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**"A PLANE" IS NOT "TO FLY": ACQUIRING THE DISTINCTION
BETWEEN RELATED NOUNS AND VERBS IN AMERICAN SIGN
LANGUAGE**

City University of New York

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ACQUIRING THE DISTINCTION BETWEEN RELATED NOUNS AND VERBS
IN AMERICAN SIGN LANGUAGE

by

PATRICIA B. LAUNER

A dissertation submitted to the Graduate
Faculty in Speech and Hearing Sciences in
partial fulfillment of the requirements for
the degree of Doctor of Philosophy,
The City University of New York.

1982



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1982

This manuscript has been read and accepted for the Graduate Faculty in Speech and Hearing Sciences in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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ABSTRACT

"A PLANE" IS NOT "TO FLY": ACQUIRING THE DISTINCTION BETWEEN RELATED NOUNS AND VERBS IN AMERICAN SIGN LANGUAGE

by

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Advisor: Professor Margaret Lahey
Committee: Professor Ursula Bellugi
Professor Michael Studdert-Kennedy
Professor Naomi Baron

American Sign Language (ASL) is a visual-manual language distinct from spoken languages. This dissertation represents the first systematic study of the acquisition of a derivational process in deaf children learning ASL as a native language.

In ASL, semantically related nouns and verbs (e.g., AIRPLANE/FLY) share the same handshape, location and movement shape, but are differentiated by features of movement (manner, frequency, size). The noun-verb process is documented in ten deaf adults (native signers), by means of elicitation tasks.

Acquisition of this process is examined in light of the influence of: semantic factors; language-specific formal devices; modality-specific factors (i.e., iconicity); and maternal input.

The early lexicons of four deaf children are compared to the first 50 words reported for English acquisition. Similarity is found in the type and frequency of nominals, but early action words vary across languages, due to language-specific and

modality-specific differences.

Spontaneous production of related nouns and verbs is traced in three deaf children and their deaf mothers. Before age two, children acquire lexical items, but without morphological marking. At the same time, mothers consistently obliterate morphological distinctions, producing ungrammatical forms. Both mothers and children elaborate signs mimetically, apparently making use of the iconic potential of these signs.

In early input, mothers often sign on the child's body, or mold the child's hands to facilitate learning. These features of "sign motherese" are also noted in a three-year old child signing to her one-year old sister.

After age two, maternal input changes dramatically, and children begin to mark noun-verb distinctions in idiosyncratic ways. Between age three and four, children systematically mark morphological distinctions, and they extend the process to unpaired forms and lexical innovations. These steps in acquisition are confirmed by elicitation tasks administered to 32 deaf children of deaf parents (age 2;0-11;0).

Early lexical acquisition seems to be influenced by semantics, iconicity and maternal input. But the course of acquiring a derivational process in ASL is strikingly similar to the acquisition of morphology in spoken languages, despite the differences in language modality.

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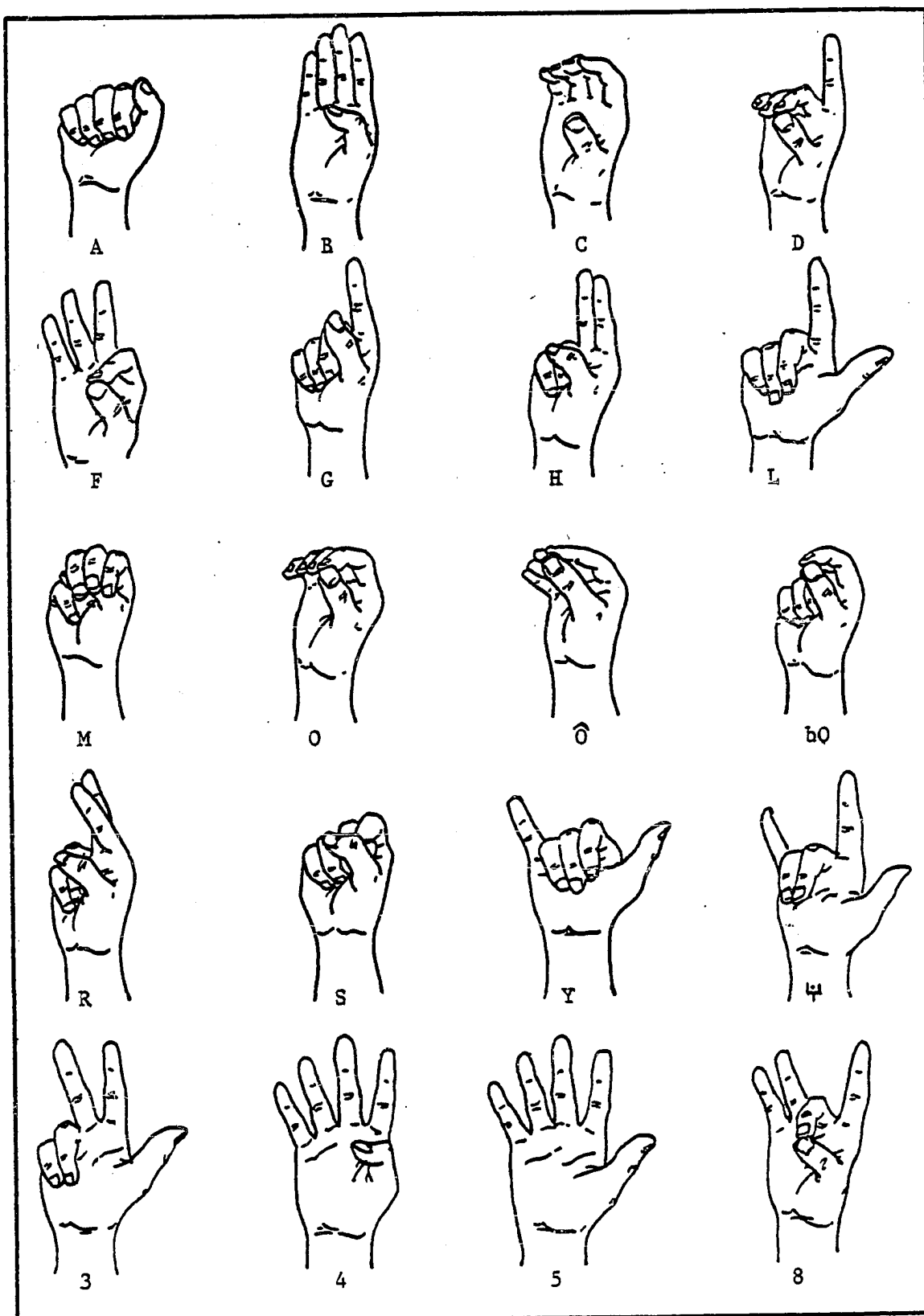
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KEY TO NOTATIONAL CONVENTIONS

SIGN	Words in capital letters represent English labels (glosses) for ASL signs. The gloss represents the meaning of the unmarked, uninflected basic form (citation form) of a sign out of context.
SIGN-SIGN	Multiword glosses connected by hyphens are used when more than one English word is required to translate a single sign (e.g., TELL-A-STORY).
SIGN^SIGN	Sign glosses joined by an arc indicate compound signs in ASL.
S-I-G-N	Letters connected by hyphens indicate a fingerspelled word.
'meaning'	Words within single quotation marks indicate the meaning or referent of the words or the signs; for example, 'dog' indicates the referent 'dog', not the English word <u>dog</u> .
<u>foreign word</u>	Underlined words represent terms in languages other than ASL, e.g., <u>dog</u> , <u>chien</u> .
H-H; B	Two hyphenated letters indicate the hand configuration for a given sign (see Figure i, ASL Handshapes). the first letter represents the handshape of the non-dominant or basehand; the second letter represents the handshape of the dominant or active hand. A single letter represents the handshape of the dominant hand in one-handed sign production.
SIGN[HC;loc;mov]	A subscript following a sign specifies the basic sign form (i.e., the root). The hand configuration is noted first, followed by the

FIGURE i. Selected ASL Handshapes



place of articulation, and then the basic movement shape. For example, in the sign CALL-BY-PHONE[Y;cheek;approach to contact], the Y-hand approaches and contacts the cheek.

SIGN[N:restr,sm,rep]

SIGN[V:hold/cont,lg,sing/rep]

These superscripts represent the criterial morphological features used here to describe the formal distinctions between related nouns and verbs. The manner of movement is noted first, followed by an indication of movement size and movement repetition. The morphological features that mark pairable nouns are restrained manner, small size and repeated movement. Pairable verbs are marked by hold or continuous manner, large size and single or repeated movement.

SIGN [I:]

A bracketed [I] indicates a sign which has been Indexed to or from particular locations. The notation following the I (marking verb agreement) refers to person number. For example, in GIVE[I:1 to 2], the verb GIVE moves from the first person to the second person. This superscripted notation can also refer to the particular person or object to which a given POINT or sign is directed, as in POINT[to picture in book] or GIVE-HER[I:to Jane].

SIGN[*];

When an asterisk appears within a set of brackets, it indicates that the preceding sign was produced in some non-standard fashion, with respect to basic phonological form, or to the morphological features for marking related nouns and verbs.

SIGN[inv]

A bracketed [inv] indicates that the sign is an invented form, not a standard lexical item in the language.

SIGN²⁺

A superscripted digit followed by a cross refers to the number of movement repetitions within a given sign, e.g., CAR⁵⁺ means that the movement was repeated five times for a single sign production.

2;3 4;2,25

Children's ages are noted in terms of digits referring to year and month (e.g., 2;3) or year, month and day (e.g., 4;2,25).

VT2 #251

The notation VT followed by a digit refers to the numbered videotape of spontaneous signing recorded for each subject. The additional numbers refer to the digital counter on videotape playback.

CHAPTER I. BACKGROUND AND RATIONALE

Introduction

Until recently, our knowledge of human language and language acquisition had been confined to the study of spoken languages. The term "language" itself has often implied a discussion of complex organizational principles thought to be uniquely connected with vocally articulated sounds.

I have chosen to depart from the traditional view of language as an auditory-vocal phenomenon and to study a language which has developed in a modality other than the auditory-vocal channel: American Sign Language (ASL), a language with its own grammatical devices which exclusively employ a visual-manual modality of communication.

The fact that ASL is a language implies that the human capacity for building complex linguistic systems is independent of the language modality. But beyond the universal principles of language and language development, analysis of ASL also sheds light on language-specific and modality-specific factors related to language in general and language acquisition in particular.

This dissertation represents the first study of the acquisition of derivational morphology in American Sign Language, focusing on the formal differentiation between semantically related nouns and verbs. Through analysis of spontaneous

conversational signing, I have traced the development of the formal distinction between related nouns and verbs in three deaf children of deaf parents, who are acquiring ASL as a first, native language. In addition, I designed and administered several elicitation tasks, in order to determine the knowledge and productivity of this process in deaf adults and in deaf children.

The uniqueness of ASL allowed me to examine this morphological relationship and its acquisition from three perspectives: cross-linguistic, language-specific and modality-specific. In particular, I was concerned with the effects of semantics, morphology, iconicity and maternal input on the acquisition of this derivational process.

This investigation contributes to an understanding of how deaf children enter and analyze the grammatical system of their language, and that understanding may help to advance the ongoing description of the adult language.

These findings also bear on more general similarities and differences in the structural organization of spoken and signed languages, and the universalities of language acquisition. Before describing the morphological process in detail (see chapter II), I provide a brief introduction to ASL itself, particularly its structure and organizational properties. First, however, some definition of linguistic terminology is in order, terminology which, as Klima and Bellugi (1979) have shown, applies to signed as well as spoken languages.

Definition of Linguistic Terms

The analysis of the internal structure of words is called morphology, which, in traditional grammar, has two branches: inflectional and derivational morphology. Inflectional morphology pertains to the study of the grammatical markers added to words to indicate such grammatical categories as tense, aspect, person, number, gender and case. For example, in English, -ed or -ing mark tense or aspect by indicating, respectively, completed or ongoing action. The variants resulting from the affixation of these inflections to word stems--e.g., acts, acted, acting--are considered to be different forms of the same verb, in this case, act (Aronoff, 1976; Fromkin and Rodman, 1978; Hockett, 1958).

In derivational morphology the formation of different words often changes the grammatical category of the lexical base; thus, nouns can be derived from verbs, verbs from adjectives, adjectives from nouns, and so forth. The verb act, for example, is the basis for the formation of the nouns action, actor, actress, and the adjective active, as well as the semantically related verbs react and activate.

It should be noted that the lines of distinction between the two branches of morphology can not always be cleanly drawn; many of the criteria are relative. Inflectional processes are generally consistent and predictable, operating over large semantic-syntactic classes. Derivational processes may operate less consistently, and the derived forms may have idiosyncratic

meanings (Aronoff, 1976; Matthews, 1974).

For the purposes of this study, the primary difference between the two branches of morphology may be summarized as follows: inflected words are determined by the rules of syntax of the language; inflecting a word does not change its syntactic category. Derived words are part of the lexicon and generally involve a change in the grammatical class of words. Derivational rules may be viewed as lexical rules of word formation (Aronoff, 1976; Fromkin and Rodman, 1978; Matthews, 1974).

Some derivational rules are highly productive; that is, they can be used quite freely to form new words from the list of free and bound morphemes in a language. For example, -er as in baker is very productive in English; many verbs accept -er as a bound morpheme to form a related noun, whereas -ity (as in scarcity) is no longer productive in English (Fromkin and Rodman, 1978:146).¹

Languages differ widely in the degree to which they employ inflectional and derivational processes, as well as in the meanings expressed by those processes. Chinese is considered an "isolating" or analytic language, with individual lexical items which are relatively immutable in form. Latin and Greek are highly inflective languages (Sapir, 1921:128-129). English is rich in derivational morphology, but not in inflectional morphology. As I show subsequently, ASL possesses a rich set of inflectional as well as derivational processes (see Klima and Bellugi, 1979). Before discussing these processes in detail, let me present a general overview of ASL and its structure.

American Sign Language

American Sign Language is a primary visual-manual system; it is the language used by the deaf community in the United States, learned by one generation from the next. Research has shown that ASL has developed as a fully autonomous language with complex organizational principles, that is, its own internal mechanisms for relating (visual) form to meaning (Bellugi and Studdert-Kennedy, 1980; Klima and Bellugi, 1979; Lane and Grosjean, 1980; Siple, 1978; Wilbur, 1979).

ASL differs from English (and other spoken languages) first in modality; it is a visual-gestural rather than an auditory-vocal language. Second, it differs from English in the formal devices used, and in the semantic distinctions which are morphologically marked. Third, ASL differs from English in its potential for exploiting iconicity, or the direct representation of aspects of the real world; this iconic potential is not pervasive in spoken languages, as it is in ASL.

Formal Aspects of ASL

ASL exhibits formal structuring at the same two levels as spoken languages: a sublexical level of structure internal to the sign (roughly equivalent to the phonological level in spoken language) and a level of structure that specifies the way signs are built up and bound together in sentences (the grammatical level). At all levels there are grammatical devices in ASL that are analogous to those of spoken languages. But many of the formal devices that ASL has developed make use of possibilities

either not available or not utilized in the auditory-vocal modality of spoken languages; in particular, the morphological and syntactic devices of ASL make structured use of space and movement. Klima and Bellugi (1979:314) have claimed that the form that the grammatical structuring assumes in a visual-manual language is deeply rooted in the modality.

Serious linguistic study of sign language is relatively new, with the work of Stokoe (1960; 1965) serving as a foundation for later research and investigation. The Dictionary of American Sign Language (Stokoe, Casterline and Croneberg, 1965) was the first "phonemic" level analysis of ASL, the first attempt to identify the minimal components that differentiate one sign from another.

According to Stokoe et al. (1965), signs are organized in terms of three simultaneous parameters: hand configuration, place of articulation and movement. Subsequent descriptions (e.g., Friedman, 1977; Klima and Bellugi, 1979) have stressed the importance of hand orientation as an additional descriptive parameter.² As in spoken languages, there are restrictions on the number and distribution of "phonological" segments and on how they may be combined to form morphemes. As with spoken languages, not all combinatorial possibilities occur, and combinatorial constraints differ from one language to another. For example, there are certain handshape configurations that occur in ASL but not in other sign languages (Friedman, 1977; Mayberry, 1978; Woodward and DeSantis, 1977).

Contrary to popular (naive) belief, there is no

international sign language. There are many different sign languages, just as there are different spoken languages, with national systems as well as dialectal variations. But in all sign language systems described thus far, the lexical sign may be viewed as a composite of particular configurations of the hand, particular locations and particular movements which co-occur in time throughout the sign.

Inflectional processes in ASL

In ASL, signs undergo a wide variety of inflectional and derivational processes, each of which operates by imposing different dynamic changes in movement. At the morphological level, there is evidence of the same kinds of simultaneous organization that ASL sign units exhibit at the lexical level (Klima and Bellugi, 1979). Rather than employing affix-like or sequential additions to signs, morphological operations in ASL are marked by superimposed spatial and temporal changes in the movement of sign stems.

For example, the uninflected sign GIVE[$\hat{O}$;neutral space; outward] has an $\hat{O}$ hand configuration, made in the neutral signing space in front of the torso, with a movement away from the signer (see Fig. 1a). One inflection adds an arc movement in a horizontal plane (Fig. 1b); another adds to it iterations along that arc (Fig. 1c); still another adds circular movement to the basic sign (Fig. 1d), and so forth. Thus, a single lexical sign can be built up by inflectional patterning to create a variety of complex sign forms into which a great deal of information has

FIGURE 1. Inflectional Processes in ASL



a. GIVE (citation form)



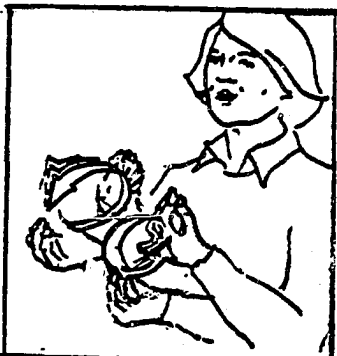
b. GIVE[multiple]
'give to them'



c. GIVE[exhaustive]
'give to each'



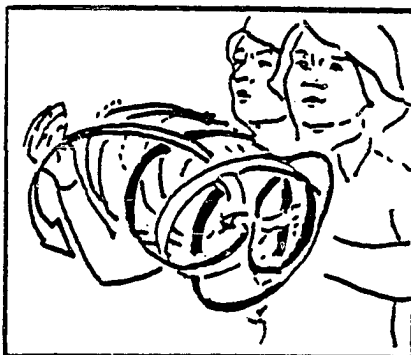
d. GIVE[durational]
'give continuously'



e. GIVE[durational]
(two hands alternating)
'give different things
continuously'



f. GIVE[allocative
determinate]
'give to certain ones at
different times'



g. GIVE[allocative
indeterminate]
'give to unspecified
recipients at dif-
ferent times'

(from Klima and Bellugi, 1979)

been simultaneously compacted.

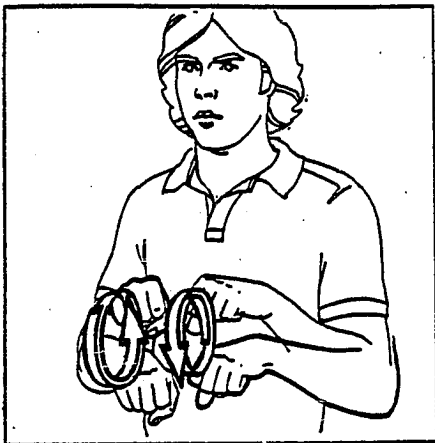
The inflectional forms of ASL can mark number distinctions such as dual, trial, and multiple, with respect to arguments of the verb (e.g., VERB 'to both of them', 'to three of them' or 'to them', the latter suggesting a group comprising more than three); reciprocal relations, which indicate mutual relation or action; distributional aspect, which indicates how the action is distributed (e.g., 'to any', 'to each', 'to certain ones', 'to members of a group including the signer', 'to members of a group not including the signer'); temporal aspect and focus (e.g., 'regularly', 'again and again', 'over time', 'for a long time', 'incessantly' (see Klima and Bellugi, 1979, Chapter 12).

The large variety of morphological processes in ASL consists of combinations of a limited number of formal components which depend on the structured use of space and movement. In addition, ASL can superimpose upon a sign grammaticized facial expressions which mark topic or focus, clausal subordination or manner adverbs (see Coulter, 1979; Liddell, 1978). For instance, Figures 2a and 2b depict the citation form signs BICYCLE and RIDE-BICYCLE; in 2c, the verb co-occurs with a facial expression that functions as a manner adverbial, adding to the verb the meaning 'with enjoyment' or 'with ease'.

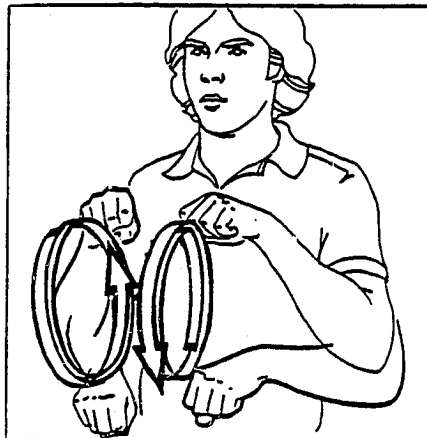
Derivational processes in ASL

As with inflectional processes, derivational processes in ASL invariably involve changes in the movement of the sign. For example, predicates can be formed on the basis of certain nouns

FIGURE 2. Grammaticalized Facial Expressions in ASL



a. BICYCLE



b. RIDE-BICYCLE



c. RIDE-BICYCLE-WITH-RELAXED-ENJOYMENT

by changing the movement to a single tense recoil (Klima and Bellugi, 1979). The derived form has single movement, produced in a rapid and tense manner, with a restrained onset. The meaning change is from a noun to a predicate meaning 'to act like ____' or 'to appear like ____'. By this process, the noun BABY[B-B;neutral space;side-to-side bidirectional] made with a repeated side-to-side movement, is modified to a single, rapid, tense downward motion, thereby becoming a predicate meaning 'babyish' (see Fig. 3a). Similarly, BUSINESS can form the basis for a predicate meaning 'business-like' (Fig. 3b), and the sign CHURCH can form the basis for a predicate meaning 'religious' or 'devout' (see Fig. 3c).

Some signs may be metaphorically or figuratively extended by derivational processes which take the form of minimal differences in size or quality of movement (i.e., tense, lax or accelerated movement). For instance, a feature change that entails a rapid, tense movement can change the meaning of the sign HUNGRY to 'horny'. These examples attest to the pervasive tendency in ASL for shifts in meaning to be marked by shifts in movement.

One widespread and productive process involves a consistent formal relationship between pairs of nouns and verbs; that process is the central focus of this investigation.

Most spoken languages distinguish nouns from verbs by means of inflection, reduplication or tone (Supalla and Newport, 1978:93). Not all languages mark noun/verb distinctions morphologically. In English, for example, there are pairs such

FIGURE 3. Derivational Processes In ASL:
Forming Predicates from Nouns



a. BABY



ACT-LIKE-A-BABY



b. BUSINESS



BUSINESS-LIKE =
'proper'



c. CHURCH



CHURCH-LIKE =
'devout'

(from Klima and Bellugi, 1979)

as a drink/to drink and an iron/to iron, which are morphologically identical, but the intended meaning of the word is clued by the syntactic environment in which it appears. English also has related nouns and verbs marked by morphological changes, such as baker/bake, denial/deny, demonstration/demonstrate. Many nouns and verbs in English are thus formed by the addition of derivational affixes.

In ASL, related nouns and verbs are formally distinguished by featural changes in sign movement. In Chapter II, I present a detailed description of these featural distinctions. The remainder of this thesis is concerned with how deaf children acquire these related lexical items, and how they learn to mark the formal distinctions between them. I propose that acquisition may be affected by the semantic relationships between these noun-verb pairs, by the inherent iconicity in the sign forms, by the ways in which mothers produce these signs, and by the morphological structure of the markers for these nouns and verbs. The next sections represent an overview of these issues in language acquisition, and how they relate to the noun-verb derivational process in ASL.

Issues in Acquisition

Semantics

Three semantic issues relate to the acquisition of paired nouns and verbs in ASL: 1) the first words for objects and actions that appear in early lexicons; 2) the order of

acquisition of nouns versus verbs; and 3) the sequence of acquisition of semantic relations.

For each of these issues, it should be noted that it is difficult to deal with the universality of semantic development without considering the nature of the particular language to be learned and the modality in which the language is formalized. ASL is similar to spoken languages in terms of the meanings it encodes, but the structure and modality of the language contribute to differences in acquisition. With this in mind, we can examine the data that relate to these semantic issues.

Objects and Actions in Early Lexicons

In Nelson's (1973) landmark study of the acquisition of the first 50 words in 18 children between one and two years of age, nominals represented the highest proportion of words in the early lexicons of all subjects; this suggests a great deal of early "label learning" in young children. The early nominals produced by English-speaking children varied in semantic categorization (e.g., animals, food, toys, vehicles, etc.) but they were generally considered to be "action-related". Nelson (1973:31) noted that

children learn the names of things they can act on, whether toys, shoes, scissors, money, keys, blankets or bottles, as well as things that act themselves, such as dogs and cars. They do not learn the names of things in the house or outside that are simply 'there', whether these are tables, plates, towels, grass or stores. With very few exceptions, all the words listed are terms applying to manipulable or movable objects.

Nelson (1973:17) defined "action words" as those that

describe, demand or accompany action or that express attention or demand for attention. She found that action words were not as numerous as might be expected according to a theory of the salience of action in the life of the young child (e.g., Piaget, 1954), but neither were they so absent that they could be considered a "secondary acquisition" (Nelson, 1973:19, referring to McNeill, 1970). Not all the action words Nelson recorded correspond to verbs in the adult language, but they clearly express "an action reference" (Nelson, 1973:19). A detailed listing, discussion and analysis of all nominals was presented, but Nelson did not specifically list the action words produced by the children.

This remained to Benedict (1979), who examined the first 50 words of eight children between the ages of 9 and 20 months. Benedict only reported the action words produced and comprehended by her subjects. Of the 37 action word types noted in the speech of the eight children (some have rather equivocal status as "words", it seems --e.g., whee, wa wa wa, boom, whoo, sssh, buzz, beep beep, rrm rrm), only ten could be classified as verbs in the adult language (excluding the "highly stereotyped" words for action and verbal games, e.g., rock rock and hop). All of Nelson's reported nominals could be classified as nouns in the adult language.

The Differences Between Nouns and Verbs

Bloom and Lahey (1978:109) noted that children use more different object names than names of action, and Goldin-Meadow,

Seligman and Gelman (1976) found a marked difference between production of nouns and verbs in their 12 subjects, age 14-26 months.³ Goldin-Meadow and her colleagues identified two stages in development: a Receptive stage, when children say fewer nouns than they understand and say no verbs at all, although they can comprehend many verbs; and a Productive stage, when children say virtually all the nouns they understand and produce some verbs.

Clark (1978, 1979), Gentner (1978), Huttenlocher (1974), Huttenlocher and Lui (1979) and Kintsch (1972), among others, have posited a differential internal organization for nouns and verbs. Clark (1978b) suggested that action categories may be more difficult to grasp than object categories, because actions are more transitory than objects; actions have vague boundaries, as compared to objects (that is, where the action begins and ends is less clear than the boundaries of an object); and actions have a less clearly definable range than categories of objects (for example, the word open can apply to actions on many different objects). These arguments appear to be unsupportable, however, in view of other very early utterance types observed in young children. All the above disclaimers about actions can easily be applied to words which refer to non-verb relations such as recurrence and nonexistence; these are among the earliest terms to appear in all acquisition studies. For example, both the utterances more and all gone may relate to events that are transitory, vague in terms of beginning and ending boundary, and broad in range of application.

On the basis of the preceding discussion, one would predict that terms for object words would be acquired earlier than terms for action words, and, by extension, pairable nouns in ASL might be acquired before pairable verbs. Since ASL signs can visually represent either the form, the motion or the use of the referent, the literature on the salience of these attributes in early lexical learning is also pertinent to the acquisition of pairable nouns and verbs.

The Salience of Object Form, Motion and Function in Lexical Learning

Gentner (1977) compared Clark's (1973) theory of early word meaning with that of Nelson (1974) in regard to the relative role of the static form of the object and the use of that object. According to both theories, an object's normal motion is likely to be included in its early meaning, but to Nelson, function is prominent, not perceptual features, or object form. To Clark, form is prominent in early word meaning, not function. To test these different hypotheses, and to partial out the salience of object form, motion and function, Gentner devised two experimental tasks using novel objects and invented nouns and verbs.

Gentner found that, even at age three, children appear to differentiate nouns and verbs. But young children (age 3 to 5) consistently learned new words on the basis of static perceptual attributes, rather than attending to dynamic perceptual information (motion) or information concerning object use.

Gentner's (1977) findings are thus consonant with Clark's theory rather than with Nelson's.⁴

In a similar design, Schwartz and Leonard (in preparation) presented "contrived lexical concepts" to children at a much earlier stage of development than Gentner's. Their 12 subjects were approximately one year old at the beginning of the study and approximately 1;6 at the conclusion. Schwartz and Leonard found no differences in the speed of acquiring perceptually-based versus functionally-based concepts, indicating to the authors that functional and perceptual relationships are equally important to the young child. But, on the basis of both elicited and spontaneous productions, all children acquired a significantly greater number of object words than action words. This finding pointed to an "object bias" early in development.

Gentner (1977) has suggested that naming an action may be a more difficult task than naming an object. She proposed the notion that children's early focus is perceptual, but they must reformulate their approach to meaning before they can deal with the relational meaning of verbs. Gentner (1977:24) suggested that "the child only has to look at the world to discover simple noun concepts. The task of discovering which relationships are considered by the culture to be linguistically relevant is a more difficult one." For this reason, children are slower to learn verbs than nouns.

Some variation from the "object bias" in young hearing children appears in Feldman's (1975) data on deaf children.

Feldman followed the early development of five deaf children of hearing parents. Although they were not exposed to sign language input, these children developed their own gestural communication.

Feldman found that the children's invented gestures were predominantly action-based. In the early sessions, the children used the action-based forms primarily to refer to the action itself, but over time, they began to use action-derived gestures to refer to objects and people as well as actions. The earliest gestures in the lexicon were derived directly from actions performed on objects. These data differ from the preceding reports, since the children were not provided with a model adult language. But they do point to a possible influence of modality in acquiring terms for actions and objects, and this influence is further explored in the present study of deaf children acquiring ASL.

The Sequence of Acquisition of Semantic Relations

Bloom, Lightbown and Hood (1975) examined the emergence of semantic relations in four children learning English (age 19-25 months). They found that existence relations appeared in the very earliest utterances, and only later did verb relations begin to emerge. Within these verb relations, actions were talked about before transitory states, and in two of their subjects, non-locational action relations appeared before locative action verb relations (that is, actions with the goal of changing the location of a person or object). There was, in addition, a set of relations that emerged quite late in Bloom's subjects. These

included actions with instruments, datives (the recipient of an action), affective states and causation of actions (Bloom and Lahey, 1978:159).

Cross-linguistic variations

Slobin (1973) has suggested that the precise sequence of the early acquisition of semantic relations may be influenced by the complexity of the syntactic devices the model language uses for expressing these relations. To Bloom et al. (1975), the fact that their subjects did not talk about certain types of events may have been related to the way in which these events are coded in English; for example, the grammatical structure for expressing the dative (indirect object or recipient of verbs such as give and show) and the instrumental (e.g., with a fork, by a pencil) adds linguistic complexity to the predicate complement in English.

In their study of five deaf children of deaf parents (ages 16-42 months) learning ASL as a native language, Newport and Ashbrook (1977) found the same sequence of emergence of semantic relations as reported by Bloom et al. (1975). That is, existence relations predominated in the earliest stages of development, and verb relations coding action appeared before those coding transitory states, static location and change of location. As in the English acquisition data, dative and instrumental relations appeared late and infrequently in the signing of the deaf children.

Newport and Ashbrook noted that some semantic relations in

adult ASL are produced much as they are in English, with one sign for each of the arguments in a relation (e.g., in an action relation, BOY KISS GIRL). But for many relations, there are not individual signs for each of the arguments; instead, the movement or handshape of the verb itself may incorporate or include its arguments (see also Fischer and Gough, 1973; Meier, 1981, 1982). Newport and Ashbrook (1977:17) cited, for example, semantic instruments, which are often signed as part of the action verb in ASL. The sign CUT-WITH-SCISSORS is made with an opening-closing V-handshape, suggestive of the blades of a pair of scissors; however, the sign CUT-WITH-KNIFE is made with a handshape that represents a long, thin object.

Newport and Ashbrook found that, even in their single sign utterances, the deaf children tended to produce a separate sign for each argument rather than incorporating the arguments into the movement or handshape of the verb. That is, despite the differences in formal marking, the young deaf children were not making use of the syntactic devices particular to ASL. In the present study, the emergence of semantic relations was also examined, as were the modality-specific aspects of the formal marking of verbs in ASL, and how this affects their acquisition.

One cross-linguistic variation in coding semantic relations pertains to the type of action words reported in the early acquisition literature. Just as Nelson described the types of objects (concrete, movable, manipulable) that were talked about in early speech, Bloom and Lahey (1978) considered the early

action names appearing in young children's lexicons. These terms were found to represent the most general actions, those that can be performed with many different objects, such as put, make, go, get, with the most frequent "action name" being the pro-verb do.

In positing a developmental hierarchy of verbs, Bloom and Lahey suggested that children will first talk about actions that can occur in a wide variety of situations. "Children can get, make, put and do many more different things than they can ride, eat and open. (And) they can ride, eat, throw and open many more things than they can turn, blow and cut" (Bloom and Lahey, 1978:134).

Clark (1978b) referred to these same action names as General Purpose Verbs, and described them as the earliest and most common verb forms appearing in the productions of English, Finnish, German, Japanese and Korean children up to 3 years of age. Initially, interpretation of these general purpose verbs demands attention to the non-linguistic context. Later in development, these general verbs are supplanted by more specific and contextually-independent verbs. For example, in English, do will be replaced by build, cut, run, unwind, climb and stretch; go will yield to run, drive, fly, walk and stand; and actions once referred to by the word make will later be specified as build, draw, cut out and write.

How do these observations relate to a language like ASL, which seems to have a minimal number of general verbs, and a wide variety of specific verbs (e.g., OPEN has a different form

depending on whether it refers to a door, window, jar, etc.)? What do young deaf children do, given the absence of general purpose verbs in the adult language? Do they devise their own means of "generalizing" verbs, or do they differ from their hearing peers by acquiring a variety of specific action verbs early in development?

Many of the pairable verbs which are considered here relate to specific actions such as OPEN-DOOR, CLOSE-WINDOW, PUT-ON-HAT, PUT-ON-RING. These pairs also represent a number of the semantic relations discussed thus far; the ways in which they are encoded in ASL differ considerably from English in particular and from many spoken languages in general. How does this affect the relative time or ease of acquisition of nouns as compared to their related verbs, or of pairs coding different semantic notions?

Gentner (in press) suggested that the greatest cross-linguistic variability occurs in the way languages encode verbs. She cited Talmy (1978) in her discussion of the "conceptual packaging" of verbs (Gentner, in press:8), noting that languages vary considerably in which aspects of a given action are selected as linguistically relevant. For example, English conflates manner of motion (e.g., floating, strolling) into the verb, whereas Spanish incorporates direction of motion into the verb. Japanese uses a general verb plus a specialized set of adverbs. In many American Indian languages, the shape of the object that moves is included as part of the transitive verb. American Sign

Language can simultaneously incorporate all of these components into one verb! For instance, in a single sign form, one can express a meaning such as 'I went by plane in a bumpy flight from a northerly location to a southerly location.'

If languages differ so much in how they encode verbs, are these differences reflected in the acquisition of nouns versus verbs across languages?

Tanouye (1979) showed that, in Japanese, the acquisition of nouns and verbs is not the same as in English. In Japanese, the development of verbs occurs at the same time as the development of nouns, and may even precede it. Even in the single word stage, there was an early emergence of verbs: 94% of the action forms produced by the two subjects would be considered verb forms in the adult language. In English-speaking children, the majority of early action words are non-verb forms (e.g., down, out), with verb forms occurring infrequently (cf. Benedict, 1979).

The differences in acquisition appear to relate directly to the structure of the language the children were learning. In Japanese, word order seems to make the verb perceptually salient, since verbs occur in terminal position (Tanouye, 1979:56). In addition, subject and object constituents are optional in Japanese, while the verb is obligatory. Thus, Tanouye's findings support the notion that the structure of the language children learn can have a considerable effect on the acquisition of nouns and verbs. In the next section, I introduce some issues in

morphological structure and its effects on acquisition.

Morphology

Slobin (1979) has noted that studies of language acquisition have devoted insufficient attention to differences among languages in terms of how and when particular linguistic structures are acquired. The linguistic task facing a young child requires learning what to encode (i.e., which subset of notions receives formal marking) and how to encode it (i.e., the means for projecting those notions onto utterances). According to Slobin (1971:17), there are at least two different kinds of determinants that affect acquisition: 1) perceptual factors, which, in spoken languages, relate to the audibility of certain speech segments, and, by extension, would pertain to the visibility of particular sign features in a visual-gestural language; and 2) rule or generalization factors, which include both the simplicity and the consistency of rules.

Prelinguistic cognitive and social development may prepare a child for the acquisition of his or her native language, but it does not provide an awareness of the particular categories and structures of that language. As the previous discussion illustrates, languages do not differ much, at least in the early stages of development, in terms of what can be said. This section looks at differences in how things are said (or signed) in a given language.

Slobin (in press) invoked a "waiting room" metaphor, to

describe how children make use of the linguistic means at their disposal while "waiting" to master the adult forms that code particular notions. The waiting room has a cognitive entry door and a linguistic exit door. The child receives the entry key upon discerning the existence of a given notion (i.e., achieving a certain level of cognitive development). The problems to be solved in the "waiting room" are semantic, morphological and syntactic, and the solutions require varying amounts of time and effort, depending on the linguistic features that pertain to a given notion.

Universal Strategies in Morphological Acquisition

Both Slobin (1973) and MacWhinney (1978) have posited sets of universal human abilities that relate directly to the acquisition of any language and its morphology. These abilities presumably constitute strategies for solving the problems encountered in the "waiting room." MacWhinney (1978) discussed three strategies for learning morphology: rote memorization, productive combination and analogic formation.

The central characteristic of rote memorization is the absence of any form of analysis of the morphological system. MacWhinney called these early forms amalgams. These are learned by rote and applied by rote, and are never broken up into their component parts. A child may subsequently turn to combination, piecing together sets of morphemes by making use of words, affixes and roots. The child may begin to attach one or more affixes to a word or root, thus breaking down forms into their

component parts. The combination strategy often leads to errors in production. When both the rote and combination strategies fail, the child resorts to analogy, which entails rule operation by comparison of one form to other similar forms.

Such a sequence of strategies has been demonstrated in young children's morphological acquisition in a wide variety of spoken languages (see, for example, MacWhinney, 1978). However, the structure and organization of these languages, particularly English, is not directly comparable to the structure of ASL. Perhaps the best or most analogous data come from the acquisition of Hebrew.

Morphological Acquisition in Hebrew

Hebrew is a morphologically rich Semitic language. It is a root-based language: most nouns and adjectives, and all verbs are formed from a combination of Root + Pattern. This is not very different from the morphology of ASL, where various spatial or movement patterns are superimposed on what may be considered root forms comprising handshape, location, orientation and an underlying movement root (cf. Klima and Bellugi, 1979; Supalla and Newport, 1978).

In Hebrew, the root is triconsonantal, and the patterns consist of vocalic infixes, with or without additional syllabic suffixes and/or prefixes (Berman, 1978; 1981a,b; 1982).⁵ An example of a root in Hebrew is k-t-b 'write', which serves as the basis for derived verbs like katav 'he wrote', nixtax 'be written', hixtiy 'dictate' = write + Causative, hitkatev

'correspond'= write + Reciprocal; and nouns like mixtay 'letter', ktay 'script', katvan 'typist', któvet 'address', etc. (Berman, 1981b:266).⁶

All verbs in Hebrew are constructed from a root in one of seven verb patterns termed binvan "conjugation" (Berman, 1982:169). This binvan system of Root + Pattern comprises derivational processes, distinct from the inflectional system of the language; it is not an entirely productive or regular system, but it does pervade the language (Berman, 1982:171). The inflectional affixal marking of verbs for number, gender, person and tense is acquired by Israeli children by age 3, but it is not until later, from age 3 to 6, that the binvan patterns are mastered. In her study of binvan verb usage, Berman (1982) utilized a wide variety of data (cross-sectional, longitudinal and experimental) available on a total of almost 100 Israeli children, ranging from 2 1/2 to 5 1/2 years of age. She found the following trends in acquisition (ages approximate):

1. Age 2-3. A given verb root is used in only one pattern, often correctly, though there are also errors caused by neutralization of a required distinction. All the major patterns do occur in the child's repertoire of verbs, but the basic pattern--the only one that is 'neutral' with respect to transitivity--is by far the most frequent form. At this stage, the verb root + pattern is an unanalyzed lexical whole.

2. Age 3-4. The first variation of patterns is noted, but only on certain verbs or in certain contexts. Errors still appear, usually in the use of a single, non-alternating pattern or in the selection of immature syntactic or lexical options. For instance, many children avoided using the causative form of the verb 'ride' (in a car, or on a bicycle, two different lexical items), and instead of using the causative for 'hurt',

they produced verbs like 'hit' and 'push' to describe the same situation. The use of analytic paraphrase was a slightly later error type, presumably because lexical incorporation is the norm across a wide range of verb-argument relations in Hebrew (Berman, 1982:181).

3. Age 4-5. At this stage, patterns are varied for numerous roots and in many different contexts, but errors in the form of pattern-mixing and creative innovations give evidence of a systematic understanding of the relations among words and the semantic core of the root + pattern variation. In pattern-mixing, the child chooses a lexically inappropriate pattern for a given semantic contrast. For example, using the base verb ne'elam 'to vanish', one child produced the following sentence, applying one of two transitive patterns, but not the correct one: ha kosem *ilem et ha safan 'the magician made-vanish the rabbit'. The lexically correct transitive form should have been he'elim 'made-vanish' (Berman, 1982:182). Lexical innovations were an unpredicted finding at this stage. These occurred when children filled accidental gaps in the lexicon by creating their own verbs, either from existing verb roots, or derived from nouns. For instance, children produced 'make-swim' from the verb root 'swim', or sentences roughly translated as 'I've banana'ed already' and 'Mommy sleeve-up for me my shirt' derived from the nouns for 'banana' and 'sleeve'. (Berman, 1982:182-3). In these cases, the choice of pattern was appropriate for the intended meaning.

4. Age 5-6. Children evidence command of the system through appropriate binyan assignment to the verbs in the lexicon, while resorting to (well-formed) periphrastic constructions for certain predicate types. For example, the inchoative change of state ('get fat', 'grow old') might be coded by the use of an auxiliary verb or the word 'become'. Both the inchoative and passive forms in Hebrew are not mastered until well into the school years.

In the same study, Berman (1982) noted some differences between verbs and nouns on purely linguistic structural grounds (see preceding section for putative cognitive/semantic distinctions between verb and noun). In Hebrew, verbs must be constructed from a consonant root + binyan pattern; these

constructions need not be applied to other form classes. Berman therefore suggests that verbs must be acquired differently from other items in the lexicon.

The children Berman studied acquired verb forms in association with, and as versions of, a more basic form. But the nouns or denominative adjectives derived from the same root may have been learned as separate, distinct lexical items (Berman, 1982:190). However, the innovative errors which appeared suggest that children do perceive that nouns are constructed from roots and patterns. For instance, at 2;11, one child created the form maglexa for 'razor, shaver' from the verb root g-l-x 'shave'.

Berman's observations relate directly to the nouns and verbs under consideration here, and help to make predictions about the way in which children may approach the acquisition of this morphological process in ASL (see Chapter II).

Morphological Acquisition in ASL

To date, the literature on the acquisition of ASL is small, but increasing in quantity and scope. There are now reports on the acquisition of handshape (Boyes-Braem, 1973; McIntire, 1977); spatial indexing (Hoffmeister, 1978; Loew, 1980; Meier, 1981, 1982); semantic relations (Newport and Ashbrook, 1977); classifiers (Kantor, 1977); inflections (Fischer, 1973) Meier, 1980a); compounds (Supalla, 1980) and verbs of motion and location (Ellenberger and Steyaert, 1978; Newport, 1981; Newport and Supalla, 1980).

Several studies have suggested that the deaf child's first

signs may emerge two to three months earlier than the hearing child's first words (Boyes-Braem, 1973; McIntire, 1974; Wilbur and Jones, 1974). In my study, I examined how the modality of the language may facilitate early lexical acquisition. But does the modality make a difference in acquiring the morphology of ASL? Newport (1981) has argued that it does not. She postulated that deaf children, like hearing children, appear to be performing formal analyses of the grammar of their language, morpheme by morpheme (Newport, 1981:33).

These claims are supported by Newport and Supalla's (1980) study of the system of "mimetic depiction" by which motion and location are represented in ASL. What at first appeared to be a loosely organized and continuously varying analogue system is claimed to be instead a complex morphological system, much like that in spoken languages. The movement root, along with hand configuration, orientation and (depending on the syntactic context) base hand morphemes, together form the stem of these verbs of motion or location. This complex stem is composed of several independent, simultaneous morphemes (Newport, 1981:19).

Newport and Supalla's (1980) study of three deaf children, age 2 1/2 to 5, suggested that children acquire the discrete components of the adult system by a slow process of morphological analysis. Simple movements which included only one movement morpheme were produced with virtually 100% accuracy throughout the time period under investigation. Complex movements, requiring more than one movement morpheme, were often avoided,

especially by the youngest children, and were sometimes produced in sequential, rather than simultaneous combinations. Not until age five were the complex, simultaneous combinations produced with consistency.

Similar developmental patterns have been identified in the acquisition of other portions of ASL (e.g., by Fischer, 1973; Kantor, 1977; Newport and Ashbrook, 1977; Meier, 1980a), and, in the more complex systems, full mastery of the formal marking is quite late.

Meier (1982), in investigating the acquisition of verb agreement in ASL, found that, despite the highly iconic nature of some forms within the system (see discussion of Iconicity), children learn verb agreement as a linguistic system in which inflected verbs have internal, morphological organization. Early in development, there were errors of omission; that is, children used the non-agreeing citation form of a verb, rather than an agreeing form. There was a strong tendency in Meier's three subjects to use the morphologically-simpler singly-agreeing verbs in contexts which allowed for use of the more complex (and often more iconic) doubly-agreeing forms. Examples of singly-agreeing verbs would be GIVE incorporating the recipient and TAKE incorporating its patient. Doubly-agreeing verbs would also optionally agree with the location of the agent. The marking of obligatory verb agreement was acquired late by these children, that is, between age 3;0 and 3;6.

There are many structural similarities between ASL and

certain spoken languages, but I propose that there may be modality-specific effects on acquisition. In the next section, I examine the nature of iconicity in ASL and the ways in which it may affect acquisition.

Iconicity

Transparency of ASL Signs

On first exposure to ASL, the naive observer typically focuses on its apparent iconicity, that is, how the visual form of a sign is related to its referent by some physical resemblance between the two. The iconic potential of sign language can be observed at the "phonological", morphological and lexical levels, as well as in utterances and discourse in ASL. But there are strong iconic constraints on the order, timing and use of space in the language (cf. Klima and Bellugi, 1979).

The iconic motivation of some signs is relatively obvious. For example, the sign DRIVE[S-S;neutral space;up-down bidirect] is based on the action of turning a steering wheel, and the sign HOUSE[B-B;neutral space; apart and down] traces the outline of the roof and walls. But the particular aspect of a referent that a sign represents iconically is not always predictable. Some signs, e.g., TREE, BALL and AIRPLANE, represent the physical appearance of the entire object, whereas CAT, FIREMAN and TELEPHONE represent a specific part of the referent, namely, the cat's whiskers, the fireman's hat and the telephone receiver. In some signs, an object is the referent, but the sign is iconically

based on the characteristic action performed with or on that object (e.g., ZIPPER, ICE-CREAM, CAMERA).

Some signs bear a rather opaque or distant relationship to their referents. For instance, the sign COFFEE[S-S;neutral space; circling contact] is based on the turning of the handle of a coffee grinder, and the sign YEAR[S-S;neutral space; circling dominant hand] is based on the revolution of the moon around the earth. As Hoemann (1975:158) has suggested, the fact that a sign's motivation may derive from a specific and narrow aspect of its referent makes it an uncertain clue to the meaning of the sign.

Although the signs of ASL do exhibit representational or iconic aspects, they can, at the same time, be analyzed as composites of a small set of purely formal elements which conform to a specific set of systematic formal constraints. This latter fact has come as a surprise to many; the former was always assumed.

It is easy to find signs that are both highly iconic and fully conventionalized within the constraints of a particular language system. By way of example, Klima and Bellugi (1979:21) have shown that the sign for 'tree' differs in ASL, Chinese Sign Language and Danish Sign Language; each is iconic in its own way and each conforms to the formational constraints of the particular language in which it occurs. Similarly, Supalla (1978:26) has noted that the sign for 'door' in ASL is based on an iconic swinging movement, whereas a linear sliding movement is

used in the Japanese sign for 'door', a representation of the prototypical door in that culture.

Culture may play a significant role in determining what aspect of a referent is iconically represented. Brown (1978:29) has suggested that iconicity is not only culture-bound, it is also time-bound, age-bound and experience-bound. Under this premise, one would expect that hearing American adults would be readily able to perceive the iconicity in ASL, which emanates from the same culture in which they have gained their knowledge and experience. However, studies by Klima and Bellugi (1979) showed that most ASL signs are not transparent in meaning to naive, adult hearing non-signers; that is, the meaning of a given sign is not self-evident from the form alone (see Fig. 4a). Most signs are instead opaque; that is, naive non-signers could neither guess the meaning of a sign nor select the correct meaning, given a series of choices (see Fig. 4b). Klima and Bellugi found that some ASL signs are "translucent", i.e., when presented with a sign and its meaning, non-signers could agree on the basis for the relation between the two (see Fig. 4c, 4d).

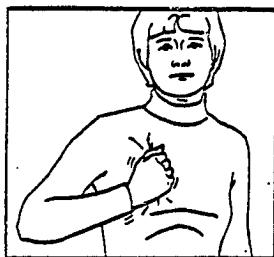
A recent study by Griffith, Robinson and Panagos (1981) questioned Brown's claims about the constraints on perceiving iconicity. These researchers found virtually no differences in rating of iconicity (of 100 noun signs) among groups of hearing adults, hearing first graders and deaf adults. This suggests that differences in age, familiarity with signs, cognitive level or native language do not seem to affect the ability to judge the

FIGURE 4. The iconicity of ASL signs: transparency, opacity, translucency



BIRD

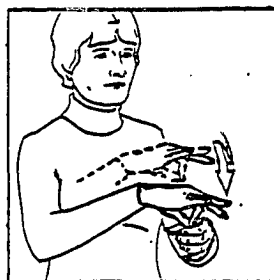
a. Example of an iconically transparent sign.



CANADA

b. Example of an opaque sign.

c. Examples of translucent signs and typical subject responses.



VOTE

'putting a ballot
in a box'



WOOD

'sawing a board'

(from Klima and Bellugi, 1979)

iconicity of signs. Of course, it is still possible that the bases for iconic judgments differ for adult and child.

In adult native signers, iconicity does not seem to play a significant role in memory storage, coding and processing (Klima and Bellugi, 1979); it is instead the non-iconic, arbitrary formational properties of the language that predominate. In addition, iconicity is often submerged in rapid discourse, during the course of historical change and when signs undergo inflectional processes.⁷ On the other hand, the iconicity of signs may be enhanced in many special linguistic activities, such as storytelling, role-playing, mimetic extension and lexical innovation (Klima and Bellugi, 1979).

It still remains to be demonstrated whether or not the iconicity of ASL facilitates its acquisition, or if deaf parents highlight iconicity to foster learning in their children.

Iconicity in Sign Language Acquisition

Brown (1980) has suggested that, because of their iconicity, "sign languages are easier to learn than spoken languages." By "learning a language," he did not refer to full adult control, but to the acquisition of an early lexicon, the first 100-400 words. In this view, the early signs should be easily acquired because they are iconic.

Brown supported his argument with data based on the early sign lexicons learned by autistic children, nonverbal retarded children and chimpanzees. He tested his hypothesis by means of two memory (recognition) tasks presented to preschool hearing

children, using a very small set of ASL noun signs. In his tasks, Brown distinguished between lexical items belonging to what Rosch et al. (1976) call the Basic Object Level (e.g., BALL, CAR, CHAIR, SAW) and objects that are more abstract, that is, without physical exemplars that can be pointed at (e.g., PAPER, ANIMAL, FOOD, CLOTHES). Brown (1980:10) felt that iconicity in ASL would be "high and detectable" in Basic Object Level terms, but that the signs for abstract terms would either be "non-iconic or else iconic at a level of sophistication above that of the four-year-old child." Even more pertinent to the present study, Brown (1980:20) proposed that the iconicity of verb signs is "probably superior to that of nouns."

Brown's results with twelve hearing children, age 4;0 to 5;0, suggested that when an ASL sign is iconic in a way that a naive learner can detect without its being pointed out (i.e., what Klima and Bellugi would call a "translucent" sign), that sign is about three times as likely to be learned as when it is arbitrary. Brown also found that iconicity detectable by four-year-old children was stronger at the Basic Object Level than in the region of abstract meaning, and this iconicity of Basic Object Level vocabulary facilitates lexical acquisition.

Brown interpreted most of the errors made by his subjects as iconically-motivated. However, Meier (1982) has observed that many of Brown's iconically-based errors could be interpreted as semantic intrusions. For instance, some children mis-remembered the sign FOOD as 'cracker', 'eat' or 'ice cream'. Brown (1980)

felt that the children recognized that some signs were "motivated" and then proceeded to guess at the meaning of almost every other sign presented; their errors, according to Brown, were "excellent iconic intrusions."

Meier (1982) also introduced the possibility that children's sensitivity to the iconicity of signs may lead them to formulate false hypotheses about the meaning of these signs. This interpretation could apply to any of Brown's reported errors, but clear, supportive evidence would have to take the form of errors that represent referents with no semantic relation to the correct meaning.

Brown claimed (on the basis of data from Rosch et al., 1976) that Basic Object Level vocabulary is greatly over-represented in early child language. Meier (1982) suggested that, if this is the case, then highly iconic signs should be similarly over-represented in the lexicons of young deaf children. Some data reported here test this assumption (see Chapter V).

A cogent criticism of Brown's study comes from Baron and Isensee (1977a,b), who directly questioned a number of Brown's claims and suggested that an understanding of the role of iconicity in language acquisition depends strongly on what is being learned and taught, and by whom. For instance, it is not necessarily the case that what is perceived as iconic by the teacher, the parent or the linguist will be similarly perceived by the child (Baron and Isensee, 1977a:5). One cannot, in any case, equate sign language acquisition in first language learners

(i.e., deaf children of deaf parents) with sign learning in language-disordered populations or in second language learners (Baron and Isensee, 1977b:3).

On the basis of a review of prior studies, Baron and Isensee (1977a,b) made the following observations: there is no evidence that very young deaf children learn their early lexicon any less arbitrarily than their speaking counterparts; no evidence that early signs of young children, however iconic they may be, are perceived as iconic by the child; and no evidence that fluent signers modeling the language call the child's attention to such iconicity.

The role of iconicity in acquisition is addressed directly in my analysis of spontaneous acquisition data. I examined the frequency of occurrence of highly iconic signs in early child production and in maternal input. Furthermore, I looked at children's and mothers' elaborations of the iconic representations of signs in general, and of related nouns and verbs in particular (see Chapter V). As I will show, my findings call into question some of the empirical claims about iconicity and the acquisition of ASL.

Iconicity in the Signing of Deaf Children

Thus far, relatively few studies have explored the issue of iconicity in the signing of deaf children. Feldman, Goldin-Meadow and others have analyzed the creation and development of a gestural language by five deaf children of hearing parents. The children were followed longitudinally, from

an age range of 1;5 to 4;3. In all cases, the parents knew no sign language at all, and the children, when old enough, attended strictly oral preschools.

Feldman (1975:100) found that the general strategy the deaf children employed in spontaneously developing a lexicon was to recreate or mimic selected features of the real world, using iconic or motivated symbols. For all the children, the early use of symbols was closely tied to action; in both form and meaning, it was possible to identify action roots.

A clear developmental sequence emerged: action-based gestures (which accounted for approximately 75% of all gestures for all children) consistently preceded and exceeded non-action-based gestures. Within the class of action gestures, there was a strong preference, across all ages, for Act-on gestures---that is, those derived from actions which temporarily or permanently affect the state or location of the object acted upon (e.g., gestures portraying licking an ice cream cone or twisting a jar lid). Next to emerge were Act-by gestures, which derived from actions performed by people or objects affecting the state or location of the actor but not the state of any external object (e.g., sliding of the feet to denote 'walking').

In general, the children did not modify their gestures in any way to indicate if they were referring to an object or an action. But at later ages, one child began to distinguish object from action by means of syntactic devices (in this instance, word order). No phonological or morphological changes were noted to

disambiguate action and object gestures. Feldman explained the early preference for action-based gestures in terms of modality; she argued that it is easier to represent actions than pictures or objects.

Feldman compared her data on deaf children to reports of acquisition in hearing children. She suggested that, at a time when one 3-year-old deaf child was using specific gestures to refer to the action base in 86% of cases, the hearing child would be capable of spontaneously naming and describing many static objects. It seemed clear to Feldman (1975:117) that hearing children tend to use "noun-like" symbols early, and deaf children tend to use "verb-like" symbols.

Like Brown (1980), Feldman (1975:101) suggested that "the most iconic version of many signs in ASL is the action" and "iconic gestures presumably facilitate communication." She postulated that action gestures are easier to differentiate visually, to remember, and to relate to the referent.

The studies of Brown suggest that iconicity may facilitate the acquisition of nouns in ASL. Feldman described iconicity in representing action in an invented gestural system. But neither study involved deaf children of deaf parents who are learning ASL as a native language and who are therefore receiving the constant and consistent input of a grammaticized sign language.

The studies of Newport and Supalla (1980) and Meier (1982) have looked at acquisition within this population of deaf children. Both studies relate to highly iconic but grammaticized

subsystems of ASL morphology.

In their investigation of the acquisition of mimetic depiction in ASL (see previous section for definition and description), Newport and Supalla (1980) hypothesized that the child might attend to the iconic or analogue aspects of the system, and predict new forms on the basis of an analogue interpretation. This would give rise to an early preponderance of mimetic forms rather than frozen forms. However, their data belied this prediction, suggesting instead that children attend to the formal morphological organization of mimetic depiction, analyzing new signs as part of a combinatorial system.

Similarly, Meier (1982) sought to explore the roles of iconicity and spatial analogy in the acquisition of verb agreement in ASL. In this system, some agreeing verbs are mimes that closely resemble the action which they identify. The location, direction of movement and/or orientation of an agreement marker on a verb is an analogue of the location of the referent of the agreement marker, when that referent is located within the immediate context of the conversation. Meier's longitudinal data on three deaf children acquiring ASL yielded no evidence to suggest that either imagery or analogy can explain the way in which children acquire verb agreement in ASL. Meier concluded that deaf children fail to exploit the analogue potential of the visual modality, even in their acquisition of those aspects of the grammar of adult ASL which do exploit that potential. As in the development of mimetic depiction, correct

use of those aspects of the morphology of verb agreement which are analogic were found to be a later acquisition than some less analogic forms.

Each of the four studies described above relates to my investigation. Feldman's work pertained to the representation of action on the hands, and Brown's experiments involved the acquisition of a small set of ASL nouns. But neither of these studies was conducted with deaf children of deaf parents. Newport and Supalla, and Meier examined aspects of ASL acquisition in young native signers, but the systems they described do not relate to early lexical learning, as does the present study.

In this thesis, I examined early lexical learning in young deaf children, with a particular focus on a specific set of nouns and verbs in ASL. I evaluated the effects of semantics and iconicity on the acquisition of these lexical items. Most important, I looked at how children learn to mark the formal morphological distinctions between these paired nouns and verbs in ASL. In addition, I was interested in observing maternal input, and how mothers' production of related nouns and verbs might influence children's acquisition.

Input

"Motherese" in Spoken Languages

There has been much written about "motherese" in English and other spoken languages, and about the purported reasons for

maternal adjustments in style of speaking to children.⁸ A brief review of some of these data is presented here, as background to what is thus far known about "sign motherese".

The modified style of speaking often referred to as "motherese" has been described (Broen, 1972; Phillips, 1973; Snow, 1977) in terms of simplicity (as reflected in reduced length of utterances and decreased incidence of subordinate clauses) and redundancy (as reflected in type-token ratios and a high incidence of repetition of utterance constituents or entire utterances). Motherese also possesses a special lexicon of "baby talk" words, which show predictable phonological simplification and deviation from adult forms (Ferguson, 1977). In addition to these (possibly universal) features of vocal linguistic input to infants, spoken languages exhibit a higher pitch level and exaggerated prosodic contours in maternal input (Garnica, 1977). Other observations indicate that motherese has a high frequency of interrogatives, more fluent (speech) production than to adult listeners, and segmentation into utterances marked by longer and more regular pauses than in adult discourse (Snow, 1977b; see Blount and Kempton, 1976 and Blount and Padgug, 1977 for a discussion of 34 special features of parent input to infants).

Thus far, the same modifications have been observed in all the languages and social class groups studied, regardless of the sex of the child addressed, or the sex or maternal status of the speaker (Snow, 1977b). It has also been shown (Sachs and Devin, 1976; Shatz and Gelman, 1973) that children as young as four

years of age produce many of these same modifications when addressing two-year-olds.

Phillips (1973) felt that mothers adjust their input to conform to their intuitions about a child's linguistic level. She indicated that adults are continually monitoring the child's degree of attention and understanding, and adjusting various features of their speech to maintain the child's responsiveness at optimal levels. Sachs (1977) found that higher pitch and exaggerated intonation contours do elicit increased attention in babies. However, attention and interest levels do not seem to explain all the features of maternal input to young children.

Bateson (1975), Snow (1976, 1977) and others have suggested that mothers' motivations in adjusting input are conversational; that is, their desire to communicate reciprocally with their children may be a crucial factor in limiting the topics discussed and the semantic and syntactic complexity of their input.

Blount and Padgug (1977) proposed the notion that prosodic and paralinguistic features--those comprising dimensions of tone, duration, pitch, phonetic quality and loudness--seem primarily to convey affect, and they are used by parents to attract children's attention. Other features--such as repetition of adult utterances and imitation of a child's vocalizations--appear to function primarily to direct the child's attention to speech as an activity. Still other features are used to relate the speech activity to the environment in meaningful, referential ways (Blount and Kempton, 1976:251). The differential use of these

features is related to the parents' interactional strategies, as well as to the child's interactional competence (that is, what the child perceives and reacts to in parental speech).

Newport, Gleitman and Gleitman (1977) have perhaps taken the strongest position on motherese as a communicative rather than a didactic strategy. In their analysis of 15 mother-child dyads, they sought to demonstrate systematically that motherese is not a simplified teaching language, in terms of its content or its structure. According to Newport et al., the three special characteristics of motherese--brevity, well-formedness and intelligibility--arise for purposes of here-and-now communication with a limited and inattentive listener and cannot be attributed to a language-instruction motive. Although they found that motherese is not a syntax-teaching language, and mothers do not even consistently simplify syntax, the maternal environment does exert some influence in relation to language-specific structures, that is, morphological and syntactic structures that vary across languages. Even then, this influence is only possible given the child's selective attention to particular features of the speech stream, such as utterance-initial portions and items whose referents are clear.

The literature on motherese in spoken languages thus poses two questions which are relevant to the present study: What modality-specific potential might there be in ASL motherese that would distinguish it from spoken motherese, and what language- and modality-specific aspects of the sign stream would be made

most salient to young deaf children by their signing mothers? These questions can then be focused more directly to relate to this study. In particular, how do the language- and modality-specific factors which may be reflected in sign motherese influence the child's learning of the formal distinctions between related noun and verbs?

Sign Language Motherese

Maestas y Moores (1980) reported on observations of seven children under 6 months of age (hearing status unknown) interacting with their deaf parents. As in studies with hearing parents and children, the deaf parents seemed to be focusing all their efforts on communicating with their infant.

The author observed several strategies aimed at communicative effectiveness which parallel those reported for hearing parents and their children (e.g., positioning themselves to maximize attention; interspersing nonvocal affective acts with language acts; using alternate or simultaneous sensory modalities; and repeating signs a number of times). In addition, there were observations of "infant-adapted sign formation" (Maestas y Moores, 1980:3) which seem to be modality-specific; for example, signing on the body of the infant or placing the infant's hands on the parent's body to form signs; molding or physical guidance of the child's hands to form movement patterns and/or hand configurations; using objects in the environment as part of the actual sign; or holding a sign in location. Some preliminary observations of a similar tendency in young deaf

children, i.e., signing on an object or incorporating the object into the sign, have been made by Ellenberger and Steyaert (1978) and by Pizzuto and Williams (1980).

Kantor (1982) examined deaf mothers' input to their deaf babies in relation to one aspect of verb inflection in ASL, the same verb agreement system studied by Meier (1982). Kantor was particularly interested in the use of linguistic pointing behavior and verbs inflected to mark the sentential arguments of subject, object and location. She followed two infants, one from age 12-20 months, and one from age 20-30 months.

Kantor claimed that deaf mothers modify and simplify their language to babies in phonological, semantic, syntactic and pragmatic domains. In relation to the morphological marking of verb agreement, she observed that mothers did not use inflected verbs in the beginning stages of child language development. Most parent utterances contained citation form signs plus deictic pointing. When inflection did occur, it was always in the presence of the referent object, location or person. That is to say, there were almost no instances where a spatial index was arbitrarily established in the signing space for a non-present noun referent.

Unlike Meier's (1982) analysis of verb agreement, Kantor did not examine the system in terms of its iconic or analogue potential, and the examples she cited are not sufficient to determine whether or not mothers exploited this potential in their earliest verb inflection to children. If, as Kantor

argued, the goal of early parent-child interactions is explicitly to point out objects in the environment, one might hypothesize that mothers would not only point to, show and identify the object, but they might also highlight any resemblance between the object and the sign that represents it. This strategy might be even easier with signs representing actions, if Brown (1980) and Feldman (1975) are correct in postulating that actions are more readily represented on the hands. This kind of strategy is often used in teaching ASL as a second language to children and adults; the relationship between a sign and its referent is frequently specified, in the hope of facilitating the acquisition and retention of individual signs.

Although mothers may not be using a teaching language with their young children, they may intuitively feel that highlighting the iconicity of basic signs will serve as some kind of mnemonic and will therefore facilitate recognition, comprehension and acquisition of these signs. In my analysis of input data, I set out to determine how maternal input changes over time, whether or not mothers highlight the iconicity of related nouns and verbs, and how they mark the morphological distinctions between paired items, to facilitate children's induction of the rules.

Summary

American Sign Language has been shown to be a formal combinatorial system with complex devices which employ a visual-manual modality of communication. The nouns and verbs to be discussed here represent one aspect of the diverse morphological system of ASL. It has been suggested (Supalla and Newport, 1978) that a formal distinction between related nouns and verbs exists in the adult language, but there has been no discussion of child production or of how these distinctions are acquired.

The semantic relations encoded by these nouns and verbs allow for comparisons to development across languages. But predictions about acquisition are certainly colored by the language-specific way in which the noun/verb distinctions are marked and by the modality-specific issue of how they are represented in the language.

As I demonstrate in the following chapter, the paired nouns and verbs encode some very basic semantic relations. They are also part of the complex derivational morphology of ASL. Furthermore, many of the signs are highly iconic, that is, they are rather clearly representative of their referents. A mother's intuitive awareness of these factors may affect the way in which she introduces these signs to her child.

Thus, we have a multifaceted view of this process, encompassing cross-linguistic, language-specific and modality-specific perspectives. My aim was to determine if the

formal system could be demonstrated in adult signers, and, if so, I intended to describe the course of development of this morphological process in young deaf children, and to determine how cross-linguistic, language-specific and modality-specific factors affect its acquisition.

Research Questions

The following research questions underlie this study:

1. Is there a systematic process for deriving related nouns and verbs in deaf adults?
2. Is there a systematic process for deriving related nouns and verbs in deaf children?
3. If so, are there developmental changes in marking distinctions between related nouns and verbs?
4. If so, can these changes be predicted by
 - a) a preference for object or action terms in early lexicons?
 - b) the sequence of semantic relations found for hearing children?
 - c) the mimetic properties of these nouns and verbs?
 - d) maternal input?
 - e) morphological complexity?

NOTES

1. Aronoff (1976:36) has noted that one cannot speak absolutely about the productivity of a word formation rule. Instead, productivity of an affix should be described only in terms of words of a particular morphological class. Specifically, in forming abstract nouns in English, -ness is much more productive than -ity with base adjectives ending in -ive (e.g., 'perceptive'), but -ity is far more productive with base adjectives ending in -ile (e.g., 'servile'). Aronoff (1976:40) also showed that, by imposing a truncation rule which is governed by the preceding vowel rather than the individual word, the number of -ity derivatives increases markedly, which is to say that the productivity of -ity increases.

2. For a complete description of a sign that distinguishes it from other signs, the particular contacting region and hand arrangement must also be specified, as well as qualities of movement. Each of these formational parameters has only a specific, limited number of values that may be realized in signs of ASL.

3. I am aware that the correlation between syntactic form class and semantic class is, as Maratsos and Chalkley (1980) have pointed out, quite imperfect. However, as Gentner (in press:31) has suggested, "the correlation between syntax and semantics is strong enough, at least for concepts at the perceptual level, for the form classes of noun and verb to have psychologically powerful semantic categories associated with them."

4. It should be noted that, in more recent papers, both Clark and Nelson have modified their positions on the role of perceptual and functional salience in early language acquisition, so that their positions are now more similar. Clark (1978c) included movement as one feature which could serve as the basis for lexical extension. Nelson, Rescorla, Gruendel and Benedict (1978) noted that lexical extension should be based on form and other inherent perceptual characteristics, although concepts which are lexicalized early should reflect extension based on function.

5. MacWhinney (1978:78) has noted that the productive use of infixes is relatively rare across languages. These kinds of internal rather than affixal (sequential) changes are more comparable to the simultaneity of morphological changes in ASL.

6. In her studies, Berman viewed the alternation between the stops /b,p,k/ and the spirants /v,f,x/ as morphophonemically conditioned. See Berman, 1982:170fn.

7. It should also be noted that some grammatical processes may themselves be iconic. For example, reduplication of a verb movement iconically represents the meaning 'repeatedly'; reduplication of nouns can represent plurality.

8. The term "motherese", which has been used in much of the input literature, originated in the historical predominance of mothers as primary caretakers. Although there is certainly a trend moving away from traditional roles and more shared parenting in America, the term "motherese" will be used here, since it is better known, understood and accepted than any more liberal, less biased term such as "parentese". In addition, the parent-child interactions studied here were, in all cases, between children and their mothers.

CHAPTER TWO. THE FORMAL DISTINCTION BETWEEN RELATED NOUNS AND VERBS IN ASL

Morphophonology of Noun-Verb Pairs

The focus of this dissertation, the acquisition of a morphological process in ASL, is an extension of a detailed analysis of that process as it appears in the adult language. The work of Supalla and Newport (1978) was an important first step in the study of this morphological process, and it served as the foundation for my procedures and analysis.

As I described in the preceding chapter, sign movement is critical to the structure of ASL, on both the lexical and morphological levels. This is particularly true of the distinction between related nouns and verbs; the formal differences are marked by specific and regular changes in movement.

Many nouns and verbs occur as unrelated lexical items, with no formationally or conceptually related counterpart (e.g., DOG, BOX, CRY, THROW). Supalla and Newport, however, confined their discussion to concrete nouns and verbs which have an obvious relation in the form of the noun referring to an object and the verb referring to the action performed with the object.

In the past, sign language handbooks and dictionaries have not noted any systematic differences in the sign form of related

nouns and verbs (e.g., a single sign form has been listed for both AIRPLANE and FLY; CAR and DRIVE; CHAIR and SIT).¹

Supalla and Newport were the first to describe a consistent formal distinction between these related pairs. They examined a corpus of 100 noun-verb pairs. In each case, the noun and verb are related in meaning, in that the verb expresses the activity performed with or on the object named by the noun. For example, the verb SIT expresses an action performed on the object CHAIR (see Fig. 5a).² The verb DRIVE represents an action associated with the object CAR (see Fig. 5b).

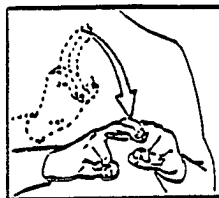
Although the discussion by Supalla and Newport was limited to concrete noun-verb pairs, there are also abstract pairs bearing a similar formal relationship (e.g., SONG/SING; STORY/TELL-STORY; see Fig. 5c,d). These abstract pairs were included in my data collection and analysis, but for the purposes of initial description, I will confine the present discussion to concrete items only.

As Figure 5 demonstrates, paired nouns and verbs share formational characteristics. They have the same handshape, orientation and place of articulation, as well as the same shape and direction of movement.³ But the nouns differ consistently from the verbs in both frequency and manner of movement.⁴ Pairable nouns always have repeated movement, whereas the verbs have either single or repeated movement. Nouns are always restrained in manner, while the verbs have either hold or continuous manner.⁵

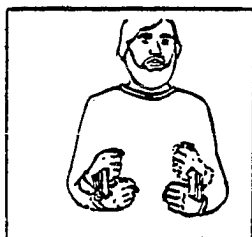
FIGURE 5. The Formal Distinction between Related Nouns and Verbs
in ASL



a. CHAIR



SIT



b. CAR



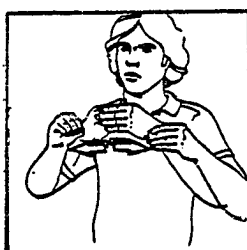
DRIVE



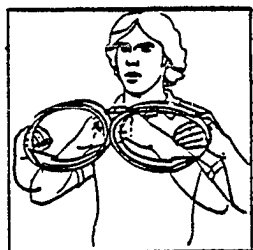
c. SONG



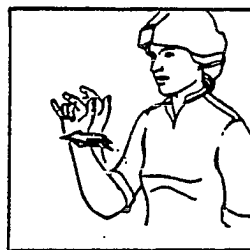
SING



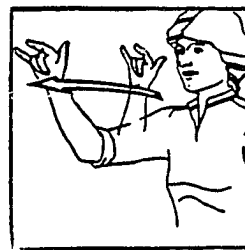
d. STORY



TELL-STORY



e. AIRPLANE



FLY



f. TELEPHONE



CALL-BY-PHONE



g. TYPEWRITER



TYPE



h. BOOK



OPEN-BOOK



i. MATCH



STRIKE-MATCH

Manner of movement

Supalla and Newport (1978:96-97) defined the manners of movement that occur in ASL signs as follows:

In continuous manner, the hands move across the signing space with no interruption. Movement is smooth and loose. The loci of motion (e.g., elbow, wrist and shoulder joints) are in "free variation" and may combine with one another. For example, a given verb sign may involve wrist movement only (as in CLOSE-GATE) or elbow movement only (as in EAT-ICE-CREAM) or both (as in DEAL-CARDS).

Hold manner occurs in signs which begin with a loose movement but end with an abrupt stop, with the arms and hands becoming stiff and briefly maintaining a stationary position. This often, but not only, occurs in signs with one active hand moving to a contact point on a base hand (e.g., SIT-DOWN). However, contact is not required for hold manner; many signs end in hold manner at points in space (e.g., OPEN-DOOR).

Restrained manner differs from the other two manners of movement in that there is no looseness in the articulators. Because the muscles are tightened, the movement is small, quick and stiff, and the hand may bounce back to its original position. In addition, action is restricted to one joint; that is, movement may be at the wrist (as in COMB) or the elbow (as in BABY) but not in both.

As Supalla and Newport (1978:105) indicated, most verbs in their corpus are either unidirectional (hold or continuous) or

bidirectional (repeated continuous). In contrast, there is little variation in types of noun movement. Except in a few isolated cases (e.g., TRAIN, MILK), directionality of noun movement is the same as in the paired verb. But citation form nouns always have repeated movement and restrained manner;⁶ restrained manner results in a concomitant decrease in size.

In their discussion, Supalla and Newport (1978:103) noted a certain morphological-semantic-iconic relationship in pairable verbs. In many of the verb items on their list, there is a consistent relationship between aspectual meaning and formal marking, particularly in the manner and frequency of movement.⁷ In general, single movement in a verb sign corresponds to a single, punctual or perfective action (i.e., verbs such as SIT-DOWN or PUT-ON-HAT relate to an action that is nondurative and momentary in time, with a relatively clear end result). Repeated movement usually refers to a durative activity or to an iterative activity which is composed of repeated punctual actions (e.g., SMOKE, EAT). Hold manner corresponds to an action with specified spatial end-points (as in OPEN-DOOR or OPEN-BOOK, where the "open" position represents a spatial terminus). Continuous manner is used for actions with non-specific or unspecified end-points (such as FLY, or GO-BY-TRAIN, which do not specify initial or final locations).

Supalla and Newport (1978:102) have suggested that the notion of a noun-verb "pair" is an oversimplification, because in some cases, there may be "a whole family of verbs" related to a

particular noun. There are two types of variation in verbs. One entails mimetic depiction, which allows a somewhat pantomimic extension of a given verb to specify how a particular action was performed (e.g., a change in the verb GO-BY-BOAT can represent the actual path traversed or the manner of motion such as a zigzag or winding course, or an up-and-down or rocking motion). The other verb variations differ in more standardized ways. For example, two relatives of the repeated continuous verb EAT are EAT-UP, a single movement continuous verb referring to eating as a punctual-perfective act, and PUT-IN-MOUTH, a single movement verb with an end-hold, representing a punctual action with a spatial end-point. Similarly, a single hold verb like OPEN-DOOR has a related form which refers to opening a door "all the way", not just to a conventional "open" position (Supalla and Newport, 1978:104). In their list of pairs, Supalla and Newport selected one of the verb forms in a given "family", although they did not specify exactly how they made these selections.

Deriving nouns and verbs

Supalla and Newport's aim was to describe the morphophonological process by which noun and verb forms are derived in ASL. They argued that nouns are not derived from verbs, nor are verbs derived from nouns. Rather, they postulated that both noun and verb are derived from a common underlying form.⁸ They posited this description as the most parsimonious account of the data.

In their analysis, the underlying form for both noun and

verb includes specification of the handshape, place of articulation, movement shape, orientation, directionality and frequency of movement. According to Supalla and Newport (1978:120), the frequency of movement at the underlying level is always single; the morphological markers for noun and verb, and all inflectional markers, are applied to this basic movement unit. Supalla and Newport postulated that manner of movement is introduced by an early rule that distinguishes noun and verb, before repetition or inflections are added.

When inflectional processes are applied to nouns and verbs, the differences in frequency of movement may be lost, but the distinctive manners of movement are retained (Newport, 1981; Supalla and Newport, 1978). Certain inflections can be applied to either noun or verb. For example, there is a reduplication process which includes a slow arc-shaped transition back to the initial point between reduplicated units. When this inflection is applied to verbs, the resulting meaning is 'performing the action again and again'; in nouns, the meaning change represents "serial pluralization," that is, 'object after object after object'. The inflection itself has the same global form for noun and verb, but the inflected sign forms are distinct: the inflected verb is continuous in manner of movement, while the inflected noun is restrained. Thus, even under inflection, the essential morphological distinctions are maintained.

The structure of ASL signs may be viewed in terms of "layers" (Newport, 1981, proposed a "shell-like structure"). The

language structure distinguishes the components that make up the lexical items (the "root" or underlying form) from the components that make up the morphology (differentiated features of movement, manner of onset or offset, repetition, etc.). There is much evidence to suggest that these layers are separable (see, for example, Klima and Bellugi, 1979). These separate layers become critical in later discussions of maternal input and child acquisition of related nouns and verbs.

The present investigation is not intended to be a linguistic re-analysis of the process as described (although some re-assessment and research needs are discussed in Chapter VI). Rather, this study traces the acquisition of the formally related nouns and verbs in young deaf children. Indirectly then, some questions asked of the data here may be relevant to Supalla and Newport's linguistic description. For example, do children first acquire an unmarked base form which is neither a noun nor a verb, and only later add the manner and frequency features which disambiguate nouns and verbs? Or, do children show a definite early preference for verb forms and only later develop and derive noun forms from these, or vice versa? In studies of acquisition, answers to questions of this sort can contribute to an understanding of the adult language.

Criteria for scoring nouns and verbs

In analyzing the pairable nouns and verbs produced by adults and children, I utilized a set of criteria based on the linguistic description of Supalla and Newport (1978). They

proposed that manner and frequency of movement are the morphological features which distinguish related nouns and verbs. But the restrained manner of nouns is difficult to observe as an articulatory feature. Supalla and Newport noted that, as a consequence of restrained manner, noun movement is small. I therefore included "small size" as a criterial feature of noun marking, because it is observable and quantifiable. Without that criterion, it was sometimes impossible to determine whether a noun and its associated repeated verb (e.g., BICYCLE/RIDE-BICYCLE) were produced differentially.

When I evaluated the presence of restrained manner in nouns such as AIRPLANE, which are articulated in neutral space, it was relatively easy to see the hand bouncing back to its original position (as described in Supalla and Newport's definition). However, in nouns with contacting movement (such as CHAIR, which has a basehand, and HAT, which contacts the head), restrained manner was much more difficult to observe. As a result, I often resorted to a kinesthetic judgment; I attempted to replicate the sign produced by a given subject in order to feel rather than see the restrained manner of production.

It seemed that contact nouns were articulated with a stiffness and tension in the muscles. I applied the term tense in my descriptions of manner of production of noun signs with unidirectional contact (e.g., FOOD, CHAIR), but in my featural analysis of pairable nouns, I consistently used restrained as the general manner feature.

Therefore, my scoring for accurate production of pairable noun and verb signs appearing in spontaneous and elicited signing was based on the presence of three criterial morphological features: for verbs, hold or continuous manner, large size, single or repeated movement, abbreviated as [V: cont/hold, lg, sing/rep]; for nouns, the criterial features were restrained manner, small size and repeated movement, abbreviated as [N: restr, sm, rep]. For all subjects, semantically and contextually appropriate verb forms were accepted as paired items; this included appropriately inflected verbs.

Effects of the morphological system on acquisition

In terms of acquisition, there are a number of tasks facing the child, each of which is necessary to the acquisition of this morphological process for distinguishing related nouns and verbs. The child needs to:

1. recognize the difference between objects and actions.
2. learn the conventional signs of ASL that encode these meanings.
3. appreciate the grammatical categories of noun and verb and their different privileges of occurrence in sentences.
4. analyze the featural movement markers that constitute the noun morpheme and the verb morpheme (or the "family" of verb morphemes which may mark, for example, punctual versus durative actions).
5. learn to mark the formal features so as to distinguish related nouns and verbs in terms of repetition, size and manner of movement.
6. find out when to apply these morphological distinctions, that is, learn which lexical items do and do not have paired counterparts.

7. extend the process to include abstract noun and verb meanings.

Morphological predictions

Prior studies of the morphology of spoken languages and of ASL (as discussed in Chapter I) can help to make more specific predictions about the acquisition of this process. Children may enter the system looking for any distinguishing clues to such basic lexical categories as nouns and verbs. Under this hypothesis, the following stages in acquisition of the process would be predicted:

I. Early correct use of some high frequency noun and verb forms. Nouns may be less accurate if, as it seems empirically, they are phonologically more complex; it appears that a good deal more motoric control may be necessary to produce the small, rapid, restrained movement required of nouns.

II. Errors consisting of neutralization of distinctions may appear; children may first produce lexical forms without any morphological markers. Certain lexical alternatives may be employed, possibly including sequential rather than simultaneous ordering (e.g., substitution of a monomorphemic form such as WEAR (signed as USE) followed by an individual sign for a clothing item, instead of the multimorphemic, simultaneous PUT-ON verbs such as PUT-ON-HAT, PUT-ON-RING, PUT-ON-COAT, etc.).

III. A wide variety of pairs will be clearly distinguished by means of the appropriate morphological markers. Errors in the form of "pattern-mixing" (as per Berman, 1982) may occur. In these cases, children might use means other than the prototypical marking to distinguish nouns and verbs. Overregularizations and lexical innovations would appear at this stage, giving further evidence of the child's systematic understanding of the rules underlying this morphological process.

IV. Complete mastery of the system, with occasional errors based on lexical gaps or formal inconsistencies in the adult language.

If acquisition in deaf children corresponds to that in

hearing children, and if, as I suggest, this system is comparable in its simultaneous organization to the binyan verb system in Hebrew, the process would be late to appear. In order to make more structurally-based predictions about whether this process would be acquired relatively early or late, I turned to Slobin's (in press) suggestions of the kinds of interacting variables which determine rate and order of acquisition of linguistic forms in a particular language.

Slobin found that the Turkish inflectional system is acquired very early (well before age two), whereas the irregular morphology of Serbo-Croatian prolongs acquisition. On the basis of these data, Slobin (in press) proposed a variety of factors which should facilitate the acquisition of morphology. For example, acquisition would be facilitated if the morphemes are: syllabic; stressed; obligatory, rather than optional; rationally ordered semantically; non-synthetic in their mapping of function onto form (i.e., without the fusional quality of conflating number, gender and case); regular (i.e., exceptionless) in terms of distribution and diversity; and distinct (i.e., there are no homonymous functions).

In terms of these factors, the formal marking of the noun-verb process in ASL can be viewed as: non-syllabic; non-stressed; non-homonymous; simultaneous, rather than ordered; synthetic in mapping function onto form; not regular in terms of distribution and diversity in the language. This combination of factors would contribute to relatively late acquisition of the

process.

The studies of morphological acquisition in ASL reported thus far (e.g., Newport, 1981; Newport and Supalla, 1980; Meier, 1982) support the notion of a gradual "teasing apart" of a given morphological system, with relatively late acquisition in these cases, presumably as a function of the language-specific features of ASL (i.e., its simultaneous, non-segmentable, non-discrete typological form, as noted by Meier, 1980a). But how do cross-linguistic and modality-specific factors contribute to the acquisition process? In the following section, the noun-verb pairs are examined in light of their semantic and iconic features, and the possible effect of these aspects on the acquisition of pairable nouns and verbs. In each case, predictions are made in regard to relative time of acquisition and the order in which particular items might be expected to appear.

Semantics of Noun-Verb Pairs

The cross-linguistic literature suggests that children make early distinctions between objects and actions, although these distinctions may initially be marked in non-adult or non-standard ways (see, for example, Benedict's 1979 data on early action words). In the data on English acquisition, a large variety of nouns but only a few verbs appear in the early lexicons (cf. Nelson, 1973; Benedict, 1979; Goldin-Meadow et al., 1976). This may also be the trend in early acquisition of nouns and verbs in ASL. Nouns may appear early to encode objects, but actions may

be encoded in terms other than verbs (as in English-speaking children's early use of particles and pro-verbs to refer to actions). In addition, early verb use may consist of "general purpose verbs" (as per Bloom et al., 1975; Bloom and Lahey, 1978; Clark, 1978), which would later be replaced by more specific verbs.

Semantic predictions

In regard to the particular pairs under consideration, early acquisition would be predicted for many of the nouns, since they represent concrete Basic Object Level terms (Rosch et al., 1976; Brown, 1980). Those that are movable and manipulable (e.g., SCISSORS, KEY, BLANKET, HAT, BOOK, FOOD) would be expected to appear first (as in Nelson's 1973 data), before nouns representing large, static objects (e.g., BED) or abstract concepts (e.g., MAGIC).

The paired verbs can be described in terms of the hierarchy suggested by Bloom and her associates (Bloom et al., 1975; Bloom and Lahey, 1978). I formulated my predictions on the basis of the sequence of acquisition reported in two of the subjects observed by Bloom et al. (1975) and in the deaf subjects observed by Newport and Ashbrook (1977). In acquiring pairable verbs, I predicted that verbs representing non-locative action relations (e.g., EAT; EAT-ICE CREAM; OPEN-BOOK; OPEN-DOOR) would appear before verbs coding locative action relations (e.g., SIT, FLY, DRIVE, GO-BY-BOAT), with later emergence of verbs reflecting instrumental relations (e.g., CUT, TYPE, SHOOT, CALL-BY-PHONE).

Verbs representing abstract concepts (e.g., TAKE-VACATION) would be expected to appear last.

Mimetic Properties of Noun-Verb Pairs

Viewing paired nouns and verbs in terms of iconicity, one would predict early acquisition of these signs, since many of them are highly iconic. However, verbs may be expected earlier than nouns (as per Brown, 1980) since they are presumably more iconic than nouns, and more easily represented in sign language.

In order to categorize the nouns and verbs according to iconicity, some precise definitions are required. Since the term iconicity has had such broad and varied application, I have chosen instead to describe the "mimetic" properties of the items.

According to Mandel (1977:63, 93), the object or action pictured or presented in a sign is the "base" of the sign; the "image" is the pictorial value of the base. I have used the term "image base" to refer to the particular aspect of the object or action that is represented in a given sign. For example, the image base of the sign BIRD[L;mouth;closing] is the bird's beak.

In Mandel's (1977:95) definition of "mime", the signer performs the bodily motions of the base. I have further specified the definition of mime, to refer only to behavior that imitates actions from the actor's perspective. This includes the representation of animate and inanimate objects, if the entire body is used to assume the role of, and represent, the object. The mime-actor may not portray the action of one body part with another.⁹

This definition fits neatly with the description of the base for many pairable verb signs, which clearly represent their action referents. To describe the signs for pairable nouns, I have borrowed some additional terms from Mandel (1977). He refers to "depiction" as the making of a picture of a base object or action. Subsumed under this category is substitutive depiction, where the shape of the base object is represented by the signer's articulator(s). (Mandel also calls this "shape iconicity," the most common form of substitutive depiction). The shape of the base is present throughout the duration of the sign, and is itself the picture. The motion of these sign forms may correspond in some way to the action motions of the base (Mandel, 1977:65,97). For instance, in the sign SCISSORS[V;neutral space;closing] the V-handshape represents, by substitutive depiction, the shape of the blades of the scissors, and the opening-closing movement of the hand corresponds to the opening and closing of the blades.

When the image base of a sign is enhanced and extended beyond the boundaries of the linguistic system (see Klima and Bellugi, 1979, Chapters 13 and 14) I have called this "image elaboration." For example, in signing to her young infant, one mother exhibited image elaboration in her production of the sign BIRD; she used the image base of the beak to "bite" her daughter on the nose with the closing L-handshape.

Mimetic predictions

With these terms available, I can now propose a sequence of

acquisition of pairable verbs on the basis of their mimetic properties, as follows:

1. Highly mimetic -- those signs whose bases directly imitate the actual movement of the hands (e.g., HAMMER[S; neutral space; downward], in which a fist makes a pounding motion).

2. Partly mimetic -- those signs whose bases portray the movement of the object non-mimetically and portray some of the action of the agent mimetically (e.g., CUT-WITH-SCISSORS[V; neutral space; closing] in which the V-handshape, representing the blades of the scissors, opens and closes).

3. "Translucent" (as per Klima and Bellugi, 1979)--sign forms which are not arbitrary, but which are much less directly mimetically-based, that is, the relationship between sign and referent can be ascertained if the meaning of the sign is provided (e.g., SIT[H-H; neutral space; approach to contact], in which the H-shape of the dominant hand, representing the legs, moves down onto the H-shape of the basehand, which represents a sitting surface).

4. Opaque -- those signs which are non-mimetic and arbitrary. In relation to paired nouns and verbs, these would only be signs with abstract meanings, (e.g., TELL-STORY[-, F-F or 8-8; neutral space; circling] in which the open hands face each other in neutral space and then move apart and come together in large, continuous circles).

I predicted that, if iconicity motivates lexical acquisition, pairable verb signs would be acquired in the sequence listed above.

The form of pairable noun signs is not iconic or mimetic per se, since static objects are being represented by moving forms which are based on the actions typically performed with those objects. However, those noun forms which represent substitutive depiction (e.g., AIRPLANE[; neutral space; forward-back bidirec], in which the image base of the  handshape is the fuselage and wings of a plane; also, SCISSORS, TELEPHONE) may be predicted to

appear earlier than other nouns, (e.g., CAR, CHAIR, ICE-CREAM) which do not give clues to the shape of their referents. Noun forms which are opaque in relation to their referents (e.g., STORY, VACATION) are predicted to emerge last.

Maternal Input

Predictions

In terms of maternal input, I predicted that mothers would facilitate the lexical acquisition of pairable nouns and verbs by exploiting the mimetic potential of these signs. Mothers might point out the similarity and direct relationship between mimetic forms and their referents, or they may use image elaboration to highlight the mimetic nature or the shape iconicity of particular sign forms. Verb signs might then become more detailed in their representation (e.g., EAT-ICE-CREAM[S;chin;downward] might be made with its typical hand movement, in addition to head tilting and licking movements of the tongue). Nouns might be produced in immediate juxtaposition with their referents (e.g., AIRPLANE might be articulated next to a picture or a toy airplane, and the extended thumb and pinkie might be compared directly to the wings of the plane). The mother might even make the noun sign static for clear comparison to the static object. By exploiting the iconicity of these forms in an effort to make them more salient to the child, mothers may help the child use iconicity as a "mnemonic" for lexical acquisition.

I predicted that early input to children would focus on highly mimetic verb forms and shape-iconic noun forms. In

addition, I expected that mothers would clearly and regularly mark the morphological distinctions between pairable nouns and verbs so as to present consistent input that would help the child induce the morphological rules.

Summary

The nouns and verbs under consideration here are related in both form and meaning. Some represent concrete objects and the actions performed on or with those objects; other pairs consist of abstract nouns and verbs. In form, the verbs may be either single or repeated, continuous or hold in manner. The nouns are repeated, small in size and restrained or tense in manner. The morphological features of pairable items are abbreviated here as [V:cont/hold,lg,sing/rep] for verbs and [N:restr,sm,rep] for nouns.

The morphological marking of these pairs leads to predictions that the process will be acquired late, but in progressive stages. Early correct forms, both nouns and verbs, may be learned by rote. These forms will be followed by errors, extensions and innovations, which will give evidence of the induction of the rules for morphologically marking these related forms.

From the standpoint of semantics and iconicity, categorization of the pairs is suggested, with attendant predictions about the relative time of acquisition of specific pairable noun and verb signs. These predictions apply only to

lexical acquisition.

Semantically, nouns that represent movable, manipulable objects should be acquired first, and verbs that code non-locative action relations should appear before those coding locative action relations. Verbs representing instrumental relations should appear later, followed by those representing abstract meaning relations.

In terms of iconicity, the most mimetic verb forms should emerge first, followed by partly mimetic and then translucent verb forms. Noun forms that include shape iconicity (i.e., substitutive depiction) should appear before less mimetic forms.

It is also predicted that mothers will highlight the iconicity of nouns and verbs to make them more salient and thus more readily learned by the child. They may introduce pairable nouns and verbs in the same sequence predicted for the children, in terms of the proposed hierarchy of semantic relations and mimetic representation. It is also expected that mothers will produce highly grammatical utterances (as per Newport et al, 1977) that clearly mark the formal distinctions between nouns and verbs, in order to facilitate the child's induction of the morphological rules.

The subjects and procedures for investigation of these hypotheses are outlined in the next chapter, after which the predictions are tested against elicited and spontaneous data.

NOTES

1. Actually, of the 100 pairs discussed by Supalla and Newport, the Dictionary of American Sign Language (Stokoe et al., 1965) listed 29 noun-verb pairs and 23 single items (20 pairable nouns and 3 pairable verbs). Four of the pairs were noted to be differentiated in form (GUN/SHOOT, SCISSORS/CUT, DRESS/DRESS, WINDOW/OPEN-WINDOW). A more recent ASL dictionary (Sternberg, 1981) included 33 of the 100 paired nouns and verbs described by Supalla and Newport. Although Sternberg cited Supalla and Newport (1978) in his references, each of the noun-verb pairs listed in his dictionary was described in terms of a single sign form.

2. Conforming to the conventions instituted by Supalla and Newport, continuous manner is graphically represented by a full arrow in illustrations here. Restraint or tension is indicated by a smaller arrow which doubles back on itself. See text for definition of manner distinctions.

3. All signs in ASL may be specified on the dimension of directionality. Unidirectional signs entail movement in only one direction; this may be single movement (as in FLY) or repeated movement (as in EAT and FOOD). In each case, the primary movement is in only one direction. In repeated unidirectional signs, there is a transition movement in the opposite direction to return the hands to their initial position (Supalla and Newport, 1978:94). Bidirectional signs have back-and-forth movement in two directions, with no transition between repetitions; the movement is primary in both directions (as in the noun and verb IRON). Some bidirectional signs have alternating movement of the hands (e.g., CAR and DRIVE); one hand moves in one direction while the other hand moves in the opposite direction, and then the directions switch.

4. The manner of movement can be described for the beginning, middle or end of a sign, but Supalla and Newport's discussion is limited to the end manner of signs.

5. Within the list of 100 pairs, Supalla and Newport found only two exceptions where the verbs are restrained in manner: STAPLE and SNAP-PHOTOGRAPH. They also noted the existence of isolated frozen forms which appear as variants of several common verbs in the language. For example, EAT and DRIVE can be made with restrained manner in citation form, although the inflected forms only occur with continuous manner. In addition, certain

inflections can themselves impose restrained manner on verbs.

6. Supalla and Newport noted two exceptions to this rule: COAT, which is single continuous, and GLOVES, which has single movement and hold manner.

7. Supalla and Newport considered this to be an iconic relation between surface form and features of the action. Later in this section, I posit more direct iconicity of verbs.

8. The original (1978) description of pairable nouns and verbs was subsequently modified (as noted in Newport, 1981; and Supalla, 1980); what was initially treated as the underlying form, or root, of the sign was later modified in description, and was considered to be a complex stem composed of several independent morphemes. In the revised description, it was postulated that rules of derivational morphology change the grammatical category of the stem from verb to noun.

9. There are exceptions to this restriction that appear in actual mime performances. In some instances of more abstract or expressionistic mime, there are times when the mime artist will use only the hands to represent an object, as when Marcel Marceau's fluttering hands portrayed a butterfly, or his writhing arm represented the snake in The Garden of Eden. The Mummenschanz mime group makes a point of surprising the audience with their body contortions in which the arms move as legs and the hands as feet, and vice versa. These are, however, exceptions, and are often used and exploited for their unexpected or comedic value.

CHAPTER III. SUBJECTS AND PROCEDURES

Both spontaneous and elicited data were utilized in this study. I designed several elicitation tasks to assess comprehension and production of related nouns and verbs; these were administered to deaf adults and to deaf children. Videotapes of spontaneous signing were collected previously for other purposes, and were made available to me through the Laboratory for Language and Cognitive Studies at the Salk Institute for Biological Studies.

Subjects

Elicitation Tasks

For the elicitation tasks administered to deaf adults, the subjects were ten native users of ASL, deaf adults with deaf parents. All are presently living in California. All ten adults were congenitally deaf; all have deaf parents and five also have deaf grandparents. Eight of the ten subjects have deaf siblings; the other two have no siblings. All ten subjects attended schools for the deaf, where they communicated primarily in ASL. ASL is the primary language used in their childhood and current homes.

The 32 subjects for child testing ranged in age from 2;7 to 10;6. All were born deaf and all have deaf parents. Twelve also have deaf grandparents; 12 have deaf siblings. All children

learned ASL as a first language, and it is the primary language used in the home. Two of the children were also part of the longitudinal study; two others attend special classes for the deaf in the San Diego Schools. The remaining 28 subjects are students at the California School for the Deaf at Fremont--pre-school through sixth grade. Sign language is used for teaching and communication at school.

No prior test data were available on any of the subjects; the criteria for subject selection were that the children were born deaf, had deaf parents and were exposed to ASL as a native language. The Fremont subjects were selected and scheduled by school personnel. These factors placed limitations on subject selection and availability. In all, 17 girls and 15 boys were presented with elicitation tasks.

Longitudinal data

Longitudinal data were available on five congenitally deaf children who will be referred to by pseudonyms: Corinne, Sally, Jane, Farrah and Kate. All five were born to deaf parents. Three children (Sally, Farrah and Kate) also have deaf grandparents. Two subjects are siblings: Jane is 2 years 5 months older than her sister, Corinne. Kate has a younger deaf sibling and Sally has an older hearing sibling. All parents are highly fluent signers of ASL, and all attended schools for the deaf. At least one parent in each family also has deaf siblings. ASL is the parents' primary means of communication, and all families rely exclusively on ASL for communication in the home.

None of the children has received any significant exposure to spoken or signed English, and all are acquiring ASL as a native language.

Videotapes of these children were previously collected as part of an ongoing investigation of the acquisition of ASL in deaf children of deaf parents. Sally's early videotapes were made in a laboratory setting, with the mother and various deaf and hearing experimenters present. All other tapes were collected in the home, while the child interacted with parent, sibling or deaf experimenters. Mothers were asked to communicate naturally with their children and to elicit storytelling whenever possible. Experimenters limited their question input to children, and focused primarily on play activities and contextually-appropriate conversations. The social context for videotaping varied, and included play settings with toys or picture books, as well as snack or meal times.

The very early lexicons of four children were examined. Jane's data could not be used for this portion of the analysis, since she was not videotaped until age 3;1. Only the data on Farrah and Kate were used for this portion of the study. A large amount of data was available on Corinne and Sally; only the first few tapes (through age 1;9) were used in the discussion of early lexicons in young deaf children. The major portion of the longitudinal study on noun-verb acquisition follows Corinne from age 1;0 to 4;2, Sally from 1;6 to 4;4 and Jane from 3;1 to 6;6. For discussion purposes, the age at each sample is rounded off,

but specific ages are noted in the table below, which lists all the data utilized.¹

Table 1. Longitudinal Data Base: Subjects and Samples

Kate			Farrah		
<u>Age</u>	<u>Tape Code</u>	<u>Time</u>	<u>Age</u>	<u>Tape Code</u>	<u>Time</u>
1;0,9	VT3	60 min.	1;2,2	VT1	30 min.
1;1,12	VT4	60 min.	1;4,0	VT2	30 min.
1;2,26	VT5	60 min.	1;4,30	VT3	unusable
1;4,6	VT6	60 min.	1;7,7	VT4	60 min.
1;6,1	VT7	60 min.	1;8,25	VT5	60 min.

Corinne			Sally		
<u>Age</u>	<u>Tape Code</u>	<u>Time</u>	<u>Age</u>	<u>Tape Code</u>	<u>Time</u>
0;9,9	VTi	30 min.	1;5,20	VT1	60 min.
1;0,9	VTii	30 min.	1;8,16	VT3	60 min.
1;2,3	Jane	30 min.	1;9,21	VT4	60 min.
	VT4 Pt.4		2;0,6	VT5	60 min.
1;3,8	VTiii	30 min.	2;2,22	VT7	60 min.
1;6,0	VT1	60 min.	2;5,28	VT9	90 min.
1;9,8	VT5	60 min.	3;0,10	VT15	60 min.
1;11,16	VT7	60 min.	3;3,2	VT18	60 min.
2;2,11	VT9	60 min.	3;6,17	VT21	60 min.
2;3,11	VT10	60 min.	4;0,2	VT26	60 min.
2;4,18	VT11	60 min.	4;3,28	VT29	60 min.
2;6,25	VT13	30 min.			
2;10,1	VT16	75 min.			
2;10,23	VT17	60 min.			
3;2,16	VT19	60 min.			
3;6,7	VT21	30 min.			
3;10,24	VT23	60 min.			
4;2,2	VT25	45 min.			

Jane		
3;1,0	VT1	60 min.
3;6,10	VT4	60 min.
3;11,14	VT8	60 min.
4;3,22	VT14	60 min.
4;8,22	VT18	60 min.
5;2,8	VT23	30 min.
6;6,2	Corinne	
	VT25	15 min.
	Pt.1	

Procedures

All elicitation tasks were administered by a deaf researcher, a native signer of ASL. All subject responses were recorded on videotape. The picture tasks were administered live; the Imitation and Action Demonstration Tasks were pre-recorded on videotape.

Elicitation Tasks for Adults

Five tasks were administered to the deaf adults: one comprehension task and four production tasks. On the basis of adult responses, I made test eliminations and task modifications for child testing, as discussed below.

Preliminary versions of picture comprehension and production tasks were developed and discussed by Lutes-Driscoll, Hom and Bellugi (in preparation). I modified the design and presentation of these tasks to allow for consistency of test stimuli and systematic variation of decoy items. In my version of the tests, the Picture Comprehension and Picture Elicitation Tasks included the same ten noun-verb pairs, representing concrete objects and their related actions. In all target pairs, the noun has repeated movement and the verb has single movement: DOOR/OPEN-DOOR; RING/PUT-ON-RING; SCISSORS/CUT; AIRPLANE/FLY; CHAIR/SIT; BRACELET/PUT-ON-BRACELET; UMBRELLA/OPEN-UMBRELLA; TELEPHONE/CALL-BY-PHONE; ROCKET/BLAST-OFF; HEADPHONES/PUT-ON-HEADPHONES. I devised the other production tasks, Sentence Imitation and Action Demonstrations, in order to evaluate the production of related nouns and verbs in sentential

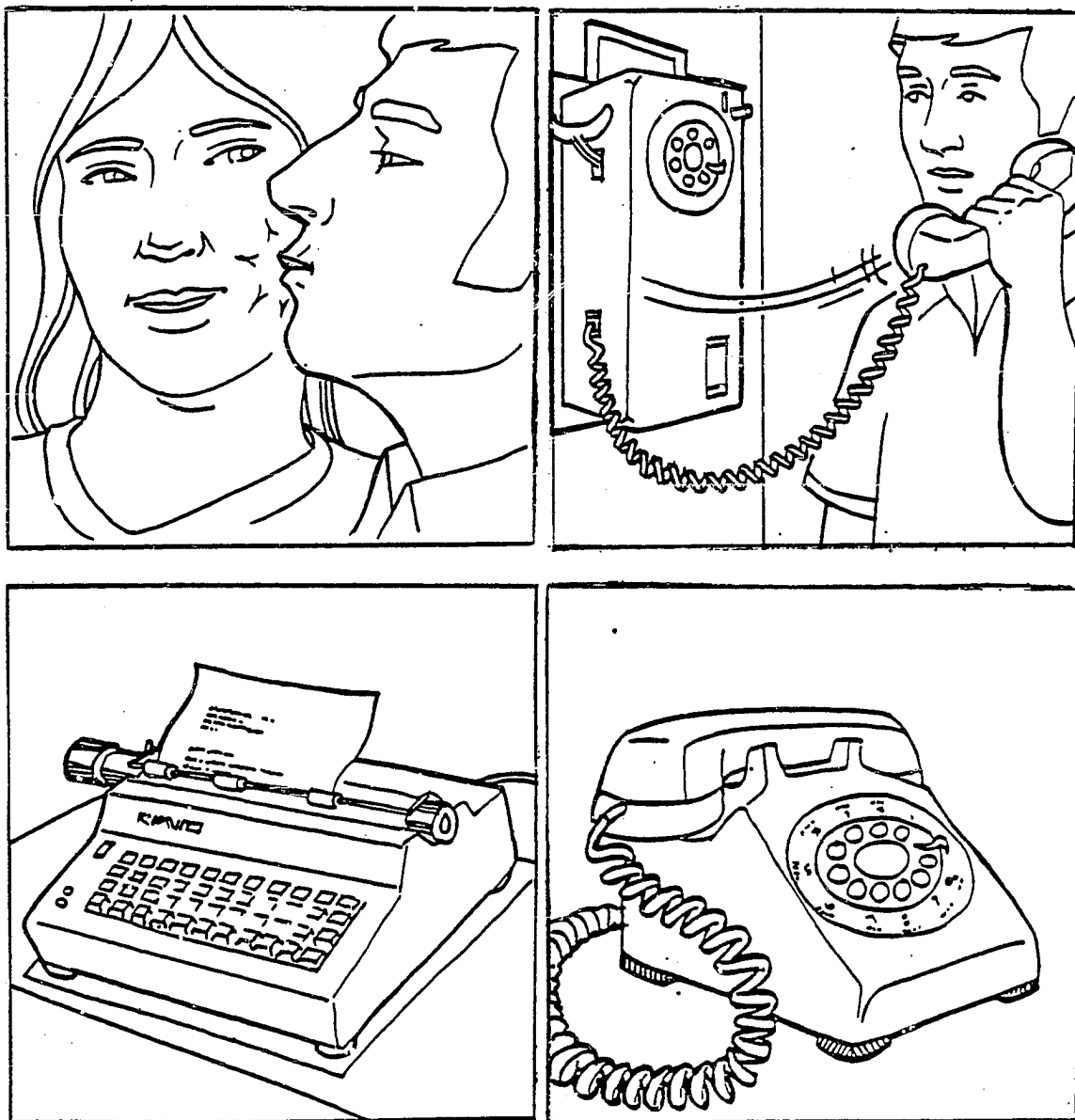
and discourse contexts. Each of the tasks and procedures is described below.

Comprehension Task

The Comprehension Task consists of a picture notebook containing line drawings depicting objects and actions labelled by 20 nouns and verbs in ASL. There are four pictures on each page, representing two nouns and two verbs. One decoy is the paired counterpart of the target item; the others are related in visual form (phonological decoys) and in meaning (semantic decoys). The phonological decoys differ from the target item in one or two of four parameters: hand configuration (or number of hands used); place of articulation; movement contour; orientation. Figure 6 shows a sample page from the test, for the target item CALL-BY-PHONE[Y;cheek;approach to contact]. The paired counterpart is TELEPHONE. Both are articulated with a Y-shape at the cheek; the noun has a small, repeated contact movement, and the verb has a single path movement with approach-to-contact. The phonological decoy, KISS-ON-CHEEK[Ū;cheek;approach to contact] differs from the target verb only in hand configuration: this sign has a single movement, approach-to-contact at the cheek, with an Ū-shape. The semantic decoy is a typewriter, which is generally related in terms of being another means of communication. This item also bears a more specific relation to the telephone in the deaf culture, since telecommunication devices for the deaf involve a typewriter linked to the telephone receiver.

FIGURE 6. Noun-Verb Comprehension Task: Sample Stimulus Page

Target Item: CALL-BY-PHONE



The position of target items on the page was randomized, as was the order of target items (noun or verb). However, the members of a given noun-verb pair were not presented in sequence or proximity. Decoy items did not always portray signs of the same form class as the target item. (See Appendix A for a complete listing of target and decoy items). Two practice items preceded actual task administration. A pointing response was requested (SHOW-ME ____) for each target noun or verb.

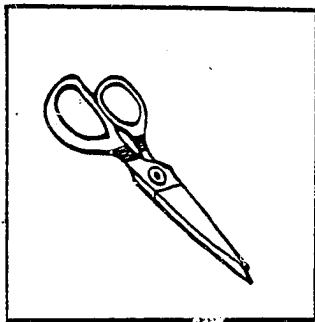
Picture Elicitation Task

For this task, I included the same ten noun-verb pairs as in the Comprehension Task, and the same line drawings. Each 8 1/2" x 11" page in the test notebook contained one picture. Noun and verb presentation order was randomized, but no two paired items were presented consecutively. Two practice items, one noun and one verb, preceded the task. The target signs for the practice items were unpaired and unrelated. The stimulus question for eliciting nouns was WHAT POINT[to picture]? 'What's that?' and for verbs DO-DO POINT[to picture]? 'What's s/he doing?' (See Figure 7, sample picture items to elicit paired nouns and verbs).

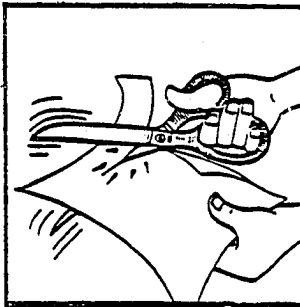
Imitation Task

This elicited imitation task comprised 27 utterances, 7 to 8 signs in length,² each containing both members of a target noun-verb pair. Both concrete and abstract pairs were included. All nouns had repeated movement; 13 verbs had single movement, and four had repeated movement. In addition, in order to make

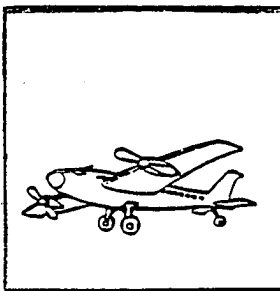
FIGURE 7. Picture Elicitation Task: Stimulus Pictures and Target Items



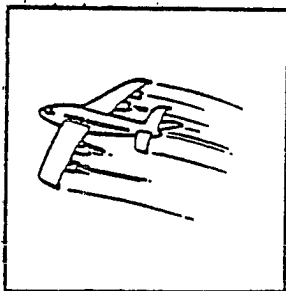
SCISSORS



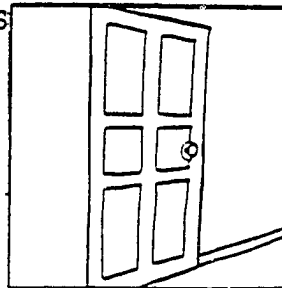
CUT-WITH-SCISSORS



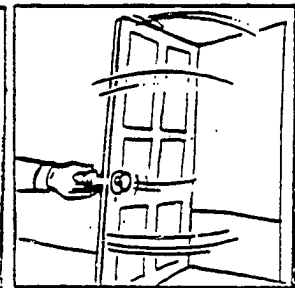
AIRPLANE



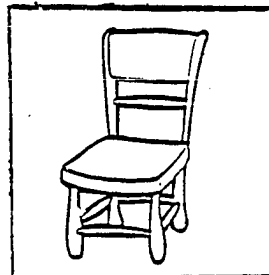
FLY



DOOR



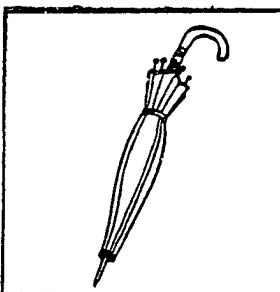
OPEN-DOOR



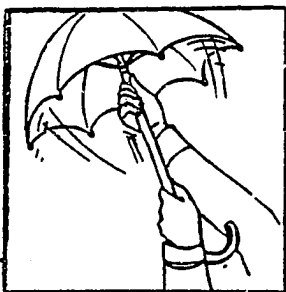
CHAIR



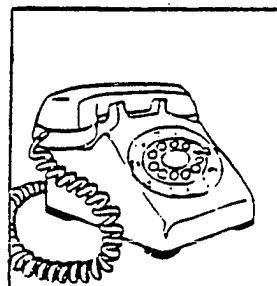
SIT



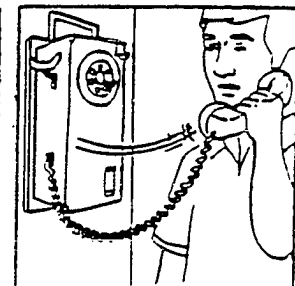
UMBRELLA



OPEN-UMBRELLA



TELEPHONE



CALL-BY-PHONE

subject responses. For example, in one sequence, a jewelry box was on the table. A woman walked in and sat down; she opened the jewelry box and took out a bracelet and a pair of earrings. She put on the bracelet, then the earrings, closed the box and walked off. The target pairs for this sequence were BRACELET/ PUT-ON-BRACELET and EARRINGS/ PUT-ON-EARRINGS.

Two types of response were required. First, each subject was requested to retell the "story" of the action sequence (NOW YOU TELL-STORY 'Now you tell the story'). I called this task "Action Demonstration Stories." Then, specific questions were asked of the subject, to ensure that all target nouns and verbs were elicited. I termed this task "Action Demonstration Questions." For nouns, the question was WOMAN HAVE WHAT? 'What did the woman have?' For verbs, the stimulus question was WOMAN DO-DO WHAT? 'What did the woman do?' (See complete task in Appendix C).

Due to constraints of scheduling and subject availability, not all tasks were administered to all adult subjects, but at least six subjects received each task. No one subject received all five tasks.

The success of the various tasks administered to the adults guided me in selecting and modifying the tasks for subsequent administration to children. Results and response patterns are discussed in detail in Chapter IV, but the overall findings are noted here in order to explain the choice of elicitation tasks for use with child subjects.

The Comprehension and Picture Elicitation Tasks elicited the highest mean performance and lowest variability of all tasks administered to adult subjects. Those were left in the same form for child assessment, but additional practice items were included, as discussed below.

Of the production tasks eliciting nouns and verbs in sentential contexts, the Imitation Task elicited higher scores and lower variability than either Action Demonstration Task (see Table 3, Chapter IV). In the latter two tasks, the response mode allowed for greater flexibility in production. The stories told by adults often included verbs but omitted target nouns. In their answers to direct questions, subjects often selected alternate, unpaired sign forms (e.g., for CIGARETTE, EARRINGS and HANGER). These options left fewer pairs for analysis.

The presence of the target items in the Imitation Task provided for much greater consistency in response, as well as fewer omissions and sign form modifications. However, the subjects did change the stimulus sentences in certain ways, to conform to their natural production of nouns and verbs in discourse contexts. For instance, all criterial features were not always included; presumably, subjects allowed the sentence context to clarify noun and verb status, and the reduction of some sign forms was appropriate to the syntactic context. This finding led to my selection of the Imitation Task for children, so that I could see if similar patterns emerged; I was interested in viewing the children's noun-verb production in sentential

contexts, not only in isolated citation form signs.

Elicitation Tasks for Children

Elicited imitation has been utilized with children in many research and clinical settings, on the premise that the imitation of sentences exceeding short-term memory span reflects the child's own linguistic system (Kuczaj and Maratsos, 1975; Merzyuk, 1963; Slobin and Welsh, 1973; Smith, 1970; for reviews of the issues, see Launer and Lahey, 1981; and Lahey, Schiff-Myers and Launer, in preparation).

In modifying the test sentences for children, I controlled for both length and complexity. Each sentence was seven signs in length, with no morphological inflections. There were only two propositions in each sentence, whereas some of the adult stimuli contained up to five propositions. In addition, I found that adult productions of pairs with repeated verbs were difficult to analyze; nouns and verbs were often almost identical in size and movement. I also felt that the abstract pairs might constitute an additional cognitive constraint for the children. Thus, in the children's form of the Imitation Task, I included only pairs with concrete meaning and single movement verbs.

I felt that the child subjects would be less likely to discern the intent of the task than the adults; with this in mind, and in the interests of decreasing the length of the task to accommodate young children's attention spans, I included only twelve stimulus sentences, preceded by four practice items. Five of the stimulus pairs also appeared on the picture Comprehension

and Elicitation Tasks (i.e., CHAIR/SIT; TELEPHONE/CALL-BY-PHONE; BRACELET/ PUT-ON-BRACELET; SCISSORS/CUT; DOOR/OPEN-DOOR). Seven additional pairs were included in the children's Imitation Task (BASEBALL/HIT-BASEBALL; TISSUE/BLOW-NOSE; BOAT/GO-BY-BOAT; CAMERA/SNAP-PHOTO; GUN/SHOOT; KEY/LOCK-UP; WINDOW/CLOSE-WINDOW). (See Appendix D for full set of imitation stimuli presented to children).

In summary, then, the following three tasks were presented to the child subjects.

Comprehension Task: a 4-item forced choice picture-pointing task. The colored line drawings depicted 20 concrete noun-verb pairs and decoy items. There were two nouns and two verbs pictured on each page: the target item, its paired counterpart, a semantic decoy and a phonological decoy. The five practice items gradually increased in their complexity and their similarity to the actual test items: from two picture choices to four; from noun requests in the context of nouns, to noun or verb requests in the context of noun and verb alternatives; and from four different pictures to a re-appearance of one object in two pictures (e.g., a picture of a book and a picture of a person reading a book on the same test page). The stimulus question for target nouns and verbs was WHERE ____?

Picture Elicitation: a picture-naming task requiring a single-word response. Stimulus items included the same 20 concrete nouns and verbs that appeared in the Comprehension Task, each pictured on a single page. There were five practice items, including both nouns and verbs, both pairable and unpaired items. The stimulus questions were WHAT POINT[to target picture]? 'What's that?' for nouns, and DO-DO POINT[to target picture]? 'What's s/he doing?' for verbs.

Imitation Task: an elicited imitation task comprising 12 utterances, each containing both members of a concrete noun-verb pair, e.g., FAT MAN SIT-DOWN, WILL BREAK MY CHAIR 'If the fat man sits down, he'll break my chair.' Each target utterance was composed of seven signs and two propositions; only repeated nouns and single movement verbs were included. Half the sentences had the noun in the first proposition, and half had the verb in the first proposition. Half the sentences ended with the target item and half did not. For standardization of presentation, the entire task was videotaped by a deaf fluent signer. During task administration, the deaf experimenter stopped the tape between

stimulus utterances. There were four practice items, increasing in length, complexity and similarity to test sentences. The practice items started with a three-sign string and ended with a seven-sign utterance. The last two practice items included one sign that reappeared in the sentence in modified or inflected form, so as to simulate the stimulus sentences without providing an exact model of a noun-verb target sentence.

For all tasks, practice items could be repeated and discussed, but there were no repetitions of experimental stimuli during the test. After the entire task was administered, omitted items or items poorly understood or unclearly articulated by the subject could be re-administered by the experimenter. There were three orders of task presentation, randomly assigned to subjects. In each test sequence, the Picture Elicitation Task preceded the Comprehension Task; since both tasks utilized the same pictures, I felt that it was necessary that the child produce the noun and verb forms before seeing any adult model of those forms. The three tasks were interspersed with other tests that were being presented to the same subjects for other purposes. All of the Fremont School children were tested at school, during the school day.

At the time of testing, given time and attention constraints, the experimenter administered only the picture tasks (Comprehension and Elicitation) to the youngest subjects (age 2;6 to 3;0). The kindergarten and first grade children were available for more than one test session, so those ten subjects, plus two from San Diego, received all three tasks. The oldest subjects (age 7;1 to 10;6) were only available for one session each, and a large variety of other tests was presented to them;

therefore, only the Imitation Task was administered. Thus, not all subjects received all tasks. The age and distribution of subjects for each task follows:

Table 2. Subjects for Child Testing: Age and Distribution

	COMPREHENSION N=17	PICTURE ELICITATION N=15	IMITATION N=28
2;0-3;0	3	3	—
3;1-4;0	2	1	1
4;1-5;0	2	2	3
5;1-6;0	5	4	4
6;1-7;0	5	5	5
7;1-8;0	—	—	6
8;1-9;0	—	—	4
9;1-10;0	—	—	2
10;1-11;0	—	—	3

For production tasks administered to children and adults, scoring of correct responses was based on the presence of the three morphological features which identify the noun or verb morpheme marker; that is, restrained, small, repeated movement for nouns and hold/continuous, large, single/repeated movement for verbs.

Longitudinal Data

As noted above, all five subjects were videotaped as part of an ongoing study of the acquisition of ASL by deaf children of deaf parents. Prior to my investigation, full transcripts were made of Jane's videotapes (from age 3;1 to 4;4). On a number of Sally's and Corinne's videotapes, a fluent hearing signer or two fluent deaf signers translated mother and child sign productions

into English; these translations were recorded on the audio track of the videotapes. Segments of the noun and verb production of Corinne and of Sally and her mother were transcribed by two deaf researchers. I utilized all these data in my analysis, and in addition, I availed myself of deaf researchers' judgments whenever possible in transcribing and interpreting individual utterances.

For the early tapes of Sally and Corinne (up to 2;3), I made complete transcripts of all mother and child utterances. The mothers did not appear on some videotapes, which were made in the presence of a deaf researcher. In those cases, I transcribed only the child's utterances. On later tapes of Sally and Corinne, and all of Jane's tapes, language output was considerable; therefore, my transcriptions were limited to those mother and child utterances which contained pairable nouns and verbs, both concrete and abstract, as well as potentially-pairable items (extensions and innovations).

My transcriptions were in the form of English glosses for ASL signs, and included the linguistic and non-linguistic context surrounding each pertinent utterance. In order to make judgments as to the noun or verb status of particular signs, I relied on the linguistic and non-linguistic context, and the mother's interpretations of child utterances. In cases of ambiguity, I checked with deaf researchers, and, if they also found the context or production to be ambiguous, I eliminated the utterance from my analysis. This only occurred on the earliest tapes of

Corinne and Sally, and only pertained to nine sign tokens.

A reliability check of my transcriptions was provided by a fluent signer, a deaf researcher. She viewed Sally's earliest and latest tapes (30 minutes each) at age 1;6 and 4;4. Agreement between her independent coding of pairable nouns and verbs and mine was as follows: at 1;6, 83% for nouns, 85% for verbs; at 4;4, 92% for nouns and 90% for verbs. The overall percentage of agreement, therefore, was 84% when Sally was 1;6 and 91% when Sally was 4;4.

The mother of Corinne and Jane received two of the elicitation tasks. She scored 100% on the Comprehension Task and on the Picture Elicitation Task (100% canonical marking). The other mothers were not available for testing. Jane and Corinne were tested at various points in their development. Corinne received the Picture Elicitation Task at 3;4 and the Imitation Task at 4;6. The Picture Elicitation Task was administered to Jane at 5;8. These test results were included in the elicitation data analysis (Chapter IV), and were also compared to spontaneous productions at the same time period (see Chapter V).

In the next two chapters, I present the results and analysis of the elicitation tasks and the longitudinal data.

NOTES

1. VT refers to the videotape recordings made on each child. For the maximal amount of early data, I examined all videotapes up to age 1;6 (Kate, Farrah, Sally and Corinne). Corinne's data were very rich; I viewed tapes from 1-4 month intervals. Sally's tapes were examined at three month intervals and Jane's at 3-6 month intervals.

2. Utterance length was controlled with child subjects in mind. Menyuk (1969:114) found that, with sentences up to nine words in length, the length of the sentence was not the factor which determined successful repetition, even for children as young as three years of age. When the Imitation Task was revised for children, all stimulus items included seven signs and two propositions; some target items had more than one sentence.

CHAPTER IV. RESULTS OF ELICITATION TASKS

Tasks Administered to Adults

As noted in Chapter III (see Procedures section), five tasks were administered to the adult subjects, in order to assess both comprehension and production of noun-verb distinctions. This testing was the first step in documenting, across adult native signers, knowledge of a process that has only recently been described. (Note that Supalla and Newport, 1978, did not indicate the source of their data, so that the presence and productivity of the process in adult native signers was in need of definitive documentation).

Although the data base was small for adult testing (10 subjects), the evidence strongly supports the claim that this morphological process is a real phenomenon in native signers' use of ASL. All five tasks were successful in demonstrating knowledge of the distinctions between target nouns and verbs. Table 3 presents the mean, standard deviation and range of overall scores across subjects for each task. These data were used to determine which tests would be selected for administration to child subjects. Item analysis then suggested needs for task revision or modification for testing of children.

Table 3. Mean Proportions of Accurate Responses on Five Tasks Administered to Adults

	<u>Task</u>				
	<u>COMP</u> (N=8)	<u>ELIC</u> (N=6)	<u>IMIT</u> (N=7)	<u>ACT/S</u> (N=8)	<u>ACT/Q</u> (N=6)
Mean	.96	.88	.79	.67	.65
SD	.07	.08	.08	.14	.14
Range	.80-1.00	.78-1.00	.70-.91	.50-.95	.47-.89

N.B. Not all 10 subjects received all tasks.

Comp=Comprehension Task
Elic=Picture Elicitation
Imit=Imitation Task
Act/S=Action Stories
Act/Q=Action-Questions

As this table shows, the Comprehension Task elicited the highest mean performance and lowest variability of all tests. Of the production tasks, Picture Elicitation and the Imitation Task elicited higher scores and lower variability than either Action Demonstration task. The three tests which tapped the noun-verb morphological process with most consistency were thus selected for child testing (i.e., Comprehension, Picture Elicitation and Imitation). These three tasks represent comprehension of individual lexical items, production of individual items and imitative production of nouns and verbs in sentential contexts.

The Action sequences also elicited nouns and verbs in sentential contexts but, because of the nature of the task, many more items were omitted by the subjects, and there was much variability in production. For example, there were lexical

substitutions (such as use of an alternate, unpaired sign form for the noun CIGARETTE). Moreover, subjects did not always find it necessary to name the object when describing the action relating to that object. This is a function of language-specific devices in ASL; the paired verbs include reference to the object represented by their related nouns, thus obviating the need to name the noun (e.g., GO-BY-BOAT, PUT-ON-HAT). In picture naming and imitation, production of nouns and noun-verb pairs was much more consistent.

Analysis of adult responses revealed some interesting trends and patterns. Only the three tasks selected for inclusion in the testing of children are described here.

Comprehension Test

In this picture pointing task, the experimenter produced the target item in canonical form. There were four response choices: a) the target noun or verb; b) the formally related noun or verb counterpart; c) a phonological decoy; d) a semantic decoy. Of the 160 responses obtained on this task, 154 were correct. There were only seven instances in which the target response was not selected, and one subject accounted for four of those errors. He alone chose decoy pictures instead of target items. In all three cases of decoy selection, the pictures chosen by the subject represented semantic decoys (e.g., 'spaceship' for ROCKET; 'clipping nails with nail clipper' for SCISSORS; and 'ear' for HEADPHONES).

In the other four instances of non-target responses,

subjects selected a noun picture (TELEPHONE, CHAIR, BRACELET) when a verb was requested, or a verb picture (OPEN-UMBRELLA) when a noun was requested.

Picture Elicitation

This picture task required a single word noun or verb naming response (see full task description in Chapter III). There were 108 pairable noun and verb responses to this task. Thirteen items (12% of all responses) were not produced in canonical form.¹ Two subjects accounted for seven of these 13 items.

The eight noun forms which were not produced canonically occurred in response to only four of the picture items: BRACELET (3); DOOR (2); ROCKET (2); AIRPLANE (1). Adult productions of these nouns displayed repeated movement without restrained manner (2 tokens) or single movement instead of the canonical repeated movement (6 tokens). Four of the six nouns produced without repetition were, however, distinguished by noticeably smaller size than the related verb. That is, two of the three morphological features (restrained manner, small size, repeated movement) were retained in adult production.

In five verb responses, a repeated form of the verb occurred instead of the canonical single movement form. This form modification was an artifact of variations in test administration. At times, the examiner elicited verbs with the signed question DO-DO WHAT? 'What's s/he doing?', and at times with the question WHAT D-O-I-N-G? 'What's s/he doing?' The appearance of the -ing in the stimulus question seems to have

triggered responses including a durative form of the verb, rather than the expected citation form. In ASL, one formal marking of durative verbs is repeated movement.

Imitation Task

On this task, each videotaped stimulus item contained both a pairable noun and its semantically and formationally related verb (see Chapter III for task description and Appendix A for task stimuli). Of 204 noun-verb responses, 168 were produced in canonical form; 36 were not (18% of all responses; 28% of nouns, 7% of verbs). Variants of canonical noun production either had single movement, or repeated movement without restraint. In both types of noun production, it is possible for the noun to look identical to the verb (in the latter type, the verb form also requires repetition). This superficial similarity necessitated closer scrutiny of subject responses.

On closer examination, I found that subjects used other distinctions which served to differentiate noun from verb. (These non-canonical distinctions also appeared with great frequency, though less regularity, in the child data, and they are discussed later in greater detail; see Note 1 at the end of this chapter).

In 11 (31%) of the pairs that did not exhibit all three morphological features, there was a noticeable reduction in the size of the noun movement relative to the verb. In some cases (e.g., HIT-BASEBALL), the verb movement exhibited a larger excursion, or a more arced trajectory (e.g., PUT-ON-RING) than

the noun form. Verbs requiring repetition (e.g., TELL-STORY, SKATE) were sometimes produced with a more rounded or circular return following the first cycle of movement, in addition to a noticeable alteration in manner (continuous for verbs, tense or restrained for nouns).

Adults sometimes provided a different marker for verbs, which did not appear on the test tape. This marker was in the form of adverbial facial expressions which served as clues to the identification of a given sign as a verb.² The most frequently-occurring facial expression in the test responses was a slight lip protrusion, which can be roughly translated as 'with enjoyment' or 'with ease' (see Chapter I, Figure 2). This facial expression has been analyzed by Liddell (1980) as one of a set of non-manual adverbials which can only co-occur with verbs; they cannot co-occur with nouns.

This particular grammaticized facial expression ('with ease') co-occurred with the verbs SKATE, HIT-BASEBALL, ZIP-UP and OPEN-BOOK. The verb SING was sometimes produced with a rhythmic side-to-side head movement, which, according to deaf observers, clearly marked it as a verb sign, not a noun, depicting (and describing) the action represented.

One other variation in noun production bears discussion. Four of seven subjects produced the noun TELEPHONE as a static or single movement form, while the verb PICK-UP-PHONE exhibited an extended excursion and trajectory. However, the same subjects produced an accurately repeated and restrained form for TELEPHONE

when it appeared in a different sentence context in another task (not part of the present study). A possible explanation for this discrepancy relates to the syntactic context for the noun: PHONE RED RING. ME PICK-UP-PHONE; NO ANSWER 'The red phone rang; I picked it up, but there was no answer.'

In a noun-adjective phrase (e.g., PHONE RED 'the red phone'), ASL seems to allow for optional deletion of repetition in the noun or adjective, or both. The videotaped stimulus sentence was produced with repeated movement in both noun and adjective. Four subjects deleted repetition of the noun movement, but retained movement repetition in the adjective; three subjects imitated the model exactly as produced.

Analysis of responses revealed other linguistic contexts that seem to allow for optional deletion of repeated movement in nouns e.g., item lists and repeated reference. These optional rules are discussed further in Chapter VI.

On the Imitation Task, only one verb omission and one variation in verb production occurred in response to the ten concrete verbs. All other verb form variants or omissions appeared in imitation of abstract verbs. In scoring subject responses, I encountered difficulties in distinguishing related nouns and verbs when the canonical verb form had repeated movement (e.g., SONG/SING; COUGH/COUGH). For these reasons, when I modified the task for children, I omitted all abstract pairs and pairs including repeated verbs.

In summary, all adult subjects demonstrated command of the

specific morphological features that formally distinguish related nouns and verbs. However, when I analyzed adult responses that did not exhibit canonical form, I found that there are various options available to the signer, which can be used in conjunction with, or instead of, the canonical distinctions as originally described. These optional markings appear to be rule-governed and systematic; in specific sentential contexts, native adult signers either add other distinguishing markers, apply optional rules or delete redundant information. These observations allowed me to take a more critical view of children's acquisition of the process, and suggested a variety of ways to analyze the child data.

Cross-sectional Testing of Children

All children were capable of performing the tasks presented to them. As noted in Chapter III, not all subjects received all tests. Due to time and scheduling constraints, the youngest children, age 2;0 to 3;0, received only the Comprehension Task. The oldest subjects, age 7;0 to 11;0, received only the Imitation Task. Twelve subjects, age 3;0 to 7;0, received all three tasks.

Response Accuracy

At first, I scored all subject responses in terms of overall accuracy (+/- scoring of nouns, verbs and combined noun-verb responses). For production tasks, this scoring was based on the presence or absence of all three criterial morphological features for marking related nouns and verbs: for nouns,

[N:restr,sm,rep]; for verbs, [V:hold/cont,lg,sing/rep].

For each task, I calculated correlation coefficients (Pearson r) to determine the relationship between age and overall accuracy (noun plus verb combined) as well as age and the accuracy of nouns, and age and the accuracy of verbs. Results are reported in Table 4.

Table 4. Correlations Between Children's Age and Test Response Accuracy

	<u>Comprehension</u> (N=17)	<u>Picture Elicitation</u> (N=15)	<u>Imitation</u> (N=28)
Overall (N+V)	.31	.73**	.37*
Noun Accuracy	.13	.67**	.38*
Verb Accuracy	.22	.27	.08

*p<.05 **p<.01

Most of these correlations were relatively low. On the Picture Elicitation and Imitation Tasks, there was some evidence of improvement in overall production accuracy and in accuracy of imitated nouns. In general, there was little evidence of improvement in verb accuracy over time, and no improvement in comprehension. This was a surprising result, which demanded a closer analysis of the data.

First, I looked at individual noun and verb responses, to determine if the tasks themselves elicited either nouns or verbs with greater accuracy. I performed three t tests to compare noun

and verb accuracy scores on each task, collapsed across subjects. There were no significant differences between noun and verb response accuracy on any task. All three tasks were successful in eliciting both nouns and verbs, but there were no differences across subjects in terms of accuracy of marking the two form classes.

Since 12 subjects received all three tasks, I performed an Analysis of Variance in order to compare their noun and verb response accuracy across tasks. The Analysis had three factors: an Age factor, with three group levels (3;0-4;11, 5;0-5;11, 6;0-7;0), a Task factor, which had three levels (Comprehension, Picture Elicitation and Imitation), and a Form Class factor, which had two levels (noun and verb). As Table 5 shows, the main effects of age group, task and form class were not significant, but there was a significant interaction between task and form class, as well as a significant three-way interaction among age group and task and form class.

Table 5. Cross-Task Analysis of Variance: Elicitation Data
on 12 Children

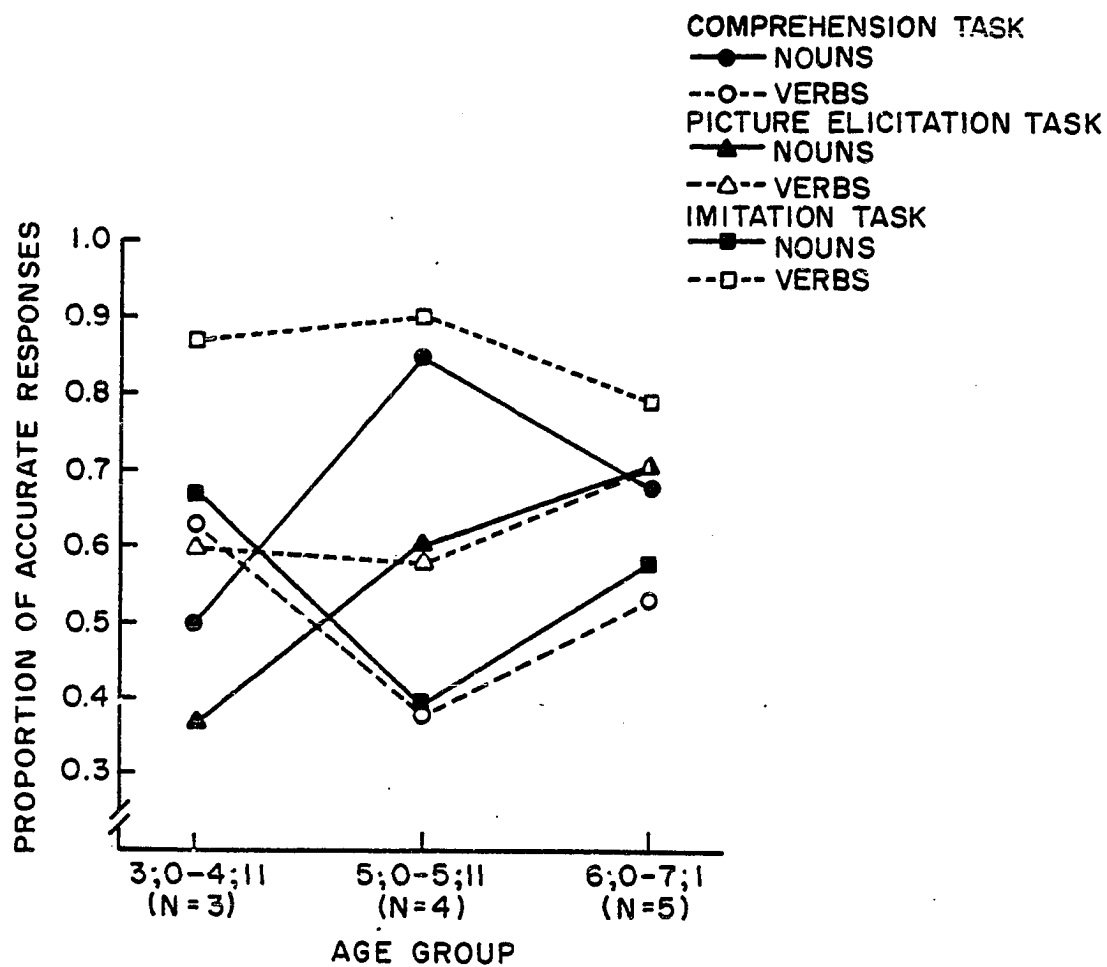
<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>
Mean	28.38	1	28.38	926.43***
Subjects(S)/Age Gp(G)	0.28	9	0.03	
G	0.03	2	0.02	0.49
S/G	0.28	9	0.03	
Task (T)	0.01	2	0.05	1.77
T x S/G	0.52	18	0.03	
G x T	0.22	4	0.05	1.89
T x S/G	0.52	18	0.03	
Form Class (F)	0.05	1	0.05	0.56
F x S/G	0.73	9	0.08	
G x F	0.11	2	0.06	0.70
F x S/G	0.73	9	0.08	
T x F	0.69	2	0.35	10.71***
T x F x S/G	0.58	18	0.03	
G x T x F	0.42	4	0.11	3.27*
T x F x S/G	0.58	18	0.03	

*p<.05 ***p<.001

These results suggest that noun and verb accuracy differed depending upon the task presented, and depending on the age of the subjects. By graphing the mean accuracy for each age group and each task, I was able to view these interaction patterns (see Fig. 8).

The young and middle groups showed a great deal of variability in their noun and verb accuracy across tasks, whereas the accuracy range was much smaller for the older subjects. The youngest subjects were least competent in comprehending and

Figure 8. MEAN ACCURACY OF RELATED NOUNS AND VERBS AS A FUNCTION OF AGE AND TASK



producing citation form nouns, but they were very accurate in imitation of verbs in sentence contexts. The comprehension and production of citation form nouns rose considerably from the youngest to the mid-range age group, although there was a dropoff in comprehension of verbs and imitation of nouns. These two response types (verb comprehension, noun imitation) rose again in the higher age group, although they remained the least accurate response types at the upper age range. Imitation of verbs remained the most accurate for all age groups. This may relate to the existence of greater variability of noun production in discourse contexts. In the oldest subjects, production of citation form verbs and nouns was equivalent, and quite similar to imitation of verbs and comprehension of nouns.

It may well be that the young children's early imitations are more rote and thus more accurate than the older children's. The older children may be filtering the input through their linguistic system, and they may be affected by their intuitive and metalinguistic awareness of both the morphological features for distinguishing nouns and verbs, and the variability in the adult language due to the presence of optional rules.

These analyses provided a detailed picture of the accuracy of child responses to elicitation tasks. But what of the responses which were not accurate? It was necessary to examine the particular response types and patterns which appeared on each task.

Response Patterns

Comprehension Task

Of the 320 responses obtained on the Comprehension Task, 187 were accurate. There were 133 instances where the target item was not selected; 84 (63%) occurred in response to verb stimuli, and 49 (37%) occurred in response to noun stimuli. These non-target selections persisted across the age range, and the same response types appeared in all age groups.

As in the adult data, decoy pictures were rarely selected. There were seven decoy selections (5% of all non-target selections). In only one case (the youngest subject, age 2;7) a phonological decoy was selected (SWIMMING-FISH for CUT-WITH-SCISSORS). In the other decoy responses, like those of the adults, the child chose the picture representing an object or action which was semantically similar to the stimulus item. These six choices involved only three test stimuli: CUT-WITH-SCISSORS (4), FLY (1) and HEADPHONE (1). In the remaining 126 non-target selections, subjects pointed to an action picture for a noun sign stimulus or an object picture for a verb sign stimulus.

Across both noun and verb sign stimuli, 59% of all responses were points to object pictures and 41% were points to action pictures. This suggests a systematic bias toward object (noun) responses, regardless of the stimulus presented. On the basis of a Binomial test, using a normal approximation to the binomial

distribution, I found that the response bias in favor of nouns was significant ($p < .0001$, $z = 3.35$).

Taking this response bias into account, I performed an additional Binomial test, to determine if the data could be explained by response bias alone. There were 112 "noun" responses to noun stimuli; even with a response bias, 95 noun responses would have been expected by chance. This difference was significant ($p < .01$, $z = 2.74$). There were 82 "verb" responses to verb stimuli, whereas 65 verb responses would have been expected by chance, assuming a bias toward nouns. Again, the difference was significant ($p < .01$, $z = 2.74$).

It is clear that children were able to demonstrate an understanding of the association between related actions and objects; virtually all responses were in the appropriate semantic domain. Moreover, there were more "noun" responses to noun stimuli, and more "verb" responses to verb stimuli than would be expected by chance, taking into account the systematic response bias toward nouns. This finding indicates that the children were capable of identifying the appropriate noun or verb target item.

The presence of the response bias toward nouns (object pictures) may be related to task construction. Every illustration of an action included the object acted upon, so that the target object appeared in both noun and verb pictures. In addition, the difficulties in illustrating actions may have contributed to children's uncertainties in the presence of verb sign stimuli.

Results may also be interpreted in light of findings on the production tasks administered to adults. In sentential contexts, adults gave evidence of variability in noun production, due to the application of optional rules which allow for deletion of repetition. Thus, in connected discourse, it may be difficult at times for children to distinguish nouns from verbs simply on the basis of sign form, since a single movement form could be either a noun or a verb. However, a small, repeated, tense/restrained form would be seen as clear noun marking. Sign stimuli in the Comprehension Test were presented in citation form; therefore, children may have had little difficulty in identifying the repeated, restrained forms as nouns, but they may have encountered more problems with the single movement forms, which, in conversational signing, sometimes represent verbs and sometimes nouns.

Production Tasks

As Table 4 showed for both production tasks, there were significant correlations between age and overall accuracy of production, and between age and noun production. Since the evaluation of accuracy scores provided minimal evidence of a developmental progression in canonical marking of verbs, I examined each noun and verb in relation to its paired counterpart. This allowed me to analyze how children develop an ability to mark the distinctions between nouns and verbs, instead of how accurately they produce each item independently. I found that what changed considerably over time was the way in which

children distinguish related nouns and verbs.

I coded the children's paired responses in terms of four categories of noun-verb distinction. A reliability check of my scoring was provided by a deaf researcher, a native adult signer. She viewed the videotapes of five children's responses, two on the Picture Elicitation Task (age 2;7 and 7;0) and three on the Sentence Imitation Task (age 4;10, 7;4, 9;11). This provided for a variety of age levels to check. Reliability coefficients were .92 for +/- scoring and .84 for determining categories of noun-verb distinction. The four categories are described below.

First, there were pairs that were identical in form, with no apparent distinction between noun and verb. I termed this category No Distinction. There were other pairs marked by complete noun-verb distinction, including all the morphological features for marking related nouns and verbs; this category was Full Distinction. Some pairs displayed a Partial Distinction, that is, some but not all of the morphological features were present. For example, the verb might be single and the noun repeated, but size and manner of production were identical. Or, both noun and verb were produced with single movement, but the noun was smaller and tense or restrained in manner. The fourth category was less predictable and less systematic. These were Non-canonical Distinctions, in which children differentiated noun from verb in non-standard or idiosyncratic ways. The following types of distinguishers were noted, in order of frequency of occurrence:

Movement distinctions: e.g., a repeated approach-to-contact for the verb PUT-ON-BRACELET[C;wrist;approach to contact] and a repeated sliding motion for the noun BRACELET[*C;wrist;sliding] (see Figure 9a); repeated hand-slapping movement for DOOR and repeated wrist pronation (the expected movement contour) for OPEN-DOOR.

Differences in manner of offset: e.g., a single movement for TELEPHONE with rapid recoil after cheek contact, versus a long end-hold maintaining contact for CALL-BY-PHONE (see Fig. 9b).

Handshape distinctions: e.g., A-handshape for TELEPHONE[*A;cheek;approach to contact], Y-hand for CALL-BY-PHONE[Y;cheek;approach to contact], both made with single approach movement. Some of the older children initialized noun signs. Initialized forms use the handshape of the first letter of the English word, so that DOOR[*B-D;neutral space; grazing + wrist twist] was made with a neutral B-basehand and an active D-hand, while OPEN-DOOR [B-B;neutral space; outward rotation] retained two B-handshapes, as in the canonical ASL form. Similarly, CHAIR[*C-H;neutral space;approach to contact] was produced with a C basehand and an active H-hand, while SIT[H-H;neutral space; approach to contact] retained the canonical H-handshape for both the active hand and the base hand. This kind of form change is, apparently, an effect of exposure in school to invented sign systems which attempt to represent English on the hands (see discussion of these sign systems in Wilbur, 1979:204-228). In spite of this English influence, it is noteworthy that some children retained the marking of ASL morphology which, presumably, was not modeled by their teachers. These children initialized noun signs but retained all the canonical movement and manner distinctions between noun and verb. For example, some children produced CHAIR[N:restr,sm,rep] with a C-H hand configuration and SIT[V:hold,lg,sing] with an H-H handshape, but the noun was small, repeated and restrained and the verb was large, with single movement and hold manner. These pairs were categorized as Full Distinctions.

Face or body movement: these usually co-occurred with verb signs, as in a head-jerk and eyeblink for SNAP-PHOTO; head tilt for

FIGURE 9. Examples of Non-canonical Noun-Verb Distinctions:
Child Production Data

a. Pair distinguished by movement shape only.



BRACELET[*C;wrist;sliding]



PUT-ON-BRACELET[C;wrist;
approach to contact]

b. Pair distinguished by manner of offset.



TELEPHONE[*N:recoil, lg,
sing]



CALL-BY-PHONE[V:hold, lg,
sing]

CALL-BY-PHONE; or lip protrusion, an adverbial facial expression, superimposed on GO-BY-BOAT.

Speed of movement: e.g., a long, slow, single movement for ROCKET and a long, rapid, single movement for BLASTOFF.

Location differences: e.g., CAMERA articulated at chin level, while SNAP-PHOTO was produced at the expected eye level.

Orientation differences: e.g., BRACELET was articulated (as expected) on the back of the wrist and PUT-ON-BRACELET was produced on the underside of the wrist; in this example, the active hand was oriented palm-down for the noun and palm-up for the verb. Repetition, size and manner of movement were otherwise the same.

Differences in manner of onset: e.g., a large, single, continuous movement for ROCKET and a similar movement for BLASTOFF, except for a stationary hold position before verb movement was initiated.

The last four non-canonical distinctions (speed, location, orientation, onset differences) occurred very rarely in the child data (a total of 12 tokens). These did not occur at all in the adult data. One other distinction occurred often in the child data but never in the adult data. This was a reversal of the morphological features, so that a response to a verb stimulus (e.g., OPEN-UMBRELLA, FLY) was produced with repetition, small size and restrained manner, as would be expected of a noun, and the noun had all canonical verb features. These reversals also occurred on individual morphological features (e.g., SHOOT [*V:cont,lg,rep] was repeated and GUN[*N:restr,sm,sing] had single movement; or CUT [*V:hold,sm,sing] was single and small and SCISSORS [*N:cont,lg,sing] had a single, large movement).

Table 6 presents the proportions of each of the non-canonical distinction types appearing in the adult and child production data.

Table 6. Proportions of Non-Canonical Distinction Types Occurring in Elicited Responses of Adults and Children

		<u>Picture Elicitation</u>		<u>Imitation</u>
	N (tokens)		N (tokens)	
ADULTS	3	.33 Head/Body movemt .33 Movement distinc .33 Offset distinctions	6	.83 Body movemt .17 Facial exp.
CHILDREN	70	.26 Movement distinc .24 Feature Reversals .13 Offset Distinctions .10 Face/Body movement .07 Speed .07 Orientation .07 Handshape changes .04 Location + Onset	37	.22 Body Movemt .22 Movemt dist .22 Feature Rev .14 Offset .08 Speed .08 Location .05 Handshape + Orientation

There was no particular consistency regarding use of a given non-canonical distinction by a particular child, or application of a certain type of non-canonical distinction to a particular noun-verb pair. However, when all the children were grouped into two-year age ranges and the data were examined according to the four categories of marking distinctions, a clear developmental pattern emerged. Figure 10 is a graph of the responses on the Picture Elicitation Task, indicating the proportion of responses accounted for by each distinction category for each age group, as well as for adults. Figure 11 presents comparable data from the Imitation Task.

Figure 10 shows that, on the Picture Elicitation task, a

Figure 10. PICTURE ELICITATION TASK :
CHILDREN'S MARKING OF NOUN-VERB DISTINCTIONS

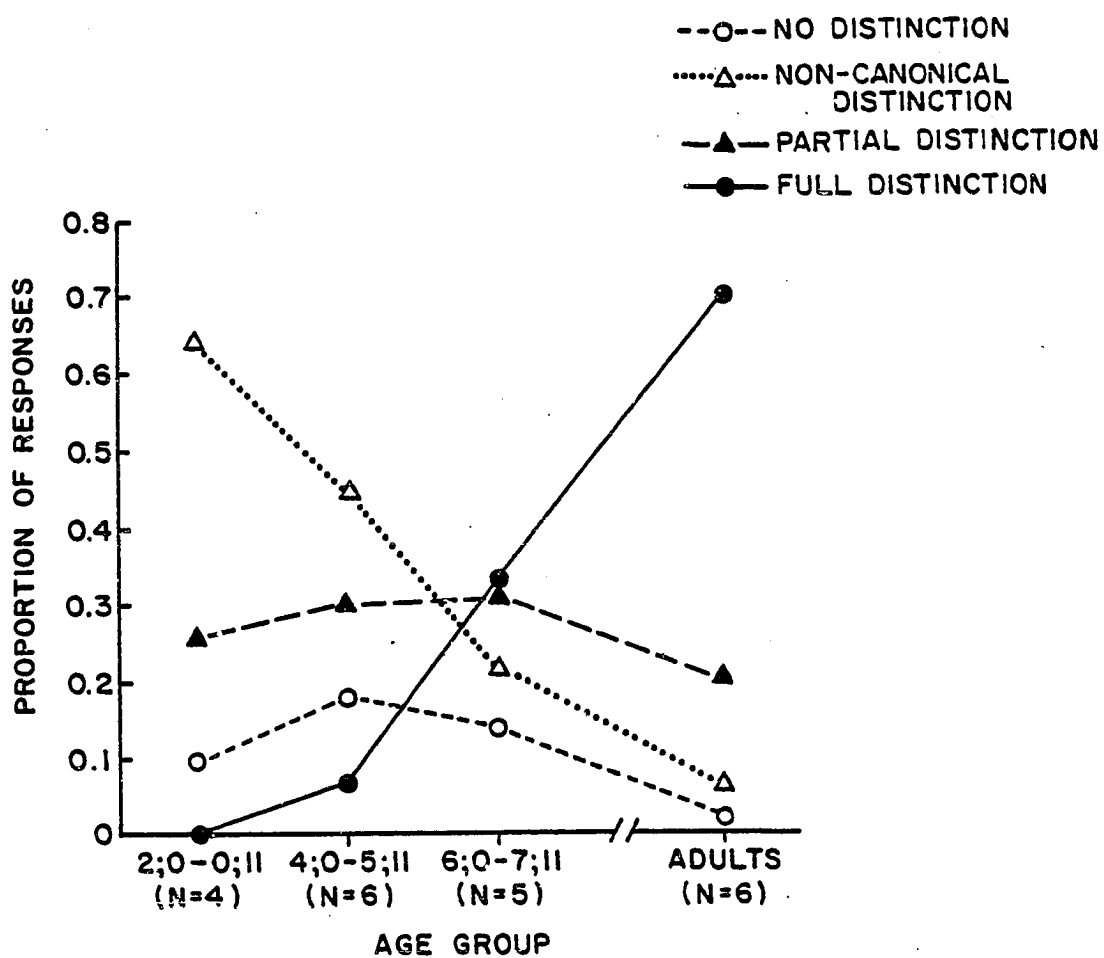
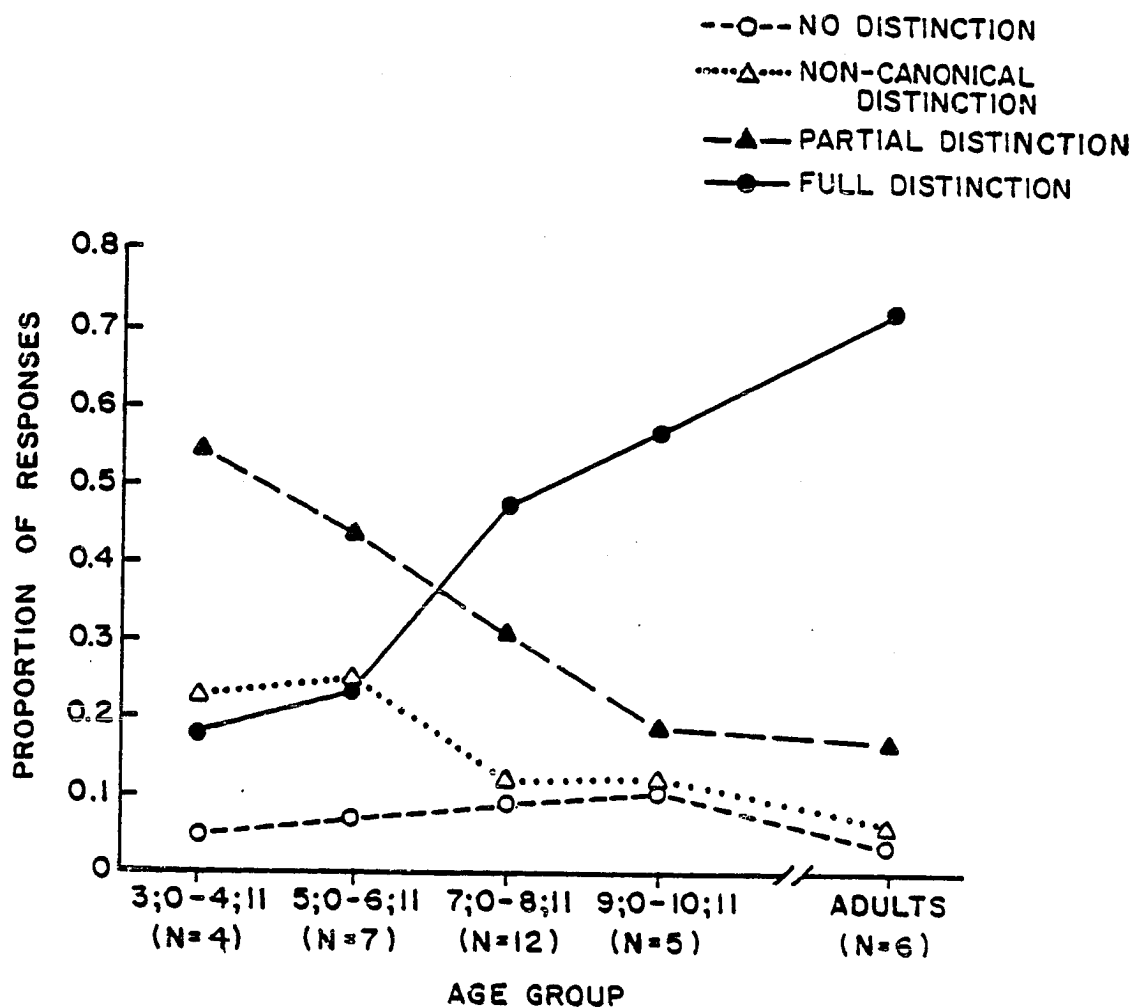


Figure 11. IMITATION TASK:
CHILDREN'S MARKING OF NOUN-VERB DISTINCTIONS



very high proportion of the young children's responses displayed non-canonical distinctions. This proportion decreased markedly in the upper age groups. By contrast, there is no evidence of full distinctions in the youngest children, but there is a considerable increase in such responses with increasing age.

I performed an Analysis of Variance on these data. Since scores were reported as proportions, it was necessary to transform them by means of arc sine transformations, to ensure homogeneity of variance (Myers, 1972:77). In the analysis, there were two factors: age group, with three levels (2;0-3;11, 4;0-5;11, 6;0-7;11) and noun-verb distinction category, which had four levels (No Distinction, Non-canonical Distinction, Partial Distinction, Full Distinction). Results are reported in Table 7.

Table 7. Analysis of Variance for the Picture Elicitation Task: Child Data

<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>
Mean	43362.82	1	43362.82	2732.59***
Subjects(S)/Age Group	190.43	12	15.87	
Age Group (G)	220.01	2	110.00	6.93**
S/G	190.43	12	15.87	
N/V Distinction				
Category(Cat)	5653.78	3	1884.59	14.02***
Cat x S/G	4838.68	36	134.41	
G x Cat	5123.29	6	853.88	6.35***
Cat x S/G	4838.68	36	134.41	

***p<.001 **p<.01

As Table 7 shows, the main effect for age group was

significant, as was the noun-verb distinction category. Even more important was the significant interaction between noun-verb distinction category and age group. This result indicates that there was a significant difference in how children of different ages marked the distinctions between related nouns and verbs.

A similar Analysis of Variance was performed on the data for the Imitation Task (using arc sine transformations), and comparable results were obtained. In this analysis, there were four age groups (3;0-4;11, 5;0-6;11, 7;0-8;11, 9;0-10;11). The other factor, noun-verb distinction category, remained the same as in the prior Analysis. Results are reported in Table 8.

Table 8. Analysis of Variance for the Imitation Task:
Child Data

<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>
Mean	78970.32	1	78970.32	3372.13***
Subjects(S)/Age Group	562.05	24	23.42	
Age Group (G)	13.63	3	4.54	0.19
S/G	562.05	24	23.42	
N/V Distinction				
Category(Cat)	10486.39	3	3495.46	14.65***
Cat x S/G	17177.43	72	238.58	
G x Cat	6830.18	9	758.91	3.18**
Cat x S/G	17177.43	72	238.58	

***p<.001 **p<.01

The effect of noun-verb distinction category was significant, although the main effect for age group was not. Once again, the interaction between age group and noun-verb distinction category was significant.

In looking back at Figures 10 and 11, we can see that there are differences which may relate to the tasks themselves, since one task (Picture Elicitation) required a spontaneous response, and the other required an imitative response. Given a canonical input model to imitate, it is reasonable that fewer non-canonical distinctions would appear in imitation than on a picture elicitation task. It also follows that a higher percentage of partial distinctions would be produced by the younger subjects, and this percentage would decrease over time as the proportion of Full Distinctions increased (see Figure 11).

Discussion

These results show definitively that both adults and children make distinctions between related nouns and verbs in ASL, and these distinctions can be tapped by elicitation tasks.

All tests administered to adults demonstrated knowledge of the morphological rules for formally distinguishing nouns and verbs in ASL. Analysis of adult production distinctions revealed that there are various rule-governed options in the language which differentiate nouns and verbs in a variety of ways, in addition to, or in lieu of, the formal distinctions as originally described. These options result in variability in the adult language; later discussions show how this variability might have an effect on the kinds of spontaneous input young children receive during the early stages of acquisition (see Chapter V). These options are also considered in terms of how they should be

incorporated into a more precise description of the noun-verb process in ASL (see Chapter VI).

The three tasks administered to deaf children were successful in demonstrating children's growing awareness of the morphological distinctions between related nouns and verbs. In fact, this awareness was reflected in young children's production of Non-canonical Distinctions, which marked a clear difference between nouns and verbs, but not in the same ways as these distinctions are marked in the adult language. As in other aspects of morphological acquisition in ASL, this pattern is not dissimilar from observations made on hearing children.

Slobin (1978) has suggested that children make use of the linguistic means at their disposal while "waiting" to master adult forms. As an example of this type of strategy in hearing children, Smoczyńska (1980:39-40) noted that young Polish children will clearly mark verbs for tense and aspect, although the realization of these categories does not correspond to the adult norm. Slobin (1971:185-186) has posited that children may at first use "idiosyncratic linguistic forms" to express new meanings, because semantic development may be ahead of formal grammatical development. Ingram (1976), in his analysis of English phonological acquisition, found that, in an effort to avoid homonyms, some children do not make use of their phonemic repertoire, but employ instead some other aspect of their system. In describing these "unique phonological processes," Ingram (1976:119-120) cited Velten's (1943) description of a child

distinguishing between foot and food solely by means of vowel lengthening.

It seems that deaf children are using comparable strategies in acquiring this morphological process of ASL. They employ aspects of their linguistic repertoire to mark, in non-standard ways, a distinction they have not yet learned to mark according to the morphology of the adult language.

In developing the ability to mark the morphological distinctions between related nouns and verbs, deaf children seemed to progress in a gradual, step-wise fashion. The youngest children made No Distinction between some pairs and Partial Canonical Distinction between others. In many cases, they found their own Non-canonical means of distinguishing nouns from verbs, on the way to acquiring the Full Canonical Distinctions. These findings suggest that children are performing a morphological analysis in teasing apart a linguistic system of the adult language. Children see that noun-verb distinctions are marked in the adult language, and they find their own means of marking these distinctions, until they have mastered the adult system. But the children tested here were already well on their way to acquiring the language. How do these findings relate to what motivates the very young child in entering the system? Is the pattern of development the same in spontaneous signing as in elicitation tasks? In the literature on the acquisition of English, there is evidence of differences between elicited productions and spontaneous output (see Launer and Lahey, 1981

and Lahey, Schiff and Launer, in preparation , for a review).

In the context of spontaneous development of the formal distinction between related nouns and verbs, other (non-formal) factors, such as semantics, iconicity and maternal input, may facilitate early acquisition. In examining longitudinal data on the acquisition of noun-verb distinctions in three deaf children, I evaluated how these other factors may affect early development.

NOTES

1. I have used the term "canonical form" to refer to signs that possess all the criterial morphological features posited here for distinguishing related nouns and verbs. That is, restrained, small, repeated movement for nouns and continuous or hold manner, large size, single or repeated movement for verbs. The term "canonical" was originally used by Hockett (1947/1957:236) to refer to the "typical phonemic shapes...of morphs." By extension, then, the canonical form of related nouns and verbs distinguishes the signs on the basis of morphological features of repetition, size and manner of movement. Partial Distinctions show some, but not all of the criterial features. "Non-canonical distinctions" differentiate noun from verb on other parameters or by other means (e.g., manner of onset or offset, speed of movement, facial expression, head or body movement).

2. Some deaf informants have suggested to me that a verb cannot be made with a neutral facial expression; a noun, however, can be produced with neutral expression or with mouthing of the English gloss. It is ungrammatical for an adverbial facial expression to co-occur with a noun sign.

CHAPTER V. LONGITUDINAL DATA

Longitudinal data were available on three deaf children of deaf parents (Corinne, Sally and Jane), all of whom were acquiring ASL as a first language. In each case, both the child's and the mother's use of pairable nouns and verbs was charted over time. Since one child (Jane) was somewhat older than the others (age 3;1) at the onset of videotaping, additional data from two young children (Kate and Farrah, age 1;0 to 1;9) were used to describe the early stages of development (see full description of subjects and data base in Chapter III). Several aspects of the early data are described first, after which I discuss the longitudinal data on the three children and their mothers.

The Early Lexicons of Four Deaf Children

This thesis represents the study of a restricted set of nouns and verbs in ASL. Realizing that I might get a misleading picture of lexical acquisition by looking only at this set of nouns and verbs, I examined all of the nominals and action words produced in the first 50 signs appearing on the videotapes of four children (age 1;0 to 1;9). Two important findings emerged from these data, one relating to putative phonological complexity in pairable nouns, another relating to early verb use in ASL.

Phonological Complexity

In Chapter III, I hypothesized that very young children might produce pairable nouns less accurately than pairable verbs, because the tense/restrained manner of nouns might add phonological complexity to the basic movement. In examining the early sign production of four young children, I found that, long before age 2;0, all children were capable of producing both unidirectional muscle tension (as in FOOD and other contact nouns) and bidirectional restraint (as in non-contact nouns such as AIRPLANE). This tension/restraint appeared in both paired and unpaired items (e.g., pairable signs such as EAT, CAR, TOOTHBRUSH and MILK; unpaired items such as BALL, SHOES and WHAT).

In Kate's data, the first tokens exhibiting tension/restraint appeared at 1;0, and in Corinne's, at age 1;3. By the age of 1;6, all four children demonstrated an ability to articulate signs with tense and/or restrained manner. This, then, rules out the issue of phonological complexity. That is, there is no evidence in these data to suggest that noun signs are more difficult to produce because they require more motor control and a greater degree of motor development than verb signs.

First Nominal and Action Signs Produced

Tables 9 and 10 list the action words and nominals which occurred in the first 50 signs appearing on the videotapes of these four children, including frequency of occurrence and corroboration with nominals reported by Nelson (1973) and action words reported by Benedict (1979) for the acquisition of English.

Many of the first signs occurred as single word utterances; signs were assigned to the category of action word or nominal on the basis of the linguistic and non-linguistic context, the mothers' interpretation of child utterances and the judgments of deaf researchers who are native signers (see Chapter III on procedures for spontaneous data collection and analysis).

Table 9. First Action Words Produced by Four Deaf Children,
Age 1;0-1;9

		()=frequency
		# =appear in
		Benedict's
		data
		* =Pairables
<u>Produced by >one child</u>	<u>Produced by one child</u>	
#*EAT (4)	PUT-IN-BOWL	*FLY (BY PLANE)
*GO-TO-BED(4)	SPILL	FLY (A BIRD)
CRY (3)	PUT-IN-MOUTH	*BLASTOFF
#*SIT (2)	CLOSE-EYES	*DRIVE
*DRINK(2)	BITE-NOSE	*BRUSH-HAIR
*CALL-BY-PHONE(2)	WASH-FACE	*CLIP-BARRETTE
*EAT-ICE-CREAM(2)	SMELL	*BRUSH-TEETH
WORK (2)	#SEE	*SWING
BREAK(2)	VOMIT	*BATHE
DRINK-BOTTLE(2)	PLAY	*WRITE
	FALL-DOWN	*SKATE
	CRAWL-UP-ARM	*PLAY-XYLOPHONE
	TURN-OFF-LIGHT	HURT
	SPANK	HUDDLE-UP
	GO-POTTY	2-BITE-ENDS
		CLAP-HANDS
		BYE-BYE
		STICK-OUT-TONGUE

Table 10. First Nominals Produced by Four Deaf Children,
age 1;0-1;9

()=frequency
=appear in
Nelson's
data
* =pairables

Produced by >one child

#*MILK (4)
#*HAT (4)
*BABY (4)
APPLE(4)
DOG (4)
BIRD (4)
CAT (3)
HORSE(3)
SHOES(3)
RABBIT(3)
HOME (3)
BOY (3)
#*CAR (2)
#*CHAIR(2)
#*MELON(2)
CANDY(2)
WATER(2)
COW (2)
CUP (2)
LIGHT(2)
ELEPHANT(2)

Produced by one child

#COOKIE	*ICE-CREAM
#BANANA	*BARRETTE
#DUCK	*DRESS
#PIG	*BALLOON
#DOLL	*BOOK
#BALL	*BED
#MOON	*WINDOW
#HOUSE	CEREAL
#*BOAT	PIE
#*AIRPLANE	SNAIL
HELICOPTER	DEER
TABLE	KANGAROO
TIME	FISH
JAIL	ALLIGATOR
MOUTH	GIRAFFE
NECK	FROG
CLOWN	BUG
GIRL	WOODPECKER
MAN	LARGE-ANIMAL
PEOPLE	
# FLOWER	
# TREE	

The overall proportion of nominals produced by the deaf children did not differ considerably from reports on the first 50 words appearing in English-speaking children: in Nelson's data, 65% of the early words produced by 18 subjects were nominals; in Benedict's study, 61% of her eight subjects' early words were nominals. In the four deaf children studied here, 59% of the early signs were nominals.

Nominals

The early use of nominals does not seem to differ much across languages. Tanouye (1979:54) reported that the substantive forms produced by her Japanese subjects were semantically similar to those described by Bloom (1973) and Nelson (1973) for English-speaking children. These forms referred to specific people and objects or classes of objects. In addition, these forms usually referred to objects that showed salient properties of change. Tanouye did not indicate what proportions of the nominals appearing in her data are noun forms in Japanese. All of Nelson's (1973) reported nominals are nouns in English. Similarly, all but one of the nominals produced by the deaf children have noun status in ASL, and 45% of the early-appearing ASL nouns also occurred in Nelson's data. Moreover, virtually all of the nouns in the present data could be classified according to Nelson's semantic categories (e.g., food and drink, animals, clothing, toys, vehicles, etc.).

Action words

Early use of nominals is similar in all the studies discussed here. There are, however, some differences among the studies in early production of action words. In Nelson's data, 13% of early word production consisted of action words; in Benedict's data, 19% were action words. In my data on four deaf children, 26% of all early forms were action words.

It may be that the deaf children were talking about action with greater frequency than the hearing children, but this is

difficult to determine definitively, since the proportions per child are not reported in the previous studies. Some of the 26 hearing children may have produced proportions of action words which parallel the deaf children's production. On the other hand, if deaf children do, in fact, use action terms with greater frequency, this may be a function of modality, and the relative ease of representing action on the hands (see earlier discussions of Brown, 1978, 1980).

What is even more interesting than the comparisons of frequency of action words is the types of action words which were produced by Benedict's subjects and by the deaf children studied here. In Benedict's data, only 27% of the action words produced by the children are verbs in the adult language. Goldin-Meadow et al. (1976) reported that, in the early stage of English acquisition, none of their 12 subjects produced any verbs at all, In contrast, 94% of the action forms produced by Tanouye's two Japanese subjects are verbs in the adult language. In the four deaf children studied here, 86% of the early action signs are verbs in adult ASL. Thus, the relative ease of verb acquisition seems to be dependent upon the particular language children are learning.

General and specific verbs

The majority of action words in Benedict's (1979:192) data were classified as "social action games," which "elicit one and only one action response involving no more than one specific object...in a social-game relationship." This category included

forms such as bye bye, peek-a-boo, nite nite, whee, boom and a variety of animal sounds and vehicle noises (e.g., quack, woof woof, moo, rrm rrm, beep beep). The rest of the action words were classified as "general actions" (namely, get, see, go, read, out, sit, stop it, two, walk, eat) and "locatives" (get down and close).

Very few forms produced by the deaf children could be considered "social action games" (e.g., BYE- BYE, CLAP-HANDS) and only two of the general action words appearing in Benedict's data were also produced by the deaf children (i.e., EAT, SIT). Although several other general action words occurred (e.g., BREAK, CRY, WORK, PLAY), the deaf children produced a large number of specific action signs (e.g., EAT-ICE-CREAM, PUT-IN-BOWL, PUT-IN-MOUTH, CLOSE-EYES, WASH-FACE, BRUSH-HAIR, BRUSH-TEETH). In fact, 39% of all the action forms occurring in the ASL data could be characterized as specific action words. None of the action words in Benedict's data could be classified as such.

There are two language-specific issues here. First, the relative infrequency of general purpose verbs in ASL may encourage the early use of more specific verbs. Second, the way in which ASL verbs encode and incorporate information may facilitate their early acquisition.

In English, there are a large number of general verbs which can be used in relation to many objects and events. This broad applicability may facilitate early acquisition, but in early

single word utterances, very young English-speaking children tend to talk about actions in terms other than verbs (e.g., up, out). The most general verbs in English (put, get, go, do, make), and English verbs in general, occur rarely in single word utterances. Later in development, general verbs appear frequently, and are the most common verbs produced in multiword utterances (Bloom and Lahey, 1978:153). For these transitive verbs, English syntax requires individual specification of the verb and its arguments (i.e., one must do, make or get some thing).

In ASL, general verbs are relatively infrequent, and this may explain their rare appearance in the child data. Young children often use the type of verb sign that includes its arguments (e.g., BRUSH-HAIR, BRUSH-TEETH, DRINK-BOTTLE). The fact that object and action can be referred to in a single sign may account for the early and frequent appearance of specific action verbs in the single word utterances of deaf children.

Many of the early nominals and action words produced by the deaf children are part of the set of specific pairable verbs under investigation here. I have traced the development of these pairable forms, both nouns and verbs, in three deaf children, two of whom were also included in the preceding discussion. Since I hypothesized that maternal input would have an effect on the acquisition of related nouns and verbs in ASL, I first examined the mothers' signs, and how input to their children changed over time.

Maternal Input to Young Deaf Children

General Characteristics of Sign Motherese

In addressing children under two years of age, mothers accentuated their sign production in a variety of ways, especially via large sign size and extreme amounts of repetition. For any given sign appearing in the earliest tapes, movement might be repeated up to 12 times, regardless of the form class to which the sign belonged. In addition, the sign itself may have been repeated many times. The mothers' early input was highly redundant and very simple in structure, usually involving only one- or two-sign strings. The following examples are illustrative.

1a)

Mother to Corinne (age 9 mos.) whom she is feeding:

#158 MORE²⁺. WANT²⁺ MORE¹²⁺. MORE⁴⁺.
SAY MORE⁸⁺. SAY MORE⁴⁺. MILK¹⁰⁺. MILK⁹⁺.
MORE³⁺ FOOD⁴⁺. MORE³⁺ FOOD⁴⁺.

'More. Want more? More. Say more. Milk. Milk. More food. More food.'

b)

Mother to Sally (age 1;6) VT1

#541 POINT [to cracker on table] CRACKER²⁺.
EAT²⁺ POINT [to cracker] CRACKER²⁺ POINT
[to cracker]. EAT²⁺ CRACKER²⁺ POINT [to
table]. EAT¹¹⁺. EAT⁷⁺ POINT [to cracker].

'There's a cracker. Eat it. That's a cracker. Eat that cracker. Eat. Eat it.'

In the latter example, another very common feature of early

input appeared, that is, articulating a sign on the child's face or body. The last two productions of EAT[0; chin; approach to contact] were made with the handshape and movement contour of the adult sign, but the location of movement was on the child's chin instead of the mother's. These features of sign motherese --excessive movement repetition, extreme simplicity and redundancy, and signing on the child's face or body--were observed by Maestas y Moores (1980) in parental input to children under six months of age.

In my data, these features continued to appear in maternal input up to the time the children were almost two years of age. Furthermore, mothers often took the child's hands in their own to demonstrate sign production. For example, when Corinne was 1;0, her mother modified the sign THANK-YOU[B; chin; outward into neutral space] by holding Corinne's hands up to the baby's chin and guiding her hands into the appropriate movement shape. When Sally was 1;9, her mother held mother's and baby's hands on Sally's torso to produce the sign MONKEY[5-5; torso; upward grazing]; then the mother used her own hand to articulate MONKEY on Sally's torso.

In these instances, it seemed that the mother was primarily interested in the child's kinesthetic awareness of the location and movement shape of the sign. At other times, mothers were also concerned about the hand configuration for a particular sign, and they would mold the child's hand(s) into the appropriate handshape.

At 9 months of age, Corinne's hands were molded by the mother to produce the sign MORE. At 1;4, Kate's hands were molded for the signs FLOWER, TOOTHBRUSH, SOAP and BROOM. When Sally was 1;9, her mother tucked in all her fingers, leaving the index finger extended, and grazed it across Sally's nose several times, to form the sign MOUSE[G; nose; grazing]. These appeared to be techniques for teaching specific signs. The mothers often articulated a sign on their own bodies, then on the child's body (with their own and/or the child's hands); then they produced the sign on themselves again, apparently in an effort to demonstrate to the child the "feel" of a given sign as well as the appropriate "look" of that sign.

Mothers frequently articulated signs on the referent object, in order to make the association more clear. In using the pointing gesture, which is pervasive in ASL for deictic and pronominal reference, mothers often touched the referent person or object; this occurred approximately 40% of the time in the earliest input to Corinne (age 1;0) and to Sally (age 1;6).

Sally's mother exhibited an interesting input strategy in the earliest tapes (age 1;6 and 1;9). This mother consistently juxtaposed her own sign form with an approximation of Sally's "baby sign" forms. For instance, she produced the following utterances when Sally was 1;6 (the subscript notations represent the hand configuration for the preceding sign; the starred notation is the non-standard form).

2a)

Mother to Sally, age 1;6, VT1

#721 POINT [to picture] BEAR5+
 CHAIR2+[H-H].
 CHAIR6+[V-V].
 'That's the bear's chair. Chair.'

b)

#954 PLAY2+[Y-Y] OUTSIDE. PLAY[I-Y]
 PLAY[A-A] MORE[O-O]
 MORE[bobo].
 'Play outside. Play. Play more.
 More.'

In each case, the mother followed the adult sign movement and hand configuration with the baby sign and handshape, including the stiffer, less rhythmic movement of the baby signs. Sometimes, Sally's mother used only the baby sign forms, without any adult input forms.

Signs Addressed to Infants vs. Older Children

The sign motherese described here included infrequent use of fingerspelling to children between one and two years of age. Maestas y Moores (1980:4) reported that caretakers often used fingerspelling to the infants in her study, all of whom were under six months of age. In the present study, the youngest child was 9 months of age, and fingerspelling input was very rare. This finding seems to suggest a considerable difference in input to infants under and over six months of age.

It may be that a higher level of comprehension is assumed in a one-year old child who is at the brink of learning signs; a

mother would not, for example, expect a one-year old child to understand fingerspelled words. Input to infants below six months may be more complex, since comprehension is not expected. In her study of input to hearing children, Phillips (1973) found that speech addressed to eight-month old infants showed greater variability in utterance length, number of verbs per utterance and type-token ratio than speech addressed to children of 2;0. In my data, only one mother (Kate's) fingerspelled to her young child with any regularity, and this was generally part of a teaching strategy, also employed by the father in his appearance on one videotape. For example, when Kate was 1;3, her mother tried to teach the name for 'ball'. First, she produced the citation form sign, BALL, then she pointed to the ball itself and fingerspelled B-A-L-L. In a similar sequence, the father was showing Kate (age 1;1) a picture of Mickey Mouse; first he fingerspelled M-I-C-K-E-Y and signed MOUSE. Then he produced the conventionalized sign for MICKEY-MOUSE. The father seemed to be using all linguistic means at his disposal for teaching purposes.

One mother clearly avoided fingerspelling to her younger child (Corinne, 0;9), but she did fingerspell to her older child (Jane, 3;1) within the same conversation. In offering the two children watermelon, the mother signed MELON several times for Jane to imitate, then she further described the melon by signing ALOT S-E-E-D-S, SEEDS. She turned to Corinne and merely asked WANT MORE?

In general, there were noticeable differences in the

mother's early sign to Corinne and to Jane, who is almost 2 1/2 years older. The length and complexity of the mother's input to her 3-year old child was much more advanced than to her one-year old child, and it reflected the same kinds of differences that mothers exhibited over time as the young child developed. Later in this chapter, I address these differences in my discussion of maternal production of related nouns and verbs.

It was interesting to note that the same kinds of modifications that appeared in mothers' signs to young children also showed up in Jane's signing to her younger sister, Corinne. When Jane was 3;4, her conversational signing was rather complex in structure, and she frequently inflected basic sign stems. However, her input to Corinne, age 1;0, was very simple and uninflected, generally consisting of no more than one or two signs per utterance.

Furthermore, Jane employed the identical teaching and demonstration strategies observed in sign motherese. For example, when mother and Corinne were looking at a picture of a dog, the mother articulated the sign DOG[B; thigh; approach to contact]; first she produced the movement on the picture and then she used the appropriate location on her own body. Immediately after this, Jane demonstrated the sign DOG, modifying production for her younger sister. She took Corinne's hand and made the sign motion on Corinne's body nine times, then she moved Corinne's hand to articulate the sign on Jane's body. A few moments later, when their mother picked up a toy duck and began

to sign DUCK[3; chin; closing], Jane produced the sign on Corinne's face, then on her own.

Two months later (Corinne, 1;2; Jane, 3;6), Jane signed CRY[G-G; cheeks; downward grazing] in citation form; then she changed the sign location to Corinne's face, and followed this sign with the personal pronoun point for YOU. Instead of merely pointing in the direction of her sister, Jane touched Corinne's chest. Jane also signed very simply and explicitly when telling Corinne, moments later, not to touch the videotape recorder:

3)

Jane VT4 Pt.4 #353-370
Jane (3;6) to Corinne (1;2):

NO TOUCH (signed on videotape recorder).
TOUCH N-o[I:to Corinne]. TOUCH
FINISH TOUCH. HERS [I:to experimenter
offscreen]. TOUCH (signed on
videotape recorder) DON'T. NOT
YOURS[I:to Corinne].
'Don't touch that. Don't touch. Stop
touching. It's hers. Don't touch
it. Not yours.'

The input features discussed thus far seem to represent efforts to increase the clarity of sign production for young children. But the predictions I made earlier relate to how mothers might make use of the inherent iconicity of signs in order to facilitate learning.

Iconicity in Maternal Input

Enhancing the image

There were a number of instances in which mothers clearly related a sign form to its referent. There were image

elaborations of signs for animal names, e.g., DUCK, BIRD, SNAIL, BULL. For example, when Kate was 1;0, her mother presented a duck hand puppet, opening and closing its mouth repeatedly. She continued doing this with one hand, and with her other hand, she articulated the sign DUCK[3; chin; closing]. The image base for this sign is the opening and closing of a duck's bill. In order to relate the sign form to the image base, the mother placed her signing hand next to the moving puppet mouth, showing the similarity between the two. Then she moved her signing hand back from the neutral signing space and produced the sign DUCK in citation form, while she simultaneously opened and closed the duck-puppet's mouth.

Corinne's mother also enhanced the image base of the sign for 'duck', when Corinne was 1;0. The mother picked up a toy duck and signed DUCK⁸⁺ POINT[to toy]. Then, as her hand continued its opening and closing action, she moved it from her mouth to "bite" on Corinne's foot, arm and chest, thus elaborating and extending the image of the duck's bill. This sequence was followed by Jane's signing DUCK to Corinne, as described above. Then the mother extended the sign image further. She maintained the citation form location and movement, while her head and body leaned forward so she could "bite" Corinne's arm.

Other animal signs were also mimetically extended. When Kate was 1;5, her mother signed BIRD[L; chin; closing]; this sign also has the beak as its image base. The mother articulated the

sign at its proper location, while at the same time moving her head in a rapid, "bird-like" fashion. Then, maintaining citation form location, the mother leaned her body forward and "pecked" at Kate's nose with the moving hand which represented the bird's beak.

Sally's mother described a sign for 'snail' which was created by her family: SNAIL[G; non-dominant forearm; upward along arm with finger bend]. When Sally was 1;6, her mother demonstrated this sign in relation to a toy snail. After articulating the sign, she indexed the toy, touching it directly, and then related the sign form directly to its image base: she made the toy "crawl" up Sally's arm in the precise path of the sign movement. Sally followed by producing the sign SNAIL, with exaggerated movement of the G-hand, extending from wrist to shoulder.

In a later tape, when Sally was 1;10, her mother enhanced the image base of the sign COW[Y; forehead; downward wrist bend]. In order to convey the meaning of 'a bull', the mother elaborated the image of the animal's horns; she used two Y-hands instead of one, and at the same time, she mimed, with her entire body, the action of moving forward, and "charging" toward Sally, with the handshapes representing the "horns" moving into Sally's stomach.

The previous examples illustrate image elaboration of noun signs, but non-noun signs (e.g., DRIVE, GO-TO-BED, DRINK, TIRED) were also extended in this fashion. For example, the sign DRIVE[S-S; neutral space; alternating up-down bidirectional] has

as its image base the turning of the steering wheel. To enhance this image, the sign was produced with rhythmic torso and head movements accompanying the movement of the hands. GO-TO-BED[B; cheek; approach to contact] was often produced with two hands to the cheek rather than one, and mothers added a marked head tilt and closed eyes. In producing the sign DRINK[C; mouth; backward wrist-twist], the image of tilting a cup backward toward the mouth was extended by adding a large backward head-tilt.

In a sign such as TIRED[B-B; torso; downward bend] the image base is much less obvious today than it was historically (Frishberg, 1975, 1979). One mother made the image of a heaving chest more transparent by accompanying the hand movement with a marked rise and fall of her entire torso (mother to Sally, 1;9, VT3 #880). GIVE[$\hat{O}$; neutral space; toward recipient] is a sign that requires inflection for person marking in the adult language, with the movement indexed toward the agent and/or recipient of the action. When Corinne was 1;0, her mother was discussing Jane's imminent arrival with paper and pencil for Corinne; she intended to sign 'Jane will give you', in which the verb sign should have taken the form of GIVE[I:3 to 2]. Instead, the mother made the sign move directly into Corinne's open palm; this is not a verb agreement option in the adult language.¹

Submerging the image

The preceding evidence supports the notion that mothers sometimes highlight the iconicity of early signs to young

children; the types of image elaboration described here occurred in 8% of all sign tokens addressed to Corinne and Sally before age 2;0. Within the set of pairable nouns and verbs, 15% of pairable sign tokens were mimetically extended by Corinne's mother and 26% by Sally's mother before the children were two years of age. The image base of most signs was not exploited in this fashion. The extreme enlargement of sign movement, which was a very common feature of motherese, often submerged the image base of the sign. Some signs were even produced in what may be considered counter-iconic ways. This occurred in 1% of all sign tokens and in 10% of all noun-verb pairables addressed to Corinne and Sally before age 2;0.

For example, for the sign BABY[B-B; neutral space; bidirectional side-to-side] the movement was often enlarged and exaggerated to highlight the image of rocking a baby. However, there were also instances (e.g., to Sally, 1;6) where only one hand was used in sign production, and the sign location was not neutral space, but with the hand flush against the chest; in these productions of the sign, the iconic relationship to the referent action was rather opaque.

Most of the time that Sally's mother imitated the phonological simplifications of Sally's baby sign, the potential iconicity of those signs decreased. This occurred when Sally was 1;6. Instead of producing the adult citation form of the sign CAR[S-S;neutral space; alternating up-down bidirectional] the mother copied the baby sign movement her daughter used; that is,

she produced a simultaneous downward movement of the two S-hands, which submerged the image base of turning a steering wheel. At the same time, the mother seemed to focus more on the morphology than the phonology or iconicity of the sign form; although the movement differed from citation form, the canonical morphological features were preserved: the restrained, small repeated movement was appropriate for a noun such as CAR[N: restr,sm,rep].

Some of the iconic potential of the sign BOAT[B-B; neutral space; downward] was partly submerged by the same mother in signing to Sally at age 1;9. The mother pointed to a picture of a boat, then signed BOAT with her two B-hands together, palms touching, making large circles in neutral space, without any forward movement in space. The circular movement seems to be based on the image of a boat sailing over the waves, and that is the movement shape that often appears in the related verb, GO-BY-BOAT. However, the canonical verb sign also moves forward in space, so the static position of the mother's sign is less iconic in that sense. Moreover, the hand configuration for the noun BOAT is two cupped B-hands, touching only along the ulnar border; this is an example of substitutive depiction. In modifying her hand configuration, the mother eliminated the shape iconicity from the sign form.

The last several examples involve mothers' production of the type of pairable forms under investigation here. The next section focuses more directly on these related nouns and verbs, and how mothers' production changes over time.

Mothers' Production of Related Nouns and Verbs

There are two questions of interest in relation to mothers' production of pairable nouns and verbs: do the mothers seem to highlight the iconicity of pairable items, and do they also clarify and specify the formal distinctions between paired nouns and verbs?

Mimetic characteristics

I first examined all pairable verbs produced by the mothers over time, and classified each according to its mimetic representation. My four-way categorization of pairable verbs, outlined in Chapter II, is summarized below.

Highly Mimetic: signs which directly imitate the actual movement of the hands.

Partly Mimetic: signs which portray the movement of the object non-mimetically and portray some of the action of the agent mimetically.

Translucent: signs which are much less directly mimetic, and whose relationship to the referent can be determined if the meaning of the sign is provided.

Opaque: signs which are non-mimetic and arbitrary.

Table 11 presents the proportion of each mimetic category of pairable verb signs which was directed to Corinne and Sally over time.

Table 11. Mothers' Production of Pairable Verbs over Time:
Mimetic Categorization

	<u>Mother to Corinne</u>					<u>Mother to Sally</u>				
	Mimetic category:									
	<u>N</u>	<u>HM</u>	<u>PM</u>	<u>T</u>	<u>O</u>	<u>N</u>	<u>HM</u>	<u>PM</u>	<u>T</u>	<u>O</u>
	(types)					(types)				
Age										
1;0	2	1.00	.00	.00	.00	*	---	---	---	---
1;6	2	1.00	.00	.00	.00	4	.75	---	.25	---
2;0	14	.64	.07	.29	.00	7	.86	.00	.14	.00
2;6	10	.50	.10	.30	.10	9	.67	.11	.11	.11
3;0	17	.47	.13	.13	.27	7	.43	.14	.43	.00
3;3	9	.33	.11	.22	.33	*	---	---	---	---
4;0	23	.22	.30	.30	.17	9	.44	.11	.33	.11

* No data available at this time period.

HM=Highly Mimetic
PM=Partly Mimetic
T =Translucent
O =Opaque

It is clear that, at the early stages of the children's development--below 2;0--a large proportion of the mothers' pairable verb signs was highly mimetic. After the children reached two years of age, the mothers began to include increasing numbers of translucent and opaque signs. Among the opaque signs used by the mothers are abstract verbs such as TELL-STORY, EXPLAIN, SIGN, INTERVIEW. Abstract forms also appeared in noun production (e.g., STORE, STORY, NAME, IMAGINATION, VACATION).

In examining the mothers' pairable noun signs in terms of my two-way mimetic classification, I found much less consistency in the data. At any given time period, the two mothers differed

considerably in their use of noun forms including substitutive depiction or shape iconicity (i.e., the shape of the image base is represented in the handshape of the sign). The proportion of these signs rarely exceeded .33 at any time in either mother, and when they did, there was no similarity in the ages of the children to whom they were addressed. When Sally was 2;6, her mother produced pairable nouns based on substitutive depiction 44% of the time. The highest proportion of these signs appearing in the data on Corinne's mother (.35) occurred at a much later time period, when Corinne was 4;0.

Thus, the mothers did not tend to focus their early input on noun signs that may be more salient in terms of shape iconicity. They did, however, increase the size of the signs and exaggerate the actions represented by the noun signs. This exaggeration may have had a direct affect on the canonical form of the signs, as I describe below.

Mothers' canonical production of related nouns and verbs

Contrary to my prediction, mothers did not produce static, non-moving noun signs in juxtaposition to their static referents. Their teaching strategies seemed more similar to those of hearing mothers, such as repeated pointing to an object and/or a picture, followed by production of the appropriate sign. As suggested previously, mothers sometimes extended the movement of noun or verb signs in an apparent effort to highlight the image base of the action, particularly by adding head and body movements to the movement of the hands. This occurred approximately 20% of the

time in the earliest tapes (up to 2;0).

Of particular interest was how the movement exaggerations and extensions that characterized sign motherese affected the canonical production of noun and verb forms. Figures 12 and 13 show the proportion of all tokens produced by the mothers in canonical form, as the child's age increased. In both mothers, there is a progressive increase in the canonical marking of noun and verb forms. The trends in this developmental progression are also similar in the two graphs. First, canonical marking of verbs is always proportionately higher than canonical marking of nouns. Second, both nouns and verbs are rarely marked canonically in the early data. When the child is less than two years old, the mothers are rarely using canonical form, but there is a considerable increase in canonical marking from 1;6 to 2;0. When the children reach approximately three years of age, the mothers' production of canonical forms increases again, although proportions never rise above 75%.

To determine how mothers specifically marked the distinctions between related nouns and verbs, I combined the pairs produced by the two mothers to the three children and grouped the data into four age ranges. Figure 14 represents the proportions of all pairs which could be accounted for by the four categorizations I used in analyzing the experimental data: no distinction, non-canonical distinction, partial distinction, full distinction (see Chapter IV for descriptions of these categories).

Figure 12. MATERNAL INPUT TO CORINNE:
CANONICAL PRODUCTION OF PAIRABLE NOUNS AND VERBS
ACROSS TIME

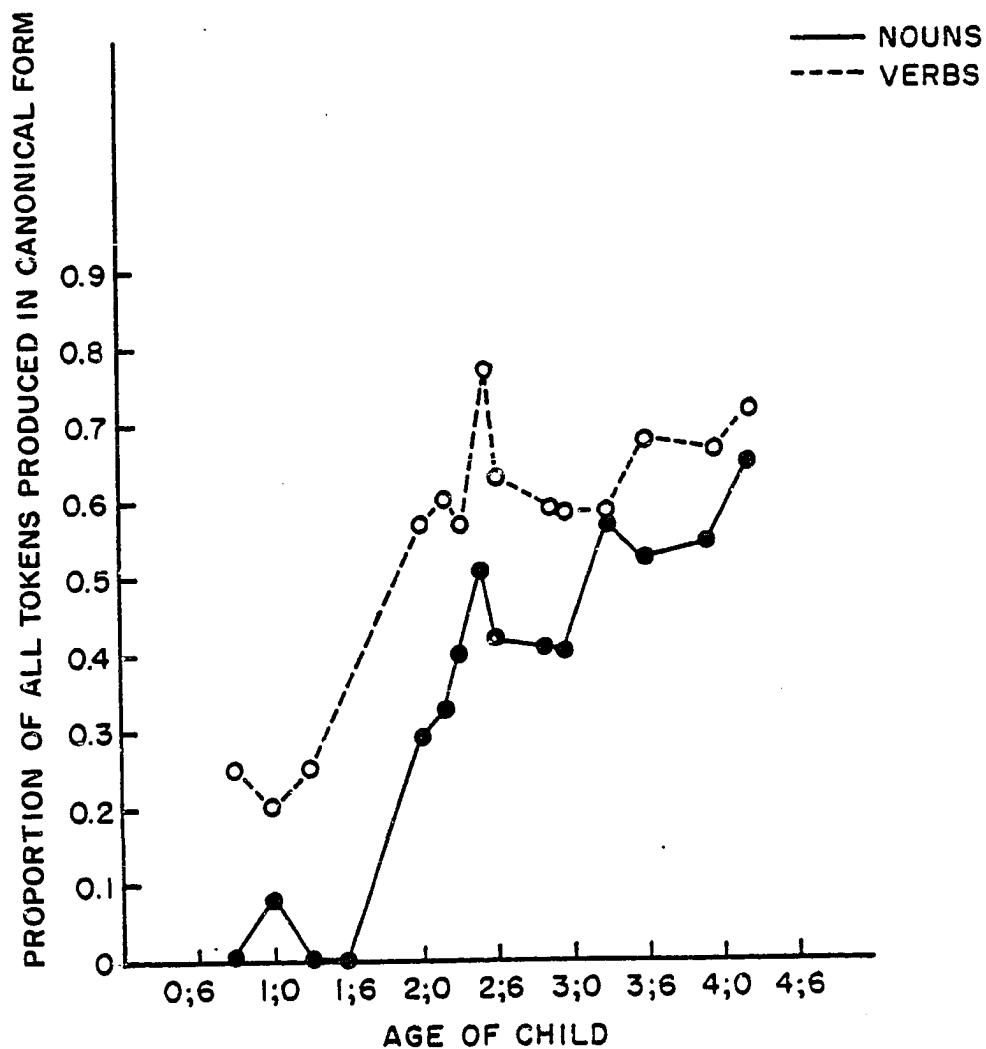


Figure 13. MATERNAL INPUT TO SALLY:
CANONICAL PRODUCTION OF PAIRABLE NOUNS AND VERBS
ACROSS TIME

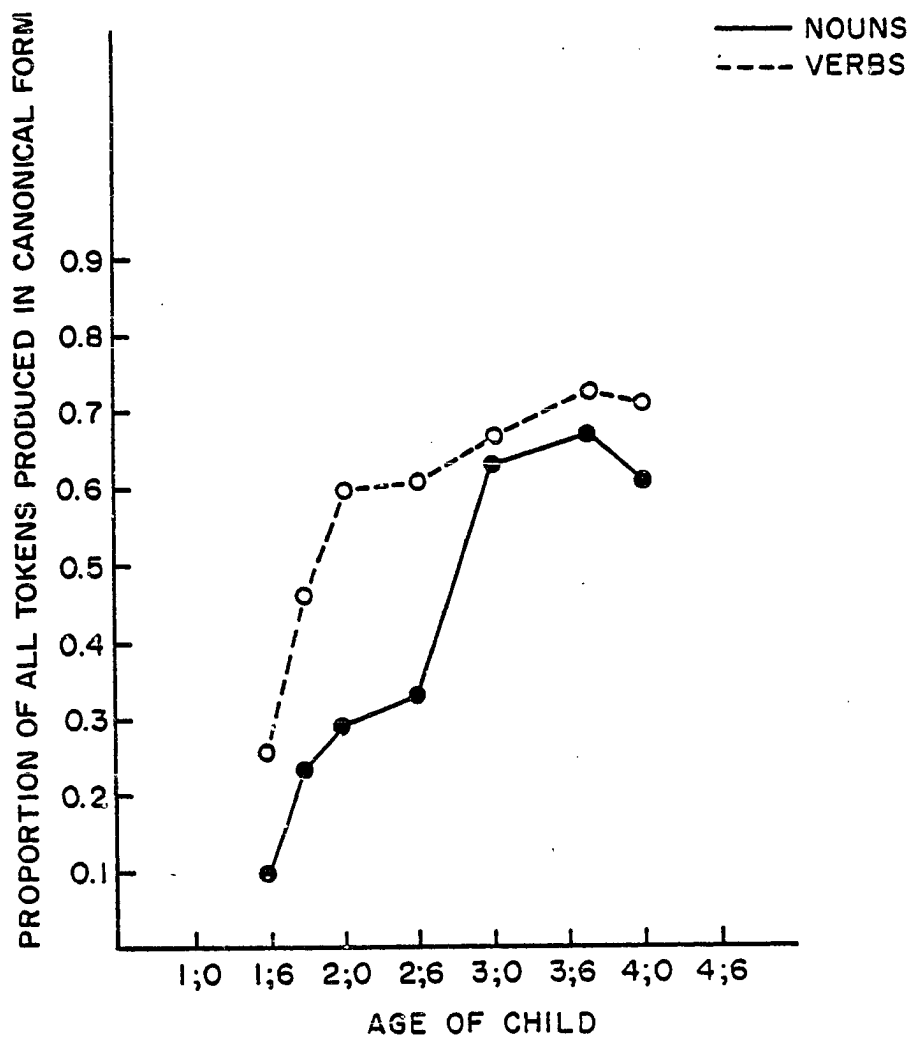
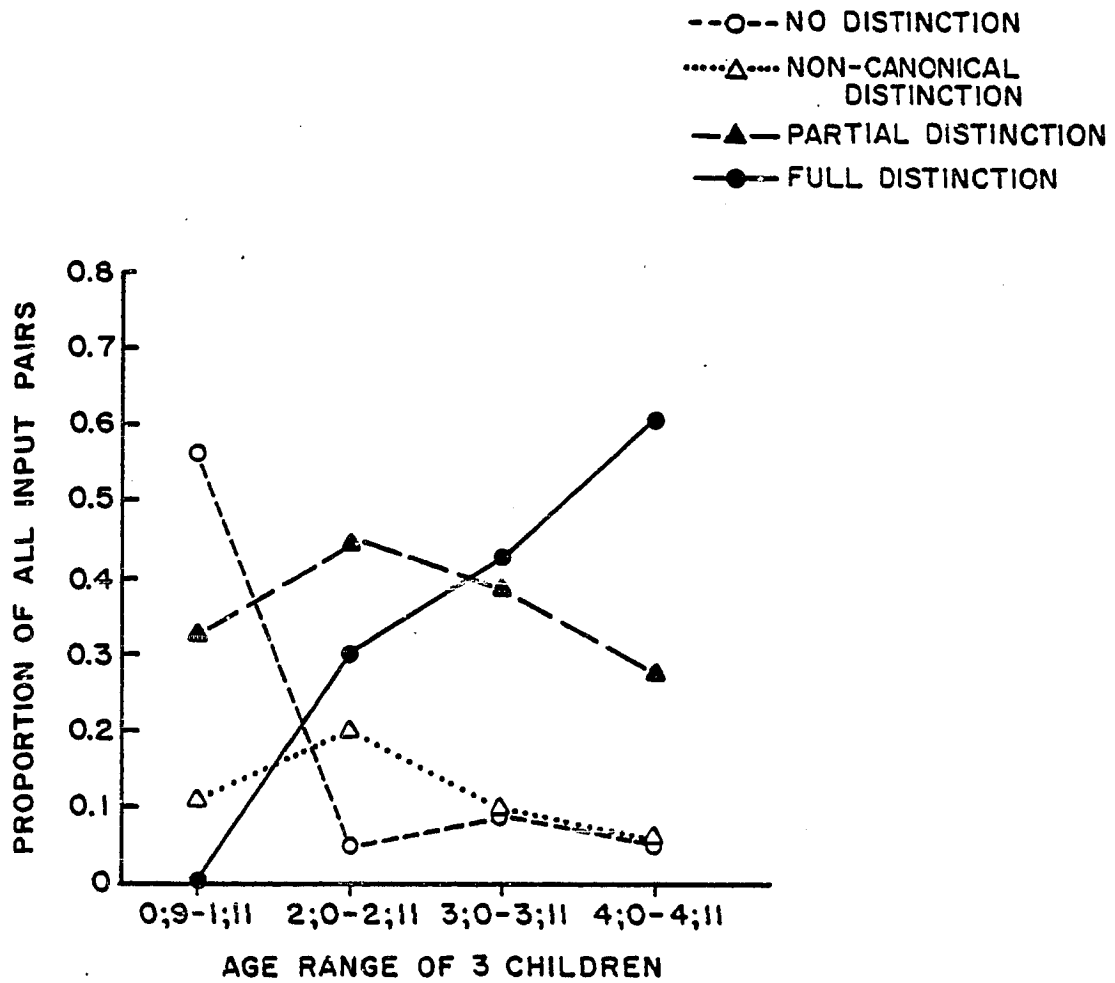


Figure 14. TWO MOTHERS' INPUT ACROSS TIME:
MARKING OF NOUN-VERB DISTINCTIONS



From this graph, it is clear that, before their children are two years old, mothers very often produce related nouns and verbs which are not distinguished in any way. At the same period, there are no pairs marked by full canonical distinction. During the next year, these trends reverse, so that, by the time the children are three years old, the mothers are producing full or partial distinctions most of the time.

The input to the older children compares favorably with the adult responses on the elicitation tasks, although the proportion of full distinctions was higher in the elicited data (approximately 70% on test responses, as compared with 52% in spontaneous input). Recall that, in the elicitation data, many of the non-canonical forms produced by adults could be explained by the application of optional rules in the adult language; these options allow for deletion of repetition in nouns and decreased redundancy in the signal, as well as alternate or additional markers on verbs (e.g., head and body movements and adverbial facial expressions might mark a given sign as a verb). The use of optional rules was also evident in the spontaneous production of the mothers, particularly at the later stages of the children's development (age 4;0 to 4;11).

In order to ascertain what percentage of the mothers' non-canonical productions would be acceptable in adult discourse, I went back to the first and last tapes of Corinne and Sally. A deaf adult (a fluent signer) looked at every noun and verb produced by the mothers, and made a judgment as to the

acceptability of its form in context. Table 12 presents the results of these acceptability judgments as compared to the proportions of noun and verb tokens produced in canonical form. The proportion of sign tokens considered to be "acceptable" reflects the addition of contextually-appropriate non-canonical forms to those forms produced canonically, i.e., $\text{Acceptable} = \text{Canonical} + \text{Non-canonical} / \text{Acceptable}$.

Table 12. Pairable Nouns and Verbs in Maternal Input: Proportion of Forms Produced Canonically and Forms that are Judged to be Acceptable in Context

V E R B S				N O U N S			
Mother to Corinne							
		N (tokens)				N (tokens)	
		<u>C</u>	<u>A</u>			<u>C</u>	<u>A</u>
at 1;0	(10)	.13	.40	(5)	.08	.40	
at 4;2	(18)	.72	.94	(17)	.65	.94	
Mother to Sally							
at 1;6	(16)	.26	.53	(22)	.10	.27	
at 4;0	(35)	.71	.94	(24)	.52	.96	

C=Canonical
A=Acceptable
(Canonical + Contextually
Appropriate Non-canonical)

It is obvious that, despite the fact that the non-canonical forms of nouns and verbs are produced by mothers when their children are four years of age, these forms are highly acceptable in adult discourse. But what of the very low proportions of

acceptability in the early stages of development? What exactly are mothers doing in their apparent early input to young children that renders their sign forms unacceptable to an adult signer?

Again, I consulted native signers for their judgments and comments. What I found was quite surprising: in their apparent efforts to exaggerate sign forms and make them more salient to young children, mothers are stripping away the morphological marking that differentiates nouns and verbs. The mothers are actually producing ungrammatical forms.

Obliterating morphological distinctions

In their input to children under two years of age, mothers often repeated the movement within a sign up to 12 times. It is rare in the adult language to have more than two or three movement iterations within a given sign, even under inflection. But more than that, deaf adults found the mothers' early signs to be "unnatural", and evidence of "breaking rules." Nouns and verbs often became indistinguishable.

In nouns paired with repeated verbs, mothers often retained repetition of the noun, but when the sign was enlarged, it also became continuous in manner. That is, when mothers increased the size of noun signs, they did not honor the featural distinctions that mark the signs as nouns; the morphological form did not include the noun morpheme marking. At times, facial expressions or head/body movements normally reserved for verbs were superimposed on nouns (e.g., BED, ICE-CREAM). Sometimes, with

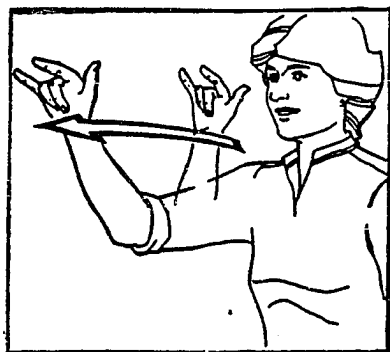
repetition of movement, verb signs became smaller and more tense, and the form resembled a noun (e.g., BATHE, WRITE, SIT).

Even more interesting, mothers often distorted the rhythm of a sign so that the movement of a unidirectional sign became primary in both directions, thus making it appear bidirectional (as in EAT). The slow production of markedly enlarged signs frequently contributed to stiff rather than smooth articulation. Furthermore, enlargement often changed the primary source of movement from one joint or muscle group to the next adjacent one, resulting in gross movements rather than fine movements.

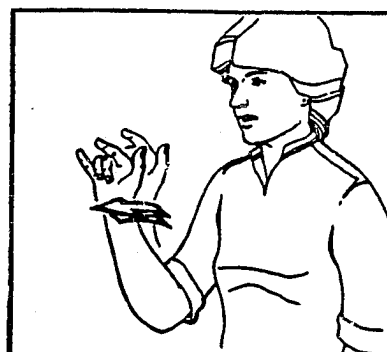
Since it seemed that exaggeration may have contributed to the obliteration of morphological marking, particularly in nouns, I examined sign forms appearing in other contexts which require exaggerated and/or enlarged movement, namely, sign "shouting" and theatrical stage sign. I asked a fluent signer with theatre experience to produce the same sign, AIRPLANE_[y]; neutral space at shoulder level; forward-back bidirectional], in citation form and as if she were in three different situations: signing to someone across a large room, signing on stage in a theatrical production, and signing to a young child (see Figure 15a-e, which also includes the canonical form of FLY, for comparison).

Each of the four noun forms was different, and each was different from the verb (Figure 15a). In the canonical form of AIRPLANE_[N:restr,sm,rep] movement was restrained, small and repeated (see Figure 15b). In sign "shouting", the place of articulation was raised to forehead level; as Figure 15c shows,

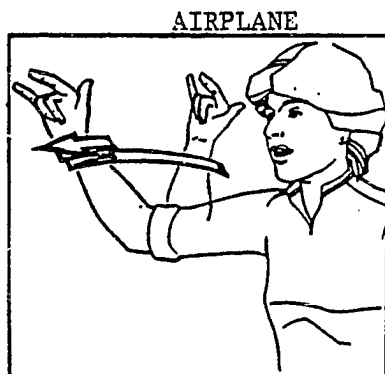
FIGURE 15. Three Contexts for Exaggerated Sign Production



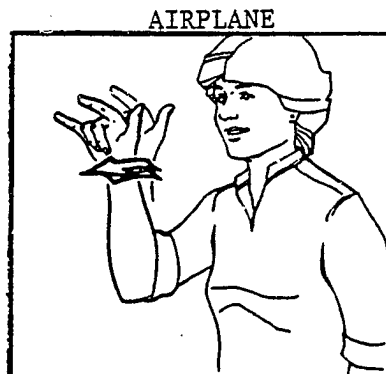
a. FLY (citation form)



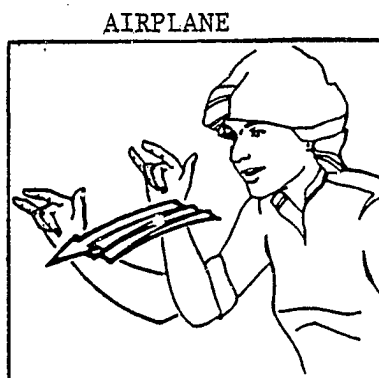
b. AIRPLANE (citation form)



c. "Shouting"



d. Theatrical Sign



e. Sign Motherese

the initial movement excursion was enlarged, but then the hand recoiled, with small, tense repetition. The location for stage sign was also raised to forehead level, apparently for increased clarity and visibility. But the sign movement was only slightly larger than citation form, and exhibited very obvious restrained manner (see figure 15d). Thus, the stage and shouting versions retained noun morpheme marking. But the movement for motherese was very different from all the others (see Figure 15e). Although the place of articulation was similar to that for citation form, the movement excursion was very long and continuous, definitive, but not at all tense or restrained, i.e., AIRPLANE[*N:cont,lg,rep].

These examples demonstrate that it is certainly possible to exaggerate and enlarge a noun sign while retaining the morphological features of a noun. But that clearly is not what occurs in sign motherese. The mother strips away the reduced size and the restrained manner, in her apparent efforts to make the sign more salient to her young child. Perhaps she intuitively feels that the young child cannot perceive the subtle manner distinction, and only later in the child's development does the mother include the complete morphological marking of nouns.

It seems as if, in their early input, mothers may be focusing on a kind of root form, that is, the handshape, location and basic movement shape of the sign. Movement may be repeated, but without regard to the layer of movement distinctions that

mark morphology in ASL. Repetition is used for many different morphological distinctions in the adult language, and it has a variety of forms. It appears that, early on, mothers repeat the movement within sign forms, but they do not use this repetition for making morphological distinctions.

The striking difference between the form of very early input (before age 2;0) and later input was evident in one mother's signs to her two daughters at the same point in time. The following sequence occurred when Corinne was 1;2 and Jane was 3;6:

4)

JANE VT4 Pt.4 #320

Mother (to Jane, offscreen):

PLEASE YOU GET HER[I:to Corinne]

BOOK2+.

'Please get her book.'

(to Corinne, showing the book Jane has brought)

BOOK3+ POINT[to book]. POINT[touching book] BOOK2+.

'This is a book. This is a book.'

The sign BOOK[N:restr,sm,rep] was addressed to Jane in canonical form with respect to the morphological features for marking nouns: it was tense, small and repeated. The same sign, BOOK[*N:cont,lg,rep] was produced for Corinne with three large, continuous movements of both hands; in the second production to Corinne, movement was repeated twice, and was slightly smaller, but there was no evidence of tension or restrained manner.

Jane and Corinne rarely appeared on a videotape together, but their separate conversations with their mother were sometimes videotaped on the same day. When Corinne was 9 months old, her mother produced the sign FOOD[*N:cont,lg,rep] with four large, continuous movement repetitions. The same sign FOOD[N:restr,sm,rep], addressed to Jane, age 3;1, had two small, tense movements. On the same day, the mother produced the sign EAT several times; to Corinne, sign movement was large, continuous and uninflected; the verb was frequently inflected in input to Jane. When Corinne was 2;0 and Jane was 4;4, the mother produced a number of signs differently, depending upon which child she was addressing. For instance, the signs BOCK, CLOTHES and DRYER were addressed to Jane in canonical form, and a larger, exaggerated, non-tense form was presented to Corinne (e.g., CLOTHES[N:restr,sm,rep] to Jane and CLOTHES[*N:hold,lg,rep] to Corinne).

A similar occurrence appeared in the early input to Kate (age 1;3). The mother signed CAR[*N:cont,lg,rep] twice in succession, once with five movement repetitions, once with three. Both times, the movement was large, stiff and jerky. Immediately after receiving this input, Kate signed CAR5+; the mother turned to her husband and signed SUCCESS! CAR2+[N:restr,sm,rep] 'Finally! Car!' The noun addressed to the adult was very different from that addressed to the child: the adult-to-adult sign was produced with one hand, and with full morphological marking.

In all these instances of input to a child under 2;0, the

mother was not honoring the featural distinctions that mark nouns in ASL. It is clear that these mothers varied their noun and verb production markedly over time as a function of the age of the child. Early forms seem to be more mimetic, and mothers sometimes highlight the image base of sign forms. Sign movement is usually enlarged and extended. In the exaggeration of signs addressed to infants, the morphological distinctions between noun and verb are often completely obliterated. How does this affect the child's early productions, and what seems to motivate the child's early acquisition: semantics, iconicity, input or morphology?

The Acquisition of Related Nouns and Verbs in Three Deaf Children

Semantic and Mimetic Predictions

Using the earliest data available (i.e., on Corinne and Sally), I examined all attempts at production of pairable nouns and verbs. First, I traced the development of nouns and verbs in terms of the semantic and mimetic categorizations I proposed in Chapter II. Recall that, in the study by Bloom et al. (1975) two of the subjects acquired semantic-syntactic relations in the following order: non-locative, then locative, with later acquisition of instrumental relations in all subjects. I predicted that the pairable verbs encoding these relations would be acquired in that sequence, and verbs representing non-concrete or abstract relations would appear after these. My expectation

for acquisition of pairable nouns was based on the observations of Nelson (1973); I predicted that forms referring to concrete, manipulable, movable objects would appear before those that refer to non-manipulable or abstract items.

My mimetic categorizations for verbs led me to predict the following order of acquisition for pairable verbs: highly mimetic, partly mimetic, translucent, opaque. For pairable nouns, I predicted that forms representing substitutive depiction (i.e., nouns which exhibit shape iconicity) would appear before those that bear a mimetic reference only to the related action, and these would appear before forms that are opaque in relation to their referents.

Table 13 shows, for each sample, the proportion of all verb types which were judged to belong in each of the semantic and mimetic categories. Table 14 shows the same proportions and categorizations of all noun types produced over time.

Table 13. Development of Pairable Verbs in Two Deaf Children:
Semantic and Mimetic Categorizations

SEMANTIC

NL=Non-Locative

LA=Locative Action

IN=Instrumental

AB=Abstract

Age	CORINNE					SALLY				
	<u>N</u> (types)	<u>NL</u>	<u>LA</u>	<u>IN</u>	<u>AB</u>	<u>N</u> (types)	<u>NL</u>	<u>LA</u>	<u>IN</u>	<u>AB</u>
1;6	3	1.00	.00	.00	.00	2	1.00	.00	.00	.00
2;0	7	.86	.14	.00	.00	2	1.00	.00	.00	.00
2;3	6	.17	.33	.17	.33	4	.25	.50	.25	.00
2;6	10	.40	.40	.10	.10	5	.60	.00	.40	.00
3;0*	13	.38	.38	.15	.08	8	.25	.38	.38	.00
3;3	5	.40	.60	.00	.00	5	.80	.20	.00	.00
3;6*	9	.33	.44	.22	.00	15	.40	.27	.27	.07
4;0*	12	.25	.25	.42	.08	13	.38	.23	.31	.08
4;3*	9	.11	.44	.11	.33	18	.44	.17	.28	.11

MIMETIC

HM=Highly mimetic

PM=Partly mimetic

T =Translucent

O =Opaque

Age										
	<u>N</u> (types)	<u>HM</u>	<u>PM</u>	<u>T</u>	<u>O</u>	<u>N</u> (types)	<u>HM</u>	<u>PM</u>	<u>T</u>	<u>O</u>
1;6	3	1.00	.00	.00	.00	2	1.00	.00	.00	.00
2;0	7	.86	.00	.14	.00	2	1.00	.00	.00	.00
2;3	6	.33	.17	.33	.17	4	.25	.25	.50	.00
2;6	10	.40	.20	.40	.00	5	.60	.40	.00	.00
3;0*	13	.62	.15	.15	.08	8	.50	.25	.25	.00
3;3	5	.60	.00	.40	.00	5	.80	.20	.00	.00
3;6*	9	.44	.11	.44	.00	15	.47	.20	.27	.07
4;0*	12	.33	.25	.33	.08	13	.46	.12	.29	.06
4;2*	9	.22	.11	.33	.33	18	.54	.17	.28	.06

*Ages have been rounded off for three month intervals;
each child was at, or within one month of, the ages starred.

Table 14. Development of Pairable Nouns in Two Deaf Children:
Semantic and Mimetic Categorizations

SEMANTIC

M =Manipulable
NM=Non-manipulable
AB=Abstract

Age	CORINNE				SALLY			
	<u>N</u> (types)	<u>M</u>	<u>NM</u>	<u>AB</u>	<u>N</u> (types)	<u>M</u>	<u>NM</u>	<u>AB</u>
1;6	4	.75	.25	.00	6	.83	.17	.00
2;0	4	.75	.25	.00	0	---	---	---
2;3	4	.25	.50	.25	6	.83	.17	.00
2;6	9	.44	.44	.11	2	1.00	.00	.00
3;0*	12	.50	.33	.17	10	.60	.40	.00
3;3	9	.44	.33	.22	6	.33	.50	.17
3;6*	10	.40	.50	.10	8	.38	.63	.00
4;0*	11	.55	.27	.18	15	.33	.53	.13
4;3*	10	.20	.60	.20	14	.57	.36	.07

MIMETIC

SD=Substitutive
Depiction
NS=Non-Substitutive
Depiction
OP=Opaque

Age	<u>N</u> (types)	<u>SD</u>	<u>NS</u>	<u>OP</u>	<u>N</u> (types)	<u>SD</u>	<u>NS</u>	<u>OP</u>
1;6	4	.25	.75	.00	6	.17	.83	.00
2;0	4	.00	1.00	.00	0	---	---	---
2;3	4	.00	.75	.25	6	.17	.83	.00
2;6	9	.22	.78	.00	2	.00	1.00	.00
3;0*	12	.25	.67	.08	10	.30	.70	.00
3;3	9	.33	.33	.33	6	.33	.50	.17
3;6*	10	.30	.60	.10	8	.38	.63	.00
4;0*	11	.27	.55	.18	15	.40	.40	.20
4;3*	10	.10	.70	.20	14	.21	.71	.07

*Ages have been rounded off for three month intervals;
each child was at, or within one month of, the ages starred.

In terms of the acquisition of pairable verbs (see Table 13), both the semantic and mimetic predictions are supported by the very early data, that is, up to age 2;0. The same is true of the predictions for noun acquisition in terms of semantic motivation, but not for the predictions based on the iconicity of nouns. These predictions apply to the acquisition of the lexicon, prior to the child's entry into the morphological system for marking related nouns and verbs. As my later discussion shows, at the time that children begin to mark consistently the morphological distinctions between related nouns and verbs (age 3;0 to 4;0), many of their signs are non-iconic, and the image base of the signs becomes irrelevant. It should also be noted that the set of nouns and verbs which was selected for this study has certain attributes of frequency and distribution which do not necessarily match those of the entire language. Therefore, predictions made on the basis of this set may or may not apply to the lexicon as a whole. In addition, there was only a small number of types appearing in the very early data. With these caveats in mind, we can examine the results reported in Tables 13 and 14.

Table 14 shows that, up to age 2;0, the children's pairable noun signs referred primarily to concrete, movable, manipulable objects (e.g., ICE-CREAM, BOOK). After that time, the children began to talk about objects which were large or static or abstract (e.g., CHAIR, BED, STORE).

Looking at noun acquisition in terms of the mimetic

properties of pairable noun signs, I found that nouns which exhibit shape iconicity (substitutive depiction) consistently accounted for only a small proportion of the pairable nouns produced by the two children; the fact that these signs are more directly related to their referents did not seem to be a motivating factor in early acquisition. In general, the pairable nouns bear a much less direct relationship to their referents than do the verbs; iconicity may be less salient in these nouns, and may play a less important role in their acquisition. This is a similar finding to that encountered in my analysis of the input data; across time, it was rare for more than 30% of the pairable nouns produced by the mothers to be marked by shape iconicity. It seems that neither mother nor child focused on shape iconicity as a salient feature of these pairable noun signs.

In their early verb production, the children primarily referred to non-locative actions (e.g., EAT, DRINK, EAT-ICE-CREAM). After two years of age, they varied the types of actions discussed, and they referred to instrumental relations (e.g., WRITE, SHOOT, TYPE), as well as to non-concrete actions (e.g., TELL-STORY, BUY, SELL).

As noted at the beginning of this chapter, many of the early verbs produced by children under 2;0 can be viewed as specific action verbs, rather than the general purpose verbs which appear so frequently in the English acquisition data. Of the five highest frequency verbs reported by Clark (1978b) and Eloom et al. (1975), i.e., go, put, get, do, make, the only general verb

that appeared early in the deaf children's productions was GO (in its various forms: GO-OUT, GO-TO, etc.). PUT appeared early as a specific verb, e.g., PUT-IN-MOUTH, PUT-IN-BOWL. MAKE and GET appeared rarely, and DO only showed up once in the data, in the idiomatic question DO-DO?, 'What are you doing?', and that was not until Corinne was 3;11. Thus, the semantic predictions which related to the developmental sequence of verb relations were supported by the present data, but the language-specific devices of ASL allowed for acquisition of a different type of verb from the outset.

Image elaboration in children's production of related nouns
and verbs

The pairable verbs produced by these children before age 2;0 also supported my mimetic predictions. The mimetic forms were predominant at the youngest age levels, but after age 2;0, both children began to produce a variety of less mimetic forms. It is important to note that, with one exception (Corinne at 2;6), the children consistently produced more verbs that were highly mimetic than did their mothers (compare Tables 11 and 13).

It certainly seemed that highly mimetic verbs were learned first by the deaf children, but it was not clear to what extent the children were aware of the iconicity of these verbs. Therefore, I looked for cases where the children appeared to be mimetically extending particular forms, elaborating on the image base and adding to the frozen form their own mime or related

actions. I found that these occurred approximately 15% of the time in all sign tokens appearing in both children's data from 1;0 to 2;0. These proportions of occurrence were twice as high as the mothers'; recall that when the children were 1;0 to 2;0, mothers elaborated the image base in only 8% of the sign tokens.

Within the set of pairable nouns and verbs, the children's image elaborations (from age 1;0 to 2;0) were also more frequent than their mothers': 22% of pairable noun and verb tokens were mimetically extended by Corinne (15% by her mother) and 40% of pairables were extended by Sally (26% by her mother). The following examples illustrate the children's image elaborations of the signs GO-TO-BED, EAT-ICE-CREAM, DRINK and EAT.

At 1;6, Sally signed GO-TO-BED[B;cheek;approach to contact] with a marked head tilt superimposed on the sign, and, in one production of EAT-ICE-CREAM[S; chin; downward], instead of moving the S-hand downward repeatedly, Sally licked the back of her hand several times, as if the hand itself were the ice cream. At 1;9, Sally added a large, backward tilt of the head to her production of DRINK[C; chin; backward wrist twist].

Corinne exhibited similar image elaborations. At 1;3, she used a G-handshape for EAT[O; chin; approach to contact], which was more mimetically appropriate to the orange slice she referred to than the citation form O-shape. At 1;6, Corinne produced the sign GO-TO-BED[B; cheek; approach to contact] while at the same time tilting her head and closing her eyes.

These types of enhancement of the image base occurred early

in the data (from 1;0 to 2;0). But despite the early appearance of mimetic extensions, there were many instances in the data where the iconicity of signs was diminished, and as a consequence, the child's sign form was much less mimetic than the citation form. This occurred in approximately 20% of the pairable noun-verb tokens appearing in both children's data from 1;0 to 2;0. Some of these distortions may be a function of phonological complexity; some of the alternate hand configurations were phonologically simpler than those required in citation form. Other aspects of baby sign may account for these less-mimetic or counter-iconic forms, but they do bear mentioning.

At 1;2, Corinne produced CAR[SS;neutral space;up-down bidirectional] with a 5-5 hand configuration, instead of the S-handshapes whose image base is the action of holding and moving a steering wheel. The alternating up-and-down movement was accurate, but the handshape change completely obliterated the iconic relationship to the base.

At 1;3 and 1;6, Corinne produced various forms of EAT[0;chin;approach to contact] which displayed less iconicity than the citation form. One token was made with the heel of her hand resting on her chin, and with repeated closing of a 5-hand to an S-hand; another was made with the appropriate O-shape, but there was a movement change which included circling the lips, instead of approaching the mouth repeatedly to represent bringing food to the mouth.

Similarly, Sally, at 1;6, produced ICE-CREAM[S;chin; downward] with an M-shape as well as with an A-shape. These hand configurations are less mimetic (and more phonologically advanced) than the S-shape which represents the hand holding an ice cream cone. Moreover, in both of Sally's productions, the downward movements were located at the base of the chin, not, as in citation form, close to the mouth. At the same age (1;6), Sally produced BOAT[B-B;neutral space;downward] with 5-handshapes, palms together, making repeated downward movements. In this form, the shape iconicity of the cupped B-hands was lost. This was similar to the hand configuration of the mother's sign during the same dialogue, but the mother elaborated the image of the sign by using circular movement, suggestive of a boat bouncing along the waves.

Although Corinne, at 1;6, enhanced the image of the sign GO-TO-BED[B;cheek;approach to contact], she also produced a form which decreased the mimetic nature of the sign: both hands approached the sides of the face and recoiled rapidly without face contact, while the head moved forward at the same time. Also at 1;6, Corinne used the appropriate handshape and movement for BIRD[L;mouth;closing], but instead of articulating the sign at her mouth (image base of the bird's beak), she located the movement at eyebrow level. Similarly, at 1;6 and 1;9, Corinne produced the sign DRINK[C;mouth;backward wrist twist] with her hand tilting backward over her shoulder, instead of mimetically approaching her mouth with the cup-shaped C-hand.

Thus, it seems that although the iconic nature of pairable verbs may facilitate early lexical acquisition and image elaboration, there are also instances in which the signs are produced in apparently counter-iconic ways. The diminished iconicity of certain sign forms does not necessarily mean that children do not make use of the iconic potential in learning particular signs.

Early lexical acquisition may be motivated by the mimetic properties of some signs, as well as by the semantic relations encoded by the pairable nouns and verbs. But this does not tell us how children enter the morphological system for marking related nouns and verbs. To test the morphological predictions, we must examine the manner in which children develop the canonical marking of these signs and the morphological means for distinguishing paired items.

Children's Canonical Marking of Related Nouns and Verbs

Table 15 presents the early nouns and verbs produced by Corinne and Sally in canonical form (i.e., according to the distinguishing features of repetition, size and manner). This table represents the sign types produced, not tokens. Each canonical form is only listed the first time it occurred in the data, but a sign is listed a second time if it appeared along with its paired counterpart in a subsequent tape. A single dash connects the paired nouns and verbs.

Table 15. Pairable Nouns and Verbs Produced in Canonical Form
By Two Deaf Children

Age	CORINNE		SALLY	
	<u>Verbs</u>	<u>Nouns</u>	<u>Verbs</u>	<u>Nouns</u>
1;3	EAT			
1;6	GO-TO-BED	CAR	GO-TO-BED	FOOD
	DRINK		EAT-ICE-CREAM	
1;9	CLIP-BARRETTE		DRINK	
		MILK		
1;10	*	*	*	ICE-CREAM
2;0	ATTACK-LIKE-	BRUSH	EAT	
	MONSTER			
	RIDE-BIKE			
	WASH-HAIR			
2;2	*	BABY	*	*
		BLANKET		
2;3	SWING	STORY	WRITE	CLOTHES
	SING		SIT	
	GO-BY-BOAT			
2;5	GO-TO-BED	SOUP	**	**
	CARRY-BAG	BARRETTE		
	BATHE	ICE-CREAM		
	SELL	STORE		
	TYPE			
	COMB-HAIR			
2;6	DRIVE	BICYCLE	SHOOT	KEY
	CLOSE-DOOR	MOTORCYCLE		
	SWIM	PICNIC		
	OPEN-GATE			
	MARCH			
	HIT-BASEBALL			
	PAINT			
2;10	RIDE-BIKE -	BICYCLE	**	**
	DRIVE -	CAR		
	TELL-STORY -	STORY		
	BUY			
	SIT			
2;11	EAT -	FOOD	**	**
	WRITE	HEARING-AID		
	EAT-SOUP	BOOK		
	PUSH-STROLLER			
3;0	**	**	EAT	-FOOD
			DRIVE	-CAR
			RIDE-CYCLE	-MOTORCYCLE
				BICYCLE
3;3	FLY	CLOTHES	*	NAME
		TRAIN		BOAT

* No new pairable items appeared on this tape.

**No data available at this time period.

When we examine the data on nouns and verbs produced in canonical form, we find, once again, that the semantic and mimetic predictions are consonant with the early data. That is, up to age 2;0, 100% of the pairable signs produced represented concrete objects and actions; 86% of the pairable verbs produced in this time period were classified as highly mimetic. Immediately after age two, these proportions changed markedly; from 2;0 to 2;6, 79% of all pairable signs represented concrete objects and actions, and only 47% of the pairable verb signs were highly mimetic.

Many more canonical forms appeared in Corinne's data than in Sally's. Corinne produced canonical verbs almost twice as often as canonical nouns; in Sally's data, the number of canonical noun and verb types was equivalent. The development of canonical marking of nouns and verbs, across time, and the proportion of noun and verb tokens produced in canonical form, can be viewed in Figures 16, 17 and 18 (for Corinne, Sally and Jane, respectively).

In the very early data (Corinne and Sally age 1;0 to 2;0) there was a great deal of variability in production. This variability was also noticeable in the production of individual signs; some tokens of a given sign were produced canonically and others were not. From age 2;0 to 3;0, canonical production leveled off, and then rose after 3;0 and continued upward. This latter pattern is also evident in Jane's data: canonical

Figure 16. CORINNE: DEVELOPMENT OF CANONICAL MARKING
OF PAIRABLE NOUNS AND VERBS

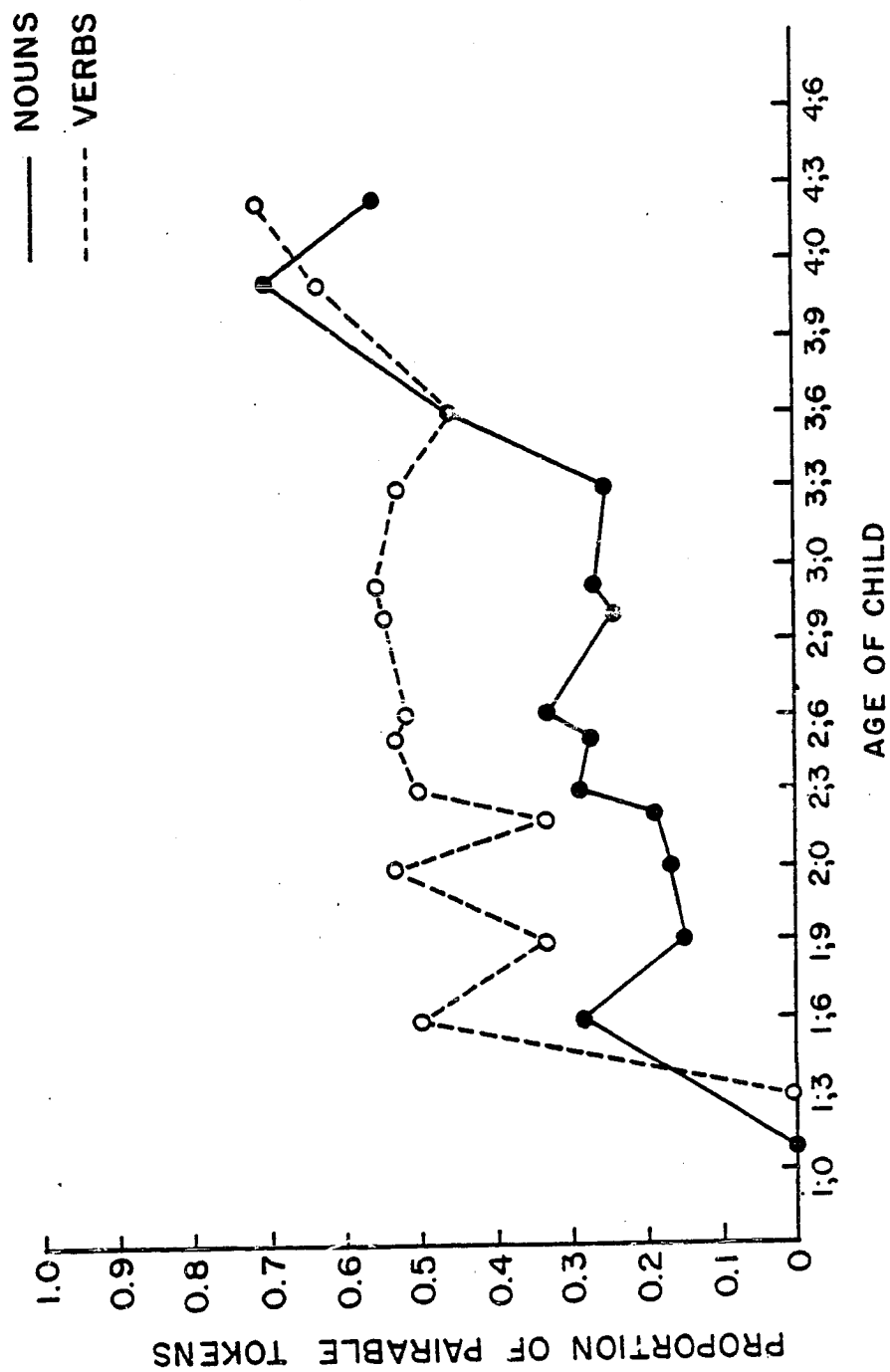


Figure 17. SALLY: DEVELOPMENT OF CANONICAL MARKING OF PAIRABLE NOUNS AND VERBS

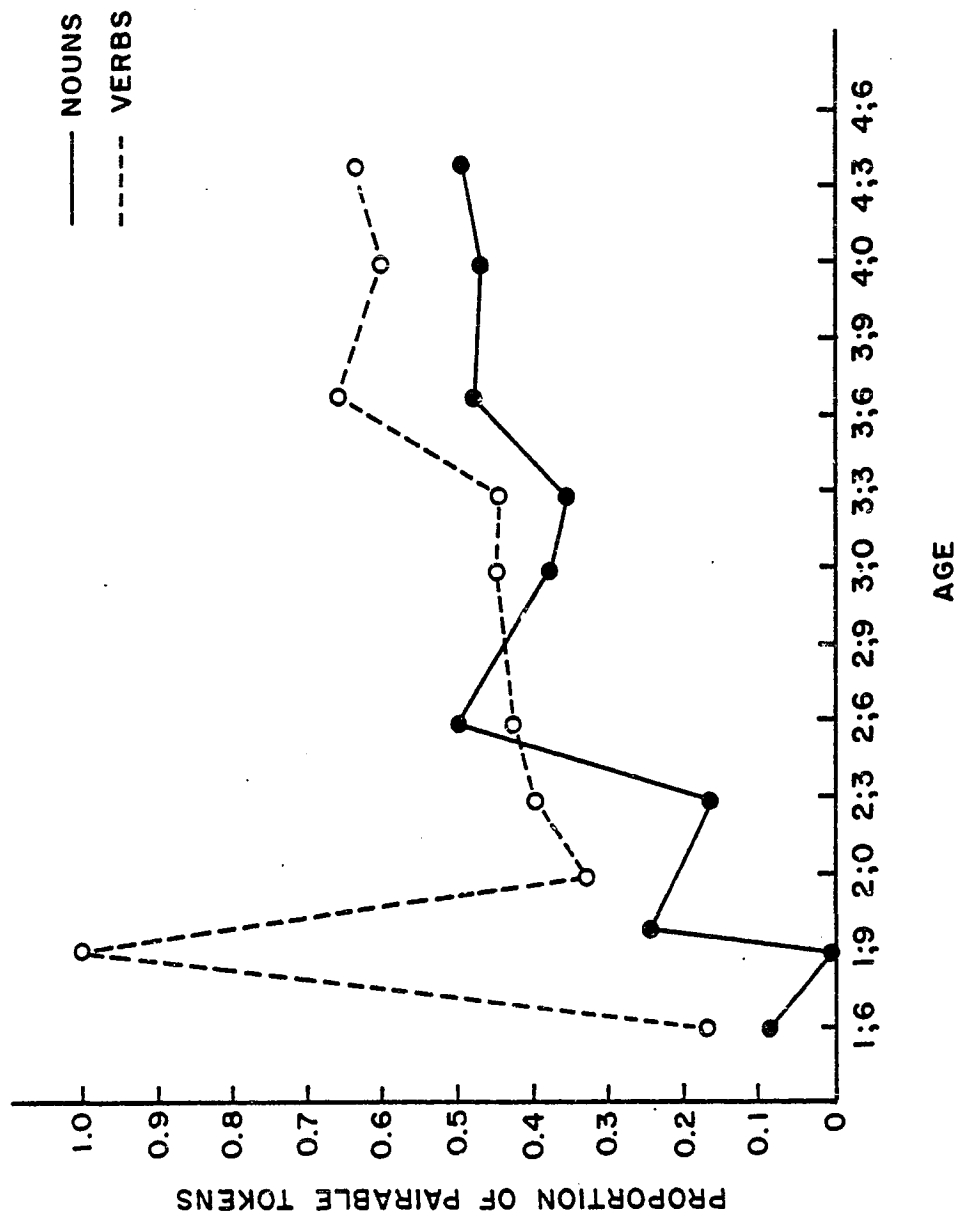
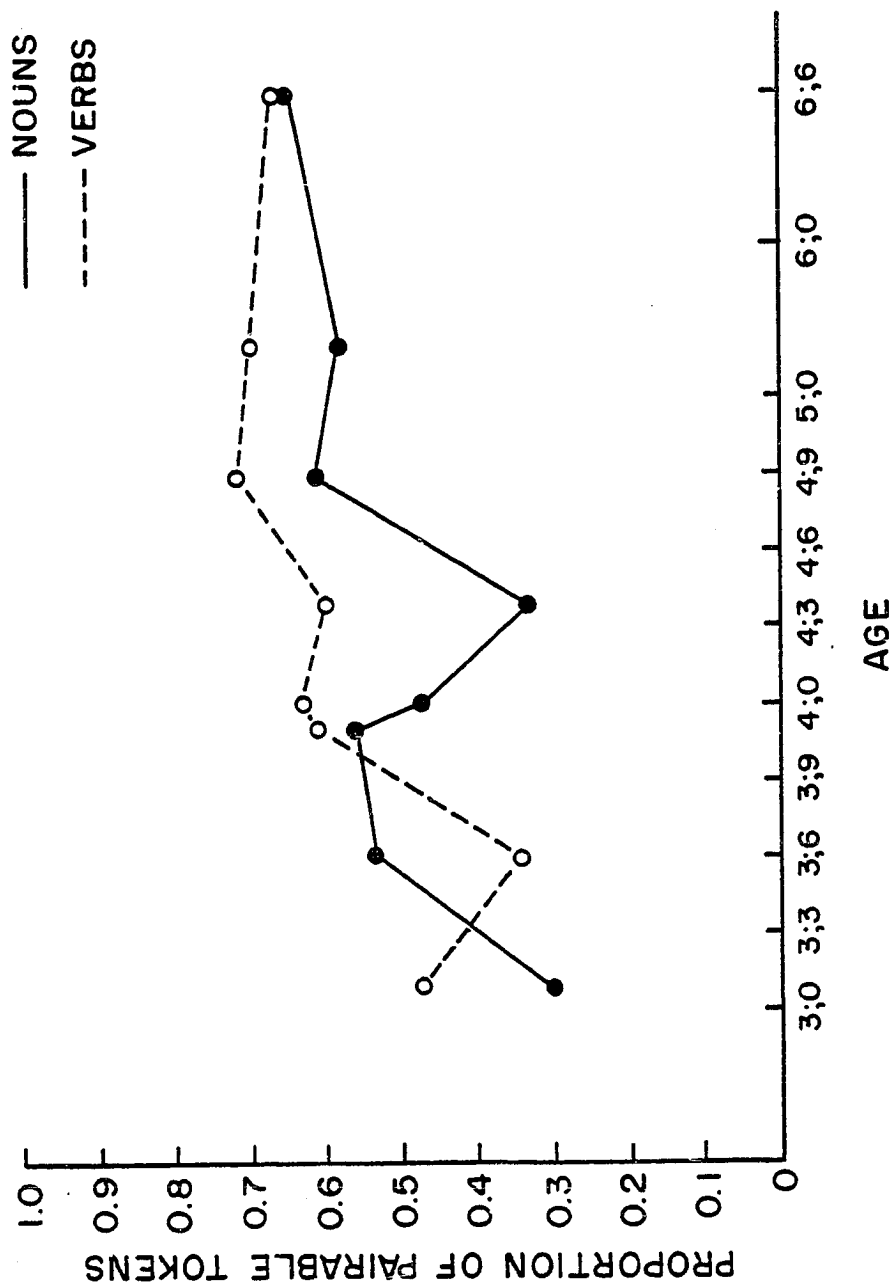


Figure 18. JANE: DEVELOPMENT OF CANONICAL MARKING OF PAIRABLE NOUNS AND VERBS



production rose after 3;0 and then again after 4;0. It is interesting to note that the discrepancy between noun and verb production virtually disappeared in Jane's latest tape (age 6;6), as it did in the mother's input to both her children after age four.

In all three children, as in their mothers, canonical marking of verbs was consistently greater, proportionately, than canonical marking of nouns. However, in Corinne and Jane, there were times when canonical marking of nouns exceeded that of verbs: in Corinne at 3;6 and 3;11 and in Jane at 3;6.² This is somewhat surprising, in view of the mother's input.

Turning back to Figure 12, it is clear that the mother's canonical production of verbs consistently exceeded canonical production of nouns. Even more striking, there is a point in time during which Corinne's canonical production of pairable nouns was greater than her mother's: at 3;11 (canonical nouns--.55 in mother, .70 in Corinne; canonical verbs--.62 in mother, .63 in Corinne). At this later stage of development, it seems that Corinne was analyzing the formal system of noun-verb morphology. Despite the inconsistencies of maternal input, particularly for pairable nouns, the child seemed to be regularizing the morphological marking; she marked the forms canonically most of the time and, in fact, more often than her mother.

When the data for production of pairable nouns and verbs are combined, a developmental pattern in acquisition is clearly

observed for each of the three children (see Figure 19). Again, the variability of production before age 2;0 is obvious; this is followed by an increase in the proportion of canonical marking by age 2;6, a leveling off, and then another marked increase at around 3;6, with generally consistent progression thereafter. The children are grappling with the acquisition of a morphological system with optional rules, and it is not until after three years of age that canonical forms are produced more than 50% of the time.

Given the variability of input, and the optional rules which exist in ASL, it was important, as with the input data, to determine what proportion of the non-canonical productions would be deemed acceptable in the adult language.

Once again, I went back to an early and late tape of Corinne and Sally, and obtained judgments from a fluent signer as to the acceptability of the forms produced by the children in context. In Table 16, those ratings are compared to the proportions of noun and verb tokens produced in canonical form. Recall that the proportion of "Acceptable" signs includes both canonical forms and non-canonical forms which are contextually-appropriate.

Figure 19. CANONICAL MARKING OF PAIRABLE NOUNS AND VERBS
IN THREE DEAF CHILDREN

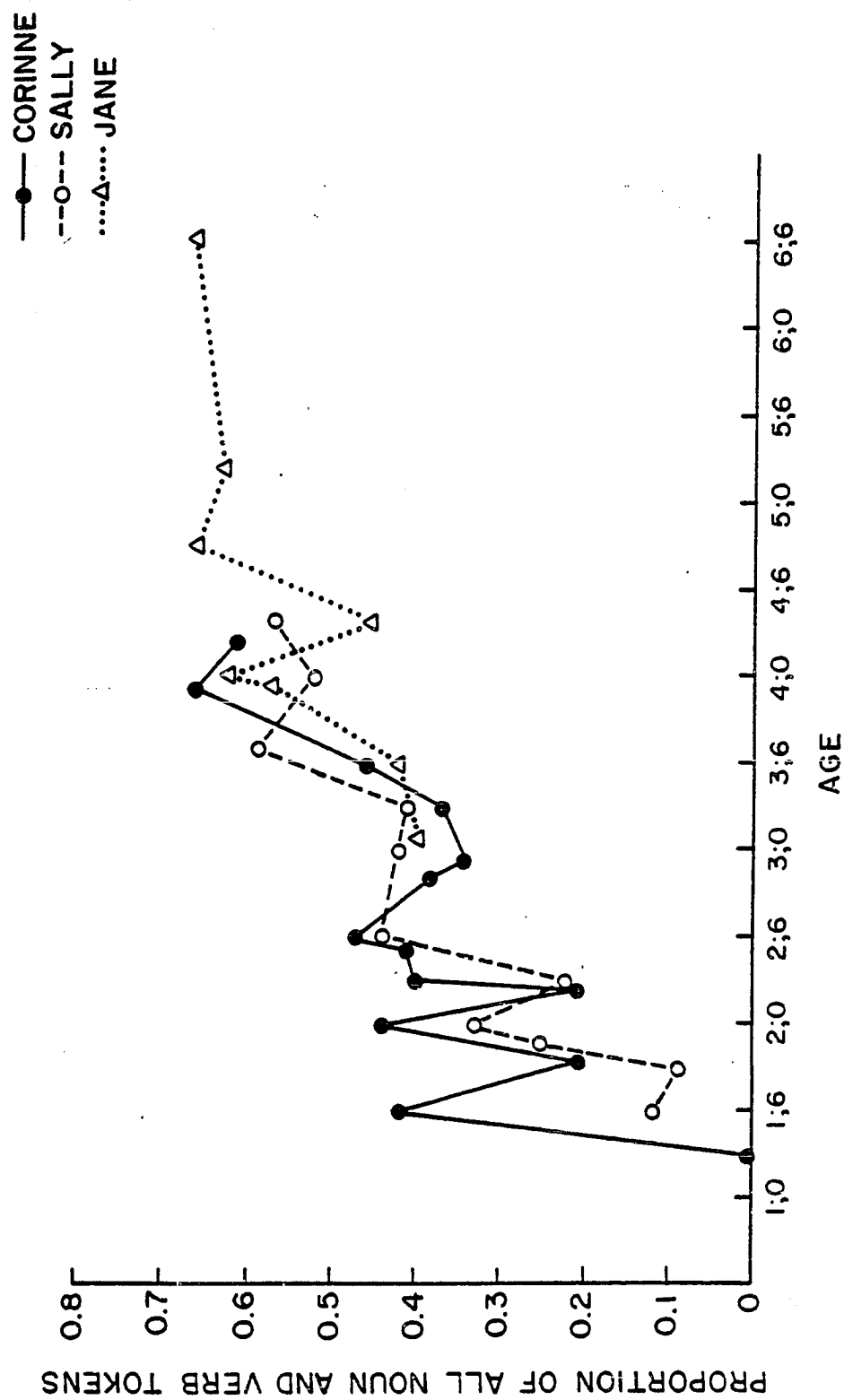


Table 16. Production of Pairable Nouns and Verbs in Two Deaf Children: Proportion of Forms Produced Canonically and Forms that are Judged to be Acceptable in Context

	VERBS			NOUNS		
	Age	<u>N</u> (tokens)	<u>C</u>	<u>A</u>	<u>N</u> (tokens)	<u>C</u> <u>A</u>
Corinne	1;6	(16)	.50	.56	(8)	.25 .38
	4;2	(17)	.71	.76	(27)	.56 .67
Sally	1;6	(10)	.20	.50	(12)	.08 .17
	4;4	(23)	.65	.78	(42)	.50 .64

C=Canonical
A=Acceptable
(Canonical +
Contextually
Appropriate
Non-canonical)

If we compare Table 16 to Table 12, which presents the proportions of canonical and acceptable forms in maternal input, we find some interesting similarities and differences. Proportions of production are generally similar in mother and child at age 1;6, with none greater than 60%. But when the children reach age 4;0, the mothers are producing "acceptable" forms approximately 95% of the time. The "non-canonical" forms appearing in the input data at this time reflect the application of optional rules in the adult language, rules that allow, for example, for the deletion of repetition in nouns. At this time, the children's proportion of canonical forms matches the mothers', but the proportion of acceptable forms is much lower

than the mothers' (.64-.78), and does not differ much from canonical production. At this point, the children were just beginning to apply the optional rules of the language. There were, for example, instances of deleted repetition in nouns for compounds such as FIRE^MAN 'fireman', BED^WATER 'waterbed' and BABY^BOWL, 'baby-sized bowl'. Some noun forms were made with single movement for emphatic stress, as in Corinne's production of the following sentence at 4;2, as she was role-playing the angry bears in the "Three Bears" story: WHO SIT¹+ MY CHAIR¹+? 'Who sat down on my chair?'

When the children reached four years of age, their mothers' production of pairable nouns and verbs was contextually-appropriate almost 100% of the time. "Unacceptable" forms were rare in the mothers, although these persisted in the children. For instance, multiply-iterated signs appeared in the children's data, and these were not judged to be acceptable by an adult signer (e.g., BABY⁴+ produced by Sally at 4;4). Some unacceptable forms in the late data could still be viewed as "errors": e.g., Sally's use of single unidirectional movement in BABY; or stiff movement repetitions in CAR that seemed to represent confusions with a verb inflection.

The unacceptable forms produced by both children at 1;6 were more "deviant" from canonical form and presented problems in directionality (e.g., Corinne's production of BOOK with a closing rather than an opening movement), or orientation (Sally's palm facing the wrong direction for ICE-CREAM), or location (as when

Corinne's thumb contacted her cheek for DRINK, and then her wrist twisted outward before twisting backward). These were distortions of production, not, as the mothers' were, with any apparent motivation such as increased salience through exaggeration. The children's early productions may have been "baby sign" and the mothers' "motherese", but the characteristics of these forms differed considerably.

Spontaneous and experimental data compared

Since Jane and Corinne received some of the experimental tasks at various points in their development, comparisons between elicited and spontaneous performance are in order. At 3;4, Corinne received the Picture Elicitation Task, and her production of citation form signs was almost identical to her spontaneous production of canonical forms: verbs--.56 elicited, .53 spontaneous; nouns--.22 elicited, .25 spontaneous).

The Imitation Task was administered to Corinne when she was 4;6. Those results compared to her spontaneous production of canonical forms at 4;2, as follows: verbs--1.00 in imitation, .71 spontaneous; nouns--.50 in imitation, .56 spontaneous. Given a model, then, verb production in imitation exceeded spontaneous production in discourse. However, even with a model to copy, noun production was similar to spontaneous production and, in fact, exhibited a slightly lower proportion of canonical production. The same trend appeared in Jane's performance on the Picture Elicitation Task, administered when she was 5;8, in

comparison to spontaneous production at 5;2: verbs--1.00 elicited, .70 spontaneous; nouns--.44 elicited, .65 spontaneous. Once again, elicited verb production exceeded spontaneous production, but the reverse was true for production of nouns.

It has been suggested that age (when combined with MLU) should be a good predictor of the use of morphological inflections in the spontaneous speech of hearing children, age two to four (Brown, 1973; deVilliers and deVilliers, 1973). In the minimal comparative data available here on the morphological marking of related nouns and verbs, there is a close match between elicited and spontaneous productions in the low age range (age 3;4). When the children were older (age 4;6 and 5;8), there was a much greater discrepancy between spontaneous and elicited production. At this time period, the children were still in the process of mastering the optional rules for marking nouns in the adult language. This may have caused some variability in their noun production in an elicitation task; in fact, 80% of the two children's noun "errors" at the upper ages were single movement noun forms, although none of these forms was appropriately applied in a rule-governed context.

Spontaneous production of paired nouns was better than elicited production at the upper age levels, but elicited production of paired verbs exceeded spontaneous production. With paired nouns and verbs in ASL, it may be that, as suggested by Lahey et al. (in preparation), the prediction of spontaneous production from elicited productions varies with the particular

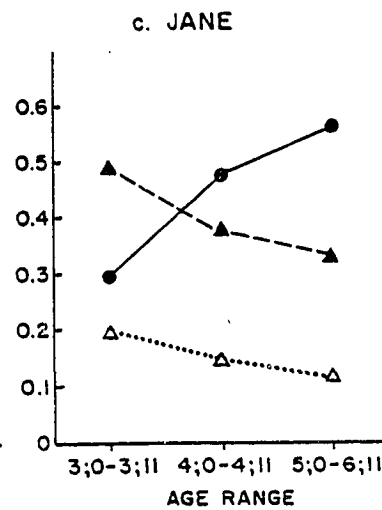
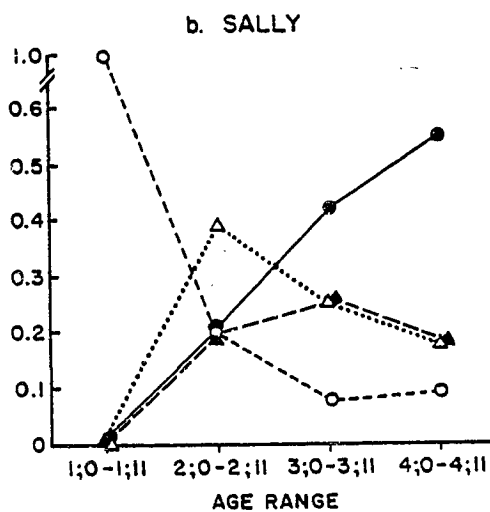
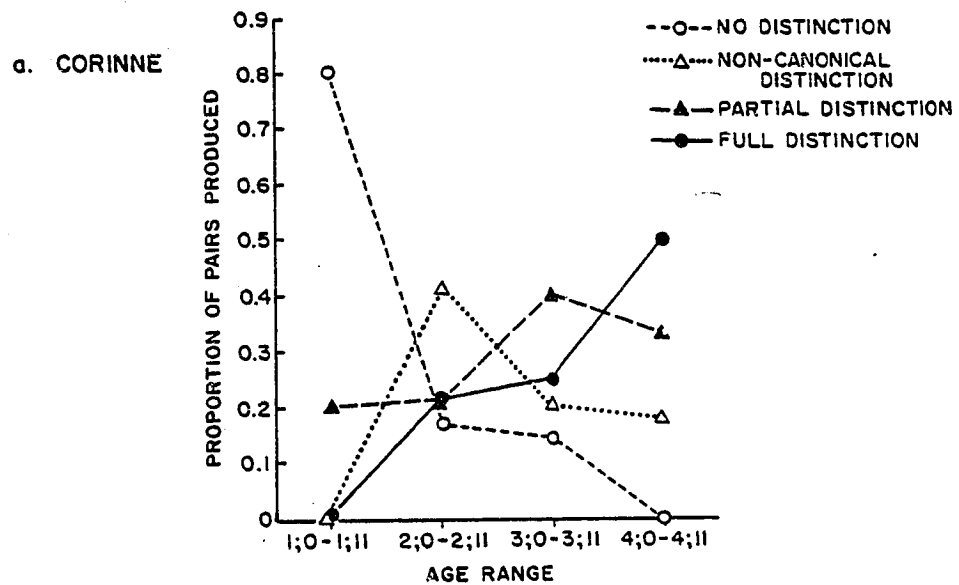
language behavior under investigation and how it is marked in the language.

Learning to Mark the Morphological Distinctions Between
Related Nouns and Verbs

Thus far, I have examined the production of pairable nouns and verbs independently. But critical evidence of the child's acquisition of this morphological process can be obtained by examining how the children distinguish related nouns and verbs. The first instance of both items appearing in a single videotape occurred in Corinne and Sally at 1;6. However, these pairs (CHAIR/SIT, DRINK/DRINK, ICE-CREAM/EAT-ICE-CREAM) were not distinguished in any way at the outset. There was a limited number of times that both members of a pair appeared in a given tape, but, by grouping each child's data in age ranges, I was able to graph the proportions of production of the four distinction categories I introduced in the previous chapter: no distinction, non-canonical distinction, partial distinction, full distinction. Figures 20 a, b and c present the graphs of those data (based on all tokens of noun-verb pairs) for Corinne, Sally and Jane, respectively. Note that in Jane's data (Fig. 20c), only three distinction categories appeared; there were no instances of pairs marked by no distinction.

In Corinne's and Sally's data, the proportion of pairs with no marked distinction was extremely high at age 1;0 to 2;0, and decreased drastically at 2;0 to 3;0. Conversely, the proportion

Figure 20. 3 DEAF CHILDREN'S MARKING OF NOUN-VERB DISTINCTIONS OVER TIME



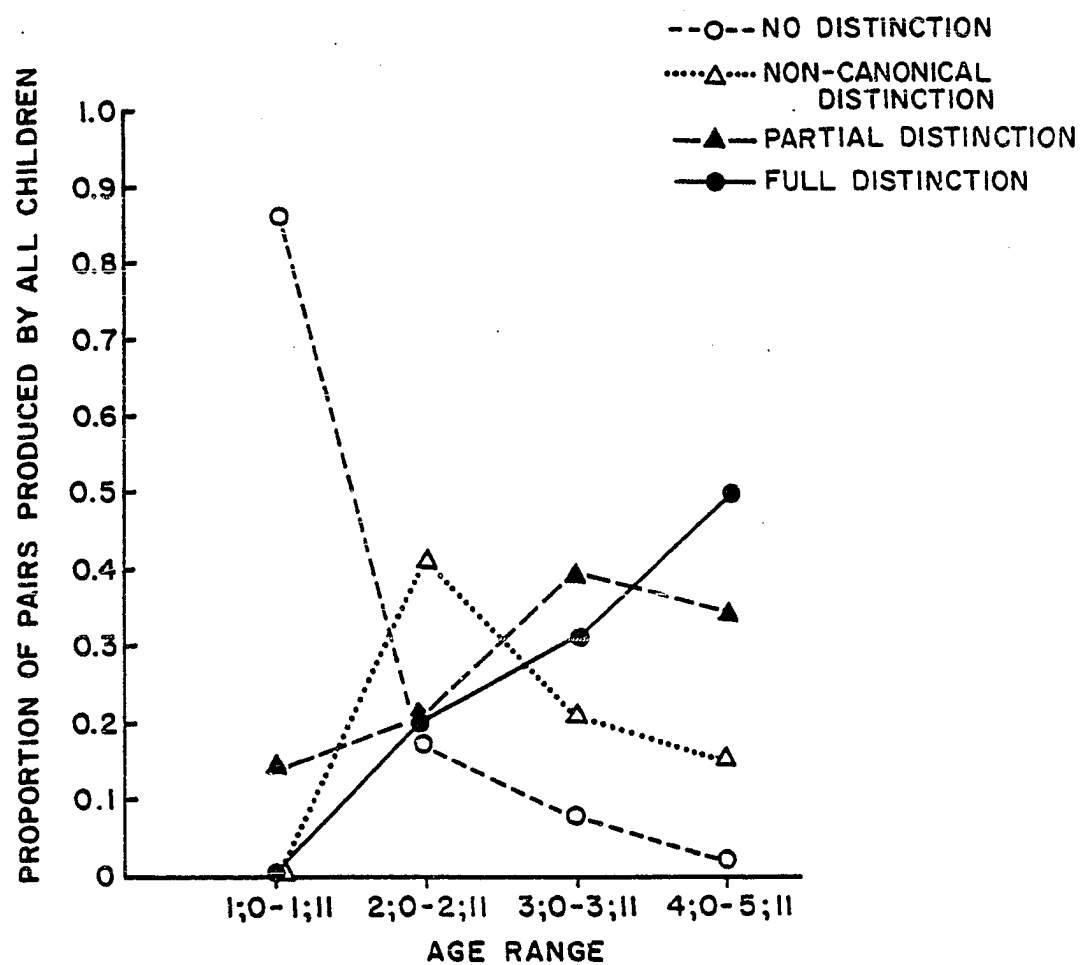
N.B. There were no instances of pairs marked by No Distinction.

of full distinctions rose markedly over time, in all three children. As this occurred, the proportion of partial distinctions decreased for all children. Non-canonical distinctions appeared at 2;0 and decreased considerably by age 4;0. I interpreted this finding in terms of the young children's growing awareness of a need to mark distinctions between related nouns and verbs; as they became aware of this need, they used whatever means were available in their linguistic repertoires, although these distinctions did not conform to the adult system. Later, these non-canonical distinctions decreased in frequency, as the children acquired the formal system for morphologically marking noun-verb pairs.

In Figure 21, the data are pooled across children and grouped by age range. The patterns of development are very clear: at age 1;0 to 1;11, most pairs are produced with no formal distinction. By age 2;0, children are beginning to mark related nouns and verbs in a variety of ways, particularly by means of non-canonical distinctions. By 3;0, full and partial distinctions have increased considerably, as the children acquire the morphological system. After age 4;0, full distinctions are most frequent. Even at this late stage, noun-verb distinctions are not marked more than 50% of the time; this seems to relate to the children's development of the optional rules for marking paired nouns and verbs in discourse.

These data are consonant with the results of the experimental tasks. First, I should note that the types of

Figure 21. THE ACQUISITION OF NOUN-VERB MARKING DISTINCTIONS
IN 3 DEAF CHILDREN (grouped data)



non-canonical distinctions which appeared in the longitudinal data were similar to those exhibited in the elicitation data. Moreover, the most frequent non-canonical distinctions were similar in both sets of data; movement, offset and head/face/body distinctions occurred most often in the data on all children. However, handshape changes occurred more frequently in the elicitation data, perhaps, as suggested earlier, as a function of those subjects' greater exposure to sign systems other than ASL.

The trends and patterns in the two sets of data are similar (compare Figure 21 to Figures 10 and 11). At the 2;0 to 3;0 range, non-canonical distinctions predominate (spontaneous data and Picture Elicitation Task), and these decrease markedly with increasing age. At the 3;0 to 4;0 range, partial distinctions are most common (spontaneous data and Imitation Task). Proportions of non-canonical and partial distinctions remain high on elicitation tasks at the age range of 4;0 to 6;0, although full distinctions predominate in spontaneous signing by this time. Note that there was no evidence of full distinctions or non-canonical distinctions in the very early spontaneous data. Not until after the age of 2;0 do these types of distinctions occur.

One notable difference between the two data collection conditions is that, at all age levels, there were higher proportions of full distinctions in spontaneous signing than in elicitation tasks. This finding is congruent with earlier suggestions that elicitation tasks may underestimate the

linguistic knowledge of certain children (cf. Slobin and Welsh, 1973).

The detailed analysis of the spontaneous data suggests that when children first acquire individual lexical items, they may be motivated by semantic and mimetic factors. When the form classes "noun" and "verb" begin to be differentiated, and their distinctive uses in sentences are recognized, children may not, at first, pay attention to morphological markers. Instead, they often mark the distinction between related nouns and verbs in non-canonical ways. Later, at about age 3;0, children begin to analyze the system morphologically, and there is a slow but steady increase in the consistency of differentiating related nouns and verbs by means of morphological marking and full canonical distinctions.

Appearance of pairs in related utterances

Clear evidence of children's entrance into the morphological system appears when both noun and verb are produced canonically in related utterances. This type of utterance began to occur in the data at approximately 2 1/2 years of age. For instance, at 2;5, Corinne produced an utterance containing both SOLD and STORE in canonical form, as example 5 shows.

5)
Corinne, 2;5 VT11 Pt.2 #496

Corinne and her mother are playing with a
toy cash register. Corinne pushes
the buttons on the register and
looks up at her mother.

Corinne: SOLD¹⁺, GONE, STORE²⁺.
'Sold, allgone from store.'

Mother: STORE. YOU GONE, YOU? OH, WORK
STORE YOU, USE-CASH-REGISTER. WORK,
YOU.

'A store. You left the store?
Oh, you work in the store. You use
the cash-register. You work.'

Later in development (age 2;11), while telling the story of "Goldilocks and the Three Bears," Corinne produced the canonical form of CHAIR and SIT-DOWN in juxtaposed utterances, as illustrated in example 6.

6)
Corinne, 2;11 VT17 Pt.2 #670

Corinne: GOLDDILOCKS BROKE CHAIR²⁺. EAT-WITH-SPOON,
SIT-DOWN¹⁺, EAT-WITH-SPOON.
'Goldilocks broke the chair. Ate porridge,
sat down, ate porridge.'

Sally put both members of a pair in related utterances at 3;0, when she canonically produced MOTORCYCLE and RIDE-MOTORCYCLE, as well as SCISSORS and CUT, as shown in examples 7a and b.

7a)
Sally, 3;0 VT15 Pt.1

Sally is alone onscreen; an experimenter is signing to her from offscreen.

#115 MOTORCYCLE²⁺, RIDE-OFF-BY-MOTORCYCLE¹⁺.
'The motorcycle rides off.'

#358 Mother and Sally are looking at a picture of a cat sewing.

M: SEW DRESS POINT[to picture].
'She's sewing a dress.'

S: POINT[touching book] SCISSORS3+, POINT[on
book] CUT3+[on S-shape basehand].
'There's the scissors; she's cutting.'

In all these cases, the children were marking the full morphological distinctions between related nouns and verbs. At this point, the children were beginning to relate a system of morphological marking to their knowledge of form class distinctions and of the differences between nouns and verbs in terms of syntactic distribution.

Lexical innovations and extensions in child production

One further piece of evidence suggests that the children are performing a morphological analysis of the marking of nouns and verbs: appearance of lexical extensions or inventions. In these cases, the children make use of the formal marking for noun or verb outside the formal system. These examples show that the children are acquiring a process which can be productively extended to new instances.

Both extensions and inventions were relatively infrequent in the data, and, when they did occur, they appeared only after age 3;6. For example, at 3;7, Sally produced the noun WHEELBARROW[S-S;neutral space;forward][N:restr,sm,rep], with small, tense, repeated movement; then she extended this sign to produce a related directional verb with long, single hold movement: PUSH-WHEELBARROW[V:hold,lg,sing], as shown in example 8.

8)

Sally, 3;7 VT21 Pt.1 #512

Sally is looking at a book with a picture of a bear holding the handles of a wheelbarrow which has a broken front wheel.

POINT[to book] WHEELBARROW2+,
PUSH-WHEELBARROW1+[inv],
WHEELBARROW2+ BREAK.
'There's a wheelbarrow. (He) pushed the wheelbarrow. The wheelbarrow broke.'

At 4;4, Jane overregularized the single movement form JAIL[4-4;neutral space;approach to contact] so that it included all the morphological features of a noun: JAIL[N:restr,sm,rep]. At the time of this utterance, Jane was complaining about her mother's control of her language use and all her activities, and she compared her house to a prison, as shown in example 9.

9)

Jane 4;9 VT18 Pt.4 #442

Jane has been repeatedly swearing. Her mother tells her some people don't like those words, but she's free to use them if she wants. Jane says she is not free at home.

JAIL2+. HOME JAIL2+. CAN'T
OPEN-DOOR. GO-OUT, CAN'T. JAIL1+.
'Jail. Home (is like) jail: jail-bars-in-front-of-my-face. Can't
open the doors. Can't go out.
(I'm) in jail.

In this example, JAIL was produced by Jane three times. The third instance conformed to adult usage; the other two sign forms represented overregularization of noun morphology. Figure 22a

FIGURE 22. A Child's Overextension of the Morphological Marking of Pairable Nouns



a. Child's sign for 'jail'

JAIL[*restr, sm, rep]



b. Adult sign for 'jail'

JAIL[hold, lg, sing]

illustrates the child's production of JAIL, with the morphological features of a noun JAIL[N:restr,sm,rep]. Figure 22b shows the single movement adult form of JAIL.

Several invented nouns appeared in the data. For instance, at 4;4, Sally produced two invented noun forms. One form, apparently derived from a verb root, referred to a picture of a very long line of elephants linked by tail and trunk. Sally's sign could be roughly glossed as LINKED-ANIMALS[N:restr,sm,rep] [*b0-b0;neutral space;approach to contact]. The sign was clearly marked for noun morphology; movement was very small, restrained and repeated.

At the same age (4;4), Sally produced an invented form for LAMB[N:restr,sm,rep][* $\hat{0}$ - $\hat{0}$;neutral space; lateral bidirectional]. She was looking at a picture of two lambs sleeping on the grass; each animal was pictured with its front hooves crossed. Sally's sign had the hooves as its image base, with the $\hat{0}$ - $\hat{0}$ hands overlapping, as the hooves were in the picture. Sally imposed noun morphology on the base image by adding small, repeated, tense movement, in the context shown in example 10.

10)

Sally, 4;4 VT29 Pt.1 #637

POINT[to picture] LAMB[inv] SLEEP.

'There's a lamb sleeping.'

Note that, in both cases of Sally's noun invention, there did not seem to be a true lexical gap in Sally's vocabulary,

since she clearly had a sign for ELEPHANT and for SHEEP. However, she apparently felt that the specific context in which these animals appeared required a specific, descriptive sign.

When Jane was 4;4, she invented a form for TYPEWRITER-KEYS[*C-5;neutral space;circular]. As in the previous examples, the invented sign was clearly marked with the morphological features of a noun: [N:restr,sm,rep]. In this invented form, the dominant hand made four small, tense movements "inside" the non-dominant basehand. The context for the invented sign is shown in example 11.

11)

Jane, 4;4 VT14 Pt.1 #193

Jane is telling an imaginary story about her imaginary husband, who recently gave her a new typewriter. She goes on to describe the typewriter as a telecommunication device for use with the telephone.

Jane: MY HUSBAND GIVE-ME NEW TYPEWRITER.
'My husband gave me a new typewriter.'

Mother: YOUR HUSBAND GIVE-YOU NEW TYPEWRITER?
'Your husband gave you a new typewriter?'

J: IN OFFICE.
'In the office.'

M: IN OFFICE OVER-THERE? REALLY?
'In the office over there? Really?'

J: SAME-AS POINT[offscreen]. SAME-AS.
'Just like that one. Same thing.'

M: SAME-AS POINT[offscreen], SAME-AS T-T-Y?
BIG?
'Just like that one? Just like the TTY? Is it big?'

- J: VERY-BIG. THIS-BIG. HAVE TYPEWRITER-KEYS⁴⁺
 [inv]. HAVE FLASHING-LIGHT. HAVE
 TELEPHONE.
 'Very big. This big. It has typewriter keys;
 it has a flashing light; it has a
 telephone.'
- M: HAVE LIGHT, HAVE TELEPHONE.
 'It has a light; it has a phone.'
- J: HAVE COUPLER.
 'It has a coupler.'

These lexical extensions and inventions reveal productive use of noun and verb morphology. Clearly, children are acquiring a systematic process in their language, and learning to apply it consistently, as well as to extend it beyond the confines of the system.

Discussion

This investigation was concerned with one specific set of nouns and verbs in ASL. In order to apply the semantic and mimetic predictions more broadly, I looked at all the nouns and verbs that occurred in the first 50 signs appearing on the videotapes of four deaf children (age 1;0 to 1;9). I found that the very early lexicons of young deaf children are, in content, very similar to those reported in hearing children (e.g., by Nelson, 1973; Benedict, 1979). The nominals produced are similar across languages, with respect to the meanings represented and the noun status of the forms in the adult language.

The data examined here also agree with the semantic ordering of verb relations that has been observed in hearing children (by Bloom et al., 1975). However, the acquisition of verbs seems to be different across languages, as Gentner (in press) has suggested. This difference appears to be a function of language-specific devices for encoding actions. All young children talk about actions, but they do so in different ways. For example, adult verb forms rarely occur in the first action words produced by English-speaking children (cf. Benedict, 1979), although verbs appear with high frequency in the first words of Japanese children (cf. Tanouye, 1979) and in the first signs produced by deaf children in ASL, as my data showed. Thus, the formal structure of a language may influence its acquisition. But the present findings may be partly explained in terms of the modality of the language.

In ASL, the mimetic nature of verbs and their obvious similarity to the actions they represent may heighten the perceptual salience of verbs for the young child. Many verbs have their source in an image based on the action of the hands in relation to an object. But the way that ASL encodes actions may also account for the early appearance of verbs in single word utterances, in contrast to the acquisition of English. In English, there are many general purpose verbs (e.g., get, do, make, put) which are the most frequent verbs appearing in early multiword utterances, but they rarely occur as single word utterances. In English, these transitive verbs require separate

marking of the verb arguments. When they are utilized, they do not appear independently, but are produced in constructions with a particular agent, object or location.

In ASL, there seem to be few general purpose verbs and a large number of specific verbs which include reference to the action as well as its object, instrument or location. These specific verbs appear in the very earliest sign lexicons as single word utterances, presumably because they can include reference to the arguments of the verb within a single sign (e.g., EAT-ICE-CREAM, BRUSH-TEETH, PUT-IN-MOUTH). Thus, language-specific devices may account for not only the difference in the frequency of early verb production in ASL, but also the difference in the type of verb produced.

In the literature on maternal input, exaggerated intonation has been cited as one of the most noticeable features of motherese, particularly in English. The sign language counterpart seems to be exaggerated size, and this pervades sign motherese. In addition, there is frequent repetition of signs and utterances, but also multiple repetitions of the movement within a given sign. As is true of many aspects of sign motherese, the latter has no real parallel in English. Another means of making signs more salient to the child is the mothers' tendency to sign on the referent object or on the child's body. Deaf mothers frequently move or hold the child's hands to form a given sign; this direct manipulation of the articulators is not feasible in spoken language. In ASL, it allows mothers to

heighten the child's kinesthetic as well as visual awareness. Children may then be able to feel the movement contour of a particular sign that they may not yet be able to articulate independently.

I also noted these features of sign motherese in the signing of a deaf three-year old to her one-year old sister. This finding corresponds to the reports of Shatz and Gelman (1973) and Sachs and Devin (1976), who described the speech modification of four-year old children addressing two-year old children. Like the deaf children, the young hearing children used a kind of motherese in talking to younger children, in an apparent effort to simplify, clarify and use specific teaching strategies.

One question of interest here was whether or not mothers would highlight the iconicity of the signs directed to young children. This was true for a small percentage of the signs addressed to children under 2;0, but there were other instances in which the mimetic nature of signs was diminished or submerged. Mothers seemed to have a variety of ways of demonstrating signs to their infants, and each had her own strategies for interaction and teaching.

In terms of the pairable nouns and verbs under scrutiny here, a large proportion of the very early verb signs appearing in the input data were classified as highly mimetic; this proportion decreased after the child reached 2;0, and more translucent and opaque forms appeared. In early input production, there seemed to be less focus on the iconicity of

pairable nouns; those forms having substitutive depiction (shape iconicity) accounted for only a small proportion of the input data. However, the action representation included within the noun signs was often exaggerated. Elaboration of the image base of pairable nouns and verbs occurred in approximately 20% of the tokens produced by the mothers when the children were under two years of age; when all sign tokens were considered, image elaboration occurred only 8% of the time. It therefore seems that iconic representation may be particularly high in this set of pairable nouns and verbs.

Insofar as canonical marking of pairable nouns and verbs was concerned, mothers rarely produced canonical forms when the child was less than 2;0, and paired items were generally not distinguished in any way. The mothers were, therefore, stripping away the specific morphological marking that distinguishes these paired items, and producing what were in fact ungrammatical forms.

Grammatical deviations are rarely reported in the literature on parent input. Newport et al. (1977:121) indicated that motherese is "unswervingly well-formed". Blount and Padgug (1977), in examining a wide variety of motherese features, found very infrequent occurrence of grammatical deviations in either Spanish-speaking or English-speaking parents, but they suggested that this feature may be more important in the baby talk of other languages (Blount and Padgug, 1977:76-77).

There has been little discussion of the grammaticality of

ASL input, but, in terms of one set of morphological distinctions, mothers seem to be more interested in presenting the global shape or "essence" of signs than the particular morphological details. In the early stages of children's development (i.e., under two years of age), mothers preserve the handshape, target locus and shape of movement--the root, as it were--but the number of movement repetitions, the size of the sign and the manner of movement are often distorted, not highlighted, in the interests of exaggeration. Presumably, children receive other clues that help them to disambiguate noun and verb--linguistic and non-linguistic context, and the mother's body/head/mouth movements--but the specific formal distinctions are not provided in early input.

The enlargement and exaggeration of signs, especially nouns, need not be responsible for the elimination of manner distinctions. In other contexts requiring exaggeration--sign "shouting" and stage/theatrical signing--the morphological features of nouns are preserved, despite the enlargement. It is clear that there is something very different about motherese.

Early mother input does not provide the child with clues to the morphological distinctions to be learned as part of the noun-verb derivational process. In addition, there is much variability in the adult language, due to the presence of optional rules for deleting noun repetition and reducing redundancy in the signal. All these factors contribute to the very late acquisition of this process in deaf children.

These children's early production of pairable nouns and verbs seems to be consonant with both semantic and mimetic predictions, and it also parallels maternal input. These predictions apply only when the child is acquiring lexical items; they cannot explain how the child learns morphological distinctions.

From a semantic standpoint, the same kinds of semantic relations appear in the early utterances of hearing and deaf children. Moreover, the sequence of noun and verb acquisition proposed in Chapter II (on the basis of the work of Nelson, 1973 and Bloom et al., 1975) is supported by the data reported here. Up to age 2;0, the children's nouns most often represented concrete, movable, manipulable objects, and verbs most often represented non-locative actions. Somewhat later, children produced nouns referring to large, immobile objects and to abstract meanings; similarly, verbs coding locative, instrumental and abstract relations were later to appear.

The early verbs produced by children under 2;0 were highly mimetic, although a mimetic factor did not seem to be involved in early noun production. As in the input data, noun forms including shape iconicity did not appear early or frequently in the child production data. Nouns were often extended mimetically in terms of the movement properties represented in the sign form. This finding lends support to the idea that movement features may be more salient to young children (as per Nelson, 1973), but it does not conform to Gentner's (1977) finding that children attend

primarily to static perceptual attributes and to the form rather than the motion of both noun and verb referents.

It was striking that the children's early verb forms were more frequently classified as highly mimetic than were the mothers'. This lends credibility to the suggestions of Brown (1978, 1980) that actions are easily represented and easily acquired in sign language. Although the iconic nature of other systems in ASL (e.g., verb agreement and mimetic depiction) does not seem to motivate acquisition (see discussions of Meier, 1982; Newport, 1981; Newport and Supalla, 1980), iconicity, as Brown (1980) has suggested, may motivate early lexical learning.

Mimetic verbs were acquired earliest by the deaf children, but it was not the case that young children produced verbs more accurately than nouns. I had hypothesized that nouns might be phonologically more complex because of the motor control required to produce tension or restrained manner. All children described here were able to produce signs with tension and/or restraint well before two years of age.

Mimetic verb forms did appear early, and so did mimetic extensions of signs representing other form classes, but there was also evidence of signs produced in less mimetic or counter-iconic ways. Thus, it seemed that the determinants of early acquisition varied with age and with particular sign forms; semantics, iconicity and maternal input all played a role in acquisition of individual lexical items. The input model may have been attended to in the children's attempts to sort out the

morphological distinctions between nouns and verbs; however, the variability of input--both in terms of canonical input production and the presence of optional rules in the adult language--seems to have contributed to the generally late acquisition of the process in deaf children. Late acquisition was also predicted because of the structure of the system itself, and its similarity to morphological systems acquired late by hearing children (cf. Slobin, 1973 and Berman, 1982).

In this study, after the children reached age two, there was a great deal of evidence supporting the hypothesis that children analyze the morphology of these noun and verb forms. At first, when they began to specify form class distinctions between related nouns and verbs, children did not use the canonical movement features that mark the morphology in adult ASL. At age 3;0, children began to mark the morphology consistently in terms of canonical distinctions, and this was the real point of departure in their morphological analysis. It should be noted that, at this same time (from age 2;0 to 4;0), children are learning a variety of other inflectional processes, each marked by featural distinctions of movement. Some involve the same features that mark the noun-verb pairs (e.g., restrained manner, reduplicated movement), but in different combinations. This may have an effect on the ways in which young children first mark the distinctions between related nouns and verbs.

Several patterns in development supported the notion that children perform a morphological analysis of the noun-verb

system. One entailed a comparison between maternal and child production at a critical period in acquisition. Throughout the input data, the proportions of pairable verbs produced in canonical form always exceeded canonical production of pairable nouns. But at a time when the children were grappling with a formal analysis of the system (around age 3;6), they reversed this input trend, and produced pairable nouns canonically more often than verbs. Somewhat later, close to four years of age, the children demonstrated their knowledge of the system for marking morphological distinctions by extending it to unpaired items and by inventing some of their own forms which exhibited all the criterial morphological features of paired nouns or verbs.

The children's acquisition of this process conformed precisely to the morphological predictions outlined in Chapter II, with two exceptions: nouns were not produced less accurately because of phonological complexity, and sequential rather than simultaneous production was not exhibited. Sequentially organized periphrastic forms (e.g., WEAR CLOTHES instead of PUT-ON-CLOTHES) did not appear in the data.

In summary, there seem to be four developmental steps in acquiring related nouns and verbs in ASL:

I. Age 1;0-2;0 Acquiring the Lexicon.

At this stage, the child is simply acquiring lexical items, and both the semantics and iconicity of the pairable items may motivate acquisition. Many concrete actions and objects are referred to, and many signs are highly mimetic. This is also true of the mothers' input. Both mothers and children enhance the image base of signs and extend the signs mimetically. But at this stage, neither the child nor the mother is morphologically marking these nouns and verbs.

II. Age 2;0-3;0 Learning about Form Class.

At this stage, maternal input changes dramatically; mothers begin to produce canonical noun and verb forms and to mark noun-verb distinctions with the criterial morphological features of manner, size and repetition of movement. Children begin to learn about form class, along with the syntactic properties and privileges of occurrence of nouns and verbs. Noun-verb pairs start to appear in the same utterance. Children begin to mark distinctions between nouns and verbs, but often in non-canonical or idiosyncratic ways.

III. Age 3;0 to 4;0 Acquiring the Morphological System.

At this stage, children are clearly performing a morphological analysis of the system; they are acquiring the process for formally distinguishing related nouns and verbs. Individual noun or verb items are usually produced in canonical form, and full morphological distinctions between pairs appear with greater regularity. The morphological markings are extended to unpaired forms and are applied to lexical innovations.

IV. Age 4;0→ Learning the Optional Rules.

From this age onward, children are learning the optional rules for marking related nouns and verbs in discourse, including contextually-appropriate use of grammaticized facial expression with verbs and deletion of repeated movement in nouns.

Early in development, mimetic and semantic factors may motivate lexical learning, but these factors are not relevant to learning the morphology. The road to acquisition of this morphological process is a long and arduous one. As predicted

from a morphological and language-specific standpoint, acquisition is very late.

On the basis of patterns of production in mothers and children, it seems necessary to re-evaluate the noun-verb process as it was originally outlined. In Chapter VI, I further explore the description of the process and the needs for future research.

NOTES

1. It should be noted that, in my data, there were numerous input examples of appropriate use of agreeing verbs and other indexed forms. This observation is in contrast with suggestions that mothers use no inflections in their early input to young children (as in Kantor, 1982; Newport, 1981).

2. The higher proportion of canonical marking of nouns in Sally's data occurs at 2;6, but the graph is deceiving, since the .50 for noun production is based on only two tokens. Similarly, the proportion of 1.00 for canonical marking of verbs at 1;9 is based on only one token.

CHAPTER VI. THE NOUN-VERB DISTINCTION:
A RE-EVALUATION AND A NEED FOR FURTHER RESEARCH

The original description of the noun-verb derivational relationship (Supalla and Newport, 1978) was a formidable beginning; it identified a formal morphological system for distinguishing related nouns and verbs in ASL, and systematically outlined the first set of features and rules for explaining the noun-verb relationship. It also provided me with a formal way to examine the process as it occurs in the adult language, in children's productions and in maternal input. My findings in this study revealed some additional information about related nouns and verbs, and how they are used in sentences of the language; these findings suggest the need for additions to the original description and for further research on the use of related nouns and verbs in ASL discourse.

It is obvious that the initial description was not a complete account of the noun-verb derivational relationship, even with respect to adult use of ASL. First, Supalla and Newport limited their discussion to a small set of nouns and verbs, proposing that the regularities they described "seem(ed) to apply primarily to concrete nouns and action verbs" (Supalla and Newport, 1978:100fn). However, my data suggest that these regularities extend far beyond their small set to include

non-concrete pairs as well as invented or newly coined pairs.

Second, in the productions of the adults studied, many of the specific items listed by Supalla and Newport (approximately 20%) did not conform to all of the criterial features posited.

Third, there is no indication of a definitive means for deciding which among the "family of verbs" is the paired verb of best "fit."

Fourth, and most important, the initial description pertains only to production of citation form signs. As my investigation has shown, there appears to be a great deal of rule-governed variability in the production of related nouns and verbs in discourse, and this variability should be part of a description of the process. As I discuss each of these areas in turn, the need for additional clarification and research will become evident.

Beyond Concrete Objects and Actions

The formal noun-verb distinction does not apply across all nouns and verbs in ASL. However, the process is productive in the language, and extends well beyond the concrete pairs initially listed by Supalla and Newport, to include a variety of pairs representing abstract concepts. I have observed a wide range of pairs which did not appear in the initial description. The following is a representative list of pairs which I have noted, either in test responses or in conversational contexts:

Non-concrete:

COMPARISON/COMPARE
COMPETITION/COMPETE
DERIVATION/DERIVE
IMAGINATION/IMAGINE
PROOF/PROVE
RAIN/TO RAIN
ATTENTION/PAY-ATTENTION
SELL/STORE
MIXTURE/MIX
REPETITION/REPEAT
ANALYSIS/ANALYZE
A COPY/TO COPY
EXAMPLE/SHOW
THUNDER/TO THUNDER

Concrete:

SHAMPOO/WASH-HAIR
MOTORCYCLE/RIDE-MOTORCYCLE
PLANT/GROW
WASHER/WASH
DRYER/DRY
SOUP/EAT-SOUP
PENCIL/WRITE
MARBLE/SHOOT-MARBLE
STAMP/PUT-ON-STAMP
STROLLER/PUSH-STROLLER
MONSTER/ATTACK-LIKE-MONSTER
BOW-&-ARROW/SHOOT-ARROW

Extending the Process

The process is not only productive for adults in terms of extending the frozen lexicon. Recent coinages have also included the canonical morphological distinctions: e.g., HANG-GLIDER/HANG-GLIDE.

I observed one innovative form in the making. In the linguistics research laboratory at The Salk Institute, there was an increasing need for a sign for videotape cassette. For their own use in daily conversation, each of the deaf researchers independently devised a sign. Each noun sign conformed to the criterial morphological features for nouns--small, tense, repeated movement--although the hand configurations differed. Each sign was iconically-based, motivated either by the shape of the cassette (with a B-B handshape, an example of substitutive depiction) or by the shape and movement of the hand inserting the

cassette into the recorder (using an $\hat{O}-\hat{O}$ handshape to create a highly mimetic sign). In each case, there was a related verb (a single, punctual action) for INSERT-CASSETTE-IN-RECORDER (see Figure 23a). When asked, some researchers indicated that they started from a noun sign, and formed a verb from that; others claimed that they started with the verb sign, and the noun was formed from the verb. The movement shape or hand configuration of the signs utilized in the lab still varies among signers, but the morphological marking is consistent.

In terms of productivity of the process, several deaf informants have suggested that the process can be extended to unpaired items, in pragmatically-appropriate situations, or in very specific contexts. These extended forms are context-dependent, but the sign creator has reason to believe that, on this occasion, the receiver can readily compute the meaning on the basis of shared knowledge. For example, in ASL, the sign SHOE[S-S;neutral space;approach to contact] is an unpaired noun sign. One deaf informant suggested that, if he were a nursery school teacher who had to put shoes on all the children in his class at the end of every school day, he could use a single (contact plus forward) movement verb form of SHOE meaning 'put shoes on' and this sign could even be inflected for distributional aspect to mean 'shoe-each-one-in-turn' (see Figure 23b).

Similarly, another deaf informant demonstrated a recently devised sign for 'take-off-by-space-shuttle' (a form combining

FIGURE 23. Adult Extensions of the Formal Distinction between Nouns and Verbs in ASL

a. Coining new lexical items



VIDEOTAPE-CASSETTE[inv]

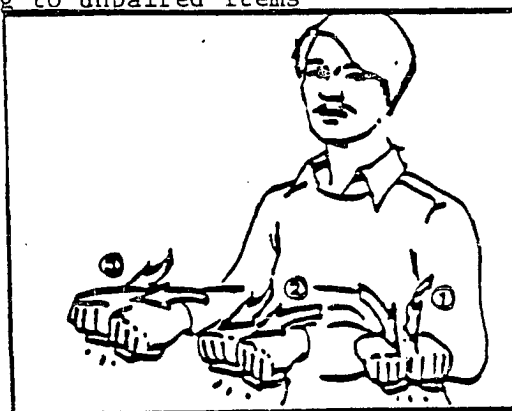


INSERT-CASSETTE-IN-RECORDER[inv]

b. Extending morphological marking to unpaired items



SHOE



Inflected form of the verb
SHOE[ext] meaning
'to shoe each one in turn'

the signs AIRPLANE and ROCKET, with a fusion of the R and ¹⁴ handshapes moving upward one time in neutral space). There is, as yet, no noun counterpart for this sign, but one was easily produced by two signers on request, each noun form bearing small, repeated, restrained movement.

Children also showed an ability to extend signs to create noun-verb pairs. For instance, within the context of a picture book illustrating a wheelbarrow, Sally (age 3;7) extended the noun WHEELBARROW to a single movement form for PUSH-WHEELBARROW. Outside that context, the verb form, in isolation, might not have been clearly understood, according to adult informants.

Clark and Clark (1979:767) have discussed similar conventions for creating denominal verbs in English (e.g., to porch a newspaper; to Houdini one's way out of a closet). In ASL, formal marking for distinguishing related nouns and verbs already exists; it seems that there can be lexical innovation in either direction (i.e., creating a noun from a verb or a verb from a noun)¹.

There is a need to investigate productivity of the formal marking in adults and children. Appropriate experimental tasks might require the production or comprehension of innovative forms based on contrived lexical items, or on unpaired items already in the lexicon. The research questions would address the following issues: Under what conditions can the extensions be employed and accepted? What are the limitations on their use?

This type of research might also clarify the derivational

history of the pairs already attested in the frozen lexicon; that is, can the process only operate in one direction (e.g., deriving verbs from nouns)? Or, given a root or stem movement shape, can signers derive both a noun and a verb form?

Lexical Gaps

In ASL, it is obvious that noun-verb pairs represent a restricted set of items, but it is not clear why this may be the case. Is there any explanation for the lexical gaps? For example, why do MILK, MELON, ICE-CREAM, DRESS, HAT, CAR and BOAT have verb counterparts, but not COOKIE, TOAST, BREAD, SHOES, BUS and TRUCK?

The semantic relationships between nouns and their associated verbs seems to be rather unpredictable. For instance, the verb EAT-WITH-SPOON has two related nouns: SOUP and SPOON. One represents the "object" affected by the action and one represents the instrument involved in the action. This unpredictability of semantic relationships also surfaces in the verb WIPE-NOSE, which has two related nouns: TISSUE and COLD. Furthermore, the image base of any given sign is unpredictable. For example, some noun signs are based on the shape of the object, and some on the characteristic action performed on or with the object.

In comparing the pairs cited by Supalla and Newport (1978) to the list of high-frequency nouns produced by young hearing children (cf. Nelson, 1973), 25% of the nouns produced by the hearing children are pairable items in ASL. Within each of

Nelson's semantic categorizations (e.g., food, clothes, vehicles), some items corresponded to ASL pairable nouns and some did not.² Some of the unpaired items do not seem to have semantically plausible verb counterparts that are immediately obvious (e.g., HOUSE, TREE, CLOCK), although semantic plausibility is not a simple issue; one could conceive of a verb that might relate to any given noun (e.g., 'house' and 'go to one's house'; 'tree' and 'climb tree'; 'clock' and 'set clock').

Many nouns, such as those unpaired items noted at the beginning of this section, have commonly and characteristically related actions. From a phonological standpoint, some of the ASL equivalents of the nouns appearing on Nelson's list have an image base which could easily accommodate a verb counterpart (e.g., SPAGHETTI, FLAG, KNIFE, SNOW), although others do not (e.g., MOON, WATER, APPLE, DISH). Further investigation may reveal patterns in the sign forms which can and cannot accept paired counterparts. However, it may be that, once again, the organization of ASL parallels Hebrew structure.

In describing the set of Hebrew nouns which are verb-related, Berman (1978:284,389) noted that the gaps are arbitrary; she found that lexical class or "semantic field" served as an inadequate criterion for specifying which nouns are verb-related, and the particular morphological pattern of the forms provided an equally ineffective explanation.

In Hebrew, a specific morphological shape is neither a necessary nor a sufficient condition for a given nominal to be

classed with the set of what Berman (1978:329) refers to as "action nouns." The same may be true in ASL, where unpaired items have the same properties as pairable signs. The morphological shape of any given sign does not characterize it as a paired or an unpaired item. For example, the repeated form BALL[5-5;neutral space;approach to contact] and the single movement, unrelated form THROW[S;neutral space;forward,opening to 3 or 5] both include all canonical features of nouns or verbs within the process described here; they also have a semantic relationship which is similar to many paired items in ASL. But neither semantics nor morphological shape gives any clue as to the status within the formal system for distinguishing related nouns and verbs. As in Hebrew, this may just be a matter of "lexical accident" (Berman, 1978:397), but further analysis is warranted.

Variability in Production

In looking at adult production of the specific noun-verb pairs listed by Supalla and Newport (1978), I found that many of the items do not, in fact, conform to all the proposed criterial distinctions. The authors themselves noted eight instances in which the noun form violates the morphological pattern of repeated movement, restrained manner and the same directionality as the verb (i.e., unidirectional or bidirectional movement). But there are a number of additional examples which do not conform to the description. These exceptions or irregularities may necessitate some modification in the description of criterial

features. Alternatively, they may be explained in terms of individual variation, where such variation requires its own "dialectal grammar."

In my confirmation checks with four deaf informants (fluent native signers), 20-25% of the paired items were produced in ways that were not consistent with Supalla and Newport's original description. In many of these pairs, both noun and verb were produced with single movement (e.g., BED, COAT, LATCH, SCARF, GAS-MASK). Moreover, in these and other pairs, noun and verb did not share the same movement contour. In some instances, the noun was single or repeated in a static location (as in EARPHONES, GUN, SCISSORS, BRACELET) but there was a straight or arced path movement in the related verb form. (Newkirk, 1981 has discussed path movement in detail). Some indication of these movement differences should be included in the description of the pairs, with, perhaps, some discussion of which items are particularly susceptible to individual variation.

Supalla and Newport classified their pairs in terms of movement repetition (specifically, single or repeated movement in verbs), manner (hold or continuous manner in verbs) and directionality (unidirectionality or bidirectionality shared by both noun and verb). But it seems that additional phonological specification is necessary, as this influences how movement shape is manifested. For instance, there is a distinction between contact and non-contact signs. Paired nouns including contact (e.g., TELEPHONE and CHAIR) exhibit muscle tension rather than

the "doubling back" movement described in restrained manner. However, restraint is more readily perceived in non-contact nouns (e.g., BOAT and AIRPLANE). In addition, the verb counterparts of these nouns often involve approach-to-contact, with a superimposed path movement.

Some pairs may be distinguished in terms of circularity versus linearity of movement; the verbs are often circular and the nouns linear (as in STORY/TELL-STORY; ICE-CREAM/EAT-ICE-CREAM). The pairs which include bidirectional "cycle movement" (e.g., BICYCLE/RIDE-BICYCLE; CAR/DRIVE) also behave differently from other pairs, particularly under reduction in discourse contexts. As I note later in this chapter, in most cases of "cycle" movement, as in bidirectional repeated movement, a single cycle is unacceptable as a reduction; a second cycle must be initiated, so that the hands return to, and proceed beyond, the first cycle.

These variations in movement exist within as well as across pairs, and the differences in citation form movement have consequences for how the sign is articulated under inflection and in discourse. Thus, a description of the noun-verb morphological system must specify movement type, over and beyond frequency, manner and directionality.

The "family of verbs"

In listing noun-verb pairs, Supalla and Newport (1978:102) selected one of the "family of verbs" which may relate to a particular noun. They noted that some related verb forms differ

from one another in predictable ways. Supalla and Newport cited the noun LAWNMOWER, which has a related verb with punctual meaning (i.e., GIVE-THE-LAWN-MOWER-A-PUSH), as well as a verb with durative meaning (i.e., MOW). The authors selected only one of these verbs (in this case, MOW) for the paired item, although they did not indicate on what basis they made their selections. Perhaps they chose the most common semantic usage, that is, mowing a lawn would most often be considered a durative action. But it is obvious that the signer's selection of a given verb form is context-dependent.

Supalla and Newport alluded to the rule-governed variations in verb forms. For example, in addition to the punctual/durative variants, they noted that spatial end-points may be unspecified (as in FLY or EAT) or they may be specified (as in FLY-FROM-HERE, FLY-THERE, FLY-FROM-HERE-TO-THERE, or PUT-IN-MOUTH). It may be that every verb has a specific set of semantic family members which are regularly marked and predictable in form. An important future research task is to characterize the "families" of verb forms and to describe their rule-governed variations.

Optional Rules for Noun Production in Discourse

In the use of members of a given "verb family", meaning in context is the criterion for selection. But there are other context-dependent modifications of noun and verb signs which seem to be governed by the syntactic environment.

Supalla and Newport proposed that manner of production is the criterial distinguisher of related nouns and verbs. In my

analysis, I posited three criterial features which mark canonical form: manner, size and repetition of movement. In spontaneous signing, I found that adult production of related nouns and verbs exhibited canonical form only 65-75% of the time. In the case of maternal input to the older children (i.e., children over 4;0), a fluent signer judged these non-canonical forms to be acceptable more than 90% of the time. Therefore, it is clear that nouns and verbs need not always appear in canonical form. This observation suggests a need to delineate optional rules, as well as obligatory contexts, for canonical production.

One very commonly occurring option involves deletion of repetition in nouns. This phenomenon has already been described for compounding processes (Newport and Bellugi, 1979). S. Supalla (1981) has suggested at least three additional contexts which allow single movement noun forms. These include emphatic stress, lists and repeated reference.

Under conditions requiring emphasis of nouns, the sign may optionally be produced in single form, but it retains a tense manner, which distinguishes it from a single verb form. In discourse, when listing a series of nouns, there is a change in the rhythmic properties of the signs;³ each noun sign is accelerated, and the pauses between them are reduced. In addition, movement repetition may be eliminated. Similarly, after a given sign is introduced into a conversation in citation form (thus providing new information), subsequent occurrences of that sign (i.e., as old or presupposed information) are reduced

and may be made without repetition. Note that these reductions of repetition apply only to noun signs with unidirectional repetition. Single movement nouns may only be reduced in size; bidirectional repeated signs must retain their repeated movement, but they may be reduced in size.

Contexts for all of these optional deletions appeared in my data, in the signing of both children and adults. For example, a compound with a reduced noun form, BABY¹BOWL 'baby-sized bowl', was produced by Jane at age 4;4. At 4;2, Corinne produced a stressed, single noun form in the following utterance: WHO SIT¹+ MY CHAIR¹+? 'Who sat down on my chair?'

In one task administered to adults (Action Demonstrations), subjects were asked questions after viewing a videotaped sequence of actions. When asked WOMAN, DO-DO? 'What did the woman do?', one subject responded: BRING-IN BOOK¹+, SCISSORS¹+, PAPER¹+ 'She brought in a book, scissors and paper'. Each of the nouns in the list was reduced in size and produced with single movement, rather than with the repeated movement of the canonical form.

One of the many instances of reduction of repetition in repeated reference occurred in maternal input to Corinne (age 3;11). The mother was telling Corinne a long, invented story about a boy who steals candy from a store. At this point in the story, the "mother" is making telephone calls, trying to find out where the boy got the candy. She hangs up the phone, then remembers the old man with glasses who owns the candy store:

Corinne, age 3;11, VT23, Pt.3, #403

Mother to Corinne:

MOTHER HANG-UP-PHONE. THINK
STORE²⁺. CALL-BY-PHONE OLD MAN HAVE
STORE¹⁺, OLD MAN, GLASSES-ON.

'The mother hung up the phone.
She thought of the store. She
called the old man who owned the
store, the old man with glasses.'

In this sequence, the first instance of STORE was signed in canonical form: movement was small, tense and repeated. The second sign for STORE (repeated reference) was small in size, with single movement.

One other context for reduction of repetition in nouns appeared in the Imitation Task presented to adults. The stimulus utterance was: TELEPHONE²⁺ RED²⁺ RING²⁺. ME PICK-UP-TELEPHONE¹⁺. NO ANSWER 'The red telephone rang. I picked up the phone, but there was no answer.' In this phrasal context of Noun + Adjective, four of six adult subjects produced a reduced, single movement form of TELEPHONE, despite the fact that the model was produced in full canonical form. All these subjects reduced the noun, but retained repetition in the adjective.

Deaf informants have suggested to me that the optional rules for reduction in Noun + Adjective phrases allow for much variation: repetition can be deleted in both signs, or retained in both signs, or retained/deleted in either noun or adjective. It seems that, when repetition is retained in the noun, the noun

takes on topicalized status. Both BALL²⁺ RED²⁺ and BALL²⁺ RED¹⁺ were translated as 'the ball is red' or 'the ball which is red'. However, when repetition was deleted from the noun, as in BALL¹⁺ RED¹⁺ and BALL¹⁺ RED²⁺, the translation was in the form of a noun phrase, 'red ball'. Experimental tasks designed to test these alternative forms may help to clarify which contexts or word orders facilitate which pattern of reduction, and how these variations are reflected in meaning changes.

Contexts for Canonical Production of Nouns

Since there are so many contexts for optional reduction of noun signs, the question remains: In what contexts is full canonical form required? It seems that, when the noun is in phrase-final position, or is topicalized within the sentence, canonical form is produced. In fact, there were several instances, in responses to the Imitation Task, when subjects changed the order of the sentence in order to produce a canonical noun in phrase-final or topicalized position. For example, in the stimulus utterance for TELEPHONE noted above, one adult subject changed the sentence as follows, producing a canonical noun in phrase-final position: RED LIGHT RING TELEPHONE²⁺. PICK-UP-PHONE, NO ANSWER 'The red light rang on the telephone. I picked up the phone, but there was no answer.'

On the children's Imitation Task, there was only one stimulus sentence in which the noun was neither topicalized nor phrase-final: ME MUST CLOSE-WINDOW¹⁺. NOT SEE WINDOW²⁺ HERE 'I have to close the window, but I don't see a window here.' Seven

of the 28 child subjects changed the sentence so that the noun was in final position (usually by omitting the sign HERE). One subject topicalized the noun as follows: WINDOW²⁺, CAN'T SEE, ME 'The window, I can't see it'.⁴ All children who modified the stimulus sentence in these ways were at least seven years of age.

Thus, it may be that the children have an added burden in their morphological acquisition task: they must learn not only the canonical forms, but also when they are required and when optional rules may apply. Cross-sectional tests can be devised to determine at what age or stage of development children do exhibit an understanding of the options (lexical, morphological, syntactic and pragmatic) which are available to them in the adult language.

Variations in Verb Production

Thus far, I have looked at morphosyntactic changes in nouns. Are there similar changes in verbs? The verb system in ASL allows for many variations in form. One variation is reflected in standard changes in form (the "verb family") in which the single or repeated movement relates to durative, punctual or perfective aspect. Verbs also can be varied in "less standardized" ways (Supalla and Newport, 1978:103), by means of the system of "mimetic depiction" (see my prior discussion of "mimetic depiction" as described by Newport and Supalla, 1980). Supalla and Newport (1978:103) have noted that, under this system, the form of a verb, e.g., GIVE-THE-LAWNMOWER-A-PUSH, can be changed to depict pushing the lawnmower "in a figure-8, in a

circle, or up and down small bumpy hills." These changes modify the shape of the verb movement in such a way that they no longer bear a direct movement relationship to their noun counterparts.

There are also processes which add repetition to single verbs and make them appear more similar to their related nouns in form and movement. For instance, the stem SIT appears as a single movement form which refers to punctual action (i.e., SIT-DOWN). A direct request, or imperative form, may also be single, but this context seems to add a longer path movement and a more definitive end-hold. Another form of SIT includes smaller, repeated movement, and appears in the context of a polite request. It usually co-occurs with a particular adverbial facial expression, a wrinkling at the eyes which means 'you really should'.

Deaf researchers have suggested that what I viewed as a polite request may, in fact, represent a derived stative verb (e.g., 'be sitting' or 'be seated').⁵ These possibilities can be tested under conditions which include a variety of sentence completion contexts such as BETTER____, ME ENJOY____, PLEASE____, YOU MUST____. It seems that not all verbs can be modified in these ways; further linguistic study can lead to a description of the rules governing which movement or meaning types permit such modifications.

Verb signs can be modified in other ways. S. Supalla (1981) has described two processes for nominalizing action verbs. One, which he calls "activity nominalization," focuses on the activity

of the verb (as in 'kicking'). The other, "action nominalization", focuses on the action of the verb (as in 'destruction'). Movement repetition is required for both processes, and is added to any single movement verb. Pauses between repetitions are eliminated to allow for "a smooth flow" of movement (Supalla, 1981).

The main difference between the two processes is that movement is extended for activity nominalizations and reduced for action nominalizations; under the latter process, movement becomes more tense as size decreases. Thus, action-nominalized verbs may look very much like nouns. This may also occur under certain verb inflections, which can add repetition, reduce size and impose tension on a verb form. Frequently, there is a rhythmic change inherent in inflectional movement.

Changes in movement repetition in verbs may also occur in emphatic stress or imperative forms. In both cases, unidirectional repeated verbs may be produced with single movement, but bidirectional repeated verbs must retain some degree of repetition, continuing at least slightly beyond one full cycle (see Newkirk, 1981 for a discussion of how inflection affects repeated verbs). If repetition is deleted in a bidirectional repeated verb, there will be a concomitant change in meaning (e.g., from HAMMER to DRIVE-IN-NAIL).

In the data reported here, adverbial facial expressions sometimes served as the only distinction between a given noun and verb form. Apparently, verbs need not be produced in canonical

form when an adverbial facial expression is superimposed. This alternate verb marking can be used to eliminate redundancy in the signal. Future experimentation should clarify whether, as has been suggested to me, verbs must be produced with an appropriate facial expression, and which expressions are applicable to which verbs. Also, we must know when a canonical verb form can be or must be produced, and which of the grammaticized facial expressions can co-occur with nouns.

The work of Supalla and Newport was a beginning. This investigation takes the study of the noun-verb process a step further. But a great deal more research is needed, in order to clarify and specify the regularities, irregularities and options that characterize this morphological process.

Listing Related Nouns and Verbs in the Lexicon

One issue that is not yet clear is how these related nouns and verbs should be listed in the lexicon. Supalla and Newport (1978:124-125) recommended only one lexical entry for each noun-verb pair, specifying place of articulation, handshape and shape of movement. Manner and frequency of movement, which distinguish noun from verb, may then be introduced or altered by a series of rules. Note, too, that the features which mark uninflected nouns and verbs can change when additional rules for other inflectional or derivational processes are applied. Due to the existence of optional rules and sign form variations, this type of listing may be less simple and direct than it seems. Perhaps, as Berman (1978:411) has suggested in her discussion of

related nouns and verbs in Hebrew,

much idiosyncratic and exhaustive listing is required--with general, productive processes and predictable interrelations being accorded the consideration they merit, and with all the rest lying outside the system as part of the speaker's accidental, real-life knowledge of how his language is used in fact.

It seems that there are many rule-governed options and variations within this process in ASL. But if, as in Hebrew, so much of the form and meaning relationship between nouns and verbs involves "accidental" learning, it is small wonder that mastery of the process comes so late in child development.

NOTES

1. As I note later in this chapter, there is also a process for nominalizing verbs, to derive meanings such as 'the act of smoking' or 'the activity of destroying'. These nominalized forms may be applied to verbs which already have paired nominal counterparts within the system under study here.

2. The only exception was the semantic category of "animals," which contained no pairable ASL counterparts. However, there is a different process in ASL which derives, from certain signs for animals, a form meaning 'to act like_____'. This process applies to PIG, TURTLE and other animal signs, and represents the same kinds of metaphorical extensions that exist in English (e.g., piggish, slow-as-a-turtle, etc.).

3. S. Supalla noted that there is a difference between list items and coordinate compounds. Newport and Bellugi (1978) have described the syntactic means by which terms are created for superordinate categories in ASL. The formation of these signs is regular: there is an equal reduction in the movement of all signs, both in extent and in number of repetitions; pauses between signs are minimal or eliminated; and the transitions between signs are minimal. These compounds are composed of selected examples, or prototypes of a given category (although the selection may vary among and within signers), and the resulting meaning is a superordinate term, not the composite meaning of the list members (e.g., APPLE^ORANGE^BANANA ETC. means 'fruit'). In lists, there are also rhythmic changes, but each sign retains its original and independent meaning.

4. Note that deaf informants found this sentence construction somewhat awkward, but acceptable.

5. Carol Padden. Personal communication, July, 1982.

CHAPTER VII. SUMMARY

My aim in this investigation was to describe the acquisition of the formal system for marking morphological distinctions between related nouns and verbs in ASL. I was interested in determining how acquisition might be affected by semantic factors which apply across languages, by language-specific devices which pertain to morphology, by modality-specific factors of iconicity and by maternal input.

The formal marking of noun-verb distinctions was identified by Supalla and Newport in 1978, but it was never before examined in adult and child production. I reviewed the initial description of the process in Chapter II, and outlined my procedures in Chapter III. Then, in Chapter IV, I presented the results of my testing of deaf adults and children. First, I set out to confirm the existence of the distinction in the adult language, since the paired nouns and verbs have not been differentiated in dictionaries of ASL. Through testing of deaf adults, I was able to answer two questions: a lexical question--Are there consistent differences between the noun and verb forms of lexical items in the adult language?--and a morphological question--Do deaf adults generally mark these formal distinctions in related nouns and verbs?

Five elicitation tasks were administered to deaf adults who

are fluent signers. Results pointed to a definitively affirmative answer to both questions. All tasks were successful in demonstrating adults' knowledge of the morphological distinctions between related nouns and verbs. Moreover, I found that the process is productive in the adult language in a variety of ways. Adults apply the formal distinctions to lexical items representing concrete objects and their related actions (e.g., CHAIR and SIT), as well as to abstract nouns and verbs (e.g., STORY/TELL-STORY). Furthermore, deaf adults can employ the noun-verb distinctions for lexical innovation in pragmatically-appropriate situations (e.g., extending the noun SHOE to produce a verb such as SHOE-THE-CHILDREN) and for coining new lexical items (e.g., VIDEOTAPE-CASSETTE/INSERT-VIDEOTAPE-CASSETTE-IN-RECORDER).

Analysis of the data gathered through elicitation tasks revealed a variety of rule-governed options which go beyond the morphology and which may be used in addition to, or in lieu of, the formal distinctions. Thus, there is variability in the adult language which may make the task of acquiring the system a difficult one for young children.

My cross-sectional testing of deaf children showed that they acquire the morphological system in stages that parallel the acquisition of some formal systems in spoken languages. The youngest subjects (age 2;0-4;0) produced some pairs with identical form, i.e., with no distinction between related noun and verb. Some pairs were marked by partial distinctions, i.e.,

criteria differences in size, repetition or manner of movement, but not all three. Full canonical distinctions were rarely marked by the young children, but the proportion of full distinctions increased significantly with increasing age. In the younger age groups, pairs were frequently differentiated by non-canonical distinctions; in these pairs, clear differences between noun and verb were marked, but not according to the morphological features that appear in the adult language. For example, paired nouns and verbs were differentiated solely by changes in movement shape, or manner of offset, or face/body movements.

There have been similar reports that hearing children may mark morphological or phonological distinctions in non-standard ways; children make use of whatever linguistic means are at their disposal while "waiting" to master adult forms (Slobin, in press). It appears that, in acquiring ASL, young children seem to be aware that there is a formal noun-verb distinction, but, until they sort out the criteria features of the system, they mark differences in a variety of non-standard or idiosyncratic ways.

In the spontaneous longitudinal data I presented in Chapter V, I followed three deaf children and their mothers, and noted how their production of related nouns and verbs changed over time. The data clearly showed that, in order to acquire the formal system for distinguishing related nouns and verbs, children proceed through a series of stages, gradually performing

a morphological analysis of the system. But very early in development, a variety of factors seem to motivate acquisition of related nouns and verbs.

There is evidence that semantic organization of the lexical items may contribute to early lexical learning. The early utterances of deaf children, like those of their hearing counterparts, are concerned with objects and actions. The first nominals used by deaf children are similar to those reported in the data on hearing children (e.g., Nelson, 1973). However, the action words appearing in early lexicons seem to differ across languages.

The early lexicons of four deaf children contained many action signs that appear as actual verbs in the adult language; many single-word utterances consisted of these signs. By contrast, verbs rarely appear as single-word utterances in English-speaking children (Benedict, 1979).

The type of verb used by young deaf children also differed from that observed in hearing children. It has been reported (Bloom and Lahey, 1978; Clark, 1978b) that, when hearing children learning English, Finnish, German, Japanese or Korean begin to use verbs, in multiword utterances, they most often produce "general purpose verbs." In English, these general purpose verbs, which can be applied across a variety of situations, appear in forms such as do, make, put, go and get. In ASL, general purpose verbs are not common, but there are many "specific action verbs" (e.g., separate lexical items exist for

OPEN-DOOR, OPEN-WINDOW, OPEN-JAR, etc.). These verbs in ASL include reference to the action and its related object within a single sign. Specific action verbs appeared frequently in the very early lexicons of deaf children, even as single-word utterances; this fact seems to relate to both the structure and the modality of ASL.

When I examined the sequence of noun and verb development, the deaf children exhibited the same order of acquisition of semantic notions that was suggested in the literature on English. Nouns representing concrete objects were more frequent in the early lexicons than nouns representing large, static objects or abstract nominals (cf. Nelson, 1973). Early pairable verbs most often represented non-locative actions; these were followed by verbs coding locative and instrumental relations, as well as abstract actions (cf. Bloom et al., 1975).

My data support the notion that, regardless of the language to be learned, young children focus on similar content in their utterances. In addition, the sequence of acquisition of particular semantic relations seems to apply across languages. However, the language-specific devices for encoding semantic relations contribute to differences in early development, particularly in verbs.

Gentner (in press) has referred to language-specific differences in the "conceptual packaging" of verbs, that is, which aspects of a given action are considered linguistically relevant. The way in which ASL encodes verbs seems to facilitate

their early use; for instance, the fact that a given verb sign may incorporate the object of the activity seems to allow for early verb use in single word utterances. In addition, the modality-specific potential of iconicity in ASL may have a facilitating effect on the acquisition of verbs. The mimetic nature of verbs in ASL, and their apparent similarity to the actions they represent, seem to contribute to early verb acquisition. The observation that noun acquisition appears to be more consistent across languages than verb acquisition lends support to the notion that there may be a difference in the internal, cognitive organization of nouns and of verbs (cf. Gentner, 1978; Huttenlocher and Lui, 1979).

I hypothesized that iconicity would be a motivating factor in acquiring related nouns and verbs in ASL. On the basis of his experimental data on young hearing children, Brown (1980) suggested that iconic signs are three times more likely to be learned than arbitrary signs. However, many others have felt that iconicity plays no role in acquisition of ASL as a native language (e.g., Baron and Isensee, 1977a,b; Bates et al., 1979). In fact, studies of the acquisition of morphological processes in ASL (Meier, 1982; Newport and Supalla, 1980) have shown that young deaf children make little use of the potential of iconicity or spatial analogy in their morphological development. By contrast, the deaf subjects studied by Feldman (1975), who devised their own gestural communication in the absence of sign language input, relied heavily on iconic gestures. And in my

data, a large proportion of the early signs of the deaf children were highly mimetic; this was particularly true in the case of pairable verbs.

The data supported my predicted sequence of acquisition of verbs in terms of their mimetic properties: highly mimetic verbs appeared before partly mimetic, translucent or opaque verb forms. Children often extended the mimetic potential of noun and verb signs, although, at times, they also produced non-mimetic or counter-iconic sign forms. When children mimetically extended nouns, it was on the basis of the related action that was represented in the sign form; the added feature of shape iconicity did not seem to facilitate early acquisition of pairable nouns. In Feldman's (1975) data, all early invented symbols were closely tied to action, in both form and meaning. All these findings seem to support the theory of the prominence of object motion, use or function in early word acquisition (cf. Nelson, 1974) as opposed to form or perceptual features (cf. Clark, 1973; Gentner, 1977), but certainly, additional investigation is warranted.

I proposed a third motivating factor in acquiring pairable nouns and verbs: maternal input. I predicted that mothers would highlight the inherent iconicity of related nouns and verbs, but would, at the same time, clearly mark the morphological distinctions between paired items. I found that mothers often focused on the iconic properties of signs in their early input, and they extended many signs iconically. In these instances, it

seemed that mothers were making the signs more salient to the children. They did not appear to be teaching their children about which aspects of a given referent are iconically represented; however, I would not expect that to be a common teaching strategy in addressing a very young child, since it would require metalinguistic awareness on the part of the child.

The specific features of sign motherese noted here fall under the same categories as indicated for hearing mothers (cf. Blount and Padgug, 1977). The "prosodic and paralinguistic feature" used to attract attention most often took the form of exaggerated intonation contours in spoken language; in ASL, it was exaggerated sign size and sign movement reduplication. The features aimed at directing attention to speech [sign] as an activity were, as in the hearing mothers' data, repetition of lexical items and imitation of child productions. However, the features which "relate [sign] activity to the environment in meaningful, referential ways" made use of modality-specific potential in ASL: signing on the child's body, molding the child's hands to form a given sign, using objects as part of a sign, and so forth.

All these features of sign motherese were also observed in the signing of a three-year old deaf child to her one-year old sister. Similar code-switching abilities have been reported in four-year old hearing children (cf. Sachs and Devin, 1976; Shatz and Gelman, 1973).

In viewing maternal production of the specific nouns and

verbs under investigation, I found that mothers' input did not highlight the shape iconicity of pairable noun signs, but these nouns were extended iconically to focus on the action represented in the sign. This type of mimetic extension of nouns also occurred in the children's signs. A very large proportion of mothers' early verb signs was highly mimetic; this was also reflected in the children's verb production. The frequency of highly mimetic verbs decreased in maternal input when the children reached approximately two years of age, after which increasing numbers of translucent and opaque forms were produced.

Most surprising was that the mothers did not often produce pairable nouns and verbs in canonical form in their early input, when the children were less than 2;0. This was not merely a function of their attempts to exaggerate sign forms, since canonical marking is retained in other discourse contexts requiring exaggeration (e.g., sign "shouting" and theatrical/ stage sign). Mothers were actually stripping away the morphological distinctions between nouns and verbs, and producing ungrammatical forms. This lack of grammaticality is rarely reported in the literature on spoken language input (cf. Blount and Kempton, 1979; Blount and Padgug, 1977; Newport et al., 1977).

It seemed that the deaf mothers were intent on demonstrating the global movement shape of these signs, but not the morphological details. It may be that mothers only introduce new signs in this more basic form, and later, when they feel that the

child has understood these signs, mothers produce canonical forms with grammatical markers. Or, it may be that mothers intuitively feel that their very young children cannot attend to and perceive the fine movement and manner distinctions with which the morphology disambiguates related nouns and verbs.

Even in the later stages of child development (>4;0), mothers were only marking canonical distinctions 75% of the time. However, unlike the early input, these later forms which were not marked with full distinctions were judged to be grammatically and pragmatically acceptable more than 90% of the time. The later production of forms which were not marked by all canonical features was due to the many rule-governed options in the language which allow for variation or reduction in nouns and verbs. These inconsistencies in input seem to make the job of mastering the distinctions more difficult for the young child.

Acquisition of these morphological distinctions is a long, slow process for deaf children. The stages of acquisition parallel those reported for Hebrew-speaking children acquiring the binyan system of verb patterns (cf. Berman, 1982). Hebrew is analogous to ASL in terms of its rich morphology and its simultaneous organizational structure. In Hebrew, the affixal inflectional system is acquired by age three, but the binyan derivational system, which is not entirely regular or productive in the language, is not mastered until age six (Berman, 1982). In ASL, certain aspects of the inflectional morphology (e.g., verb agreement) are acquired by age 3;0 to 3;6 (Meier, 1982). It

seems that, as in Hebrew, derivational systems in ASL may be mastered only after certain inflectional systems are acquired.

The following steps were observed in the deaf children's acquisition of the derivational process for distinguishing related nouns and verbs:

I. Age 1;0-2;0. Children make no distinctions between noun and verb forms.

II. Age 2;0-3;0. Children sporadically mark nouns and verbs with appropriate features, but they do not do so systematically. Noun-verb pairs are often distinguished in non-canonical or idiosyncratic ways.

III. Age 3;0-4;0. Children mark distinctions between nouns and verbs quite systematically, and they begin to extend the morphological markings to unpaired forms and to lexical innovations.

IV. Age 4;0→ From this age onward, children are learning the optional rules for marking related nouns and verbs in discourse.

In the early child data, there was much variability in production, both across and within pairs. At the same time that the mothers were not marking canonical distinctions, neither were the children. In maternal input, verbs were almost always produced in canonical form more often than nouns; this was also true in child production. This finding did not, however, relate to any difference in phonological complexity, as I had hypothesized; even the very youngest children were able to produce nouns in canonical form, despite the apparently high level of motor control I thought would be needed to produce restrained manner.

Although early child production may have reflected maternal input, at a point when the children were clearly performing a morphological analysis of the noun-verb system (age 3;0-4;0), their canonical production was proportionately higher than the mothers', and nouns were produced canonically more often than verbs. As they progressively learned the optional rules of the language, the children's noun and verb forms were, like their mothers', judged to be acceptable in context (60-80% of the time at age 4;2-4;4). Children have to learn not only how to produce the canonical forms, but when to produce them; that is, they must learn the criterial morphological markers, as well as the contexts which are appropriate for production of reduced forms. These two levels of learning seem to add complexity and time to the task of acquisition.

Surely, additional corroborative data are required to document the acquisition of the noun-verb process in ASL. And a more detailed description of the process is in order, as I discussed in Chapter VI. Additional testing of children and adults will help to confirm the productivity of the process for lexical extension and innovation, to describe the optional rules for alternate marking of nouns and verbs, and to determine the rules governing obligatory and optional use of canonical forms in discourse.

This study contributes to the body of knowledge about the morphology of ASL and how it is acquired by deaf children. It also addresses the role of iconicity and input in acquisition,

which is often under-emphasized. The elicitation procedures employed here may facilitate the development of a battery of tests to assess morphological acquisition in deaf children. Most important, this study underscores the similarities and the differences between ASL and spoken languages, in terms of the semantic organization that applies across languages, the morphological devices that exist within specific languages, and the iconic potential particular to the modality of a signed language. It seems that what very young children talk about in different languages may be basically the same, but how they encode these meanings can differ considerably, depending on the structure and modality of the language they are learning.

The results I have reported suggest that, in the early stages of learning the lexicon of ASL, acquisition may be influenced by semantics, iconicity and maternal input. But in acquiring a morphological system, children must go through the gradual process of performing a morphological analysis. Only by means of this analysis can deaf children master the distinctions between related nouns and verbs in ASL, and understand when and why "A PLANE" is not "TO FLY".

Appendix A. Stimuli for the Comprehension Task Administered
to Children and Adults

<u>TARGET ITEM</u>	<u>PAIRED COUNTERPART</u>	<u>PHONOLOGICAL DECOY</u>	<u>SEMANTIC DECOY</u>
DOOR OPEN-DOOR	OPEN-DOOR DOOR	COOK TURN-OVER (flip pancake)	HOUSE WINDOW
ROCKET BLAST-OFF	BLAST-OFF ROCKET	ELEVATOR STRIKE-MATCH	FLYING SPACESHIP SPACEMAN
TELEPHONE CALL-BY-PHONE	CALL-BY-PHONE TELEPHONE	PIPE KISS-ON-CHEEK	WRITE-LETTER TYPEWRITER
SCISSORS CUT	CUT SCISSORS	CRAB SWIMMING-FISH	CLIP-NAIL-WITH CLIPPERS CUT-WITH-KNIFE
BRACELET PUT-ON-BRACELET	PUT-ON-BRACELET BRACELET	ROCK PUT-ON-SOCKS	PUT-ON-NECKLACE WRISTWATCH
UMBRELLA OPEN-UMBRELLA	OPEN-UMBRELLA UMBRELLA	MOP ZIP-UP-ZIPPER	HOLD NEWSPAPER OVER HEAD RAINCOAT AND BOOTS
EARPHONE PUT-ON-EARPHONE	PUT-ON-EARPHONE EARPHONE	WASH-HAIR PUFFED CHEEKS	EAR PUT-RECORD-ON RECORD PLAYER
AIRPLANE FLY-BY-PLANE	FLY-BY-PLANE AIRPLANE	KNOCK-ON-DOOR THROW BALL	BIRD FLYING HELICOPTER
CHAIR SIT	SIT CHAIR	TRAIN HANG-ON-HANGER	LIE-DOWN TABLE
HAT PUT-ON-HAT	PUT-ON-HAT HAT (sun hat)	PIRATE SLAP-ON-CHEEK	BRUSHING HAIR SUNGLASSES

Appendix B. Stimuli for the Imitation Task Presented to Adults

(All target nouns and
verbs are underlined)

INSTRUCTIONS: YOU WATCH-ME. ME SIGN. FINISH. YOUR-TURN. YOU
COPY-ME. SIGN EXACTLY-SAME-AS-ME.

'Watch me. I'll sign something, and then
it's your turn. Copy me. Sign exactly the same as I
do.'

1. WOMAN WANT SHOW PICTURE. SEE THREE CHILDREN, SHOW3+.
'The woman wanted to show the picture. She saw three
children, and showed it to each of them.'
2. ME THINK SOCKS IN DRAWER; MOM OPEN-DRAWER, ZERO.
'I thought the socks were in the drawer, but Mom opened the
drawer and it was empty.'
3. MOTHER NEED YOUR ATTENTION NOW. PAY-ATTENTION PLEASE.
'Mother needs your attention now; pay attention please.'
4. ME HAVE BAD COUGH; CAN'T STOP COUGH.
'I have a bad cough and I can't stop coughing.'
5. WOMAN WANT NEW RING. MAN GIVE-HER; HE PUT-ON-RING.
'The woman wanted a new ring, so the man gave her a ring and
put it on her.'
6. ME KNOW-HOW SEW-ON-SEWING-MACHINE. EVER-SINCE GROW-UP ME
SEW-ON-SEWING-MACHINE.
'I know how to use a sewing machine; I've sewn all my life.'
7. MY OLD ZIPPER BROKE. FIX. SUCCESS. ME ZIP-UP.
'My old zipper broke; I finally fixed it and I zipped it up.'
8. GIRL NOT-LIKE SWEEP BASEMENT; SHE PATIENT SWEEP EVERY-DAY.
'The girl doesn't like to sweep the basement, but she
patiently sweeps it every day.'
9. MY FATHER BEFORE HAVE STORE. NOW SOLD.
'My father used to have a store, but now it's sold.'
10. ME ENJOY RIDE-BIKE. YESTERDAY ALL-DAY ME RIDE-BIKE.
'I enjoy bike-riding; all day yesterday I rode my bike.'
11. PHONE RED, RING. ME PICK-UP-PHONE, NO ANSWER.
'The red phone rang; I picked up the phone, but there was no
answer.'

12. ME HUNGRY; ALL-DAY FOOD NONE. WOW, HUNGRY NOW.
'I'm hungry; I haven't eaten all day; boy, I'm hungry now.'
13. MAN KNOW MAGIC EXPERT. HE CAN MAKE-MAGIC.
'The man really knows magic; he can cast a spell.'
14. YESTERDAY DAD BUY BOOK. TODAY HE OPEN-BOOK. READ.
'Yesterday Dad bought a book; today he opened the book and read.'
15. MY FRIEND SICK AGAIN. TEND-HIS SICK ALL-HIS-LIFE.
'My friend is sick again; he's been sick all his life.'
16. ME BUILD PUT-TOGETHER AIRPLANE. FINISH, PAINT. ME FLY-AIRPLANE.
'I built an airplane, then I painted it and flew the plane.'
17. ME KNOW STORY. YOU WANT ME TELL-STORY?
'I know a story; you want me to tell you a story?'
18. ME HAVE HORDES WATCH; THIS MY FAVORITE WATCH.
'I have lots of watches, but this is my favorite watch.'
19. YESTERDAY MY KEY LOST. LOOK-FOR, FIND, ME LOCK-UP WITH-KEY.
Yesterday my key was lost; I looked for it, found it and locked up.'
20. ME NEED VACATION; SUCCESS, ME TAKE-VACATION NOW.
'I need a vacation, and I'm finally off now.'
21. ME LEARN NEW SONG, ME SING FOR-YOU.
'I learned a new song that I'll sing for you.'
22. BROTHER HAVE MANY BOX; ME HAVE ONE BOX.
'My brother has many boxes, but I have only one box.'
23. ME BUY NEW CAMERA; ME WANT TAKE-PICTURE MAMA.
'I bought a new camera because I want to take a picture of Mama.'
24. MY SISTER LOVE EAT-ICE-CREAM; EVERY-DAY SHE EAT-ICE-CREAM.
'My sister loves to eat ice cream; she eats it every day.'
25. ME HAVE ROLLER-SKATES, BROKE; FIX, FINISH; ME GO-ROLLER-SKATE.
'My roller skates broke; I fixed them and went skating.'
26. ME LOVE BASEBALL; SEE MAN HIT-BASEBALL GO-FAR.
'I love baseball; I saw a man hit a baseball really far.'
27. DAD FORCE-ME MOW-LAWN; PATIENT, ALL-DAY ME MOW-LAWN.
'Dad made me mow the lawn and I patiently mowed all day.'

Appendix C. Stimuli for the Action Demonstration Sequences

Instructions: WOMAN WILL DO DIFFERENT³⁺. YOU WATCH-HER.
REMEMBER. THEN YOU TELL-STORY. NOW WATCH. REMEMBER.

'The woman will do diferent things. You watch her and remember what she does. Then you'll tell the story. Now watch and remember.'

1. Woman takes out toothbrush and hairbrush from drawer. She brushes her teeth, then brushes her hair.

Target items: TOOTHBRUSH/BRUSH-TEETH
HAIRBRUSH/BRUSH-HAIR

2. Woman walks in carrying coat hanger and coat, wearing a smock. She takes off the smock and hangs it up. Then she puts on her coat and leaves the room.

Target items: HANGER/HANG-UP
COAT/PUT-ON-COAT

3. Woman takes bracelet and earrings from a jewelry box. She puts on the bracelet, then puts on the earrings, and closes the box.

Target items: BRACELET/PUT-ON-BRACELET
EARRINGS/PUT-ON-EARRINGS

4. Woman comes in carrying paper, scissors and a book. She puts each on the desk, then opens the book, cuts strips of paper, inserts them in the book. Then she closes the book and leaves.

Target items: SCISSORS/CUT
BOOK/OPEN-BOOK

5. Woman takes cigarette and matches from her purse. She strikes a match, lights the cigarette, and smokes.

Target items: CIGARETTE/SMOKE-CIGARETTE
MATCH/STRIKE-MATCH

STIMULUS QUESTIONS:

For Action Demonstration Stories:

NOW YOU TELL-STORY.

'Now you tell the story.'

For Action Demonstration Questions:

WOMAN HAVE WHAT?

'What did the woman have?'

WOMAN DO-DO WHAT?

'What did the woman do?'

Appendix D. Stimuli for the Imitation Task Presented to Children

INSTRUCTIONS: WATCH-ME. ME SIGN. FINISH. YOUR-TURN. YOU COPY-ME.
SIGN EXACTLY-SAME-AS-ME. PRACTICE NOW. WATCH-ME.

'Watch me. I'll sign something, and then it's your turn.
You copy me. Sign exactly the same as I do. We'll
practice now. Watch me.'

Practice items: MAN BUY CAR.

'The man bought a car.'

TODAY BOY GO-OUT FISHING.

'Today the boy went fishing.'

MY SISTER NOT-LIKE ICE-CREAM; ME LOVE
ICE-CREAM.

'My sister doesn't like ice cream, but I love
ice cream.'

ME ENJOY RIDE-BIKE. TOMORROW ME RIDE-BIKE
ALL-DAY.

'I enjoy bike riding and tomorrow I'm going to
ride my bike all day.'

Test Stimuli (target pairs are underlined):

1. ME LIKE BASEBALL. ME EXPERT HIT-BASEBALL GO-FAR.

'I like baseball, and I can really hit a baseball far.'

2. FAT MAN SIT-DOWN WILL BREAK MY CHAIR.

'If the fat man sits down, he'll break my chair.'

3. MY TELEPHONE BROKE SO CAN'T CALL-BY-PHONE DAD.

'My telephone broke, so I can't call Dad.'

4. YOU WANT BLOW-NOSE, YOU BETTER USE TISSUE.

'If you want to blow your nose, you'd better use a tissue.'

5. ME MUST CLOSE-WINDOW, NOT SEE WINDOW HERE.

'I have to close the window, but I don't see a window here.'

6. MOTHER SEE PRETTY BRACELET; SHE DECIDE PUT-ON-BRACELET.

'Mother saw a pretty bracelet and she decided to put it on.'

7. I WANT CUT-WITH-SCISSORS PAPER; MY SCISSORS WHERE?

'I want to cut some paper; where are my scissors?'

8. THAT DOOR NOW LOCKED; YOU CAN'T OPEN-DOOR.

'That door is locked now; you can't open it.'

9. MY FRIEND GET-IN BOAT; HE GO-BY-BOAT HOME.

'My friend got into the boat and sailed home.'

10. I WANT TAKE-PICTURE MOM; MUST BUY CAMERA.

'I want to take a picture of Mom, so I have to buy a camera.'

11. MAN HAVE GUN BUT HE NEVER SHOOT-GUN.

'The man has a gun but he never shoots.'

12. ME CAN'T LOCK-WITH-KEY CAR, MY KEY LOST.

'I can't lock the car, because my key's lost.'

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