, culture, and cognition. Surprising similarities in the nature of analytic encodings for the relevant attributes of size, color, shape and pattern were demonstrated by the two language groups. Moreover, to the extent that these materials allowed for holistic encodings, the language groups were surprisingly similar. For example, the encoding "tiger" was occasionally produced by Japanese and American children alike to describe the yellow, striped dog. Finally, the results from the small sample of Japanese living in Houston supported the consistency of linguistic effects on referential communication performance in spite of varying cultural settings (see means of Table 1).

Yet there were some cultural differences in performance. In the perceptual matching task the Japanese children performed mental rotations to clarify perceptual differences which the language does not encode (at least in the vocabulary of young children). Also, the significant interaction of sex with linguistic coordination revealed different performance for males and females in the two cultures. However, the significance of this finding is reduced by the floor effect in the linguistic coordination of all the American encodings, both male and female and the fact that females at this particular school in Japan were outperforming males on entrance examinations.

Finally, cultural differences may account for the higher proportion of irrelevant features produced by American children. Less than 10% of the features encoded by Japanese children in Japan and in the United States were irrelevant to the listener's task. Yet in the American sample the proportions were about 40% for five year olds and 20% for seven year olds (see Table 4). The Japanese may have an international reputation of being low in communicative skills but the suggestion here is that when placed in a communicative context of referential specificity Japanese children can be more concise and informative than American children. However, before a label like "verbose" is applied to American children further research with culturally different English-speaking children (e.g., British children) as well as American children who have acquired productive competency in prenominal adjective ordering rules should be conducted.

In conclusion, the relationship between language, culture, and cognition is a complex interaction. By controlling processing capacity across language groups, by considering perceptual saliency, by selecting a "high workload" referential communication task (Shatz, 1977), and by attempting to separate language and cultural factors with a sample of Japanese children living in the United States, we have maximized our focus on the effect of specific linguistic rules concerning attribute coordination on communication performance. By assessing decoding as well as encoding performance at the point of linguistic acquisition -- ages five and seven -- we have seen how the linguistic structures of two very different languages -- English and Japanese -- are applied differentially in the comprehension and production of informative messages.

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Table 1

Table of Means for Communication and Perceptual Task Measures Broken Down by Language Group and Age

Dependent Variable		Japanese 5	Japanese 7	American 5	American 7	(Japanese in U.S.) 5 (N=5)	(Japanese in U.S.) 7 (N=10)
Communication Task							
Encoding:							
# Rel. Attrib. in initial encodings		1.89	3.02	2.34	2.79	(2.76)	(3.18)
# Rel. Attrib. in final encodings		2.15	3.64	1.99	3.13	(2.72)	(3.42)
# Steps of feedback		1.96	.89	1.85	1.18	(1.40)	(.72)
Linguistic coord. in initial encodings	M	.56	1.20	.02	.36		
	F	.74	1.80	.16	0		
	T	.65	1.50	.09	.18	(.68)	(1.20)
Linguistic coord. in final encodings	M	.28	1.42	.18	.34		
	F	.68	1.86	.14	.06		
	T	.48	1.64	.16	.20	(.20)	(1.56)
Decoding:							
Self		.45	1.85	.75	1.25		
Adult		1.90	2.00	1.30	1.90		
Perceptual Task							
# Rel. Attrib. matched		2.54	2.82	1.69	2.4	(2.12)	(3.18)

Note: All means are per trial except in the case of linguistic coordination, where means are per initial and final encodings.

Table 2

Intercorrelations of Encoding and Decoding Measures and Cucui Test for Japanese and American Children

	Lang. Group	Cucui	Rel. Attrib. I.E.	Rel. Attrib. F.E.	Feed-back	Ling. Coord. I.E.	Ling. Coord. F.E.	Decoding Self-Adult
Cucui	A							
	J							
Rel. Attrib. in Ind. Enc.	A							
	J	.58**						
Rel. Attrib. in Final Enc.	A	.55**	.66**					
	J	.72**	.56**					
Feedback	A	-.34*	-.83**	-.74**				
	J	-.59**	-.97**	-.52**				
Ling. Coord. in Init. Enc.	A		.28*		-.32*			
	J	.47**	.69**	.42**	-.71**			
Ling. Coord. in Final Enc.	A				-.30*			
	J	.53**	.55**	.61**	-.55**	.73**		
Decodings - Self	A		.59**	.75**	-.59**	.31*		
	J	.78**	.59**	.63**	-.60**	.46**	.54**	
Decodings - Adult	A	.35*		.30*				
	J		.26*		-.29*			

Note. - J = Japanese; A = American

* $p \leq .05$
** $p \leq .001$

Table 8

Significant Main Effects and Interactions in Perceptual and Communication Task ANOVAs

Dependent Variable	Main effects & interactions	F ratio	P	Contrasts
Perceptual Task:				
# matches	Language Groups	F(1,72)=14.85	$p \leq .001$	J > A
Communication-Encoding				
# Rel. Attrib. in Init. Enc.	Language Group x Age	F(1,72)= 4.21	$p \leq .05$	(See Fig. 1)
	Age	F(1,72)=22.70	$p \leq .001$	5 < 7
# Steps of feedback	Age	F(1,72)=24.20	$p \leq .001$	5 < 7
# Rel. Attrib. in Final Enc.	Language Group	F(1,72)= 3.72	$p \leq .05$	J > US
	Age	F(1,72)=57.38	$p < .001$	7 > 5
Linguistic coord.*	Language Group	F(1,72)=49.80	$p < .001$	J > A
	Age	F(1,72)=17.21	$p < .001$	7 > 5
	Language Group x Age	F(1,72)=13.28	$p < .001$	J > A
	Language Group x Sex	F(1,72)= 4.32	$p < .05$	F > M for J M > F for A
Communication-decoding**	Language Group	F(1,72)= 7.26	$p < .01$	J > A
	Age	F(1,72)=49.06	$p < .001$	7 > 5
	Trials (Self vs. Adult)	F(1,72)=54.28	$p < .001$	Adult > Self
	Trials x Age	F(1,72)= 9.97	$p < .01$	Self > Adult in age gain
	Trials x Lang. Gr. x Age	F(1,72)=13.57	$p < .001$	(See Fig. 2)

Note - * Initial encodings and Final encodings are considered here as repeated measures

** Because of concerns about homogeneity assumptions the Geisser-Greenhouse Conservative F test was utilized (cf., Kirk, 1969, p. 143)

Table 4

The Frequency with which Relevant &

Irrelevant Attributes are Produced in U.S. and Japanese Encodings

Encodings		Relevant Attributes: Color	Shape	Size	Pattern	T	Irrelevant Attributes*: Elab/Rep.	Mislead	Irrel.	T	Total Attrib.	% Rel.	% Irrel.
Initial													
U.S.	5	64	63	25	82	234	21	5	128	154	388	60	40
		27%	27%	11%	35%								
	7	77	68	43	91	370	13	0	72	85	455	81	19
		21%	18%	12%	24%								
Japan	5	46	60	14	69	189	7	0	6	13	202	93	7
		24%	32%	7%	36%								
	7	73	82	65	85	305	8	0	4	12	317	96	4
Final													
U.S.	5	51	57	20	72	200	15	2	150	167	367	54	46
		25%	28%	10%	36%								
	7	78	89	52	94	313	14	2	77	93	406	77	23
		25%	28%	17%	30%								
Japan	5	51	77	14	72	214	3	0	7	10	224	95	5
		24%	36%	6%	34%								
	7	86	95	81	97	359	2	0	5	7	366	98	2

* Irrelevant attribute categories are: Elaboration/Repetition; Misleading; Irrelevant.

Figure 1

Language Group x Age Level

Interaction in Analysis of

Initial Encodings

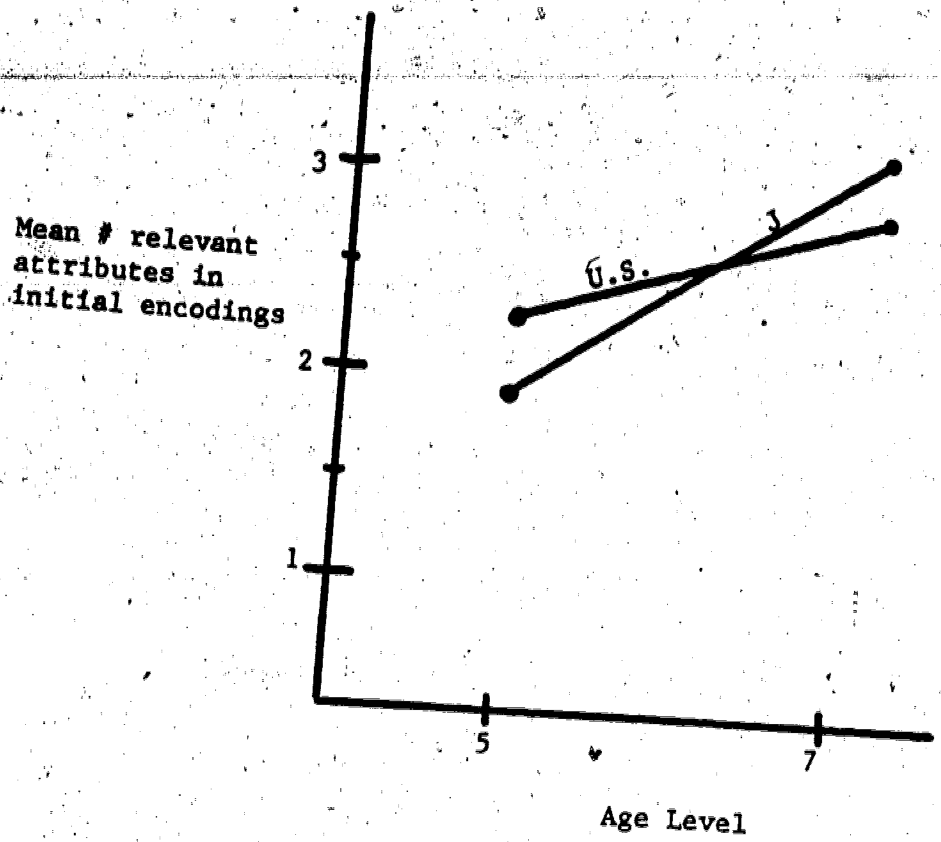

Figure 2

Language Group x Age x

Decodings Interaction