# Constraints of Pronominal Anaphora in Second Language Acquisition of English: An Empirical Study Under The Framework of Universal Grammar

陳 庸

**Abstract**

*This study is an attempt to subsume the acquisition of anaphora in Second Language acquisition (L2) under the framework of Universal Grammar (UG), showing that L2 acquisition of anaphora is constrained by the incorporation of two sets of cognitive principles: the learning principles (the Subset Principle, in particular) and the language principles (the notion of c-command, in particular). The general hypothesis tested is that all structural restrictions of pronominal anaphora are developmentally acquired. That is, the hypothesis tested was that learners who rely on the learning principle (i.e., the Subset Principle) as their learning strategy initially would use the restriction based solely on directionality and later would have to retreat from that overgeneralization by taking the structural factor (i.e., c-command) into account. The linguistic properties involved in the study are : 1) the directionality, 2) the notion of command (c-command and d-command). In the experiment, 107 students from three designated language groups (Japanese, Spanish, and Arabic) were grouped into two language proficiency levels (high and low). Subjects were asked to take a written comprehension test containing 42 token sentences designed to elicit their judgments on pronominal reference. Results showed 1) that subjects allowed anaphora more frequently when the direction of anaphora is forward than when the direction of anaphora is backward, 2) that subjects based their coreference judgments on the notion of c-command, 3) that subjects' order of development in their acquisition of anaphora in terms of principles used is: initially, 'directionality only' and later 'the notion of command'.*

## Introduction

### Universal Grammar and First Language Acquisition

Linguistic universals, according to Chomsky (1965, 1980, 1981a), have generally been proposed to explain two very different types of facts in First Language acquisition (hereafter L1 acquisition). First, it has been observed that languages, sometimes not closely related to each other historically, share very specific characteristics. Second, it has long been observed that all children, regardless of intelligence, seem to learn their native language with ease, in a rather short period of time. The above two facts support the idea that human beings are innately endowed with universal language-specific knowledge, or what Chomsky calls Universal Grammar (hereafter UG). The main argument here is that it would not be possible for children to learn their mother tongue without a set of innate principles, since the input data available are insufficient to allow the children to discover certain rules. Linguistic universals, as claimed by some linguists (e.g., Hornstein and Lightfoot 1981, Bley-Vroman 1988), are thus

*本文作者現任教於海洋大學

assumed to provide the solution to what is called the 'logical problem' of language acquisition. The relationship between linguistic universals and first language acquisition, therefore, has been most thoroughly explored in terms of Universal Grammar.

## Universal Grammar and Second Language Acquisition

On the other hand, an increasing number of studies concerning Second Language acquisition (hereafter L2 acquisition) have shown that learners must have access to Universal Grammar (hereafter UG) as well (e.g., Ritchie 1978, Otsu and Naoi 1986, Coppieters 1987, Finer and Broselow 1986, White 1988c, Bley-Vroman et al. 1988). First, these studies have shown that principles not exemplified in the L1 can be activated in the L2, and that learners appear to be able to go beyond the L2 input despite its deficiency and do not accept or produce 'impossible' errors. Second, the once-promising proposal of problem-solving and hypothesis-testing has been proved not capable of accounting for L2 acquisition as it cannot for L1 acquisition. The argument is that if UG is inaccessible and L2 learners construct grammars only by general problem-solving and hypothesis-testing, there is no reason why they should not adopt logical possibilities which do not represent parameters of UG, because there is nothing in the L2 data alone which dictates that only a specified set of possibilities is allowed. However, as we know, no evidence in previous studies has proved this argument correct. In short, the problem-solving model fails to explain the fact that L2 learners are able to arrive at the kind of complex and subtle knowledge attained by native speakers in the case that there is nothing obvious in the input to lead to the appropriate hypotheses, and that certain error-types are never present in L2 acquisition. Third, as evidenced in previous research (e.g., Krashen et al. 1979, Krashen 1985, Bowerman 1982, Karmiloff-Smith 1984, Kellerman 1985) L2 learners often go through similar acquisition sequences as those of L1 learners. This serves as another proof that a problem-solving and hypotheses-testing model is potentially problematic, because theoretically if L2 acquisition is a form of hypotheses-testing, then grammars underlying the L2 acquisition process will be essentially different from grammars internalized by native speakers, and again research findings from previous studies have shown that this is not true at all. Successful L2 learners, in fact, are just like L1 learners in that they are able to achieve knowledge of subtle and complex properties of language which are not present in the input.

## Anaphora and Its Grammatical Centrality

Over the last decade, anaphora has emerged as central to research on natural language; especially, within the Government and Binding (hereafter GB) framework, anaphoric relations are most important to the formulation of UG. Anaphora relates to widely varying aspects of language structure. As Wasow (1986:108) points out, when anaphoric elements derive their interpretation from non-linguistic context, their analysis belongs to the domains of pragmatics; when pronouns are interpreted as bound variables, they affect semantics; and in determining

linguistic antecedents for anaphoric elements, both tree configurations and stress level are relevant, so syntax and phonology are involved. Also, anaphoric elements are a pervasive fact of life in natural languages, so any theory that purports to characterize a speaker's linguistic abilities must address itself to the phenomenon of anaphora. Again, the rules governing the interpretation of anaphoric elements appear to be a part of a speaker's knowledge of language which is not explicitly taught. As noted, studies on the acquisition of anaphora in L1 and L 2 acquisition are many. The question whether there is a 'forward directionality preference' in the use of anaphora in L1 and/or L2 acquisition, however, remains unresolved. It has been claimed that there is a forward directionality constraint in many languages, requiring that an antecedent must always precede a pronoun to which it is related. For example, children have been found to imitate sentences with forward pronouns such as in 'Tommy ran fast because he heard a lion' significantly more successful than sentences with backward pronouns such as in 'Because he heard a lion, Tommy ran fast'. This constraint may be stated as:

Within a sentence, a preceding pronoun cannot be coindexed with a following NP. The proposed constraint is often referred to as a 'precedence constraint'. That is, in these languages, only if a pronoun follows an antecedent NP can it be interpreted coreferentially with an NP. The languages for which this claim has been made include Chinese (Tai 1973), Japanese (Nakai 1976), Tamil (Veluppillai 1981), Malayalam (Mohanan 1981, 1981b), and Arabic (Gray and Gamal-Eldin 1982). This claim asserts an exclusively linear principle which grammatically constrains pronoun coindexing regardless of the configurational relation (e.g., c-command) between antecedent and pronoun.[1] For example, Tai states of Chinese:

> Unlike English, Chinese doesn't allow backward pronominalization under any condition ... even if two referential noun phrases are in the relationship of command (1973:661)

Similarly, many other linguists have claimed that English speaking young children have often demonstrated a preference for forward patterns of anaphora, especially in structures that in principle allow both directions (e.g., Tavakolian 1977, 1978a, Solan 1977, 1983, Lust, Loveland, and Kornet 1980, Carden 1986).

However, subsequent studies of pronouns (e.g., Oshima and Huang 1982, Whitman 1982, Huang 1982) have shown that the proposed 'precedence constraint' is not supported for all languages cited above. As Oshima and Huang (1982) and Whitman (1982) suggest, for example, Japanese speakers frequently accept backward anaphoric pronouns in cases like (1) and (2).

(1) Kare$_{i,j}$ no tuma wa masayuki$_i$ o dekiai site iru.
he poss wife Masayuki doting on is
(His$_{i,j}$ wife is dotting on Masayuk1$_i$)

[1] According to Reinhart's (1983:18), the definition of c-ommand is: Node A c(constituent)-commands node B if the branching node most immediately dominating A also dominates B.

(2) Soko$_{i,j}$ kara John ga yatte kita tokoro$_i$
there from John came place
(The place$_i$ that John came from there$_{i,j}$)

(Huang 1982:393)

Responding to the fact that backward anaphora does exist in certain languages, Lust and others have further predicted that children acquiring left-branching languages will exhibit a preference for backward patterns of anaphora (e.g., Lust & Wakayama 1979 on Japanese; Lust & Mangione 1983 on Japanese; Lust & Chien 1984 on Chinese). Lust (1981, 1983, 1986), henceforth, proposes the Principal Branching Direction (PBD) to account for certain aspects of L1 acquisition:

> PBD refers to the branching direction which holds consistently in unmarked form over major recursive structures of a language, where 'major recursive structures' are defined to include relative clause formation of complex NP, adverbial subordinate clause, and sentential complementation. (Lust 1983:138)

In addition, the 'Directionality Constraint' or 'Directionality Principle' on L1 acquisition is assumed:

> In early child language, the directionality of grammatical anaphora accords with the Principal Branching Direction (PBD) of the specific language being acquired ..... Specifically, in RB (right-branching) languages, early anaphora is constrained in a forward direction; in LB (left-branching), it is constrained in a backward direction. (Lust 1983:141-2)

Lust's claim is that in right-branching (RB) languages like English, children have been observed to 'prefer' pronouns occurring later in the sentence than the antecedent (forward preference), whereas the reverse has sometimes been claimed for children acquiring left-branching (LB) languages. For example, in (3) and (4), the pronoun he can be coreferential with the noun phrase John, usually referred to as the antecedent:

(3) After John had eaten, he went to a movie
(4) After he had eaten, John went to a movie

Children acquiring right-branching (RB) languages like English, according to Lust, will strongly prefer sentences like (3) where the antecedent precedes the anaphora, a case of forward anaphora (FA), and avoid case like (4), which are known as backward anaphora (BA). Following Lust's Directionality Principles, Flynn (1984, 1987a, 1987b, 1987c) originally proposed a parameter-setting model of L2 acquisition to account for certain aspects of L2 acquisition of anaphora. Like Lust, Flynn assumes (a) that there is a parameter of PBD, and (b) that there is a Directionality Constraint which relates anaphora acquisition to branching direction. She looks into the questions whether second language acquisition is related to branching direction, and whether the acquisition of anaphora in L2 is constrained by branching direction. She

later recast her claims in terms of Head-position (e.g., 1987a, 1987b). In summary, her proposal is that a language which is principally head-initial will: (a) prefer adjunct adverbial clauses in sentence-final position and (b) prefer pronouns to follow their antecedent, and that the converse will be true of head-final languages. In her research (1987a, 1987b), the subjects are adult learners of ESL, 51 native speakers of Spanish, and 53 native speakers of Japanese, divided into three proficiency levels, low, intermediate and high. Spanish is head-initial like English, whereas Japanese is head-final, or left-branching. If L2 learners are sensitive to the branching direction of English and guided by a Directionality Constraint, they should find forward anaphora easier in English than backwards. Thus, Flynn predicts that Spanish subjects will show forward directionality preference for anaphora because Spanish and English have the same branching direction. The basic idea of her theory is:

> Patterns of acquisition should be similar to L1 acquisition ... both where the head direction of the L1 matches the L2 (L1HD = L2HD) and where it does not (L1HD ≠ L2HD) .... When L1HD ≠ L2HD, L2 learners must assign a next value to the parameter, and we would expect acquisition patterns to correspond to early L1 acquisition patterns for this parameter .... When L1HD = L2HD, .... acquisition patterns should correspond to later stages in the L1 acquisition of these structures (Flynn 1987b:84).

However, recent research has shown that English children do allow backward anaphora in their grammars, given suitable contexts (Crain and McKee 1986, Goodluck 1987, Lasnik and Crain 1985); some other research by O'Grady, Suzuki-Wei, and Cho (1986), Eubank (1989), Bley-Vroman & Chaudron (1990), moreover, has shown results in contradiction to backward preference. The possible reasons for Flynn's failure in her predictions are quite a few, but most likely, we think, the most fundamental one may result from her invalid attempts in combining the two not-so-related linguistic properties, i.e., linearity and precedence. Lust (1986:38) points out that linearity (e.g., word order) refers to a dimension of organization along which items may be related, while precedence (e.g., pronoun precedence) a specific linear relation between items. For this reason, when a linearity-based theory proposes that children bring a hypothesis of 'precedence' to bear first on anaphora and that this hypothesis is independent of structure, a specific principle of non-structure-dependent precedence, not one of linearity, is at issue.[2] White (1989:95) also points out that, in any case, there is an important difference in the status of the PBD Parameter and the Directionality Constraint. Despite the fact that the status of PBD as a parameter is controversial, the general idea that there are parameters which account for word order is fairly noncontroversial. However, the Directionality

[2] According to Chomsky (1975:32), UG predicts that children's early hypothesis about language will be 'structure-dependent'. 'Structure-dependence' in this case means that experienced language data will be analyzed in terms of an abstract representation of sentence stimuli. On the other hand, 'structure-independence' involves only analysis into words and properties like 'earliest' ('leftmost') defined on word sequences. In plain words, a rule which operates independently of th syntactic structure of the sentence might be called a structure-independent rule; otherwise, it is called a structure-dependent rule (Radford 1989:32-33).

Constraint, linking PBD and anaphora, on the other hand, is much more questionable. Most languages violate this constraint, allowing backwards anaphora, so it can not be a constraint of UG. Flynn has identified two very important issues for second language acquisition research, namely the role of word order parameters and the question of anaphora interpretation, but her problems stem from trying to combine these two. As White (1989:99) suggests, Flynn is correct in her claim that there is a parameter of head-position and that this would have to be assigned a new value for the L2 where L1≠L2. However, positive evidence for this difference will show up in very simple sentences, so L2 learners should already have reset this parameter by the time they have to deal with anaphora in complex sentences with adverbial clauses.

Clearly, anaphora in L2 acquisition should now be investigated independently of word order parameters. Languages show anaphora prohibitions and possibilities that are not captured by Lust's Directionality Constraint. However, most important, Flynn's results, in any case, should not be taken as an evidence of non-operation of UG in second language acquisition, nor can they be taken as that the theory of parameter-setting is incorrect; at most, they can only mean that some inappropriate parameters and constraints have been wrongly identified for this particular aspect of the grammar. Instead, under the framework of Universal Grammar, we propose a developmental model of the acquisition of anaphora which involves the interaction of learning principles (the Subset Principle, in particular) and language principles (c-command, in particular) to account for the constraints in L2 acquisition of anaphor.[3] It is the interaction of these two linguistic properties that results in the phenomenon of 'forward directionality preference' and of the developmental stages. Here, 'forward directionality preference' refers to the phenomenon that language learners tend to 'prefer'-that is to process more easily-pronouns occurring later in the sentence than the antecedent. Based on the premise that this interaction exists, the general hypothesis of this study is that learners initially will rely on the learning principle, i.e., the Subset Principle, as their learning strategy, a restriction based on directionality, and later they will have to retreat from that overgeneralization by taking the structural factor, i.e., c-command, into account. This hypothesis is tested with data on intrasentential pronominal anaphora in English. We argue that only this proposed developmental model of language acquisition, which claims that all structural restrictions on pronominal anaphora are developmentally acquired, is able to account for the acquisition of anaphora successfully.

[3] The Subset Principle states that language learners select the most restrictive grammar in the given input. The whole concept of the Subset Principle can be easily understood if the phonetic system of natural languages is taken as an example. For instance, if the phonetic system of a target language contains five vowels. In order to guarantee only positive evidence will be used, language learners, on hearing a sentence, will hypothesize the phonetic system of the target languge only contains, say, two vowels as the initial input indicates; this hypothesis grammar, therefore, is a subset of the target language. The ongoing input will disconfirm this hypothesis, and five-vowel phonetic system, in a very short period of time.

## Theoretical Rationale of the Study

Modern syntactic theory has provided evidence that Universal Grammar (UG) contains principles of a general, but specifically linguistic, form that apply in all natural languages. The major goal of this study is to extend the notion of principle to language acquisition. In such a theory each choice that the learner makes in his/her growing language is determined by the interaction of language principles and learning principles (Pinker 1984). Obviously, the language principles and the learning principles are related (they interact); however, as claimed in Wexler and Manzini (1987), separating them to some degree may seem to be a successful approach to language acquisition theory. The general idea is that there are aspects of markedness theory that are not part of linguistic theory, but are part of learning theory. Thus, it may be possible to remove certain substantive assumptions about markedness, which are motivated primarily by learning conditions, from linguistic theory. The markedness hierarchies instead would be calculated from principles of learnability theory. In general, there are two sets of approaches in learnability theory dealing with language acquisition issues. The first set of approaches are linguistically-based. The second set of approaches are psychologically-based. They will be discussed briefly in the following.

First, linguistic approaches have focused on the logical problem and the issue of success. The research of these approaches is mainly concerned with how a language learner, faced with language input that is considered degenerate, finite, and not targeted towards error correction (negative evidence) can attain all of the complexities of a target language successfully (e.g., Atkinson 1982, Hornstein & Lightfoot 1981). Second, psychological approaches have focused primarily on stages of development. The research of these approaches is mainly concerned with how a language learner, faced with complexities contained within the target language input, forms initial hypotheses, develops through stages, and overcomes overgeneralizations (Pinker 1984, Slobin 1971). Due to the fact that the above approaches are the two major concerns within learnability theory, Pinker (1984), therefore, proposes a unifying constraint on the theories of language acquisition, the *learnability condition*. This condition suggests that an adequate theory must explain how a language is completely learnable, from initial hypothesis through developmental stages on the way to eventual success. Wexler and Manzini (1987:41-76), and Wolfe (1992:40), furthermore, have proposed that it is these two linguistic principles, i.e., language principles and learning principles, which are responsible for learners' success and developmental stages in the environment of input. On one hand, language principles are assumed to be the principles providing linguistic categories and information about language structures, so that a learner is capable of making hypotheses about possible language structures, resulting in eventual success in handling a target language grammar. On the other hand, learning principles are assumed to be the principles providing the strategies necessary to interpret specific target language structures, so that the learner is able to develop increasingly more complex hypotheses about the language input he or she is exposed to, resulting in development through stages. Both language and learning principles are

necessary to explain language learnability, by accounting for the type of language knowledge a learner has prior to exposure to input and the type of learning mechanisms the learner utilizes to analyze and represent the input that is available. These researchers are notable in that they integrate both language principles and learning principles into their theory of language acquisition (Pinker 1984, Wexler and Manzini 1987, Wolfe 1992). They propose that 1) the nature of innate language knowledge is a source of initial hypotheses for the learner, and that 2) the nature of learning mechanisms is a necessity in mapping the target input onto a developing representation.

In line with the theories of Pinker (1984), Wexler and Manzini (1987), and Wolfe (1992), we propose here that L2 acquisition of anaphora is constrained by the interaction of learning principles and language principles. L2 acquisition is similar to L1 acquisition in this respect. The primary learning principle involved in the L2 acquisition of anaphora is the Subset Principle, which causes a learner to select *the most restrictive possible grammar* generated by UG that is consistent with the language input, and which prevents the learner from overgeneralizing a grammar (Berwick 1985, Manzini and Wexler 1987, Wexler & Manzini 1987). The primary linguistic property concerned with language principles is an innate knowledge of all natural languages, i.e., the notion of c-command.

The Subset Principle states that the parameter setting yielding the subset language is the unmarked one (i.e. the initial assumption), and the value yielding the superset is marked, adopted only if the relevant positive evidence occurs. Similarly, Solan's BAR theory makes three separate claims, i.e., (a), (b), and (c) below, as to the constraints in the acquisition of anaphora:

Backward Anaphora Restriction (BAR):

(a) $Pro_i$.....$NP_i$ is impossible if:
(b) Pro c-commands NP; or
(c) Pro and NP are within the same minimal S, and Pro d-commands NP (Solan 1983:69).[4]

The first claim, (a), that the BAR makes is that the restriction on anaphora is a restriction on backward anaphora. Here, the BAR theory makes a specific prediction for language learners. That is, if we assume that the unmarked case is stated as (a), '$Pro_i$.....$NP_i$ is impossible', then the BAR predicts that language learners initially will assume that forward anaphora is the only possibility (i.e., to hypothesize the most restrictive grammar as the Subset Principle states). Later, they will have to relax the restriction in certain environments allowed by Universal Grammar (UG) as a marked alternative. The second claim, (b), is that

[4] According to Solan (1983), d-command can be defined as: Node A d-commands another node B if (1) neither A nor B domintes the other; and (2) the cyclic node that most immediately dominates A also dominates B [where NP, S are cyclic nodes]. (Solan:44).

the acquisition of anaphora is structure-dependent, constrained by c-command. Similarly, the third claim, (c), is that the acquisition of anaphora is structure-dependent, constrained by d-command. Under these constraints, all structural restrictions on pronominal anaphora are developmentally acquired, and they concern only backward anaphora. This proposal forms the basis for a model of acquisition of anaphora, which Solan terms 'the Developmental Model' and is one of the main hypotheses to be tested in the study.

> According to Solan, the Developmental Model is defined as: Children will have trouble learning the relevant structural definitions, and will learn them over period of time, through deductive methods (Solan 1983:92).

In greater detail, this model claims that all structural restrictions on pronominal anaphora are developmentally acquired, i.e., language learners will follow the principle that the unmarked cases are acquired before the marked cases; therefore, the language learner, when acquiring anaphora, will first use the restriction based solely on the directionality effect and later take structural factors into account by consulting the command relations. In contrast to Solan's (1983) study, this study uses L2 acquisition data with a much larger sample size, showing that adult L2 learners, similar to L1 learners, will go through the same developmental stages in the acquisition of anaphora; that is, learners will go through a stage-wise process of language development: initially, they will rely on the learning principle, i.e., the Subset Principle, as their learning strategy, and later they will restructure some of their early constraints on anaphora under the guidance of structure-dependence.

In the study, an experiment was conducted to show that ESL subjects' developmental order in their acquisition of anaphora is progressing from the early stage of 'using directionality only' to the later stage of 'consulting command relations'. The present study, therefore, is intended 1) to show that ESL subjects will base their coreference judgments on the directionality effect, 2) to show that ESL subjects will base their coreference judgments on the notion of command (c-command and/or d-command), 3) to show that language proficiency level and native language background are factors affecting ESL subjects' coreference judgments.

## Method

### Subjects and Settings

The subjects in this study were 138 (n=138) students selected based on two criteria: 1) language proficiency level in English and 2) first language background. Of them, 107 subjects were adult L2 learners; 31 of them were native speakers of English.

The L2 subjects were students enrolled in the English Program for Internationals (EPI) of the University of South Carolina. All of the students in EPI were tested; however, only those students belonging to the three designated language groups (Japanese, Spanish, Arabic) were used as the subjects of the experiment. The ESL students were selected across two language proficiency levels (high level and low level). The three ESL language groups (Japanese speakers, Spanish speakers, and Arabic speakers) were selected because of the

*branching direction* of their native languages, i.e. Arabic and Spanish are right-branching languages, while Japanese is a left-branching one. The Japanese language group contains 22 students (n=22), while the Arabic group has 43 (n=43), the Spanish group 42 (n=42), and the English group 31 (n=31).

## Measures and Materials

### Independent Variables

(1) First Language Background

Three language groups: Japanese ESL learners, Spanish ESL learners, Arabic ESL learners.

(2) Language Proficiency level

Two language proficiency levels: high and low.

(3) Structural Factors Concerning Command Relations

The three structural factors concerning command relations in the experiment are 1) Position of the Pronoun (PP), 2) Place of Attachment (PA), and Type of Complement (TC). The first two structural factors are mainly tested for *c-command*, while the last one is tested for *d-command*.

Position of Pronoun (PP) has two categories: 'pronoun in subject position' and 'pronoun in object position'. 'Pronoun in subject position' will be measured by sentence types 1,3,5,7, while 'pronoun in object position' will be measured by sentence types 2,4,6,8 (see Table 1 below).

Place of Attachment (PA) has two categories: 'complement attached to VP node' and ' complement attached to S node'. 'Complement attached to VP node' will be measured by sentence types 1,2,5,6, while 'complement attached to S node' will be measured by sentence types 3,4,7,8 (see Table 1 below).

Type of Complement (TC) has two categories: 'phrasal type complement' and 'clausal type complement'. 'Phrasal type complement' will be measured by sentence types 5,6,7,8, while ' clausal type complement' will be measured by sentence types 1,2,3,4 (see Table 1 below).

(4) Directionality

The directionality of anaphora has two categories: 'forward anaphora' and 'backward anaphora'. 'Forward anaphora' will be measured by sentence types 12,14, while 'backward anaphora' will be measured by sentence types 9,10 (see Table 1 below).

(5) Factors Concerning the Order of Development

In order to exhibit language learners' order of development in their acquisition of anaphora, four conditions reflecting different degrees of restriction were set up to exhibit language learners' order of development in the acquisition of anaphora. Note that each condition is set up by a pair of sentence types with minimal structural differences. The four conditions, termed 'judgment conditions' in the present study, are: 'Backward Most Restricted', 'Backward Least Restricted', 'Backward not Restricted', 'Forward not Restricted'. The judgment condition of 'Backward Most Restricted' will be measured by sentence types 1, 5.

The judgment condition of 'Backward Least Restricted' will be measured by sentence types 4,8. The judgement condition of 'Backward not Restricted' will be measured by sentence types 9,10. The judgement condition of 'Forward not Restricted' will be measured by sentence types 12,14 (see Table 1 below).

## Dependent Variable

The dependent variable is the percentage of anaphoric responses each student gives over a particular sentence type. For example, if a student gives anaphoric responses on ten out of twelve tokens, then this student has 83% of anaphoric responses. Here, '*anaphoric responses*' (coreferential responses) refer to the cases in which students chose *A* and/or *B* as the answer(s) to each question of the experiment, thinking that the anaphoric relationship is *possible* between a pronoun and an antecedent within that sentence. Note that although the term 'anaphora' may be used to refer to certain relations in discourse, we restrict our attention to *intrasentential anaphora* in the present study.

### *Table 1*

Summary of Sentence Types

| Sentence Types | DA | PP | PA | TC |
|---|---|---|---|---|
| 1. She told Mary that Ann would jump. | Back | Sub* | VP* | Cl |
| 2. John told him that Peter would go away | Back | Obj | VP* | Cl |
| 3. She hit Mary while Ann ran around. | Back | Sub* | S | Cl |
| 4. Mary hit her while Jane walked around. | Back | Obj | S | Cl |
| 5. He pushed Mike in Peter's garden. | Back | Sub* | VP* | Ph* |
| 6. Peter pushed him near John's house. | Back | Obj | VP* | Ph* |
| 7. She caught Susan before Ann's walk. | Back | Sub* | S | Ph* |
| 8. Ann bothered her during Susan's class. | Back | Obj | S | Ph* |
| 9. After he ran around, Bill hit John. | Back | N/A | N/A | Cl |
| 10. After his run, Bill hit John. | Back | N/A | N/A | Ph |
| 11. John told Peter that he would walk around. | For | N/A | VP | Cl |
| 12. Jane met Mary before she went to lunch. | For | N/A | S | Cl |
| 13. Ann surprised Susan in her garden. | For | N/A | VP | Ph |
| 14. Mary hit Jane before her walk. | For | N/A | S | Ph |

* indicates that coreference is blocked.

DA = Direction of Anaphora. PC = Position of Complement.
PP = Position of Pronoun. PA = Place of Attachment.
TC = Type of complement. Back = Backward. For = Forward.
Sub = Subject. Obj = Object. Cl = Clausal. Ph = Phrasal.
N/A = Not Applicable

## Materials

The experiment to be described below tests the constraints in adult ESL learners' acquisition of anaphora, with special interest in directionality and c-command relationship. Closely modeled after the conditions in Solan's (1983) four experiments, the experiment is mainly intended to examine: 1) the factor of c-command, 2) the factor of directionality, and 3) the order of development as a result of factors 1) and 2), in ESL students' acquisition of anaphora. Adult ESL learners will be tested on fourteen sentence types which differ minimally according to whether the pronoun and intended antecedent are in the same clause, whether the pronoun occurs within the main clause, and whether the complement is attached to the S node or the VP node. Each subject receives three token sentences for each of the fourteen sentence types. In total, therefore, each subject responds to forty two (n=42) tokens. For each token, there are three potential answers available to subjects: i.e., A, B, and C, right below the sentence. Answers A and B are the two possible choices of antecedents of a pronoun in a sentence. If the students think anaphora is possible, either or both of these two will be chosen. Answer C refers to the case in which the subjects think the anaphoric relationship between a pronoun and an antecedent in a sentence is not possible. Table 1 above presents examples and conditions of each sentence type.

The types of sentence used in the experiment were modeled after Solan (1983). Sentence types 1-8 are used to test command relations, while sentence types 9-14 are used to test directionality. Most important, combining the analyses for these two pairs will provide an overall picture of the order of development in ESL students' acquisition of anaphora. The structural restrictions on pronominal anaphora involved in the experimental sentence types are discussed in the following:

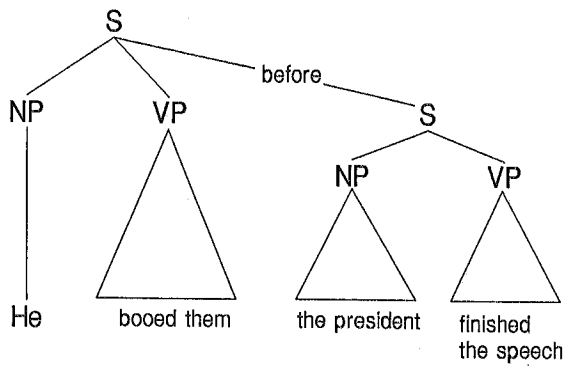
(1) Position of the Pronoun (PP)

If the pronoun were moved from the object position to the subject position, then the pronoun would c-command the antecedent, and thus anaphora is made impossible. Sentence (5) below illustrates this:

(5)* He booed them before the president finished the speech.

Tree (5') shows that the intended antecedent the president was c-commanded by the pronoun he:

(5')



(2) Place of Attachment (PA)

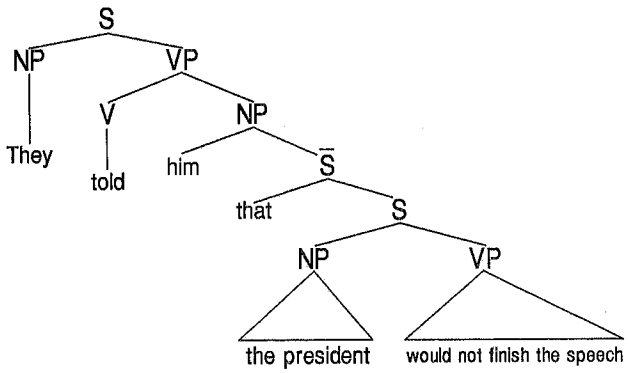
If the complement were attached to the verb phrase rather than to the S node, then the pronoun would *c-command* the antecedent. Both that-complements and locative prepositional phrases are examples of verb phrase complements:

(6)* They told him that the president would not finish the speech.

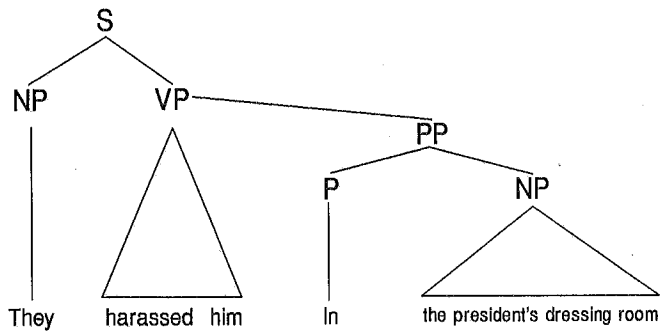
(7)* They harassed him in the president's dressing room.

As the tree (6') illustrates, the pronoun him in (6) c-commands the intended antecedent and thus the anaphora is made impossible. Similarly, the tree (7') shows that the pronoun him in (7) c-commands (and d-commands) the intended antecedent the president (the pronoun and intended antecedent are clausemates), rendering anaphora impossible.

(6')




(7')



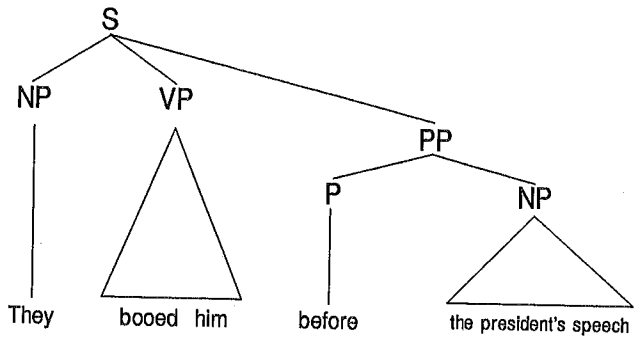

(3) Type of Complement (TP)

If the intended antecedent were embedded in a noun phrase in the same clause as the pronoun, the notion *d-command* (see footnote 4) would replace the notion c-command, and anaphora would be ruled out. Sentence (8) is an example of this:

(8)? They booed him before the president's speech.

This is illustrated by (8'):

(8')




## Results

Generally, results of the experiment in the study have shown:

I. The directionality effect:

(1) The results of split-plot analysis of variance, using proficiency level as the between-subject factor and directionality as the within-subject factor, showed that there was a significant main effect of directionality ($F(1,105)=24.39$, $P=.0001$). ESL subjects across high and low proficiency levels and native language backgrounds showed that they allow anaphora more frequently when the direction of anaphora is forward (98.44%) than when the direction of anaphora is backward (88.79%). That is, results indicate that ESL subjects had shown a preference for forward anaphora, and that low-proficiency-level ESL subjects tended to rely more on the directionality effect in their coreference judgments than high-proficiency-level students. ( See Table 2 and Figure 1 below)

II. The command relations:

(1) The results of 'Proficiency Level X TC X PA X PP' split-plot ANOVA (see Table 3 below), using proficiency level as the between-subject factor and TC, PA, and PP as the within-subject factors, showed that: (a) ESL subjects across high and low proficiency levels showed that they based their coreference judgments on the c-command. That is, ESL subjects allowed anaphora more frequently when the pronoun was in the object position (42.29%) than when it was in the subject position (30.92) ($F(1,105)=40.73$, $P=.0001$). (b) ESL subjects allowed anaphora more frequently when the complement was attached to the S node (44.86%) than when the complement was attached to the VP node (28.35%) ($F(1,105)=67.07$, $P=.0001$). (c) ESL subjects across high and low proficiency-levels showed that they allowed anaphora more frequently when the antecedent was embedded in a phrase (39.49%) than when the antecedent was embedded in a clause (33.72%) ($F(1,105)=8.61$, $P=.004$) (note that these results are contradictory to the prediction that ESL subjects will base their coreference judgments on d-command). The results of the study, however, also indicate that ESL subjects will base their coreference judgments on d-command after they have moved to a certain more advanced stage of language development (see Figure 2).

III. Native language background effect

When subjects' native language background was taken into consideration, results of split-plot ANOVA indicated that it interacted with TC ($F(2,104)=6.01$, $P=.003$), PA ($F(2,104)=7.89$, $P=.006$) and PP ($F(2,104)=63.95$, $P=.02$) (see Table 4). For example, when native language background interacted with TC, in the Spanish group, there was almost no difference between the anaphoric responses to the phrasal complement (20.44%) and the anaphoric responses to the clausal complement (21.43%); in the Arabic group, subj ects allowed anaphora more frequently when the antecedent was embedded in a phrase (40.56%) than when it was embedded in a clause (33.33%); in the Japanese group, subj ects allowed anaphora more frequently when the antecedent was embedded in a phrase (73.86%) than when it was embedded in a clause (57.95%). It is interesting to note that, as indicated in the results of the Spanish group, when the subjects' overall anaphoric responses were low, the preference for anaphora when the antecedent was embedded in a phrase began to reverse.

IV. The order of development:

(1) ESL subjects exhibit an order of development in their acquisition of anaphora. That is, ESL subjects in four judgment conditions which were set up according to different levels of structural restriction produced different degrees of anaphoric responses. (See Table 5 and Figure 3 below). (There was an interaction effect between proficiency level and order of development ($F(3,315)=6.15$, $P=.0005$) in 'Proficiency Level X Backward Most Restricted X Backward Least Restricted X Backward Not Restricted X Forward Not Restricted' split-plot ANOVA).

## *Table 2*

Mean and Standard Deviation of Percentage of Anaphoric Responses on Directionality

By Proficiency Level

| | | Backward | | Forward | | Total | |
|---|---|---|---|---|---|---|---|
| Prof | n | Mean | SD | Mean | SD | Mean | SD |
| High | 71 | 92.02 | 18.87 | 99.06 | 4.79 | 95.54 | 9.54 |
| Low | 36 | 82.41 | 21.80 | 97.22 | 7.45 | 89.81 | 10.56 |
| Total | 107 | 88.79 | 20.31 | 98.44 | 5.85 | 93.61 | 10.21 |
| Native Speaker | 31 | 96.77 | 7.95 | 98.39 | 5.00 | 97.58 | 4.41 |

## Table 3

Mean and Standard Deviation of Percentage of Anaphoric Response on Structural Factors By Proficiency Level

| | | Type of Complement (TC) | | | | Place of Attachment (PA) | | | | Position of Pronoun (PP) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Clausal | | Phrasal | | VP | | S | | Subject | | Object | | Total | |
| Prof Level | n | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| High | 71 | 29.93 | 26.97 | 35.33 | 34.80 | 25.59 | 31.60 | 39.67 | 31.32 | 27.35 | 30.71 | 37.91 | 29.91 | 32.63 | 29.50 |
| Low | 36 | 41.20 | 28.17 | 47.69 | 33.25 | 33.80 | 33.09 | 55.10 | 28.33 | 37.96 | 33.95 | 50.93 | 29.13 | 44.44 | 29.21 |
| Total | 107 | 33.72 | 27.77 | 39.49 | 34.63 | 28.35 | 32.19 | 44.86 | 31.09 | 30.92 | 32.07 | 42.29 | 30.15 | 36.60 | 29.80 |
| Native Speaker | 31 | 27.42 | 20.77 | 33.33 | 31.33 | 18.55 | 23.54 | 42.20 | 30.58 | 24.46 | 27.04 | 36.29 | 27.01 | 30.38 | 25.10 |

## Table 4

Means and Standard Deviations of Percentage of Anaphoric Response on Structural Factors By Native Language Background

| | | Type of Complement (TC) | | | | Place of Attachment (PA) | | | | Position of Pronoun (PP) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Clausal | | Phrasal | | VP | | S | | Subject | | Object | | Total | |
| Lang. | n | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Japanese | 22 | 57.95 | 33.97 | 73.86 | 27.61 | 64.77 | 31.07 | 64.05 | 30.04 | 64.78 | 31.49 | 67.05 | 28.34 | 65.90 | 28.45 |
| Spanish | 42 | 21.43 | 20.26 | 20.44 | 26.81 | 12.30 | 21.95 | 29.56 | 26.56 | 14.68 | 20.73 | 27.18 | 25.90 | 20.93 | 22.53 |
| Arabic | 43 | 33.33 | 22.57 | 40.50 | 30.10 | 25.39 | 26.47 | 48.45 | 28.19 | 29.46 | 28.54 | 44.38 | 26.15 | 36.92 | 25.49 |
| Total | 107 | 33.72 | 27.77 | 39.49 | 34.63 | 28.35 | 32.19 | 44.86 | 31.09 | 30.92 | 32.07 | 42.29 | 30.15 | 36.60 | 29.80 |

## Table 5

Mean and Standard Deviation of Percentage of Anaphoric Responses on Order of Development By Proficiency Level

| | | Backward Most Rstrict. | | Backward Least Rstrict. | | Backward Not Rstrict. | | Forward Not Rstrict. | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Prof | n | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| High | 71 | 24.18 | 31.22 | 48.83 | 32.89 | 92.02 | 18.87 | 99.06 | 4.79 | 66.02 | 16.02 |
| Low | 36 | 31.02 | 36.76 | 65.28 | 29.91 | 82.41 | 21.80 | 97.22 | 7.45 | 68.98 | 17.21 |
| Total | 107 | 26.48 | 33.17 | 54.36 | 32.73 | 88.79 | 20.31 | 98.44 | 5.85 | 67.02 | 16.41 |
| Native Speaker | 31 | 16.13 | 27.38 | 51.61 | 33.71 | 96.77 | 7.95 | 98.39 | 5.00 | 65.73 | 12.85 |

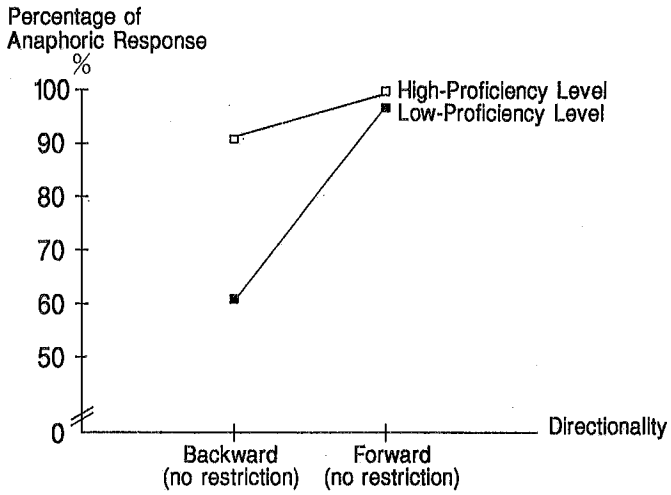



Figure 1
Interaction Between Proficiency Level and Directionality

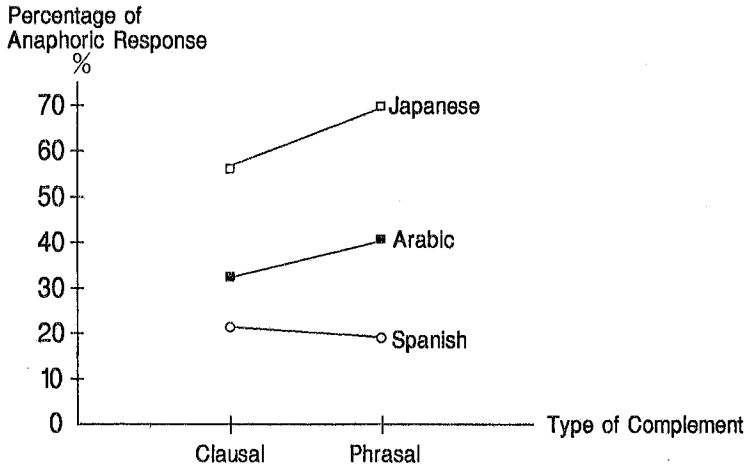



Figure 2
Interaction Between Native Language Background
and Type of Complement

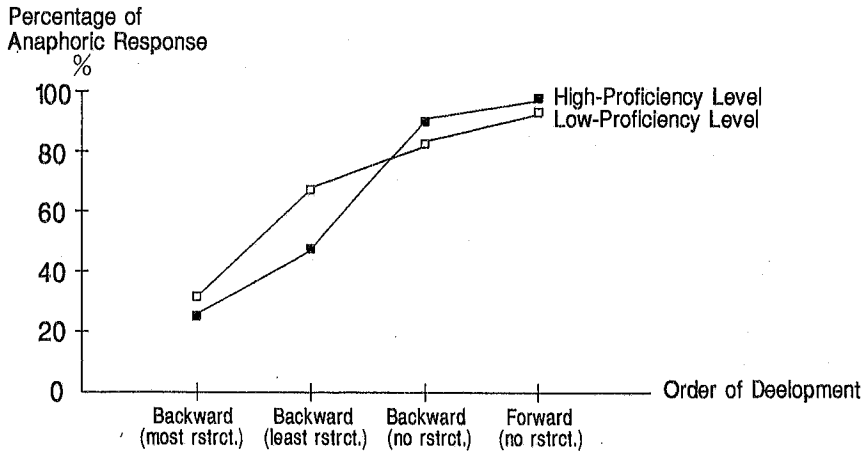



Figure 3
Interaction Between Proficiency Level and Order of Development

## General Discussion

As stated before, the present study is an attempt to subsume the L2 acquisition of pronominal anaphora under the framework of Universal Grammar (UG), showing that L2 acquisition of pronominal anaphora is constrained by two sets of linguistic principles being incorporated: the learning principles (the Subset Principle, in particular) and the language principles (c-command, in particular). It is the interaction of these two sets of linguistic principles that results in the phenomenon of 'forward directionality preference' and of the developmental stages in the L2 acquisition of anaphora. Here, the unmarked case ( i.e., considering directionality only ) is acquired before the marked case ( i.e., considering the command relations ).

In other words, this work provides empirical evidence that ESL adult learners shift from a linearly based approach to coreference to a structurally based approach in their acquisition of pronominal anaphora. That is, the evidence indicates that all structural restrictions of pronominal anaphora are developmentally acquired: learners who rely on the learning principle (i.e., the Subset Principle) as their learning strategy initially will use the restriction based solely on directionality and later will retreat from that overgeneralization by taking the structural factor (i.e., c-command) into account.

Several implications for general theories of linguistics were drawn from the results discussed before:

First of all, the finding regarding ESL students' use of the notion of c-command in restricting coreference indicates that c-command is part of Universal Grammar (UG). An equally important matter is that these findings support the claim that both L1 and L2 learners have access to Universal Grammar (UG).

Second, the finding that ESL students have to learn to use the notion of d-command indicates that the notion of d-command is not part of Universal Grammar. Most important, the results of the experiment indirectly support the claim that only those principles embedded in 'core grammar' (e.g., c-command) are part of the mental structure of the language learner, and need not be learned from data.

Third, results show that native language background is a factor affecting ESL students' coreference judgments based on the notion of c-command. As indicated in Saito's (1984) study, the Japanese group's unusually high anaphoric responses are an indication that some L1 features of the Japanese language (e.g., the vague status of VP node in syntactic structure) might interfer with the Japanese learners' use of the notion of c-command in the coreference judgements.

Fourth, results show that in all cases forward anaphora is not restricted. This finding indicates that forward anaphora preference is a universal and thus might be a part of UG.

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