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A Comparison of Null and Pronominal
Anaphora in First Language Acquisition[1]

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In this paper we report selected results of an experimental study
of the acquisition of certain forms of anaphora in first language acquisition
of English. (These results will be reported in full in a larger paper now
in preparation.) We argue that children at early language levels conflate
null and pronominal anaphora in environments such as those shown in 1
and 2. More specifically, we argue (1) that children generalize restrictions
which hold on pronominal anaphora as in 1 to also hold on null anaphora
as in 2; and (2) that they fail to observe specific restrictions which hold
on null anaphora as in 2 and not on pronominal anaphora as in 1.

1. a. John saw Tom when he ran down the street.
    b. John   saw Tom   when he   ran down the street.
          (2)   (3)   (2,3,4)
2. a. John   saw Tom   when ∅ running down the street.
    b.   John   saw Tom   when PRO   running down the street.
          (2)   (3)   (2)

The anaphoric structures of 1 and 2

The basic grammatical facts about 1 and 2 are well known. In general,
both 1 and 2 represent forms of anaphora where interpretation of an NP,
the subject of the subordinate clause, is determined by reference to interpre-
tation of some other term. (We are using the term 'anaphora' here in a
general sense, not in the technical sense of Chomsky's recent work.[2]) In
sentence #2, this NP is phonetically null (in a non-tensed subordinate

clause) in surface structure and rules of control construe the interpretation of this null NP (designated as PRO in 2b) to obligatorily accord with the subject of the main clause. (2b reflects this subject control of PRO with coindexing.) In sentence #1, this NP is filled in surface structure by the lexical pronoun 'he' (in a tensed subordinate clause). The pronoun may be construed in relation to another NP in the sentence, such as e.g., subject or object of the main clause, but is optionally determined by context (discourse or other pragmatic context) (as suggested by coindexing in 1 b).

In general then, the anaphora types in 1 and 2 are differentiated in adult grammar in that 1 involves a lexical anaphor (the pronoun) which represents a form of free anaphora; #2 involves a null anaphor which represents a form of obligatory anaphora, and which specifically requires subject control. The pronominal anaphora in 1 does not require grammatical control but allows pragmatic control, and if it is controlled grammatically, it need not be by the subject.

The structure of this study

In this study we tested the claim that children conflate pronominal and null anaphora in these contexts by testing whether first language acquisition of null anaphora is subject to the same principles or constraints which hold on first language acquisition of pronominal anaphora. Specifically, we tested whether the two constraints in 3 which have previously been found to hold on pronominal anaphora in first language acquisition of English, would hold similarly on acquisition of null anaphora (in English).

3. Constraints on first language acquisition (of English)

 i. Directionality
  The anaphor must follow the related term in early child language (Lust, in press; Lust, Loveland & Kornet, 1980; Tavakolian, 1977; Solan, 1978).

 ii. Pragmatic Context
  Pragmatic context (e.g., discourse context) may determine the referent of an anaphor (Kuno, 1972a, 1972b; Stenning, 1979; Lasnik, 1976; Lust, Loveland and Kornet, 1980).

First, we tested whether the 'directionality constraint' (3i), would also hold an null anaphora. In keeping with this constraint, previous study had shown children to favor forward pronominalization as in 4a and to resist backward pronominalization as in 4b. However, a similar effect has not been confirmed for null anaphora as in 2. In fact, some previous research has suggested that this directionality constraint might not hold on null anaphora like 2 (Goodluck, in press).

4a. Forward Anaphora
 Tommy ran fast because he heard a lion.
 Jenna drank some juice while she was having lunch.

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4b. <u>Backward Anaphora</u>
    Because <u>he</u> heard a lion, <u>Tommy</u> ran fast.
    While <u>she</u> was having lunch, <u>Jenna</u> drank some juice.

    Second, we tested whether the 'pragmatic context' constraint would hold on null anaphora. By this constraint (3ii) a term which is mentioned in a previous utterance determines the reference of an anaphor in a following utterance. In previous study of acquisition of pronominal anaphora, sentences like 5a which establish a pragmatic (discourse) context, have been shown to significantly affect children's interpretation of pronominal anaphora in a following utterance such as 5b.

    5. <u>Pragmatic Context - Pronominal Anaphora</u>
       a. I'm going to tell you a little story about <u>Cookie Monster</u>.
       b. When <u>he</u> closed the box, <u>Cookie Monster</u> lay down.

    Notably, if children generalize the 'directionality' constraint from pronominal to null anaphora, they are generalizing a constraint which is unnecessary to null anaphora unless children are in some way conflating null and pronominal anaphora in their early hypotheses about language. If children generalize the pragmatic context constraint to null anaphora, however, they are generalizing a constraint which is not only <u>not</u> necessary, but actually inconsistent in principle with this form of anaphora; since null anaphora, such as in 2, does not allow pragmatic control, but must be grammatically controlled by subject.[3] If children apply the pragmatic context constraint to null as well as to pronominal anaphora, then they are not only <u>generalizing</u> constraints over both types, but they are failing to observe specific restrictions on null anaphora.

Method

    In this study we tested 81 Ss from 3,6 to 7,5 (mean age 5,5), (grouped in 6 month age groups) on sentence types such as shown in Table I. Sentences varied according to <u>Anaphor type</u> (<u>pronominal</u> or <u>null</u>) and <u>Directionality</u> of anaphora (<u>forward</u> or <u>backward</u>). The basic 4 types of sentences resulting from these 2 factors were tested by standardized procedures in both an <u>elicited imitation</u> task to test children's production, and an <u>act-out task</u> to test children's comprehension. In the act-out task, children were asked to illustrate the meaning of the sentence by choosing a doll or dolls from a reference set of 3 dolls and demonstrating the administered sentence with their actions. The child's success at representing a correct meaning for the sentence, as well as the child's choice of referent for interpretation of the anaphor were analyzed in its act-out behavior. In the elicited imitation task, the child was asked to repeat each sentence after the adult experimenter and the success or structural conversions in the child's responses were analyzed.

    In the comprehension (act-out) task, sentences varied additionally as to whether they included a <u>Pragmatic Lead</u> (PL) on the <u>object</u> of the main clause. That is, in 1/2 the cases, the sentence was preceded by a lead; <u>viz.</u>, a sentence which named the object as topic. For example: "I'm going to tell you a story about <u>Fozzie Bear</u>." "When ∅ hitting the block, Scooter kicked <u>Fozzie Bear</u>." The lead was misleading for null anaphora, but acceptable for pronominal.

All sentences were equal in syllable length and reflected appropriate controls on lexical content across types. Control sentences such as 9 and 10 on Table I were also tested to insure that simple preposing of subordinate clause, not backward anaphora, did not significantly explain directionality results. Comprehension sentences 11-18 were designed so that coreference to either subject or object or noncoreference was semantically possible to an equivalent degree.

The design thus allowed factorial analysis (by ANOVA) on the 3 factors, Anaphora Type (2) x Directionality (2) x Developmental age group (8), for both imitation and comprehension and analysis of an additional (fourth) factor, presence or absence of Pragmatic Lead (to the object) on the comprehension task. (Score range was 0-2.)

Imitation data

Children did not significantly differentiate between null and pronominal forms in the amount correct on their imitation, although pronominal anaphora is slightly easier overall (F(1,73)=3.53, p=.06). On the other hand, there was a significant main effect of Directionality of anaphora where forward forms are preferred overall (F(1,73)=9.37, p =.005).[4]

As Figure I shows, however, there was a significant interaction between Directionality and Anaphora type (F(1,73)= 17.57, p =.001). As can be seen from this figure, both forward and backward null anaphora are as difficult as backward pronominal anaphora; forward pronominal anaphora is preferred overall. These differences begin to lessen by group 5 and by group 9 there is no significant difference among the types. Overall, anaphora errors drop similarly for both null and pronominal forms by group 5, as Figure II shows.[5]

First inspection of these gross results might suggest that although null and pronominal anaphora do not in general differ significantly, the 'directionality' constraint is not evidenced on null anaphora as it is on pronominal anaphora. Forward and backward null anaphora do not appear to differ. A more fine-grained analysis which takes account of the nature of children's anaphora errors in imitation, however, confirms that directionality affected both pronominal and null anaphora.

Error analyses showed a close relation between pronominal and null anaphora. They showed a unified effect of directionality over both pronominal and null anaphora types in that there were significantly more anaphora errors on backward than on forward over both pronominal and null anaphora types; there was no significant interaction between anaphora type and direction for amount of anaphora error. In their imitation children frequently resisted backward anaphora in both types, often reversing these backward to forward anaphora or otherwise blocking backward anaphora (for example by converting to NP-NP or Pronoun-Pronoun). About 20% of anaphora errors on backward pronominal and 33% on backward null convert the backward direction to a forward and both backward types are blocked more often by NP-NP or Pronoun-Pronoun conversions than are forward forms.) In no case was there a conversion of forward to backward anaphora in either pronominal or null types.

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Error analyses additionally suggested a primacy of pronominal over null anaphora in children's imitation. Children frequently converted null to pronominal anaphora accounting for 42% of errors (67% of anaphora errors). They much less frequently converted pronominal to null anaphora (19% of errors; 29% of anaphora errors).

Error analyses also showed a common effect of directionality and a tight relation between null and pronominal anaphora in that the largest single anaphora error on all these types was a conversion of the forward null anaphora to forward pronominal anaphora. (86% of anaphora errors on an item like "Johnny washed the table, when $\emptyset$ drinking juice," inserted a pronoun in place of the null site). Anaphora error on the backward null anaphora type only infrequently involved conversion to backward pronominalization (15% of anaphora error). Moreover, as we mentioned above, backward null anaphora was often directionally reversed to forward anaphora, and in these cases it was almost always converted to forward pronominal anaphora.

Notably, the fact to be explained in Figure I if the directionality constraint holds on null anaphora is that forward null anaphora is not significantly easier than backward null anaphora. The frequent (incorrect) conversions of forward null to forward pronominal anaphora explain this depression of success on forward null anaphora. Imitation evidence thus, analyses of amount correct, as well as errors, suggests that in their production, children generalize a "directionality" constraint over both pronominal and null anaphora, thus treating these two anaphora types similarly. These imitation data also evidence a primacy of pronominal anaphora over null anaphora in children's spontaneous conversions of null to pronominal rather than of pronominal to null anaphora.

Comprehension (Act-out Task) data

Results of the comprehension task reflected children's generalization of both constraints (Directionality and Pragmatic Context) over null anaphora.

Confirming generalization of the "Directionality" constraint to null anaphora, Figure III shows that there were significantly more null anaphora items correct with forward anaphora than with backward. Confirming generalization of the "pragmatic context" constraint to null anaphora, Figure IV shows that the pragmatic lead significantly depressed the amount correct on null anaphora while increasing amount correct on pronominal anaphora. Since the PL was to the object, this depression in amount correct for null anaphora suggests that children interpreted PL as determinant of anaphor reference, as they did with the pronominal anaphor.

Coreference Judgment. Analysis of children's coreference judgments shows similarity between pronominal and null anaphora in that there is a general preference for choice of subject over choice of object in sentences without pragmatic lead for both pronominal and null as shown in Figure V. There is little choice of an extra-sentential referent in either case (only 4% of pronominal and 1% of null items involved an extra-sentential referent). Critically, as Figure V shows, PL (to the object) significantly, and similarly, increases choice of object and similarly decreases choice of subject for both pronominal and null anaphora.

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Moreover, coreference judgments for both pronominal and null anaphora interact similarly with direction. The preferred choice of subject holds more strongly for forward anaphora than for backward. For both types of anaphora, the PL has its strongest effect in depressing this choice of subject and increasing choice of object on the backward forms, rather than on the forward. This is in accord with the results found previously on pronominal anaphora where backward anaphora appears more sensitive to (or dependent on) pragmatic context than does forward in child language. It thus further supports the claim that the Directionality Constraint and the Pragmatic Context Constraint apply similarly to the null and pronominal forms.

Conclusion

The data from this study confirm that children generalize both principles stated in 3, viz., the 'Directionality' constraint and the 'Pragmatic Context' constraint over both pronominal and null anaphora, and that in doing so they deny specific restrictions on null anaphora. In particular, children deny the specific obligatory constraint of subject control of the null anaphor.

Notably, this is not to say that children are incapable of distinguishing null from pronominal anaphora at least at some level. There are indications in the data that they do distinguish them (for example, the comprehensive conversion of null to pronominal forms). Rather, the data confirm that at the same time children distinguish these anaphor types, they treat them unitarily at the level at which they apply the general constraints (Directionality and Pragmatic Context). Thus, at a certain level, children conflate these anaphora types to define a general theory of anaphora in early child language.

General significance of results. These results (in which children conflate pronominal and null anaphora in English) accord with a general model of first language acquistion in which children's first hypotheses about language structure are general and abstract, and in which development involves differentiation or specification of these hypotheses. They are in disaccord, in this case, with a model in which children begin by hypothesizing the more specific restrictions and gradually develop the more general.

In general, these results also evidence that children represent a level of language structure other than the immediate acoustic surface; in particular, that they represent a gapped structure. (In current theory, "S-structure" cf. Chomsky, 1980.) The fact that children develop null anaphora in close relation to pronominal and the fact that they spontaneously convert null to pronominal anaphora evidences representation of the gap per se at some level.[7]

These results may be in general accord with a recent theory of NP's (Chomsky, Pisa Lectures) which suggests that pronoun and PRO are grammatically categorized uniformly as "Pronominals," both of which share a set of feature specifications (person, gender, number), and which differ essentially only in that PRO lacks the phonetic matrix which characterizes the pronoun. For example, children's spontaneous conversions of nulls to pronouns in their imitation may be viewed as a phonetic realization of an underlying set of features of the PRO.[8]

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More specific significance of results. These results appear to be in general accord with a theory of Universal Grammar (UG) where this grammar significantly defines the initial cognitive state of the child in first language acquisition and critically constrains the acquisition process. Elsewhere (Lust, in press), we have argued that the Directionality Constraint provides an important constraint on the development of first language acquisition of anaphora. The aversion to backward anaphora in English, we have argued, is determined by children's sensitivity to the basic right-branching nature of English, and insures acceptable dominance structure for anaphora. That is, given the directionality constraint (foward) an anaphor will generally not dominate its controlling term in a right-branching language like English. Data from this paper argues that this directionality constraint is a general one, holding over a possibly wide domain of anaphora types.

With regard to the effect of pragmatic context, the results of this study appear to cohere more specifically with UG in that the children's hypotheses about anaphora reflect what may be the unmarked form of anaphora in such contexts in natural languages. We saw that children not only conflate null and pronominal anaphora but also generalize principles from pronominal to null rather than from null to pronominal. (Data from both imitation and comprehension tasks confirmed this.) Many languages use null anaphora where English uses pronominal, in contexts similar to those we have been studying. Such null anaphora is often optionally or pragmatically controlled as is pronominal anaphora in these contexts in English. Japanese or Sinhalese (e.g., 6) would be examples of such languages.

6. Yudde ivərə unaamə rajjuruwo maaligaawəTə aawa. EnəkoTə maaligaawə
   (war having-ended king palace return-past. When coming palace

   lassənaTə sarə-sannay kiyə la bisoo wəɛe Də kaarəyanTə kiwiva.
   beautifully decorate comp queen workers-DAT said)

   (The war having ended, the king returned to the palace. When Ø coming, the queen told the workers to decorate the palace beautifully.)

In fact, null anaphora in English is often optionally or even pragmatically controlled, e.g., in contexts where the participle phrase does not include a connective, e.g., "Going down the street, John saw Tom"; or in certain gerundive subjects e.g., "Going to the movies pleases John" (cf. Solan, 1977). Notably, if this (unmarked optionality) is a correct explanation for our findings, apparent preference for a pronominal basis to the first language acquisition of anaphora types studied here in English is not merely a preference for a lexical rather than a null anaphor, but a preference for unmarked general principles of anaphora in these contexts (although cf. footnote 7). Current work in first language acquisition of languages other than English is pursuing this issue further.

Development. On this view, the child (who is predisposed to acquire any possible language) must learn language-specific variations in the mapping from the S-structure (where abstract anaphora structure is represented) to phonetic representation. (For example, in English it must learn a lexical pronominal

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representation, where in Japanese or Sinhalese it learns a null). In addition, the child must learn the language-specific restrictions on this anaphora, e.g., the apparently somewhat idiosyncratic restriction on null anaphora in English, which we have been studying here, viz., that it requires subject control in a non-tensed (participle) subordinate clause.[10]

In conclusion, the child appears to form a general theory about anaphora in its first language acquisition; it generalizes over anaphora types which are distinct in surface realization and distinct in certain language-specific constraints which hold on them in adult grammar. The form children generalize to - the pronominal form - may represent the unmarked form of anaphora in these contexts in natural languages. Children thus apply a general and abstract theory to language-specific facts to devise the adult grammar of anaphora.[11]

FOOTNOTES

[1] This study was supported in part by the National Science Foundation under grant #BNS-7825115. We thank Helen Goodluck, James Gair and D.T. Langendoen for helpful discussion. We thank Yu-Chin Chien and Terri Clifford for invaluable help in data collection and analysis.

[2] Chomsky's recent theory with regard to NP's restricts the term 'anaphor' to items "lexically identified as anaphors, e.g., "each other" or reflexive pronouns, and distinguishes both pronouns and PRO from these as 'pronominals.'

[3] Exceptions to this claim have been noted by Langendoen (pc) who observes, for example, "When walking down the street, it started to rain." As Langendoen adds, however, the unacceptability of examples like "When shaving himself, Mary saw Tom" suggests the strength of the principle of subject control in these contexts.

[4] Analyses of control sentences (9, 10) on Table 1 confirm that the effect of directionality is not due to clause position alone.

[5] Anaphora errors in imitation included any change in the anaphora-name relation while maintaining 2-clause structure, e.g., changes of anpahora direction or expansion of the anaphor to a lexical noun.

[6] Notably also, this is not to claim that children can not in general distinguish optional and obligatory anaphora. These results hold only for subordinate clause contexts of anaphora as in 1 and 2. Other study for example on anaphora in reduced coordinate structures has given no indication that even young children do not treat these as obligatory.

[7] Children's gap elaboration of null to pronominal anaphora observed in this study may be consistent with their observed elaboration of gaps in reduced coordinate structures (cf. Lust, Flynn, Chien and Clifford, 1980).

[8] It should be noted however, that the PRO we have noted in the subordinate clauses of this study may be differentiated essentially from the PRO concerned in the Pisa Lectures system, namely embedded infinitive complements; in which case this generalization might be spurious.

[9] The 'dangling participle' in English might be a further example of possible 'free' anaphora in contexts such as we have been studying here (cf. Footnote 3).

[10] It may be that the obligatory subject control of the null anaphor in English sentences like 2 can be described by facts consistent with c-command. If this is true, this control would be a more principled one, and its delay in acquisition would require a different explanation than the one we propose here.

[11] Helen Goodluck has kindly provided us with a preliminary report of her current work conducted independently of that reported here in which she reports results which appear to be remarkably convergent with those we report here (see her paper listed in our references).

Table I
EXAMPLE SENTENCES
Imitation
Forward

I. Pro

   1. Billy dropped the penny, when he saw the cat.
   2. Billy read the book, when he ate the dinner.

II. Null

   3. Johnny washed the table, when Ø drinking juice.
   4. Bill ate the apple, when Ø coloring the book.

Backward

III. Pro

   5. When he colored the books, Tommy drank the milk.
   6. When he sang a song, Jimmy opened the door.

IV. Null

   7. When Ø dressing the baby, Daddy dropped the book.
   8. When Ø cutting the grass, Jimmy walked the dog.

Control

   9. When Daddy chased the cat, he picked a flower.
  10. When Tommy read the book, he ate the ice-cream.

Comprehension (Act Out)
Forward

I. Pro

  11. Fozzie tickled Kermit Frog, when he dropped the car.
  12. Ernie tickled Big Bird, when he dropped the penny.

II. Null

  13. Scooter squeezed Fozzie, when Ø dropping the tissue.
  14. Big Bird patted Oscar, when Ø pushing the car.

Backward

III. Pro

  15. When he dropped the tissue, Kermit rubbed Scooter.
  16. When he pushed the penny, Ernie pinched Oscar.

IV. Null

  17. When Ø hitting the block, Scooter kicked Fozzie Bear.
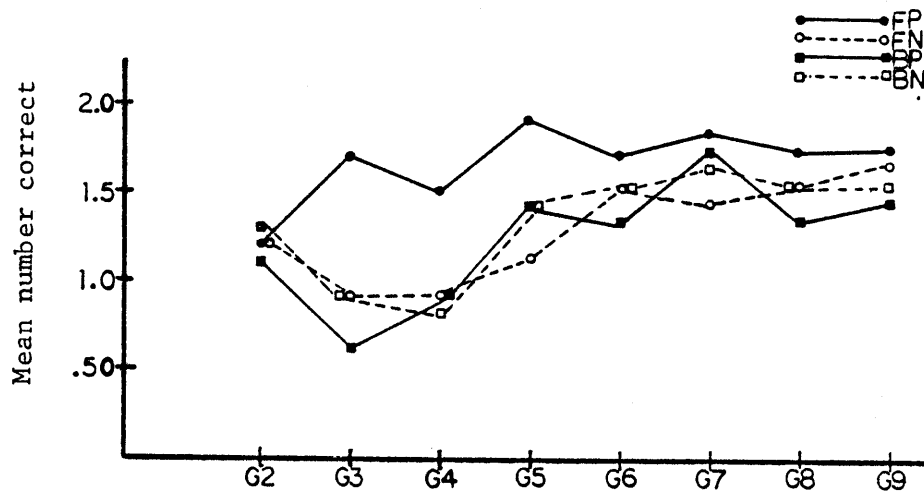 18. When Ø pushing the car, Big Bird patted Ernie.

Figure I.

Amount Correct Imitation of Null and Pronominal
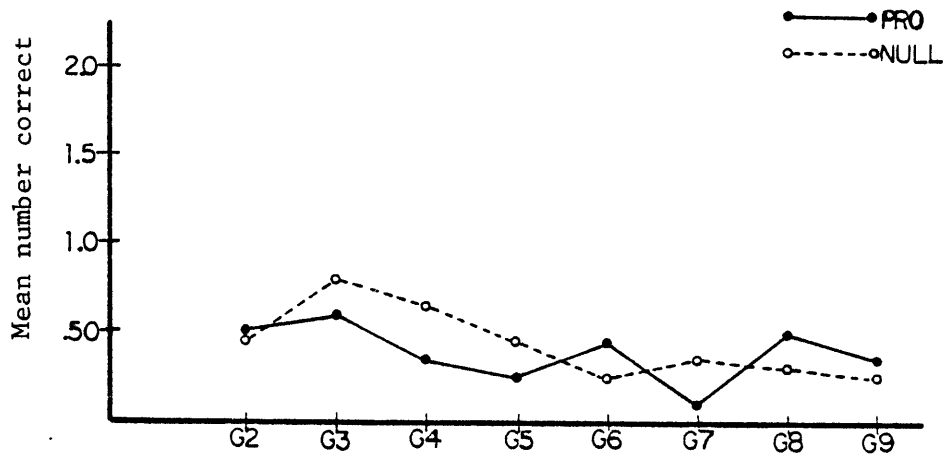Anaphora in Forward and Backward Directions Over
Age Group

Figure II.

Amount of Anaphora Error on Null and
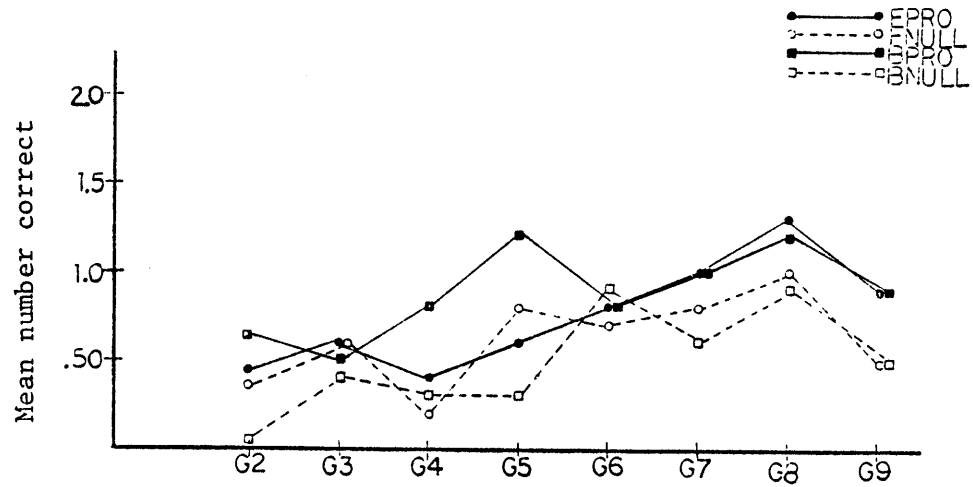Pronominal Anaphora Over Age Group

Figure III.

Amount Correct on Comprehension Task for Each
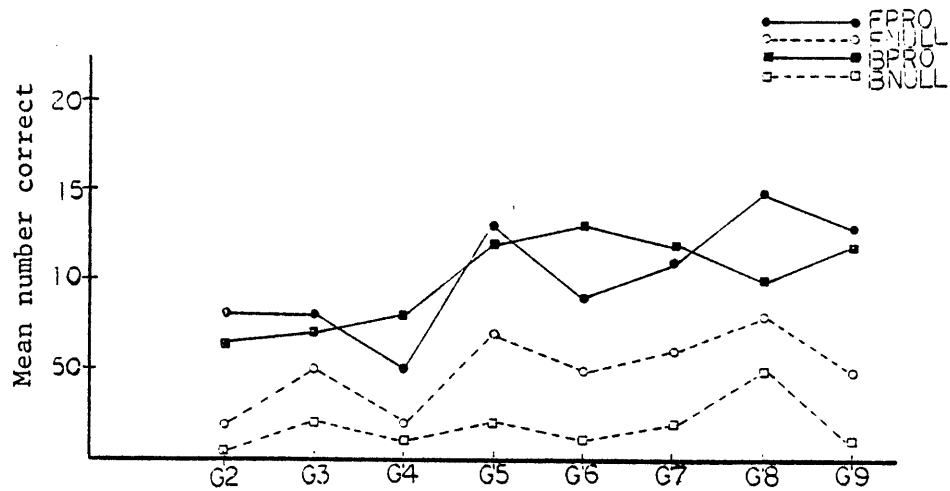Type of Anaphora with no Pragmatic Lead

Figure IV.

Amount Correct on Comprehension Task for Each
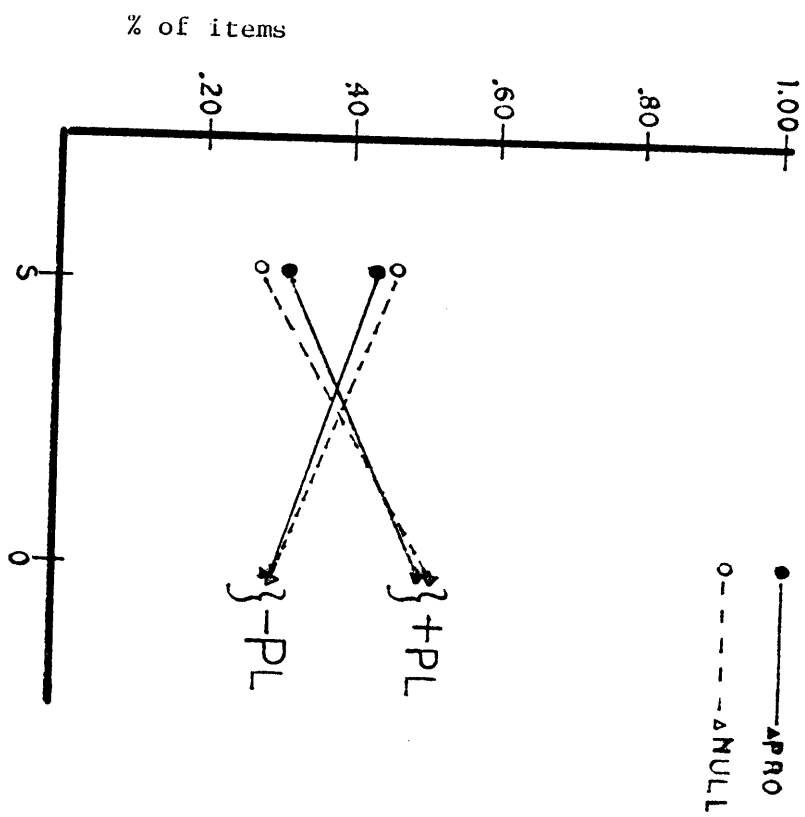Type of Anaphora with Pragmatic Lead

% of items

Choice of Subject or Object as
Coreferential with Anaphor in
Pronominal and Null Anaphora

Figure 5

● ──── ΔPRO

O ─ ─ ─ ─ ΔNULL

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