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Structural and Pragmatic Constraints on Children's Understanding of "Backwards Anaphora"

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1. Introduction

The central concern of Generative Grammar is to investigate knowledge of language: its aspects of form and meaning which are determined by the language faculty or Language Acquisition Device (LAD). The LAD is endowed innately in the human mind, yielding a particular language through interaction with experience. Chomsky (1986) raises three basic questions in the study of knowledge of human language: (i) What constitutes knowledge of language? (ii) How is knowledge of language acquired? and (iii) How is this knowledge put to use? The first question concerns the specification of the nature of the language faculty: this is the subject matter of the theory of generative grammar, which aims to capture universal principles of human language. This theory is called Universal Grammar, and represents the initial state of the language faculty. The second question concerns learnability; this is often referred to as Plato's Problem: How and why can children attain the final state on the basis of poor and degenerate input stimuli? The third question concerns a theory of how one's knowledge of language is used.

The purpose of the present paper is to study the acquisition of anaphora in the framework of the Government and Binding (GB) theory. In particular, I will focus on the phenomenon of "backwards anaphora".¹ Anaphora has been investigated from both syntactic and pragmatic points of view. In this paper, we argue that both factors must be taken into consideration in assessing children's grammatical knowledge. In particular, we present evidence that, under certain pragmatic circumstances, children override Binding Condition C, and allow backwards coreference in structures which should prevent it. However, when these pragmatic conditions (which we call 'plausible denial') are controlled, children consistently respond according to structural constraints. This paper seeks support for the hypothesis that children have innate knowledge of Universal Grammar (UG). According to this hypothesis, coreference relations are determined by structural conditions.² This study aims to investigate whether or not the structural constraints function for interpretation of pronominal reference, even for young children, and to evaluate the hypothesis that children do not *learn* the structural conditions in question, but know them *a priori*, thereby trying to provide a partial answer to the second question Chomsky raised, as discussed above.

2. Structural Conditions on Anaphora

Linguistic theory attempts to provide an explanation for why English-speaking adults allow coreference in (1) - (3), but not in (4).

- (1) When John_i was sick, he_i read a book.
- (2) When he_i was sick, John_i read a book.
- (3) John_i read a book when he_i was sick.
- (4) *He_i read a book when John_i was sick.

¹ The term "backwards anaphora" refers to the anaphoric relation in which a pronoun precedes its antecedent in surface structure, and is coreferential with it, as in (2).

² This position is contrasted with the view that coreference relations are crucially determined by pragmatic context.

In the generative framework, the theoretical study of the linguistic phenomenon of "anaphora" (as in (1) through (4)) has been investigated since the late 1960's. Extensive work has been undertaken to investigate the proper formulation of the structural conditions governing anaphor-antecedent pairs (e.g. Ross (1967), Lakoff (1968), Langacker (1969), Postal (1970), Wasow (1972), Lasnik (1976), Reinhart (1976), Chomsky (1981), Lasnik (1981), Lasnik and Uriagereka (1988)). Within this framework, the linguistic antecedents for anaphoric elements are determined by syntactic configurations.

The most detailed explanation of anaphora is given by the Binding Theory of Chomsky (1981: 188). The Binding Conditions are summarized as follows.

- (5) Binding Theory:
 - a. An anaphor is bound in its governing category
 - b. A pronoun is free in its governing category
 - c. An R-expression is free

In this paper, we follow the definition of binding presented in Lasnik and Uriagereka (1988: 33): A binds B if and only if (i) A c-commands B and (ii) A and B are coindexed. As for the structural relation of c-command, we follow the definition of Reinhart (1976:146): Node A c-commands node B if neither A nor B dominates the other and the first branching node which dominates A dominates B. Condition C of the Binding Theory explains why backwards anaphora is allowed in (2), but not in (4). (2) is grammatical under the reading where the NP *John* is coreferential with the pronoun *he* because the pronoun is coindexed with the name and the pronoun does not c-command the name; however, (4) is not grammatical under the reading where the NP *John* is coreferential with pronoun *he* because, in this case, the pronoun is coindexed with the name *John* and the pronoun c-commands *John*. The Binding Theory prohibits coreference between a pronoun and a lexical NP (such as a name) in these circumstances.

3. Studies on the Acquisition of Backwards Anaphora

3.0. Introduction

Previous acquisition studies have led several researchers to conclude that children do not initially abide by the structural conditions governing anaphora just given. Instead, these researchers propose that two other factors constrain children's interpretation of the anaphoric relations in (1) - (4). These factors are summarized in (6).

- (6) (i) Directionality:

An anaphor must follow its antecedent.
(Tavakolian, 1978; Lust, 1981;
Lust, Loveland and Kornet, 1980; Solan, 1983)
- (ii) Pragmatic Context:

The pragmatic context determines the reference of an anaphor.
(Lust, Loveland and Kornet, 1980)

In 3.1.1, I will review research findings which have led to the claim that young children initially hypothesize a purely linear prohibition against backwards anaphora, as in (6i). I will also review studies that oppose the directionality effect in the acquisition of anaphora. Following this, in 3.1.2, I turn to claims concerning pragmatic context. The acquisition studies that have been taken as support for the existence of stages in acquisition are reinterpreted as showing the influence of pragmatic factors, which sometimes mask children's syntactic knowledge. In that section we explore the nature of these pragmatic influences, and consider the extent to which they may influence children's

decisions about pronominal reference. Finally, we discuss the learnability of backwards anaphora in section 3.2.

3.1. Previous Studies

3.1.1. The Directionality Effects in the Acquisition of Anaphora

To begin, it will be helpful to review research findings which have led to the claim that young children initially hypothesize a linear prohibition against backwards anaphora. This is referred to as the "directionality effect" by Lust (1986).³

Evidence from both children's imitation and comprehension of sentences, as shown in studies of the acquisition of backwards anaphora, has been taken to support a linear prohibition, such as (6i), against coreference between a pronoun and a lexical NP that comes later in the sentence. For example, an imitation task using sentences such as, *When he dropped the tissue, Kermit rubbed Scooter*, resulted in errors on backwards anaphora sentences. The errors consisted of children's reversals of anaphora direction or replacing the anaphor by a proper noun. These responses were not characteristic of forwards anaphora, however. The results of act-out comprehension tasks have also been taken as support for the directionality effect. Children were found to correctly act out forwards anaphora significantly more often than sentences with backwards anaphora. In responding to sentences with backwards anaphora, children tended to act-out their meanings in a manner which suggested that the pronouns referred to "extrasentential" objects (i.e., objects not mentioned in the sentence).

On the basis of these findings, it was concluded that there is a complete asymmetry between forwards and backwards anaphora in early child language: coreference is allowed between a pronoun and its antecedent if and only if the pronoun comes later in the sentence. This would mean that the children would initially allow all cases of forward pronominalization, but would reject all cases of backward pronominalization. For our purpose, the relevant contrast between child and adult grammars would involve sentences like (2), (repeated below), that allow coreference in the adult grammar, but, supposedly, not in child grammar.

- (2) When he_i was sick, John_i read a book.

Lasnik and Crain (1985) question whether the observed directionality effect in the acquisition of anaphora represents a grammatical hypothesis by children. First, they question whether the imitation errors, wherein children convert backwards anaphora to forwards anaphora, actually mean that the children *allow* backwards anaphora, since they convert them into sentences with the same logical form. Lasnik and Crain also advance an alternative explanation for the apparent effect of directionality in act-out tasks. Citing a proposal by Hamburger and Crain (1984), they suggest that children may prefer an extrasentential interpretation of a pronoun in sentences where the pronoun precedes its antecedent, in order to "close off" processing the constituent that contains the pronoun.

Lasnik and Crain (1985) also point out a problem with the evidence used to support the claim that children have a linear prohibition against backwards anaphora. Recall that this precedence principle was based in part on the observation that children seem

³ It is worth noting also that the directionality effect is not limited to sentences with pronouns. It is also claimed to hold for sentences which involve a null anaphor like (a) *The sheep tells the duck Ø to jump over the horse.* (b) *Ø to kiss the lion would make the duck happy.* To support this claim, Tavakolian (1978) reported that children gave a significantly greater amount of coreference judgements on the forward cases of null anaphora as in (a) compared to cases like (b).

to assign only the extrasentential reading to sentences like (2) in an act-out task (Tavakolian, 1978; Solan, 1983). Lasnik and Crain point out that the finding that children tend to choose the extrasentential reading merely shows their preference for interpreting backwards anaphora sentences in this way, but does not show that the alternative interpretation is not available to children. Assuming that children are able to act-out only one interpretation of an ambiguous sentence, the act-out task cannot reveal the availability of a nonpreferred reading.

To circumvent this problem, Crain and McKee (1985) invented a new technique, a truth value judgement task, to assess children's understanding of the alternative meanings of ambiguous sentences. They tested the following types of sentence.

- (7) When he_i stole the chickens, the lion_i was in the box.
(8) *He_i stole the chickens when the lion_i was in the box.
(9) The lion_i stole the chicken when he_i was in the box.

Using the truth-value judgment task, Crain and McKee (1985) found that even 2- and 3-year-old children consistently accepted and rejected backwards anaphora in the same circumstances as adults. Specifically, sentences like (7) were accepted by children in two different types of contexts: a context that is appropriate to the extrasentential reading and, most importantly, a context that is appropriate to the backwards anaphora interpretation of the sentence. The results of this study call into question the claim that children adhere to a linear prohibition against backwards anaphora, since no evidence of a preference for the extrasentential interpretation was found. It is also worth adding that children *rejected* sentences like (8) in contexts which were appropriate to (9). Taken together, these findings were interpreted as evidence that children have knowledge of the structural constraints (Binding Condition C) on coreference relations. Unfortunately, Crain and McKee's study did not test sentences with forwards anaphora as a control to provide a direct test of the directionality effect.

3.1.2. Pragmatic Influences on the Acquisition of Anaphora

In this section we focus on the interaction of pragmatic context and syntax in the acquisition of backwards anaphora. First, I review two points of view concerning the effects of pragmatics in the acquisition of anaphora. One viewpoint is advanced by Lust et al. (1980), who suggest that a pragmatic lead sentence affects the acquisition of anaphora as summarized in (6ii) above. Then, we review Solan (1987) and Otsu (1986), who question the pragmatic lead effect on the interpretation of coreference in anaphora.

Evidence favoring the directionality effect is seen to come from research showing that pragmatic context (e.g., discourse context) can influence children's interpretation of pronouns. Lust, Loveland, and Kornet (1980) investigated this possibility using two experimental techniques, an Elicited Imitation Task and an Act-Out Task. Both tasks examined the directionality effect and the effect of pragmatic lead on the acquisition of pronominal reference, using examples like the following:⁴

⁴ In Lust et al. (1980) a set of 16 sentences, ranging evenly over all four sentence types, was randomly selected. In each set, a randomly selected subset of one-half the sentences of each type were provided with a pragmatic lead, which established a discourse context for the referent of the name in the sentence. The pragmatic lead was introduced in the following way: "Now I am going to tell you a little story about ____", where the name in the model sentence to follow was substituted for "____".

(10) Pragmatic Context --Pronoun Anaphora

This is a story about Ernie.

- a. When he_i sat down, Ernie_i turned around.
- b. When Ernie_i sat down, he_i turned around.
- c. *He_i turned around when Ernie_i sat down.
- d. Ernie_i turned around when he_i sat down.

In the Imitation Task, the directionality factor remained significant despite the pragmatic context. That is, children were significantly better at imitating forwards anaphora sentences like (10b) and (10d) than backwards anaphora sentences like (10a) and (10c), whether or not the pragmatic lead was given. Of course, in the case of (10c), where coreference between the pronoun and the name is not structurally allowed, the directionality effect also predicts that children should reject coreference. And they did, regardless of the existence of a pragmatic lead sentence. Lust et al. conclude that children's responses are consistent with a directionality effect, which they assume to be part of their grammatical knowledge.

In contrast to the Imitation Task, in the Act-out Task with a pragmatic lead sentence, the directionality effect had little influence on children's correct comprehension of sentences like (10a) through (10d). No more errors were observed on backwards anaphora sentences like (10a) than on forwards anaphora sentences like (10b). The presence of a discourse context also significantly increased the number of errors in response to sentences like (10c). Thus, this study shows that, apparently, young children allow the pragmatic lead to override structural constraints on anaphora. On the basis of this study, Lust et al. (1980) interpret the acquisition of 'pronoun anaphora' as follows.

Our developmental results confirm that children appear to be sensitive to both syntactic and pragmatic factors in anaphora from the early stages of language development. Although these factors are independent, our developmental results suggest that the interrelation of these independent domains may change with development. The syntactic factor which constrains directionality of anaphora at early stages of language development is modified at later levels when the child learns to modulate direction of anaphora in accord with the syntax of the specific language being learned. When this specific syntactic acquisition is achieved, it may override the effects of pragmatic context on interpretation of anaphora, as it may in adult grammar. (Lust et al., 1980: 388-9)

There are two articles that oppose the proposal of Lust et al. that pragmatics overrides syntax in the acquisition of the Binding Conditions. These articles are by Otsu (1986) and Solan (1987).

First, we review Solan (1987). Solan's experimental study tested whether children's binding principles are complementary, that is, whether the governing category is the same for binding conditions A and B; and whether the presence or absence of tense makes a difference in children's performance. Accordingly, the test sentences differ along the following two parameters: (i) sentences containing reflexives vs. non-reflexive pronouns; (ii) whether the embedded clause of test sentences is tensed or infinitival. 37 children whose age ranged from 4 through 6 years old served as subjects in this experiment. The experiment was held using an act-out task. Examples of the test sentences are the following:

- (11)
- a. The dog said that the horse hit himself.
 - b. The dog said that the horse hit him.
 - c. The dog told the horse to hit himself.
 - d. The dog told the horse to hit him.

Furthermore, half of the test sentences were preceded by a misleading pragmatic cue, designed to see whether the child would erroneously choose the discourse topic as the antecedent of the proform. For the sentences with reflexives ((11a), (11c)), the pragmatic lead (PL) mentioned the nonlocal animal; an example is given in (12) PL 1. For sentences containing pronouns ((11b), (11d)), the pragmatic lead mentioned the local NP; this is given as PL 2.

- (12) PL 1: This is a story about the dog.
PL 2: This is a story about the horse.

The results of Solan's study showed no significant interactions between the presence and absence of the pragmatic cue and any of the factors. However, there was an effect of tense, in that there were more correct responses for tensed embedded clauses than infinitival ones. Furthermore, there were more correct responses for reflexives than for pronouns. These results stand in contrast to the proposal by Lust et al. (1980) regarding the influence of pragmatic factors on children's interpretation of pronouns.

Along the same lines, Otsu (1986) tested the acquisition of backwards anaphora by using the possible conflict between "pragmatic" and grammatical leads.⁵ The purpose of his experimental study is to explore when English-speaking children come to know the structural conditions governing backwards anaphora. In order to pursue this question, two kinds of tests were administered to forty subjects aged 3 years through 5 years: one is a Syntax test, and the other is a Pronoun test. The Syntax test examines whether or not the subjects know the relevant structures in which the Binding Condition C applies. The Pronoun test examines the acquisition of Binding Condition C. Otsu's hypothesis is that the structural conditions ("principle C") are endowed innately. Therefore, as soon as the children know the relevant structure, innate knowledge of the Binding principles on pronominal reference should be applied to the structure. Thus, subjects who passed his Syntax test, should also pass the Pronoun test. The test sentences were as follows:

Syntax test

- (13)
- a. Mary waved when John waved.
 - b. Bill laughed when Susan ran.
 - c. Ken smiled when Nancy sang.
 - d. When Mary jumped, Ken smiled.
 - e. When Bill ran, Nancy waved.
 - f. When John sang, Susan laughed.

⁵ His usage of the word "pragmatic" is not exactly the same as that used by Lust and Solan. It seems to the present writer that his "pragmatic lead" is not given by a leading sentence containing reference to possible antecedents; but it is given by the subject's logical thought and knowledge of the world inside his/her mind. Therefore, it could be interpreted that his "pragmatic" means 'logical'.

Pronoun test

- (14) a. When he caught cold, Mickey took some medicine.
b. He took some medicine when Mickey caught cold.
- (15) a. When he got hungry, Donald ate donuts.
b. He ate donuts when Donald got hungry.
- (16) a. When he got dirty, Mickey took a shower.
b. He took a shower when Mickey got dirty.
- (17) a. When he got sleepy, Donald went to bed.
b. He went to bed when Donald got sleepy.
- (18) a. When he worked hard, Mickey became tired.
b. He became tired when Mickey worked hard.

Prior to the Pronoun test, as a pre-test, subjects were given a pair of sentences such as those in (19), and are asked which sentence sounds strange.

- (19) a. Mickey caught a cold, and took some medicine.
b. Mickey caught a cold, and Donald took some medicine.

The two propositions carried by the two clauses combined with the coordinator 'and' are "causally" related. In (19a), the causal relation holds; but in (19b), it cannot. The same is true for the a-type and b-type sentences in (14) through (18). Thus, the "pragmatic" lead forces the pronoun to be coreferential with the name. However, in the b-type sentences, the structure does not allow coreference; in the a-type sentences, the structure does. Therefore, if the child knows the grammar, he should say that the b-type sentences sound strange, while the a-type sentences should sound all right.

The results were as follows. Seventeen out of twenty subjects passed both the Syntax test and the Pronoun test. Just one subject passed the Syntax test but did not pass the Pronoun test, and nineteen out of twenty subjects who failed the Pronoun test also failed the Syntax test. Finally, there were three subjects who did not pass Syntax test but did pass the Pronoun test. As additional evidence of children's knowledge of grammar, Otsu (1986: 67) cites a response children made. The following comments were from a child aged 3;6 in response to (14a) and (14b).

- (14) a. When he caught cold, Mickey took some medicine.
b. He took some medicine when Mickey caught cold.

(20)

E: Which do you think sounds weird?

(Subject indicates (14b))

E: Do you know why?

S: 'cause it sounds as if I'm listening to the radio and watching TV at the same time.

Taken together, these results were interpreted by Otsu as showing that young children adhere to the structural conditions on anaphora, and do not allow pragmatics to override them. This is confirmed by the high correlation between passing the Syntax test and passing the the Pronoun test. This supports the hypothesis that as soon as a child knows the relevant construction, he/she correctly applies the Binding Conditions to that construction. This knowledge is evident even when it runs counter to the "pragmatic" context.

3.2. Discussion

The two factors, "directionality" and "pragmatic context", which are proposed to constrain children's interpretation of the anaphoric relations in (1) - (4) discussed in 3.1

raise certain learnability problems. As Crain and McKee (1985) suggest, the linear order hypothesis includes the problem of supposing the existence of intermediate acquisition stages based on a structure-independent hypothesis. This hypothesis has theoretical problems. First, from a learnability point of view, why and how do children proceed from the structure-independent to the structure-dependent hypothesis? If children's language acquisition is based on hypothesis testing, then what kind of direct negative evidence could be provided to change the hypothesis? As for the possibility of positive evidence, Crain and McKee (1985) give the following discussion. According to the explanation which is based on the linear order hypothesis, children reject backwards anaphora at some stage of language development, making their grammar undergenerated at the stage. This outcome conforms to the Subset Principle. However, the positive data children require to converge on the final state of grammar is of a special kind, since the children's grammar already generates the sentences in question (but assigns to them only a subset of the meanings assigned by the target grammar). This means that the data that are required are not simply grammatical sentences, but the sentences given in contexts where the pronoun and an R-expression are obviously coreferential.

Further, as Crain and Nakayama (1987) report in their experimental study on Subject-Aux Inversion, children unerringly use a seemingly computationally complex structure-dependent rule, rather than a rule based solely on linear order. This result provides evidence for the hypothesis that children adopt only structure-dependent hypotheses in the course of acquisition. If children adopt a structure-independent hypothesis in the acquisition of anaphora, it should be asked why they hypothesize a structure-independent hypothesis here, but not in the development of the rule of SAI.

Let us return now to the findings of Lust et al., which they interpret as evidence of a directionality effect. First, there is the methodological problem that, in one experiment the presence of pragmatic context significantly affected the understanding of anaphora, but in another, the presence of pragmatic context had little effect. This leaves us with no clear evidence that the directionality effect is a grammatical phenomenon, since it is not consistent across tasks. Second, in Lust et al.'s Elicited Imitation Task, there is no evidence that pragmatic lead had any effect at all, since it did not interact significantly with any of the factors manipulated in the experiment. If so, this task does not provide concluding evidence in favor of the directionality effect.

This discussion raises the more general issue of how syntactic knowledge interacts with pragmatic factors at the early stages of language acquisition. This question is important because it ties in with the question of the innateness of principles of universal grammar. Do children have the principles of UG in place early, but aren't able to access them at the beginning because they are masked by pragmatic factors? If so, it becomes necessary to explain how children retreat from allowing pragmatics to override syntax.

This problem ties in with a more essential problem: the confusion of the system of adult grammar and child grammar in the analysis of acquisition stages. Lust states that children abide by directionality beyond the sentence level, namely, when the pronoun and the antecedent cross a sentence boundary. Actually, some researchers who agree with the pragmatic point of view find that the most prominent topic in the previous context is coindexed with the pronoun, and propose a pragmatic directionality effect on the determination of antecedents for pronominal reference (e.g., McCray, 1980). Lust et al.'s conclusion says that their developmental results confirm that children appear to be sensitive to both syntactic and pragmatic factors in anaphora from the early stages of language acquisition, and they further state that pragmatics overrides syntax before the stage when the children modify the "syntactic factor which constrains directionality of anaphor"; and once this specific syntactic acquisition is achieved, it may override the effects of pragmatic context on interpretation of anaphora.

It should also be noted that if adults are sensitive to both syntactic and pragmatic factors in the interpretation of anaphora, as the debates between pragmatics vs. syntax for the last 30 years suggest,⁶ it is no wonder that children would be expected to be sensitive to these factors as well. Even if children at early stages of language development consistently preferred the interpretation of pronominal anaphora on the basis of pragmatics, this fact, even if it is true, does not contradict the innateness of UG because the reading based on pragmatics is also given by adults, although this problem bears a trading relationship between the module of pragmatics and that of syntax theory internally. Thus, the developmental process of "from pragmatics to syntax acquisition" does not seem to be deduced, at least, directly from this line of argument.

To respond to the question of how syntactic knowledge interacts with pragmatic factors at the early stage of language acquisition, Solan (1987) and Otsu (1986) independently answer in the same ways for different sentence structures. Solan (1987) finds that the pragmatic lead in his task did not affect children's interpretation of anaphors and pronouns in sentences subject to Conditions A and B. Otsu finds that the "pragmatic" (or logical) lead does not affect the children's interpretation of sentences which are subject to Condition C. These studies find that young children can display Universal Grammar even in a misleading pragmatic context, and provide support for the theory of innateness of Universal Grammar.

The theoretical and empirical discussion in this section can be summarized as follows. In the adult grammar, something like the Binding Conditions governs anaphoric relations (Lasnik, 1986). The two different points of view discussed so far (pragmatics vs. syntax) might be interpreted coherently by hypothesizing that the apparent overriding of pragmatics over syntax in the acquisition of anaphora depends on the methodology of the experiment used to assess the children's knowledge. The next section focuses more closely on the investigation of pragmatic context and syntax in the acquisition of backwards anaphora. The experimental study which is introduced in Section 4, is a methodological study focussing on one of the pragmatic factors that may influence our assessment of children's knowledge of grammar. In order to reveal children's syntactic knowledge in psycholinguistic experiments, the nature of pragmatic influences on the determination of coreference judgements is considered in detail. My goal is to help improve the design of the experimental methodologies used for studying the acquisition of anaphora. By exploring the extraneous factors that influence children's responses we may be in the position to control for these factors in subsequent research.

4. Experiment on Plausible Denial and Coreference

4.0. Introduction

This section presents a methodological study exploring the nature of pragmatic influences on the acquisition of anaphora. The study focuses on cases in which pragmatic factors influence children's responses on experiments of the acquisition of the binding conditions. We thus reconsider the nature of pragmatic influences on the determination of coreference judgements.

⁶ For the claim that some of the facts which Binding Conditions are supposed to cover can be accounted for from a pragmatic point of view, see Reinhart (1986). Similarly, Kuno (1987) attempts an account of anaphora from a functional perspective. However, Lasnik (1986) gives convincing arguments for the necessity of Binding Conditions as purely syntactic conditions, with the example of *He_i thinks that John_i is smart*. This sentence is ungrammatical irrespective of the existence of a pragmatic antecedent preceding the pronoun, even in languages (e.g., Thai and Vietnamese) that allow *John_i likes John_i*

First, consider the example (21).

- (21) (context) Here is Santa and the Incredible Hulk.
He_{x_i/j} is looking at the picture of Santa_i

In (21), there are two characters which could be candidates for antecedent of the pronoun *he* in this context: *Santa* and *Incredible Hulk*. The structural constraints prohibit coreference between *he* and *Santa*. In the experimental study of language acquisition, if coreference between *he* and *Santa* in (21) is allowed by children at certain stages of acquisition, such data could be taken as supporting evidence for the existence of an intermediate stage in grammar acquisition at which children violate the principles of UG (in this case, Condition C). However, there might be a pragmatic factor concerning the experimental methodology which overrides the structural constraint on pronominal reference in children. The factor I have in mind will be called 'plausible denial',⁷ as will be explained below.

In pilot studies, sentences like (21) were presented by Crain and McKee (1987) in the following situation. *Santa* was looking at a picture of himself. On the other hand, the *Incredible Hulk* was not looking at anything; he slowly walked away from the picture of *Santa*. In this case, some children tended to take *he* and *Santa* as coreferential in (21), accepting (21) as a true description of the event.

The present writer observed in the pilot study that children gave two types of comments after they gave an answer to each session in the truth value judgement task. One type of comment is exemplified by one child who accepted the sentence (21) with the comment that the *Incredible Hulk* might have looked at the picture of *Santa*, but *Incredible Hulk* is pretending that he did not look at it. This observation clearly suggests that, although the child judged the sentence as adults do in terms of the grammar, her competence was not being properly attested.

Another type of comment was made by several children who accepted the sentence, when answering the experimenter's question of "Why is that right?". They said, "Because *he* (pointing to *Santa*) was looking at the picture of *Santa Claus*". This observation suggests that the child was not judging the acceptability of these sentences on the basis of his/her grammar (Binding Condition C, in this case). However, it also does not prove that the child does not know the grammar. This is because the child did point to *Santa* when referring to *he*, which could be interpreted as a deictic use of *he*. In each case, the cloud covering children's competence may have been a pragmatic factor. The nature of this pragmatic factor should be closely examined. Unless the character who is not named in the sentence is occupied in some salient activity which makes it clear why the sentence is false, children may tend to accept the sentence which for adults can only illustrate coreference between the pronoun and the more salient name. In other words, I am proposing that unless the pragmatic demands of plausible denial are satisfied, children will judge sentences like (21) to be correct. In the following section, I will examine the nature of plausible denial in the experimental study of structural conditions on pronominal reference in a systematic way.

4.1. Purpose and Hypotheses

The purpose of this experiment is to assess the grammatical knowledge of Binding Condition C in English-speaking children and to investigate the nature of a potential pragmatic factor in experimental methodology which I call plausible denial, that influences the determination of coreference judgements.

⁷ The term "plausible denial" was used originally by Crain and McKee (1987).

Our hypothesis consists of the following two sub-hypotheses:

(22)

(a) Innateness of UG

The Binding Condition C, a condition which is part of UG, is not "learned" but is given *a priori*.

(b) Pragmatic Satisfaction of Plausible Denial

Unless the pragmatic demands are satisfied so that it is reasonable for the subject to say "no" in response to the intrasentential reference reading of coreference, children's demonstration of their syntactic knowledge of the Binding Conditions may be masked.

The hypothesis of plausible denial predicts that unless the character who is not named in the sentence is occupied in some salient activity which makes it clear why the sentence is false, children may allow pragmatics to override their syntactic knowledge.

The hypothesis (22b) ties in with the claim that unless the context provides enough information to meet with the presupposition of the target test sentence, the subject cannot deny the coreference relationship between a pronoun and an R-expression in the sentence. On the other hand, if the context provides proper information for both possible antecedents for the pronoun in the target sentence, then the subject can judge the non-coreference relationship between a pronoun and an R-expression. It is hypothesized that the plausible denial problem arises in the former case. As Hamburger and Crain (1982) suggested, unless the presuppositions of a sentence are satisfied, then it is very hard for the children to understand it. After each protocol, the target sentence is pronounced. In one context, the target sentence includes a predicate which corresponds to only one predicate in the sentence used in the protocol. That is, only one toy is *looking* or *covering* -- hence that toy is the only possible antecedent. For example, in one presentation of sentence (21), *Santa* was looking at a picture of himself, but the *Incredible Hulk* was not looking at anything; he slowly walked away from the picture of *Santa*. In this case, children tended to accept *he* and *Santa* as coreferential. In the other situation, on the other hand, the grammatical antecedent of the pronoun in the target sentence is clearly occupied in the action described by the target sentence. This context had the *Incredible Hulk* looking at a picture of Kermit. In this case, the child can judge whether the correct antecedent is doing what the sentence says. In this context, children did not allow the ungrammatical reading, rejecting (21) as incorrect. We interpret this difference as evidence of a pragmatic factor of plausible denial.

The effect of plausible denial is to bias children to pursue the ungrammatical reading. Here, it is hypothesized that some of those children who can interpret the pronominal reference extrasententially, according to their knowledge of grammar, in the latter situation, might not be able to correctly judge the same sentence in terms of pronominal reference, in the former situation. The barrier covering their grammatical knowledge is the pragmatic factor concerning the experimental methodology. Those children who can detect the grammatical coreference relations in the pragmatically proper situation, might be biased to select only one reading when the context does not provide them enough information regarding presupposition for the target sentence to correctly be judged concerning the coreference relationship between the pronoun and the R-expression.

This bias could be related to a linguistic phenomenon known as "focus" (Howard Lasnik, p.c.). Children could mistakenly have accepted sentence (21) with the first situation (the more vague situation), because the background information which should be

provided in order to focus on the object NP *the picture of Santa* is not provided in the context.

4.2. Method

In this experiment, a truth-judgement task was used to test the effect of pragmatic factors on children's coreference judgements for backwards anaphora. In order to examine whether or not the hypotheses given above are borne out, a cross-sectional experiment was conducted with twenty 3- to 6-year-old children. The subjects were from middle-upper class homes. These twenty children are divided into two groups. Group I contains ten children whose age ranged from 3;7 to 4;6. Group II contains ten children whose age ranged from 4;7 to 6;2. The experiments were held at Children's World and UConn Child Labs in Connecticut, U.S.A. Ten adults whose native language is English were also tested as a control group. These adult subjects are all students of the University of Connecticut, U.S.A.

Before discussing the test sentences, I briefly summarize the truth judgement task. In this task, on each trial one experimenter (Experimenter I) manipulates the toys in the experimental field, acting out the situations which correspond to one interpretation of a target sentence. Experimenter II controls a puppet. The subject and the puppet watch the event that is staged by Experimenter I. Then, the puppet which is controlled by Experimenter II says what he thought happened, using a target sentence, which includes a pronoun and an R-expression. On hearing the sentence, the subject is asked to feed the puppet a cookie, if he says the right thing about a story; a rag, if he says the wrong thing.

In this task, then, both an utterance and a meaning are provided by the experimenters: the meaning is provided by Experimenter I, who stages the situation by manipulating toys; the utterance is provided by Experimenter II, who controls the puppet. In this sense, it is different from other comprehension tasks, e.g., the act-out task. In the act-out task, the utterance is given by the experimenter; and the children themselves are in charge of the meaning. For the ambiguous utterances, as we saw, this task cannot be used to see if children know more than one meaning. On the other hand, the truth-judgement task has a merit in being capable of clearly assessing knowledge of alternative meanings by asking children to judge whether or not one utterance-meaning pair the experimenter presents is right or wrong. This task has a second virtue from a methodological standpoint. Since the child has only to judge the truth value of the utterance and meaning pair, he/she has a minimal requirement of planning in attaining the matching of utterance and meaning pairs. Finally, the task seems fun for children. It allows us to test 3- to 5- year old children for about twenty test sentences, which takes about thirty minutes to complete in one experimental session. For these reasons, this task seems to be a good task to attest the linguistic knowledge of ambiguous sentences, including sentences with pronouns.

The test sentences consist of two parts: One is the Pre-test; and the other is the Main session. In the Pre-test, the relevant syntactic constructions used in the Main session are tested in order to provide a control, so as to be able to examine the acquisition of linguistic knowledge of UG. The sentences in the Pre-test do not contain pronouns. In the Main session, the sentence type of backwards anaphora where the R-expression does not c-command the pronoun, but the R-expression is c-commanded by the pronoun, is tested. In these sentences, the pronoun precedes the name. The Main session examines the effect of plausible denial with the sentences including backwards anaphora which are out by Binding Condition C. Furthermore, according to the context presented by the protocol of the experimenter, test sentences were divided into two groups: (a) the pronoun in the target sentence takes external reference, and the anaphoric relation is corresponding to the presented situation (23 II: 1, 2, 3, 5, 6, 7); (b) the pronoun takes

sentence external reference, and the anaphoric relation is *not* corresponding to the presented situation (23 II: 4, 8). The sentences tested are the following:

(23)

I. Pre-test

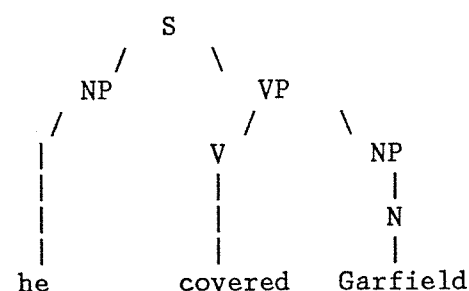
1. Smurf is looking at the picture of Teddy Bear.
2. Cabbage patch doll covered Mother.

II. Main session

1. He covered Garfield.
2. She washed Sister Bear.
3. She smelled Strawberry Short Cake.
4. He tickled Teddy Bear. (control sentence)
5. She is standing on the drawing of Minnie Mouse.
6. He is looking at the picture of Santa.
7. He is playing with the mask of Donald Duck.
8. She is reading a book about Gummy Bear. (control sentence)

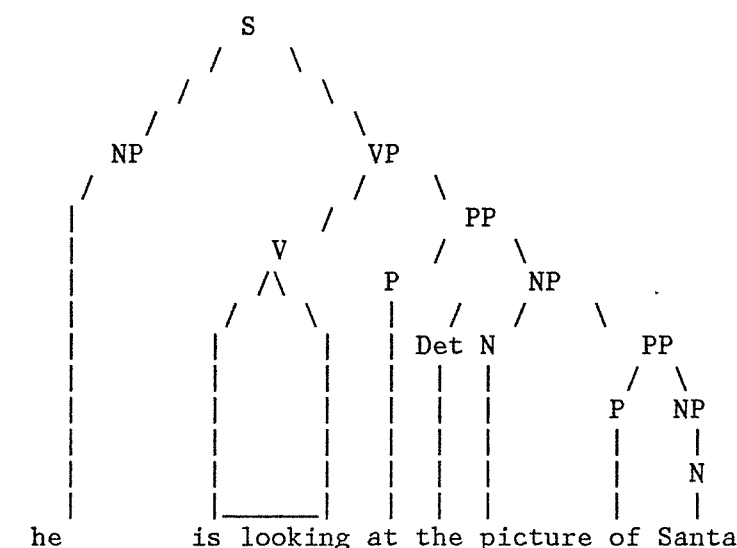
The Main session contains two syntactic types of sentences. Type 1 (i.e., (23 II: 1, 2, 3, 4)) is a simple sentence structure in which there is no NP-node between the pronoun and the R-expression. Type 2 (i.e., (23 II: 5, 6, 7, 8)) is a simple sentence structure in which there is structurally an NP which is commonly called a "picture noun phrase" between the pronoun and the R-expression. The S-structures of the sentences of Type 1 and Type 2 are diagrammed below:⁸

(24) (a) Type 1:



⁸ The details of the internal structure of AUX and Tense are not expressed in the tree diagram, because it is irrelevant to our present concern.

(b) Type 2:



Further, there are two contexts corresponding to sentence (23, II), which I call Situation 1 and Situation 2. All subjects were given all 8 sentences in Situation 1 first (the sentences given in random order), and then all 8 sentences were given in Situation 2. For example, for the sentence 6 in (23, II), the following two situations are set up.

(25) $He_{xi/j}$ is looking at the picture of $Santa_i$

- <Situation 1>: a. Santa is looking at a picture of himself.
b. Bat Man is not doing anything.

(Protocol)

Santa and Bat Man walk along and go in opposite directions.
Santa comes to his own picture and looks at it to see it :
"Bat Man! Look what I found!"
Bat Man slowly walks away.

- <Situation 2>: a. Santa is looking at a picture of himself.
b. Bat Man is looking at a picture of Kermit the Frog.

(Protocol)

Santa and Bat Man walk along and go in opposite directions.
Santa comes to his own picture and looks at it to see it :
"Bat Man! Look what I found!"
Bat Man says: "I can't see from way over here. I am looking at the picture of Kermit!"

In Situation 2, the two possible antecedents are looking at different things. Thus, the contrast between the action of the 'correct' antecedent and the 'incorrect' antecedent is clear in the experiment. In short, plausible denial is satisfied. In Situation 1, however, only one of the two possible antecedents is doing the action mentioned in the sentence; but the other character, who *could* be the antecedent of the pronoun is not performing the kind of action mentioned in the sentence. Therefore, this might be a case where the

child chooses the answer, not on the basis of his syntactic knowledge, but because he cannot see why the sentence is false. If so, we cannot deduce that the child does not know the structural constraints on pronominal reference; rather, the reason could be due to this pragmatic factor. To summarize:

(26)

	Test Sentences			
	Situation allows extra-sentential reference (Response:yes)		Situation does not allow extra-sentential reference (Response:no)	
Sentence Type	Type 1	Type 2	Type 1	Type 2
Situation 1	4	8	1, 2, 3	5, 6, 7
Situation 2	4	8	1, 2, 3	5, 6, 7

In order to focus on the effect of plausible denial, the Main session controls the following factors. First, the test sentences include only the backwards anaphora where the grammar predicts that the coreference relationship is not allowed between the R-expression and the pronoun. Moreover, the fact that the test sentences include only backwards anaphora entails that the linear order of antecedent-pronoun is controlled. Furthermore, the context provided by Experimenter I with the protocol consistently ends up with the story about the character (referred to as an R-expression) which is different from the one mentioned in the sentence. That is, taking the hypothesis of Lust et al. (1980) into consideration, the last mentioned person in the protocol in this Main session is always the name which is predicted by the grammar as the antecedent for the pronoun in the target sentence. This is for the control of a pragmatic factor. By observing the discourse principle as well, which might concern the determination of pronominal reference, we aim to see the effect of plausible denial.⁹ That is, the experiment tests whether or not children judge the coreference relation between the R-expression and the pronoun *intrasententially* for sentences like (23 II: 1 - 8) in the situation where the discourse principle as well as the grammar in the narrower sense drive the subject to determine the antecedent of the pronoun *extrasententially*, thereby, testing the existence of the plausible denial phenomenon in the acquisition of structural constraints on pronominal reference.

All subjects were tested first with sentences (randomly ordered) in Situation 1, followed by Situation 2. Then, in the follow-up experiment, nine subjects who showed an effect of the phenomenon of plausible denial were re-tested with the same sentences, this time, in Situation 2 first, followed by Situation 1: five subjects from Group I, and four subjects from Group II were tested. The follow-up test aimed to test whether or not the phenomenon of plausible denial was found even in reverse ordered situations. As a control group, ten adults were also tested.

The predictions for this experiment based on the notion of plausible denial are as follows. In Situation 2, coreference judgements by the child should reflect the knowledge

⁹ It should be noted that there are only two R-expressions which could be candidates for the antecedent of the pronoun in the experimental field. Therefore, whether (i) the subject tells directly on the basis of his grammar (and discourse principle) that the extrasentential object is coreferential with the pronoun, or (ii) the subject deduces from both context and his knowledge of grammar that the name in the sentence is not coreferential with the pronoun, the result observed in this truth-judgement experiment ends up with the same answer: *yes* or *no*.

of his/her grammar. Thus, the grammar (and, possibly, discourse principles) yields that the reading for the pronoun in those test sentences must be extrasentential. However, in Situation 1, where the problem of plausible denial arises, children's responses will be affected by the pragmatics of the situation. Since the context does not contain an action that makes the sentence false, there will be a bias for letting the children accept the sentence in the incorrect context. Even if the discourse principle as well as the grammar tell them to say *no*, the linguistic knowledge is overridden by the pragmatic condition concerning plausible denial, and thus, in the truth judgement task, the appropriateness of the target sentence is judged to be *yes*. In this case, the child's competence is not, thus, properly being attested. Rather, what I show is the difficulty one has in seeing why the sentence is false.

4.3. Results

This section summarizes the results. All the subjects in the three age groups passed the Pre-test. The results of the Main session are summarized in the tables (27) through (30). These results include only subjects who passed the control sentences (23 II: 4,8). That is, the correct responses for the test sentences (23 II: 1, 2, 3, 5, 6, 7) are summarized. (27) and (28) show the results of the experiment with Situation 1 first (the main Experiment). In (27), the results of Situation 1 are given; in (28), the results of Situation 2 are given.

(27)

Situation 1 First

Percentage of correct responses for Situation 1

Sentence Type	Type 1	Type 2
Age Group		
Group I (3;7-4;6: N= 10)	76.7(%)	36.6(%)
Group II (4;7-6;2: N= 10)	85.8(%)	57.2(%)
Group III (adults: N= 10)	100(%)	94.2(%)

(28)

Situation 1 First

Percentage of correct responses for Situation 2

Sentence Type	Type 1	Type 2
Age Group		
Group I	100(%)	96.6(%)
Group II	100(%)	100(%)
Group III	100(%)	100(%)

(29) and (30) show the results of the experiment with Situation 2 first (the follow-up test). (29) is a table showing the percentage of correct response for Situation 1; (30), Situation 2. Notice that all the subjects who were given the experiment with Situation

2 first were among those who showed the phenomenon of plausible denial in the experiment with Situation 1 first.

(29)

Situation 2 First

Percentage of correct responses for Situation 1

Sentence Type	Type 1	Type 2
Age Group		
Group I (3;7-4;6: N= 5)	86.7(%)	71.4(%)
Group II (4;7-6;2: N= 4)	100(%)	73.3(%)
Group III (adults: N= 10)	100(%)	100(%)

(30)

Situation 2 First

Percentage of correct responses for Situation 2

Sentence Type	Type 1	Type 2
Age Group		
Group I	93.3(%)	92.9(%)
Group II	100(%)	100(%)
Group III	100(%)	100(%)

4.4. Analysis

Analyses of children’s judgement error types provide evidence that plausible denial has a strong effect on children. Analyses of variance show that the effect was statistically significant ($p < 0.001$).

First let us look at the results concerning sentence Type 1, that is, simple sentences with no NP-node intervening between the binder and the bindee. In Situation 1, the situation where the character which should be an antecedent in the adult grammar was not occupied in the salient activity, sentence Type 1 was correctly answered by 76.7% in Group I; 85.8% in Group II. The most errors were found for sentence 3, in which the verb *smell* was the head of the VP predicate. (The reason for this will be discussed later.) In Situation 2, on the other hand, where both characters (possible antecedents) were occupied in the actions introduced by the verb, 100 % of the children in both age groups could interpret the binding relations between pronoun and R-expression as adult subjects do. The results of the adult control test show that 100% of the adults interpreted the binding relations between pronoun and R-expression.

Second, let us look at the results concerning sentence Type 2, that is, simple sentences including a picture NP. In Situation 1, where the character which should be an antecedent in the adult grammar was not occupied in the salient activity, sentence Type 1 was correctly answered by 36.6% in Group I and 57.2% in Group II. In Situation 2,

on the other hand, where both characters (possible antecedents) were occupied in the actions introduced by the verb, 96.6 % of the children in Group I and 100 % of the children in Group II could correctly interpret the binding relations between pronoun and R-expression. In the tests of both sentence Type 1 and sentence Type 2, there were no children who said *yes* in Situation 2 but said *no* in Situation 1. That is, there were no children who interpreted the anaphoric relation as intrasentential, violating Binding Condition C, in Situation 2; while interpreting pronominal reference extrasententially, observing Binding Condition C in Situation 1. Interestingly, the adult control subjects also showed the effect of plausible denial though to a lesser extent than children. This result suggests that the pragmatic constraint of plausible denial is not specific to children, but it is governing the adult grammar in broader sense as well.

The effectiveness of plausible denial is strongly supported by the follow-up experiment. As the results given in (29) and (30) show, the effect of plausible denial was observed less often in the case where Situation 2 was presented preceding Situation 1 for the same sentence. Unlike the experiment with Situation 1 first, the presence of the specific actions for the extrasentential reference in the first cycle of the experiment significantly aided the interpretation success in all age groups, since the anaphoric relations for the test sentence was more clearly shown in the experimental field. Therefore, we can speculate that for some subjects, after finishing one session with Situation 2, the context for the correct anaphoric relations was retained in the subject’s mental image, and that the fact that the clearer context was presented prior to the vague context provided the subject an indirect cue for another cycle of the test of the same sentence with Situation I, in which no specific action of the antecedent for extrasentential reading was given in the context. Thus, some of those who made some ‘mistakes’ in the test with Situation 1 first, followed by Situation 2, made no mistakes in the follow-up test with Situation 2 first followed by Situation 1. This effect was also true for some of the children in the younger group (Group I). It should be noticed, however, that in this younger group, the plausible denial phenomenon was also observed. In this follow-up experiment also, for both sentence types Type 1 and Type 2, there were no children who said *yes* in Situation 2 but said *no* in Situation 1. The children who did not make any different judgements from adults’ in the test with Situation 1 first also did not make any in the test with Situation 2.

Finally, we summarize the effect of age difference. The results on the truth judgement task with children revealed no significant effect of age in sentence Type 1, but they did show a significant effect in sentence Type 2. The phenomenon of plausible denial was observed even in adult controls, just in the case of Situation 1 with sentence Type 2, though to a lesser extent than children.

4.5. Further Discussion

In this section, we will discuss why the effect of plausible denial takes place.

In the protocol of Situation 1, the action of the extrasentential referent is always described by a verb different from the verb for describing the action of the referent that is mentioned in the target sentence. On the other hand, in Situation 2, the two possible antecedents are occupied in the action described by the predicate with the same verb, but with a different object NP. The plausible denial problem arises in the former case.

There are several possible explanations for this difference. The reason for this plausible denial phenomenon (at least in part) could be attributed to the lexical meaning of such verbs as *smell*; which is contrasted with the verb *cover*. Recall that one child accepted the sentence (21) in the pilot study with the comment that the *Incredible Hulk* might have looked at the picture of *Santa*, but that *Incredible Hulk* was pretending that he did not look at it. This observation seemed to suggest that the vagueness of the lex-

ical meaning of the verb as well as the vague situation presented in the experimental field covered the children's linguistic knowledge. In the experiment, in order to look at this phenomenon more closely, the verbs *smell* and *look*, whose lexical meaning does not necessarily require the agent's intention were used in some of the sentences, in order to describe the action of the extrasentential reference which should be a grammatical antecedent. There was only one child who commented, after allowing the sentence-internal coreference in (23 II: 3), as follows:

(31)

OT (4;6)

- E1: Here is Strawberry Short Cake and Minnie Mouse.
 Strawberry Short Cake said, "I smell something very nice. What's that
 Hmmm. That's me. I smell so sweet."
 Minnie Mouse is just looking at Strawberry Short Cake.
 E2: She smelled Strawberry Short Cake.
 --->S: ... (pause) Yes.
 E1: So, what does Kermit eat?
 S: Cookie!
 E2: Thank you. Yum yum...
 E1: OT, what happened in the story?
 --->S: Minnie Mouse smelled Strawberry Short Cake.
 E1: Oh, really? Let me see... in this story,
 Strawberry Short Cake said, "I smell very nice,"
 and...
 S: She (pointing to the Minnie Mouse) can smell, too.

It seems that this could be sometimes interpreted as a case for the phenomenon of plausible denial.

A related suggestion was offered by Stephen Crain (p.c.). He suggests that contexts which do not offer the chance for plausible denial were ones in which the correct interpretation of a sentence has an unmet presupposition. In this circumstance, the child may not be able to do what Lewis (1979) suggests adult do, "accommodate" the presuppositional failure by mentally fixing things up so that the presupposition is met (Hamburger and Crain, 1984: 133). Hamburger and Crain (1984) claim that accommodating presuppositional failure is a significant cognitive achievement for children.

However, there were several children who really *understood* the situation and yet accepted the sentences (23 II: 5,6,7). For example, as the example (32) shows, there were some children who commented on the pronominal reference for several sentences by revealing their reading as intrasentential reference.

The reason for the plausible denial effect, might also involve sentence focus. Children could mistakenly have accepted sentence (21) with Situation 1, because the presupposition which should be provided in order to focus on the object NP *the picture of Santa* is not present in the context.¹⁰ As there was only one referent (by the intrasentential reading) that can satisfy the presupposition of the target sentence, the intrasentential reading for *he*, which can function deictically as well as anaphorically,

¹⁰ Here, it should be noted that the last mentioned name in the pragmatic lead (in the protocol) should also direct the subject to choose the extrasentential reading.

might have been taken for a sentence like *He_{*i}/j is looking at the picture of Santa_i* by the children.

The present writer observed in the experiment that there were several subjects who were looking at the extrasentential referent when they heard sentences like (23 II:5, 6, 7) in Situation 1, but thought for a while, looked at the other character, and then concluded by accepting the sentence internal reference reading, giving the comment of "Yes, he was." In this case, *he* is used deictically, but not as an anaphor. MT (3;4), who did not allow sentence internal reference in Situation 2 allowed it in Situation 1, with the following comments.

(32)

MT (3;4)

- E1: MT, in this story, here is Smurfette,
 Minnie Mouse and a drawing of Minnie Mouse.
 Smurfette and Minnie Mouse look at this drawing (point).
 Minnie Mouse says: "I like this drawing. But I have to stand
 on it to see it better."
 Smurfette is just looking at Minnie Mouse.
 E2: She is standing on the drawing of Minnie Mouse.
 ---> S: Yes! (gives the puppet (Exp. II) a cookie)
 E1: Can you tell Kermit why he was right?
 E2: I said a right thing! yum yum ...
 ---> S: Because, she (pointing to Minnie) was standing on this
 picture.

On the other hand, this subject gave the following comments with the same sentence with Situation 2.

(33)

- E1: MT, in this story, here is Smurfette, and here is
 Minnie Mouse. Here is a drawing of Minnie Mouse.
 Here is a present. At first,
 Smurfette and Minnie Mouse look at this drawing (point).
 Minnie Mouse says: "I like this drawing. But I have to stand
 on it to see it better." Smurfette said, "I don't think
 it's a good idea to stand on the drawing of Minnie Mouse.
 I think I will stand on the present!"
 E2: She is standing on the drawing of Minnie Mouse.
 ---> S: No... (gives the puppet (Exp. II) a rag)
 E2: No? Oh... yucky rag!
 E1: Can you tell Kermit why he was wrong?
 ---> S: Because, she (pointing to Smurfette) was standing on this
 present, and she (higher pitch) was standing on the
 picture.
 E2: Oh, I see.
 E1: Well, so what did Kermit say before?
 --->E2: She is standing on the drawing of Minnie Mouse.
 --->E1: MT, who is "she"?
 ---> S: Smurfette.

This subject also showed the relevancy of the phenomenon of plausible denial in the follow-up test where two situations were given in the opposite order from the Main session. There were several children who gave comments in the same line. Thus, here we conclude that the plausible denial strongly affects the experimental study on Binding Condition C.

Here arises another problem. Examining the data closely, analysis of variance revealed a marginally significant effect of the variable of sentence type ($p < 0.08$). The percentage of the accuracy of sentence type 2 including "picture NPs" was also lower than that of sentence type 1 in both situations. Furthermore, the interaction between the variables of sentence type and situation was statistically significant ($p < 0.01$). That is, the effect of the difference of situations on the sentence containing a complex NP was greater than that on the sentence containing a simple NP. The other factors being controlled, the only difference between Type 1 and Type 2 sentences is, syntactically, whether or not there is an intervening NP-node between the subject NP and lower NP in the predicate.¹¹ This result suggests that some other factor besides the pragmatic condition of plausible denial is concerned to drive the subject to allow the violation of Binding Condition C for the case where an NP-node is intervening between the binder (in this case, a pronoun) and the bindee (in this case, a R-expression) much stronger than for the case where there is no NP-node intervening between the binding NP and the bound NP. I offer the following highly speculative analysis for this problem. The upper NP in the predicate, or the picture NP, makes one semantic unit, and the inner structure within the upper NP is invisible to those children (and, even for some adults) and it, therefore, makes them admit the coreferential relationship between the subject NP and lower NP in the predicate. So, the upper NP makes an 'island', and the lower NP can thus be coreferential with an outside NP. In this paper, this explanation will be called an hypothesis of 'anaphoric island'.

For an alternative hypothesis, the following explanation could be also given. The reason why the lower NP is an invisible R-expression could be due to the fact that R-expressions in a picture NP are different from other usual R-expressions. That is, the R-expression of lower NP in picture NPs and that of upper NP belong to different semantic classes.¹² This is because, although the R-expression in a picture NP is describing the image of the referent, it does not directly refer to the NP in the actual world as it is. It could be roughly stated that the R-expression in picture NPs is an R-expression which refers to the denotation in the imaginary possible world of the speaker/reader, while the usual R-expression refers to the denotation in the actual world.

Then, how does this distinction of R-expressions account for the fact that some of the younger group of children (and even some adults) fail to rule out sentences like (21)? My conjecture is that it may be easier to put an index to a more 'referential' NP, since the unmarked use of an index is to indicate a real entity in the actual world, as the name "referential index" suggests. Therefore the upper NP as the noun referring to the actual

¹¹ It should be noted here that the tense and the aspect of the Type 1 sentences are different from those of Type 2. The reasons are summarized as follows. First, it was because of the naturalness of the sentence, due to the natures of the verb and the picture NPs. The selected verbs that can take a picture NP as direct object were judged to be more natural with the progressive form in the experimental context in question by native speakers of English. For example, it was considered that test sentence 1 would be interpreted naturally with past tense; the test sentence 5 would be interpreted naturally with present progressive. Further, we tried to avoid the repetition of using the same pattern of the verb forms. The other variables, for example, the type of situation, the structure of the test sentence and the linear order of pronoun-name in the target sentence are all controlled. Therefore, the protocol as well as the target sentences might sound to the subjects always in the same pattern, causing a loss of attention. In order to control the inconsistency of form of verbs in sentences of Type 1 and Type 2, the tense and the aspect of the verbs in the Pre-test were designed to correspond to those of the verbs used in the test sentences in the Main session.

¹² This suggestion ties in with a proposal that there are two kinds of R-expressions.

object in the world is easier to get an index as an R-expression, and thus functions as a candidate for a bindee. However, *he* and *the picture of Santa*, for example, are interpreted as semantically anomalous when they are assigned the same index, because of the difference in gender. On the other hand, the lower NP which is also a name but which does not refer directly to the referent in the actual world, cannot get an index, at least, for some adults and children, because it is not a usual R-expression.

Whichever analysis is true, the following scenario would be provided to explain why the accuracy of sentence type 2 including picture NPs was lower than that of sentence type 1 in both situations. In the experiment, the pragmatics of the experiment supports the intrasentential reading. First, the plausible denial enters in this case. In the experimental field, for example, the situation where *Donald Duck* is playing with *the mask of Donald Duck* is acted out using the actual toys of *the mask of Donald Duck* and *the doll of Donald Duck*. Then, the subject hears the target sentence *He is playing with the mask of Donald Duck*. The presented context provides the subject a visual input that *Donald Duck* is playing with *the mask of Donald Duck*. The pronoun *he* can be used deictically because of its lexical property. Further, the lower NP *Donald Duck* is invisible for the children (and even for some of the adults) as a bindee to get an index with the preceding pronoun, and the upper NP also gets a different index, for the semantic or syntactic reason. Thus, the subject might have concluded on the basis of these computations that the target sentence is describing the situation correctly; thus, the subject's answer is *yes*. If the pronoun *he* can be used deictically, then, truly, *he* is playing with *the mask of Donald Duck*.

Therefore, even if the child knows the structural relationships of c-command, and irrespective of their noticing that *Donald Duck* functions as a noun and the pronoun c-commands the R-expression in the target sentence, the Binding Condition C does not apply in this case because it is not coindexed with the pronoun. In other words, the actual situation and the linguistic knowledge that (i) there are two main characteristics of R-expressions, (ii) the R-expression in the picture NP is different from usual R-expressions and (iii) a pronoun can be used deictically as well as anaphorically, lead the children to the 'incorrect' answer in the present experimental task. Notice, however, that this explanation does not directly concern the question of whether or not the Binding Condition C is acquired in those children, because this condition is not *applied*. Before the condition of UG is applied, children (and even some adults) have some problems in the sentence including pronoun and picture NP to detect that the lower NP inside the picture NP can be an R-expression which can be a bindee in the target sentence.

So far, we discussed two possible analyses: the explanation of 'island' and that of 'image'. Howard Lasnik pointed out to me that NPs with the genitive could be used in order to disentangle these two possible hypotheses, as in (34). The sentence (34) has two readings, as shown in (34a) and (34b).

(34) *He_i is looking at John_i's picture.

- a. Ben is looking at the picture of John (i.e., the image of John.)
- b. Ben is looking at the picture drawn by John.

According to the 'island' explanation, the upper NP is visible but the lower NP is not. Therefore, if this analysis is correct, then, the sentence (34) should be accepted by the subjects whichever reading they give it: (34a) or (34b). That is, the subjects would interpret the pronominal reference in (34) intrasententially regardless of the reading. However, suppose the 'image' hypothesis is correct. Then, the subjects who accept the reading (34a), would not accept the reading (34b). If the subject interprets the sentence (34) with the (34a) reading, then, according to this hypothesis, the lower NP is invisible because it is not a usual referential expression; rather, it describes an image. If it is in-

terpreted with the reading of (34b), however, the lower NP is not invisible because a lower NP as well as an upper NP belong to the same semantic class of R-expression. Therefore, if the experimental context leads subjects to choose the reading in (34b) when sentence (38) is presented, according to the 'image' hypothesis, then, the pronominal reference in (34) would be interpreted extrasententially. In this way, the two possible analyses could be disentangled. This project remains for future study.

Further, in order to test the 'image' hypothesis, the following small experiment was held using two subjects who had showed the effect of plausible denial in the previous experiment. Those subjects were tested with the sentence *She is reading a book about Gummy Bear*, a sentence which was used as a control test in the previous experiment to test whether or not the subject can *accept* the intrasentential reading. Howard Lasnik pointed out to me that the sentence shown above is different from others tested in the Main session. *Gummy Bear in the book about Gummy Bear* denotes a character in the actual world whereas *Santa in the picture of Santa*, merely describes an image. In this experiment, we used the same technique as was used in the experiment of plausible denial, to test whether or not those subjects who showed the plausible denial effect in other sentences would also accept the intrasentential reading for this sentence.

The result of this small experiment showed that those two subjects could allow the extrasentential reading without showing the plausible denial phenomenon. In the context of Situation 1, those subjects answered *no* for the target sentence given in the context where the grammatical antecedent should not be the R-expression (*Gummy Bear*, in this case) in the adult grammar. The subjects allowed the intrasentential reading in other sentences, but did not allow the intrasentential reading in such a sentence as *She is reading a book about Gummy Bear*, in which the lower NP in the picture NP is more 'R-expression-like' than the other lower NPs in the tests. This result provides support for our 'image' hypothesis on why it is more difficult to detect that Binding Condition C applies to the lower NP than the other simpler NPs.

5. Concluding Remarks

Linguistic theory has sought to explain how and why children make the transition from the initial state of language to the final state on the basis of the primary linguistic data. It is commonly assumed further that the data available to the learner are highly limited in character. For one thing, negative data -- evidence that certain sentences are ill-formed -- are not available for the acquisition of grammar. Chomsky (1986) terms this 'Plato's Problem': How is it that we can know so much given that we have such limited evidence? The rules that concern the interpretation of anaphoric elements, which are pervasive in many natural languages, are a part of language which is not "learned". Despite the absence of negative data, children become able to tell the anaphoric relations in (3) from the disjoint reference in (4).

On the basis of these assumptions, this study has proposed to test whether the effects of 'plausible denial' in the experiment affect responses regarding coreference judgements. Examining these factors in the Main session, we aimed to study the acquisition of structural constraints on pronominal reference, trying to examine whether or not the prediction that 'once the children know the the relevant syntactic structure, the innate knowledge of structural constraints may emerge' was true. Thus, by noticing the importance of pragmatic factors, we studied the condition in which pragmatic factors override children's syntactic analyses. In particular, we presented evidence that, under certain pragmatic circumstances (which we call 'plausible denial') children override Binding Condition C, and allow backwards coreference in structures which should prevent it. However, when this pragmatic condition is controlled, children consistently respond according to structural constraints. Moreover, adult controls also show (though to a lesser extent) the effect of plausible denial. The experiments used a truth judgement

task with twenty English-speaking children 3 to 5 year-olds. Our data, together with the results of earlier studies, are interpreted as support for the early emergence of structural knowledge, as anticipated by current linguistic theory.¹³

Appendix 1

SENTENCES

I. Pre-test

- 1. Smurf is looking at the picture of Teddy Bear.
- 2. Cabbage patch doll covered Mother.

II. Main session

- 1. He covered Garfield.
- 2. She washed Sister Bear.
- 3. She smelled Strawberry Short Cake.
- 4. He tickled Teddy Bear.
- 5. She is standing on the drawing of Minnie Mouse.
- 6. He is looking at the picture of Santa.
- 7. He is playing with the mask of Donald Duck.
- 8. She is reading a book about Gummy Bear.

Appendix 2

PROTOCOL (Pre-test)

- 1. Here is a Teddy bear. He has a flower-patterned bag.
On the other side, there is a picture of Teddy Bear.
Smurf came along, went to the direction where Teddy Bear was standing and said, "Oh, Teddy Bear, you have a pretty bag.
I like it very much! hmmm, wonderful."
- 2. Here is Cabbage Patch Doll.
Here is Mother.

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Mother is sick, today.
 Mother said to Cabbage Patch Doll, "Could you please tuck me in?"
 Cabbage Patch Doll said, "OK", and goes like this. (Cabbage Patch Doll covers Mother.)

Appendix 3

PROTOCOL (Main session)

1. (Situation 1)
 Here is Garfield and Arnie.
 Garfield is sleepy, and goes to bed.
 "Arnie, will you please tuck me in?"
 But Arnie says: "You are too big for me to tuck you in. Do it yourself." And Garfield covers himself.
 Arnie is just standing here.

 (Situation 2)
 Here is Garfield and Arnie. And here is Snow White.
 Garfield is sleepy, and goes to bed.
 "Arnie, could you please tuck me in?"
 But Arnie says, "No, you do it by yourself."
 So, poor Garfield covers himself.
 Then Arnie found Snow White sleeping without any blanket.
 "I will tuck you in. Is that warm?"
2. (Situation 1)
 There is a Mother and Sister Bear.
 Sister Bear woke up and said, "Mother, Mother, could you wash my face?"
 But Mother said, "No. You are six years old. You can do it by yourself. Do it by yourself."
 So, Sister Bear washes the face by herself.
 Mother is just standing over there.

 (Situation 2)
 There is a Mother and Sister Bear.
 Sister Bear woke up and said, "Mother, Mother, could you wash my face?"
 But Mother said, "No. You are six years old. You can do it by yourself. Do it by yourself."
 So, Sister Bear washes the face by herself.
 Then Mother said, "I have to wash the dishes."
 And Mother washes the dishes.
3. (Situation 1)
 Here is Strawberry Short Cake and Minnie Mouse.
 Strawberry Short Cake said, "I smell something very nice. What's that?"
 Hmmm. It's me. I smell so sweet."
 Minnie Mouse is just standing over there.

(Situation 2)
 Here is Strawberry Short Cake and Minnie Mouse.
 And here is a beautiful flower.
 Smell Strawberry Short Cake. Smell the flower.
 (Aren't they smell nice?)
 Strawberry Short Cake said, "I want to smell something nice.
 Hmmm. Oh, I smell very nice. How nice it smells!"
 Minnie Mouse said, "I don't think so.
 Hmmm. Here is a beautiful flower. This flower smells so sweet."

4. (Situation 1)
 Here is Teddy bear and Mickey Mouse.
 Mickey Mouse feels like tickling somebody. Mickey Mouse found Teddy Bear, and ---- tickle tickle tickle. (Mickey Mouse tickled Teddy Bear.)

 (Situation 2)
 Here is Teddy bear, Mickey Mouse and Minnie Mouse.
 Mickey Mouse and Minnie Mouse are very good friends, you know.
 One day, the nasty Teddy Bear tickled Minnie Mouse.
 Tickle, tickle, tickle. Mickey Mouse look at that, and got upset.
 "Teddy Bear is tickling my best friend!"
 So, Mickey Mouse goes like this.
 ---- tickle tickle tickle. (Mickey Mouse tickled Teddy Bear)
5. (Situation 1)
 Here is a picture of Minnie Mouse.
 Smurfette and Minnie Mouse look at the picture.
 Minnie Mouse says: "I like this drawing. But I have to stand on it to see it better."
 Smurfette is just looking at Minnie Mouse.

 (Situation 2)
 Here is a picture of Minnie Mouse.
 Smurfette and Minnie Mouse look at the picture.
 Minnie Mouse says: "I like this drawing. But I have to stand on it to see it better."
 Smurfette says: "I don't think it is a good idea to stand on the drawing of Minnie Mouse. I think I will stand on the present."
6. (Situation 1)
 Santa and Bat Man walk along and go in opposite directions.
 Santa comes to own picture and looks at it to see it :
 "Bat Man! Look what I found! It's me!"
 Bat Man slowly goes away.

 (Situation 2)
 Santa and Bat Man walk along and go in opposite directions.
 Santa comes to his own picture and looks at it to see it :
 "Bat Man! Look what I found! It's me!"
 Bat Man says: "I can't see from way over here. I am looking at the picture of Kermit!"
7. (Situation 1)
 Here is a mask of Donald Duck.

Donald Duck and Papa Smurf are looking at the mask.
 Donald Duck says: "I like this mask very much.
 I want to play with it."
 But Papa Smurf is just standing by the mask.

(Situation 2)
 Here is a mask of Mickey Mouse.
 Here is a mask of Donald Duck.
 Here are Donald Duck and Papa Smurf.
 They are looking at the mask of Donald Duck.
 Donald Duck says: "I like this mask. It's big and nice.
 I will play with it!"
 But Papa Smurf says: "I don't like this mask.
 Oh, here is a mask of Mickey Mouse.
 I like the mask of Mickey Mouse."

8. (Situation 1)
 Here is Gummy Bear and Here is Wonder Woman.
 They go to school. Gummy Bear found a big book
 in a classroom. "Oh, no. It's embarrassing. It's
 a book about me." And Gummy Bear goes away.
 But Wonder Woman said, "I don't think so. I want to read a book
 about Gummy Bear. Hmmm. It's very interesting."

(Situation 2)
 Here is Gummy Bear and Here is Wonder Woman.
 And, here is a book about Gummy Bear and here is a book about
 Grover.
 They go to school. Gummy Bear found a big book
 in a classroom. "Oh, no. It's embarrassing. I do
 not want to read the book about me." And Gummy Bear turned around.
 "Oh, here is a book about Grover. I think I will rather read
 a book about Grover."
 But Wonder Woman said, "I don't think so. I want to read a book
 about Gummy Bear. Hmmm. It's very interesting."

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