Effects of the Acquisition of Morphology on Syntactic Parameter Setting

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1. Introduction

In a principles-and-parameters approach to language acquisition, it is assumed that children come to the task of language learning with certain innate language-universal principles that restrict the possible grammars constructed, and other language-specific parameters to be set in accordance with the syntactic constructions which the child hears as primary language data (e.g. Chomsky 1981, Lightfoot 1983). Under such an approach, the task of learning syntax, which would otherwise be quite a formidable one, is reduced to setting a limited number of parameters on the basis of readily available data. However, the task of learning the lexicon and morphology now becomes a much more difficult one, as almost all language-particular variation (i.e., all except that captured via parameters) is now assigned to those areas of the grammar. Learning a word thus involves learning its pronunciation, meaning, selectional restrictions, category, subcategorization, Case- and θ-assigning properties, pronominal/anaphoric status, and other factors. This is therefore not a simple task, and even with possible principles and parameters, or redundancy-type rules within this part of the grammar, learning

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lexical/morphological material will take time.

If the acquisition of words interacts with the acquisition of syntax, then it could be expected that the setting of a syntactic parameter might be influenced by the time course of the acquisition of morphology. The overt manifestation of the correct setting of such a syntactic parameter could very well be influenced or obscured by the steps in the acquisition of morphological material. In this paper, data is presented from the acquisition of null argument structures in American Sign Language which indicates that such is the case.

In the next three sections, I will provide background information on ASL, the null argument constructions in ASL which will be discussed, and previous work on the acquisition of null argument structures in other languages. In section 5, the acquisition of null arguments in ASL will be discussed, and in section 6 data will be presented on the acquisition of ASL verb agreement morphology. In the final sections, the relationship between the acquisition of these two sections will be explained, and some conclusions drawn.

2. American Sign Language

American Sign Language (ASL) is the visual-gestural language used by deaf people in most of the United States and parts of Canada (see Klima & Bellugi 1979 for descriptions of ASL structure). On the surface, this language (and all signed languages) seems radically different from the spoken languages which have been used to formulate the theories of linguistic principles and parameters. However, if these theoretical constructs are meant to hold for Language in general, then they should hold for natural human language in any modality; and if ASL is such a natural human language, then it too must be accounted for by any adequate theory of Universal grammar. Recent work within several theoretical frameworks of syntax as well as phonology (e.g. Relational Grammar, Padden 1983; Government and Binding, Lillo-Martin 1985a,b, and Shepard-Kegl 1985; Autosegmental Phonology, Johnson and Liddell 1985) have argued that indeed, ASL is such a language. Let us assume then, without further argument here, that principles of Universal Grammar, and principles that derive from it, are applicable to ASL, and in fact that ASL can serve as one of the languages which test Universal Grammar.

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Before presenting data from the acquisition of ASL to test Universal Grammar, however, I will first argue that the acquisition of ASL is comparable to the acquisition of spoken languages. During the last ten years, a great deal of research has accumulated on the acquisition of ASL. Although research has been done on other groups, the discussion below applies to a specific subset of deaf children, those raised by deaf parents using ASL, which constitutes only 5-10% of deaf children. Only in this group of children is the language input consistent enough for these claims to be made at present. The findings from these studies overwhelmingly show that deaf children go through the same developmental processes and stages to those found in hearing children. (See Bellugi & Klima 1982, Launer 1982, Meier 1982, Petitto 1983, Supalla 1982, and see Newport and Meier in press for a review of the relevant research).

These studies show that similar to their hearing counterparts, deaf children go through a sign babbling stage (as well as a speech babbling one), in which many different meaningless hand configurations and movement combinations are explored. (See Petitto in press for discussion of the misattribution of sign-hood to some of these early pre-linguistic gestures.) Next, between 1;0 and 2;0, deaf babies pass through a one-sign stage, where they produce some phonological errors, and the full range of semantics associated with single-word utterances in hearing children. Then, around 2;0, two-sign combinations appear, and some kinds of morphology and early syntax are apparent.

Due to the apparent iconicity of some signs, an interesting question in acquisition studies of ASL has arisen: Does the modality in some way facilitate the acquisition of language? For example, deictics, and parts of the verb agreement system (described below) could have some iconic bases. However, the answers from these studies have always been, 'No'. Given natural language input, the acquisition of ASL seems to follow a linguistically-driven course, showing remarkable similarities to the developmental course of spoken languages (Petitto 1983, Meier 1982).

3. Null Arguments in ASL

Let us put aside for a moment the topic of acquisition and look at the syntax of the construction I will be discussing. ASL has a class of verbs which takes agreement morphology, and a class which does not (Padden 1983). When agreement morphology is present, it

is manifested in the following way. Agreement for first, second, and third person referents who are present in the signing situation is signaled by changing the movement dimension of the verb root. Under this modulation, the sign begins at the locus which the subject occupies, and terminates at the locus of the object. So for example, to sign, 'I give to you', the basic sign GIVE[1] is articulated so that the movement begins at me, and moves toward and ends at you: $_1GIVE_2$. For referents which are not present, abstract loci in the signing space in front of the signer's body are associated with each referent, and the verb is executed between these abstract loci as above. Thus, if John is associated with a locus to my right, and Mary is associated with a locus to my left, then movement of the sign root (GIVE) from the locus on my right to the locus on my left means, 'John gives to Mary'. Similarly, if the verb moves from my left to my right, it means, 'Mary gives to John'. An example of the locus association and verb agreement morphology system is illustrated in Figure 1 below. The sentence consists of associating 'the dog' with a locus on the signer's left, called 'a', and 'the cat' with a locus on the signer's right, called 'b'. The movement of the verb is from the left to the right; thus, the sentence means, 'The dog bites the cat'; if the verb moved from right to left, it would mean, 'The cat bites the dog'.

aDOG   bCAT   aBITEb
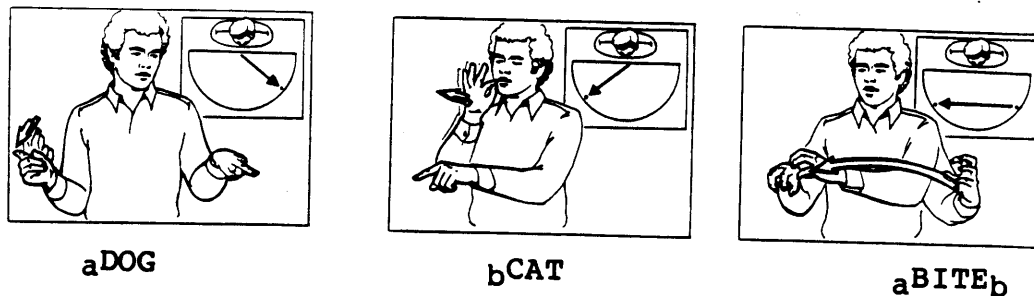
Figure 1.   ASL Verb Agreement Morphology

For verbs which do not take the agreement morphology, basic Subject-Verb-Object word order serves to convey grammatical relations, as in the examples in (1) below.

(1)   a.   JOHN LIKE MARY
           "John likes Mary."

      b.   aBILL THINK aINDEX KNOW ANSWER
           "Bill$_i$ thinks he$_i$ knows the answer."

As often happens in rich morphological systems, in those cases in which agreement is marked in ASL,

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subjects and objects can be phonologically null (non-overt). Some examples are given in (2a-c) below.

(2) a. $_a$JOHN KNOW-WELL PAPER FINISH $_a$GIVE$_b$
          "John$_i$ knows (he$_i$-) gave the paper to (-her)."

    b. $_a$JOHN KNOW-WELL PAPER FINISH $_b$GIVE$_a$
          "John$_i$ knows (she-) gave the paper to (-him$_i$)."

    c.   A.   Did John send Mary the paper?
              (John is established at "a" and Mary at "b")

         B.   YES, $_a$SEND$_b$
              "Yes, (he-) sent (it) to (-her)."

        I have argued elsewhere that the null arguments in these sentences are members of the empty category pro, because their distribution and function is identical to overt pronouns in locus-assigning, resumptive pronoun 'saving' of island violations, and other tests for pronominal status (Lillo-Martin 1985a,b).

        For example, ASL obeys the Sentential Subject Constraint, as illustrated in (3a). This type of sentence, (which violates subjacency and the ECP) can be 'saved' by the appearance of an overt resumptive pronoun in object position, as illustrated in (3b). In (3c), the embedded verb is marked for agreement. I have argued that although there is no overt resumptive pronoun in (3c), the agreement marker sanctions the presence of a null resumptive pronoun which can also 'save' the sentence.

```
         ___t___ _____br
(3) a. *_aBILL, _bBETTY LIKE t_i, OBVIOUS
```
        "As for Bill$_i$, that Betty likes t$_i$ is obvious."

```
         ___t___ _____br
    b.  _aBILL, _bBETTY LIKE _aINDEX, OBVIOUS
```
        "As for Bill$_i$, that Betty likes him$_i$ is obvious."

```
         ___t___ _____br
    c.  _aBILL, _aBETTY _bGIVE_a PAPER, OBVIOUS
```
        "As for Bill$_i$, that Betty gave (him$_i$) the paper is obvious."

        Thus, although ASL does not display free subject-verb inversion and some other phenomena common to many so-called 'pro-drop' languages, there is good evidence that pro can be licensed by subject and object agreement in ASL agreeing verbs.

For those ASL verbs which do not take agreement morphology, null arguments are not as freely allowed as they are with the agreeing verbs. However, some null arguments are allowed, and an example with the non-agreeing verb ENJOY is given in (4).

(4) $_a$JOHN $_a$FLY$_b$ $_b$CALIFORNIA $\overline{\text{LAST-WEEK.}}^{hn}$
       ENJOY SUNBATHE[dur].
       "John$_i$ flew to California last week.
       (He$_i$'s) enjoying a lot of sunbathing."

These null arguments could be analyzed as null variables, bound by an empty operator in topic position, following Huang's (1984) analysis for Chinese.[2] ASL displays many of the characteristics of so-called 'Discourse Oriented Languages', including topicalization-like structures with no gap, as given in (5).

(5) $\overline{\text{MEAT,}}^{t}$ $_1$INDEX LIKE LAMB   (Padden 1983)
       "As for meat, I like lamb."

Since ASL displays the characteristics of a Discourse Oriented Language, it is reasonable to postulate that it has the topic-chaining rule which Huang argues is the basis for many of the null arguments found in Chinese. Furthermore, null arguments with non-agreeing verbs are found in the same structures as null arguments in Chinese (Lillo-Martin 1985b). Thus, two types of null arguments are found with ASL agreeing and non-agreeing verbs.

4. Setting a Pro-drop Parameter

How does the young deaf child learning ASL learn to use null arguments appropriately? First I will consider what predictions the theory makes, and then review recent work on the acquisition of the appropriate setting of the Null Subject Parameter in English and Italian.

Parameters can be viewed as having one unmarked setting which is the biologically first-given. Children will change the setting of a parameter only when presented with positive evidence for that change. It has been proposed (Suñer 1982) that the unmarked setting of the null argument parameter allows nulls freely. The child learning to speak a language like English, which does not allow null subjects, will use the presence of

expletive elements such as 'it' (as in 'It's raining') and 'there' (as in 'There's the cat') in conjunction with the Avoid Pronoun Principle as evidence that English is not a null subject language. Following this line of argument, the deaf child begins with the assumption that ASL does allow null pronouns, and since there are no overt expletives in ASL this assumption should be kept. Thus it would seem that the correct use of nulls would come relatively early for children learning ASL.

Hyams' (1983) work on the acquisition of English and Italian supports the suggestion that the unmarked setting of the Null Subject Parameter allows nulls. She found that children learning to speak English initially made errors of subject omission, even when comparable sentences with overt pronouns (first, second, and third person) were also found. Some examples of the null subject sentences from Hyams are given in (6).

(6)   Read bear book   Bring Jeffrey book
      Want go get it   Want look a man
      Ride truck   See under there

In each of the cases in which a null subject was used, a definite pronominal interpretation could be assumed. Hyams then postulated that these children started with the hypothesis that English is a pro-drop language. Later, when the children begin to use overt expletives, null subjects disappeared, suggesting that the presence of an overt expletive in English served as evidence that English was actually not a Null Subject Language.

5.   The Acquisition of Null Argument Structures in ASL

     Methodology
     The ASL data to be considered here comes from partially longitudinal studies of fifteen deaf children with deaf parents. The children range in age from 1;7 to 8;2, and are learning ASL as a first language. Each child was videotaped for two or three sessions for a total of thirty-six different sessions, with a research assistant conducting conversation entirely in ASL. The time between testing sessions for each child ranged from 2 to 10 months. At each session, one of the tasks involved showing the child picture booklets depicting stories with two or three characters. The child was shown each page at a time and asked to sign what was happening in that picture. After each book was finished the child was then asked to tell the whole story again. The signed stories were later transcribed and coded for

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null argument and verb agreement use as well as other aspects of grammaticality.

Two stories discussed here are the Balloon Story and the Paint Story. In The Balloon Story, a boy is seen walking down a sidewalk, and he sees a man holding a group of balloons. The man gives the boy a balloon, and he walks down the street holding the balloon. Then, the boy lets go of the balloon and it flies away. The boy continues walking down the sidewalk, crying and downcast. In the Paint Story, a boy and a girl are sitting at a table with paints and paper, and a woman is standing in the background with her back to the children, washing dishes. The boy then paints on the girl's face, and the girl responds by painting on the boy's face. Then the boy pours a can of paint on the girl's head, and the girl pours another can of paint on the boy's head. Finally, the woman approaches the children and scolds them.

Results
Several stages in the development of the correct use of null arguments emerged. (In this case, 'stages', refers to a clustering of output phenomena across children at similar ages – not the syntactic stages challenged by Crain & McKee in this volume.)

I. In the first stage, the child uses only single signs to describe each picture, such as BOY, BALLOON, or CRY. No verb agreement is used in these single-sign utterances. This stage was only manifested in two children, one at 1;7 and the other at 2;4.

II. In the next stage, at the two-year range, several-sign combinations are used, along with null arguments. These sentences are very similar to the ones observed in English-speaking children by Hyams. For example, GIVE BALLOON, and LET-GO FLY-UP, were produced by children telling the balloon story. Since these sentences appear without verb agreement or mention of the topic, the nulls are ungrammatical for ASL.

III. Beginning around age three, and continuing for some children through age five, longer sentences are used without verb agreement, with null arguments which are sometimes correctly used with non-agreeing verbs, and often incorrectly used with both kinds of verbs. Supplementary data from these children demonstrate that utterances of the length necessary for using overt pronouns or grammatical nulls do not present a problem. Moreover, overt arguments do occur in their data. However, because of the lack of verb agreement (use of

the citation, uninflected form), most of the nulls are not identified and therefore, ungrammatical.

IV.   For deaf children around age four, although verb agreement does not significantly improve, overt subjects and objects appear.   Examples of this include MAN GIVE BOY BALLOON, and GIRL PAINT BOY FACE.   In these cases, word order rather than verb agreement is responsible for signifying grammatical relations for all verbs.   It is possible that these children are beginning to discover the relationship between verb agreement and overt arguments in ASL, and since they are not using the verb agreement, null production ceases.

V.   Then, for brief periods in each child's development, at about age five, verb agreement appears correctly with overt pronouns and noun phrases, or with incorrect null pronouns.   For an example of the former, in one child's production BOY $_a$POUR$_b$ WATER GIRL FACE THEN GIRL $_b$POUR$_a$ WATER BOY, overt nouns are used for all arguments.   An example of the latter is $_a$POUR$_b$ SPILL-ON-HEAD THEN $_b$POUR$_a$ SPILL-ON-HEAD, in which the referents for the "a" and "b" loci have not been established, and this null use is thus inappropriate. At around age five, sentences totally lacking in verb agreement, and others with incorrect agreement markers also appear.   At this stage, then, the children appear to be experimenting with the use of verb agreement, and reviving the use of nulls.

VI.   Finally, by age six, most children control the grammatical interaction of nulls with verb agreement.   An example of the paint story is given in (7).   Grammatically this child could have increased pro-drop, since overt arguments are optional with agreement.

(7) $_a$INDEX BOY WANT PAINT. $_a$PAINT$_b$ GIRL.   THEN GIRL
      $_b$PAINT$_a$.   THEN BOY $_a$POUR$_b$ $_{b/1}$SPILL-ON-HEAD.   GIRL
      $_b$POUR$_a$.   THEN MOTHER $_c$SCOLD$_{a,b}$.

"The boy wants to paint. He paints the girl. Then the girl paints him. Then the boy pours on her and it spills on her head. The girl pours on him. Then mother scolds them both."

To synthesize, the overall pattern of development of nulls resembles the following:

1)   single-sign utterances
2)   incorrect nulls

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3) mostly overt pronouns and nouns
       & some incorrect nulls
4) correct null usage

Additional refinements of ASL narrative continue to emerge (see for example Loew 1984).

Compared to Hyams' results for English, the acquisition of the appropriate null usage in ASL is quite late for deaf children. In the English data correct use of null subjects is accomplished by age 2-1/2. This large difference between the two groups is puzzling. Theoretically, the appropriate use of nulls in ASL should not take so long to acquire. Why this apparent discrepancy?

6. The Acquisition of ASL Verb Agreement Morphology

The answer to this puzzle lies, I will suggest, in the acquisition of the verbal morphology itself. Recall that I claimed that the acquisition of ASL in general follows the same time course and stages of development as the acquisition of spoken languages. However, aside from the syntactic null argument construction under discussion above, there is one area in which the acquisition of ASL seems to lag behind. In this section I will discuss the acquisition of ASL verb agreement, and in the next section I will discuss how this relates to the acquisition of null argument constructions.

Consider the use of spatial loci in the verb agreement system. For referents physically present, the loci used in the verb agreement and pronominal systems are the actual physical spaces occupied by the referents themselves. Hence, first person reference is made by the signer pointing to himself, and agreement for first person is marked at the locus of the signer's chest (or immediately in front of it). Research on the acquisition of verb agreement morphology for referents that are present (Meier 1982) shows that consistent and correct use of this morphology in production occurs around age 3-1/2; this is the same age that agreement morphology usually shows up in children learning inflecting spoken languages.

However, the narratives discussed in this paper refer to non-present referents. When referents are not present, the signer associates an arbitrary locus in space with the referent. This can be done in several ways, including signing the name and then indexing that point in space, or signing the name and then beginning verb agreement in that place. Pronominal reference and

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verb agreement then are directed towards these abstract points in space. It is this aspect of verb agreement morphology that is delayed in the acquisition of ASL.

To investigate this phenomenon, we administered several systematic tests examining the development of the child's comprehension of verb agreement with non-present referents (Lillo-Martin, Bellugi, Struxness, & O'Grady 1985).

To determine whether children understand the abstract association of loci with nominals, we used a Nominal Establishment test. In this test, the experimenter associates two or three nominals with abstract points in space, then asks the child to indicate where a particular nominal was established, or what was established in a particular locus. The results from this test are illustrated in Figure 2 below. One- and two-year-old children failed this task, searching the room for a real doll when asked, for example, with which locus the doll was associated. However, by age three, the children's responses are 67.8% correct overall (where chance is 50% on one fourth of the test, but much lower on the other three parts). The major difficulty for three-year-olds is remembering what was in a particular location when three items were initially established. By age four, the children were performing at ceiling, around 90% correct. In sum, it is not just the idea of abstract association of nominals with points in space that is puzzling the children.
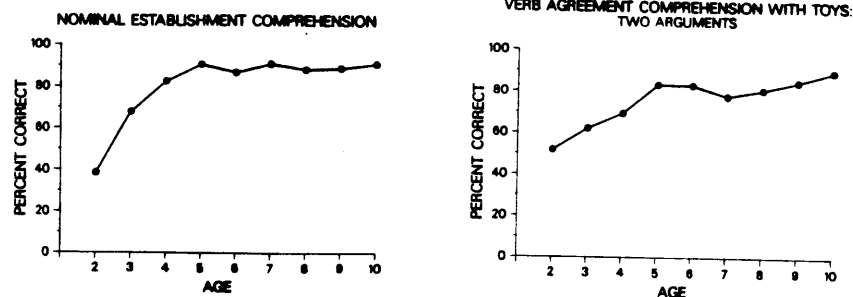

Figure 2. Nominal Establishment Comprehension
Figure 3. Verb Agreement Comprehension

Several tests were given to assess comprehension of sentences with non-present verb agreement, using different testing paradigms and sentences of varying length. The task which most successfully demonstrated the child's competence was a toy manipulation task, in which the child was given two toy figurines. The child is asked to act out with the toys a sentence the experimenter signed. These test sentences consist of establishing two referents in signing space, and then

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signing a verb between them so that one of the referents is the subject and the other is the object. For example, one sentence was GIRAFFE $_a$INDEX, LION $_b$INDEX, $_b$KICK$_a$, which means, 'The lion kicked the giraffe'. Notice that in ASL, either the subject or the object can be signed first in a situation such as this, and either one can be established on the right or left side. The results of this test are given in Figure 3 above. On this test, for which chance is about 50%, even four-year-olds scored less than 70% correct, and ceiling is not reached until age 5. Errors invariably consist of reversed subject and object grammatical relations.

Thus, even on comprehension tests, for verb agreement with non-present referents deaf children do not score well until age five-six. Furthermore, as we saw in the results from the story booklets, they do not produce correct verb agreement also until age five-six.

7. Summary

According to the analysis presented here, the correct use of null arguments in ASL depends on syntactic parameters which can be set on the basis of readily available positive data. Thus, the appropriate use of nulls should be relatively early and easy to learn. However, the story-telling data shows that errors with null arguments continue as late as five to six years of age. I will argue that this apparent contradiction is actually accountable by the theory itself, once morphological learning is considered.

At the early stages, children use null arguments, but incorrectly, without verb agreement morphology. These children appear to be working under the assumption that ASL is a null subject language, without yet having fully mastered the verb agreement system. Next, the children begin to use overt pronouns and strict word order for all verbs, some time after verb agreement appears with present referents. This perhaps indicates that once children use verb agreement with present referents, they realize that they are not using it with non-present referents, and so because of the connection between verb agreement and nulls in ASL they stop using the nulls.

Last, the verb agreement system which the children use for present referents finally encompasses non-present referents. At this point, there are cases where only overt pronouns are used, and there are instances where nulls are used incorrectly. These errors, however, are relatively infrequent and appear

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over a short period of time. Once the children master the verb agreement system, they are quick to integrate this new information in their production of nulls.

Thus, it is not surprising that the deaf four-year-old, who does not use the verb agreement morphology correctly for non-present referents, is not able to use the null argument system correctly, since the nulls in part depend on the verb agreement. A summary of the steps in the development of the nulls and the verb agreement is given in (8).

(8)   Null Argument and Verb Agreement Development

    1)   single-sign utterances
    2)   incorrect nulls   no verb agreement
    3)   overt pronouns/nouns   no verb agreement
    4)   overt pronouns and   correct verb agreement
        some incorrect nulls
    5)   correct nulls combined with correct agreement

8.   Factors Contributing to Morphology Acquisition

At this point, I would like to point out some factors possibly involved in the late appearance of the verb agreement system in ASL.

First, notice that although the children can comprehend explicit association of nominals with abstract loci at age three, they do not produce them. In fact, these explicit associations are not made by children until much later, and even adults use this kind of association infrequently. Recall also that there are several ways of associating a nominal with a locus in space. One possibility is to use an explicit indexing of a locus accompanied by a noun, as used in the Nominal Establishment test. However, in some instances indexing can be analyzed as a separate predicate (cf. Padden 1983), which certainly would add length and complexity complications for young children. Usually, the association of a nominal to a locus is much more subtle, and includes a slight, quick point, or an eye gaze shift. The index can be omitted when followed by an agreeing verb; I have argued that this is another pronominal-like function of _pro_ in ASL. Further complications are added by the shifting of the whole spatial framework, which is a possibility not discussed here, but which is a technique frequently used in adult narratives.

An additional complication in the verb agreement system facing the child learning ASL is the division of

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verbs into those which do take agreement and those which do not. This distinction seems to be lexical, so the child must learn the lexical marking for each verb. Additional complications include whether a verb takes subject and object agreement, or only subject, or only object agreement. Furthermore, while most verbs move from the locus of the subject to the locus of the object, some do just the opposite. While there may end up being lexical generalities which can regularize some of these phenomena, it is nonetheless complex. A more complete comparison of the acquisition of this system with the acquisition of similarly complex agreement in spoken languages is called for.

9. Conclusion

In conclusion, I suggest that the data from ASL show that looking only at syntax, even when examining a syntactic parameter, can be misleading.

These data also have provided a clue to the organization of the parameter itself. The first choice that must be made is whether a language allows pro-drop at all. In addition, once it is determined that a language does accept null arguments, the child needs to know under what conditions they may appear. Agreement is often relevant to both choices, but not necessary in every case. Children who have determined they have a null argument language must be able to go on to decide, on the basis of positive evidence, whether nulls are also allowed in their language in various instances when not identified by agreement. However, the developing child can only test this parameter-within-a-parameter after he understands agreement in his language. Hence, the signing child uses overt pronouns with non-present referents when his production of agreement occurs only with present referents. Only later, when he understands that the agreement system extends to non-present referents, can he expand the use of nulls correctly.

Finally, principles-and-parameters approaches, which are currently being tested and revised for empirical validity as models of adult grammar, can help to explain the acquisition of syntax. However, the shifting of the bulk of language variation into the lexicon and morphology suggested by this approach, predicts that the learning of lexical/morphological material will be a complicated, time-consuming process which will have visible effects on the rest of language acquisition.

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FOOTNOTES

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1.   The following notation is used in the text. Upper case English glosses stand for signs with approximately the same meaning as the English word. Subscripts from the beginning of the alphabet are used to indicate spatial locations. Nouns are marked with a subscript at the beginning of the gloss to indicate the space at which they are signed. Inflecting verbs are marked with a subscript at the beginning to indicate the onset location, and/or a subscript at the end to indicate the endpoint location. Subscripts 1 and 2 are used similarly to the subscripts a,b, to indicate first and second person respectively. Subscripts from the middle of the alphabet are used to indicate abstract coreference. A line on top of a sign or signs indicates that a specific grammatical facial gesture was used during the sign(s).

2.   Recent work on Chinese and Japanese null arguments have challenged various aspects of Huang's analysis (for example, Hoji and Saito 1986, Li 1985, Liejiong and Langendoen 1985, and Whitman 1985). Many of these authors have suggested that at least some of the null arguments (including objects) that Huang analyzed as variables are actually pronominal. The ASL data indicates that some distinction between null arguments of agreeing and nonagreeing verbs must be maintained.

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