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Quantification without Qualification without Plausible Dissent

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In this paper we report results of an experiment on Japanese-speaking children's knowledge of universal quantification. Our results indicate that Japanese 4- and 5-year-olds can correctly comprehend sentences with the universal quantifier, which in turn provides cross-linguistic support for Crain et al.'s (1996) conclusion that young children have full grammatical competence with universal quantification. Yet, at the same time, we argue against Crain et al's (1996) methodological claim that the use of the Truth Value Judgment task, which contains *the condition of plausible dissent* as its major feature, is crucial in eliciting the child's knowledge of quantification. We will demonstrate that children show adult-like performance even in the situation where the condition of plausible dissent is not satisfied.

1. Introduction

Since the introduction of the principles-and-parameters approach to Universal Grammar (Chomsky 1981), there has been a large number of studies which indicate that children acquire very early the basic syntactic knowledge that reflects properties of UG (see e.g. Crain 1991, Otsu 1981). These findings have naturally led to the question of whether basic semantic properties are also in the grammars of young children. Various recent studies have shown that the answer to this question is positive (e.g. Conway 1997). Yet, there is one phenomenon that has posed an interesting puzzle: the acquisition of universal quantification. It has been observed since Inhelder and Piaget (1964) that children as old as 4 or 5 frequently misunderstand sentences with the universal quantifier, as well as sometimes providing a correct interpretation. For example, when the children are presented with a picture such as Figure 1 and asked the question "Is every cat kicking a ball?", they often respond "No." When asked to explain this answer, they point to the ball that no cat is kicking. This response, called *the symmetrical response*, indicates that the children require symmetry between cats and balls in Figure 1. Such a symmetrical response has been obtained not only from English-speaking children (Philip 1991, 1992, 1995, Roeper and de Villiers 1991) but also from Japanese-speaking children (Takahashi 1991).

Two major accounts have been proposed in the literature. One account suggests that children assign sentences containing universal quantifier a semantic representation that differs from the one adults assign (Philip 1995). The other account argues that children do not lack knowledge of any aspect of quantification and that all symmetrical responses are errors due to flaws in experimental design (Crain et al. 1996).

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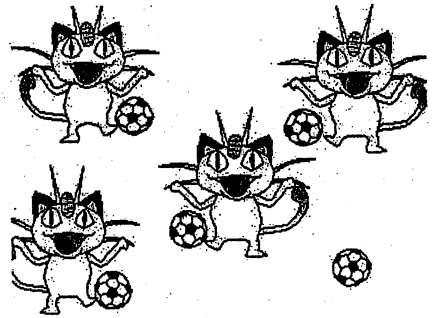

Figure 1

In this paper we report results of an experiment on Japanese-speaking children's knowledge of universal quantification. Our results indicate that Japanese 4- and 5-year-olds can correctly comprehend sentences with the universal quantifier, which in turn provides cross-linguistic support for Crain et al.'s (1996) position that young children have full grammatical competence with universal quantification. Yet, at the same time, we argue against Crain et al's (1996) methodological claim that the use of the Truth Value Judgment task, which contains *the condition of plausible dissent* as its major feature, is crucial in eliciting the child's knowledge of quantification. We will demonstrate that children show adult-like performance even in a situation where the condition of plausible dissent is not satisfied.

2. Explanations for the Symmetrical Response

In this section, we review Philip's (1995) and Crain et al.'s (1996) explanations for the symmetrical response and point out their problems. Philip (1995) has proposed a linguistically based account of children's symmetrical responses within a generative framework. According to his *symmetrical account*, the child's and adult's analyses of sentences like "Every cat is kicking a ball" differ in two ways. First, children treat the universal quantifier not as a determiner but as an adverb of quantification, and hence the domain of quantification in children's one-clause sentences may extend beyond the nominal constituent that contains the quantifier. Second, while *every* quantifies over an individual variable in the adults' semantic representations, it quantifies over an event variable in the child's interpretation. Thus, the symmetrical account provides the following semantic representation as the child's preferred analysis of the sentence "Every cat is kicking a ball."

(1)	Quantifier	Restrictor	Nuclear Scope
	∀e	PART (cat, e) or PART (ball, e)	a cat is kicking(e) a ball

'All minimal events in which either a cat or a ball (or both) is a participant are events in which a cat is kicking a ball.'

This symmetrical account is quite plausible in light of the cross-linguistic distribution of determiner quantifiers like *every*. It is reported that adverbial quantifiers are typologically more widespread than determiner quantifiers and that the following implicational universal seems to hold: If a language has a determiner quantifier, it also has an adverbial quantifier (Bach et al. 1995). If this cross-linguistic variation is a reflection of UG properties, then we can say that adverbial quantifiers constitute a default option in UG, and hence their use appears earlier than the use of determiner quantifiers.

Yet, in spite of its plausibility, the symmetrical account faces several empirical and theoretical problems. (See Crain et al. 1996 for a detailed discussion.) The most serious one will be a learnability problem. As mentioned in the introduction, it is observed that children seem to have access to an adult-like interpretation as well as the symmetrical interpretation. If so, how do they recover from their error, in the absence of negative evidence?

In light of such problems, Crain et al. (1996) have proposed a nonlinguistic account of symmetrical responses. They claim that children have full knowledge of universal quantification, and that all symmetrical responses are caused by flaws in experimental design.[1] In Philip's (1995) experiments, children were presented with a single picture like Figure 1, and were asked Yes/No questions like "Is every cat kicking a ball?" According to Crain et al., children made nonadult "No" responses to those questions because the circumstances were inappropriate for a Yes/No question on the adult interpretation. They divide the experimental test sentences into the following four components, and suggest that in order for the question to be felicitously answered 'Yes', the assertion must be in doubt at some point during the experimental trial.

(2)

Background:	Every cat is kicking a so-and-so.
Assertion:	A ball
Possible Outcome:	Some cat kicks a stone.
Actual Outcome:	Every cat kicks a ball.

In other words, for the child to answer 'Yes', an outcome other than the actual one has to be conceivable at some point during the trial. Crain et al. (1996) point out that this *condition of plausible dissent* is not satisfied in Philip's (1995) experiment: Given that children were presented with a single picture, no alternative to the actual outcome can ever be under consideration in that experiment. Crain et al. (1996) justify their claim by conducting a series of experiments with the Truth Value Judgment Task, which satisfies the condition of plausible dissent. In this task, short stories are acted out with toys and props, and after each story, a puppet describes what he thinks has happened in the story. The child's task is to judge whether the puppet's description of the story is true or false. By using this experimental technique, Crain et al. (1996) have successfully elicited 88% correct responses from English-speaking children.

Even though Crain et al.'s (1996) conclusion, that adult-like knowledge of universal quantification is in the grammar of young children, seems convincing, a careful look at the sample story used in their experiment raises a question about their methodological claim. In addition to the satisfaction of plausible dissent, there is another important difference between their experimental design and that of Philip (1995). In Philip's experiments, the number of extra objects (e.g. the ball that no cat is kicking, in Figure 1) is one or two. Yet, in Crain et al.'s experiments, the number of extra objects is relatively large. Let us take a look at the sample story that Crain et al. provide.

1. See Gouro et al. (to appear) for a pragmatic explanation based on Grice's Maxim of Quantity.

(3) Sample Story (Crain et al. 1996: 126):

Characters and Crucial Props:
Three skiers (a mom and her two girls)
Five bottles of soda and five cups of apple cider
A Styrofoam mountain, with an arch to ski through
Protocol:
Exp:
In this story, this mom and her two girls go skiing. They're going to ski down this mountain here and try to ski through this arch. Over here are the drinks at the ski lodge for when they've finished skiing. First, they all go on the ski lift to the top of the mountain. Then, this girl skis down the mountain.
Girl 1:
This looks a bit scary. Here I go! Whee! Oops, here comes the arch... Yeah, I made it! <First girl skis down the mountain, and safely through the arch.>
Girl 2:
Now, it's my turn. Whee! Oops, I nearly fell. But I made it. Yeah! <Second girl skis down the mountain and safely through the arch.>
Mom:
OK girls, watch me. Whee! Oh wow, I didn't realize this arch was so low; I'll have to really bend down to make it through. <Mom skis down the mountain, but barely makes it through the arch.> Oh girls, that gave me a real fright. I almost banged into the arch. Let's go in now and get a drink. <Mom and girls go over to drinks set out on a table.> I'll have a cup of this nice hot apple cider. This will help calm me down. <Mom takes a cup of cider.>
Girl 1: Oh, look at these sodas. I want this bottle of orange soda.
Girl 2: I want this bottle of cola.
Mom:
Girls, don't take a bottle of soda. You should have a cup of hot apple cider so you get nice and warm. You can have soda another time.
Girl 1:
OK, I'll take this cup, it's full to the top.
Girl 2:
I want a full cup too. Are any of these other cups of cider full?
Oh, this one looks very full. I'll have this one. Mmm, it's good.
Kermit:
This was a hard story, but I think I know something that happened. Every skier drank a cup of hot apple cider.
Child: Yes.
or No, not these cups of apple cider. (symmetrical interpretation)

In this sample story, each skier took one cup of hot apple cider, and the total number of remaining objects was seven (five bottles of soda and two cups of apple cider). This difference between Philip's and Crain et al.'s experiments raises the possibility that what was really crucial in eliciting adult-like responses in Crain et al.'s experiments was the relatively large number of

remaining objects. In order to test this possibility we designed a new experiment, reported in the next section.

3. EXPERIMENT

The subjects in our experiment were twenty Japanese-speaking children, ranging in age from 4;0 to 5;5 (mean age 4;9). The task was basically the same as in Philip's (1995) experiments: The child was shown a single picture, and was asked a question. There was one important modification, however. Children were divided into two groups. One group of children (*Control Group*) was tested with pictures like Figure 1. The other group of children (*Experimental Group*) was tested with pictures like Figure 2.

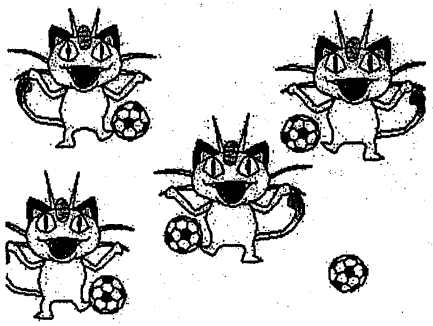

Figure 1

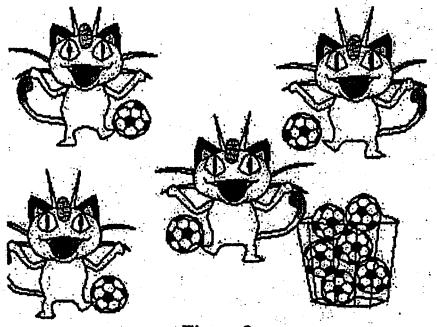

Figure 2

In the pictures used for the Control Group, there was only a single remaining object. In the pictures used for the Experimental Group, the number of remaining objects was more than four.

The test items were two intransitive and four transitive sentences with a universally quantified subject, and four fillers. The sentences containing the universal quantifier are listed below:

(4) *Every: Intransitive*
A: Dono Nyaasu-mo neteiruyo.
'Every Meowce is sleeping.'
B: Dono kujira-mo oyoideiruyo.
'Every whale is swimming.'

Every: Transitive
C: Dono hitsuji-mo tori-o oikaketeiruyo.
'Every sheep is chasing a bird.'
D: Dono Nyaasu-mo booru-o ketteiruyo.
'Every Meowce is kicking a ball'
E: Dono usagi-mo zou-ni notteiruyo.
'Every rabbit is riding an elephant.'
F: Dono Pikachu-mo ringo-o tabeteiruyo.
'Every Pikachu is eating an apple.'

The results are summarized in Table 1. Overall, for the children who were tested with pictures containing only a single remaining object, the mean percentage of correct responses was 37.5%, but for those who were tested with pictures containing many remaining objects, the mean percentage correct rose to 87.5%.[2] At this point, we do not have a good explanation for why the number of the remaining objects crucially matters. Yet, the results reported here cast serious doubt on Crain et al.'s (1996) claim that plausible dissent is crucial in eliciting children's knowledge of quantification, because adult-like responses can be obtained even in a situation where the condition of plausible dissent is not met. On the other hand, the results provide cross-linguistic support for Crain et al.'s (1996) conclusion that children have full grammatical knowledge of quantification, given that children in the Experimental Group showed adult-like performance.

2. Howard Lasnik (personal communication) has pointed out to us that in the case of Figures 1 and 2, the presence of the basket in Figure 2 could have raised the number of correct responses. We have therefore conducted a pilot experiment to check this point, and have found that the contrast is still present even if we eliminate the basket.

Control Group

		Every: Intransitive		*Every: Transitive*			
		A	*B*	*C*	*D*	*E*	*F*
4;0	M	C	C	W	W	W	C
4;4	F	C	C	C	C	C	C
4;4	M	C	C	C	W	W	W
4;7	M	C	C	W	W	W	W
4;7	M	C	C	W	W	W	C
4;8	F	C	C	C	W	C	C
4;10	M	C	C	W	W	C	C
5;3	F	C	C	C	C	W	C
5;5	M	C	C	W	W	W	W
5;5	F	C	C	W	W	W	W
							15 / 40
				%correct			.375

Experimental Group

		Every: Intransitive		*Every: Transitive*			
		A	*B*	*C*	*D*	*E*	*F*
4;0	F	C	C	C	C	C	C
4;5	M	C	C	C	C	W	C
4;7	M	C	C	C	C	C	C
4;8	M	C	C	C	C	W	C
4:8	M	C	C	C	C	W	C
4;9	M	C	C	C	C	W	C
4;10	F	C	C	C	C	C	C
5;3	M	C	C	C	C	W	C
5;4	F	C	C	C	C	C	C
5;5	M	C	C	C	C	C	C
							35 / 40
				%correct			.875

(C: correct answer, W: wrong answer)

Table 1: Summary of the results

4. Conclusion

The results of our experiment show that Japanese-speaking children have full knowledge of universal quantification, and thus we have provided cross-linguistic support for Crain et al.'s (1996) conclusion that children do not lack knowledge of any aspect of quantification. Yet, at the same time, we have argued that the relatively large number of extra objects constitutes a confounding factor in Crain et al.'s study, and our experiment reveals that this factor indeed plays a crucial role in eliciting the adult-like responses. Since we have shown that adult-like responses can be obtained even in a situation where the condition of plausible dissent is not met, our results cast serious doubt on Crain et al.'s (1996) claim that the satisfaction of this condition is crucial in eliciting children's knowledge of quantification.

Our results suggest that while children's semantic knowledge of quantification develops early, there is another relevant module, outside the grammar, that develops considerably later. As a result of this delay, children still make errors when presented with a picture like Figure 1. Such a developmental dissociation lends strong support to the fundamental assumption in generative grammar that our knowledge is modular in nature, and that sentence grammar, including semantics, constitutes an independent module.

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