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Phonology of a Soundless Language: Phonological Structure of the American Sign Language

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Phonology of a Soundless Language: Phonological Structure of the American Sign Language

By

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A.B. (Columbia University) 1971
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Dissertation

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Phonology of a Soundless Language:
Phonological Structure of the American Sign Language*

Lynn A. Friedman

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Dedicated to the hope that Sign Language is universally accepted as the primary language of the deaf.

You never forget that frightening experience...You were left out of the dinner table conversation. It is called mental isolation. While everyone is talking or laughing, you are as far away as a lone Arab on a desert that stretches along every horizon. Everyone and everything are a mirage; you see them but you cannot touch or become a part of them. You thirst for connection. You suffocate inside but you cannot tell anyone of this horrible feeling. You do not know how to. You get the impression nobody understands or cares. You are not granted even the illusion of participation. You are expected to spend 15 years in the straightjacket of speech training and lipreading. You learn not how to communicate, only how to parrot words, never to speak your own. Meantime your parents never bother to put in an hour a day to learn the sign language...Instead, the most natural form of expression for you is dismissed as vulgar. It has never occurred to them that communication is more than method or talk. That it is a sense of belonging, an exchange of understanding, a mutual respect for the other's humanity.

Shanny Mow
-- How Do You Dance Without Music?
in
Leo M. Jacobs
A Deaf Adult Speaks Out
The material and analysis presented here is the result of nearly five years of research on the phonological structure of American Sign Language (ASL). In no way do I presume that this dissertation is the final analysis of ASL's phonological structure. In 1960, Stokoe presented a phonemic analysis of ASL (which he calls cheremic). His work was an exciting breakthrough; however, it did not represent a complete analysis and more importantly, it was constrained to a conservative model not conductive to an accurate description of the formational properties of the signal of a manual/visual language. I felt that after 16 years, a new and more complete analysis was needed—one that attempts to account for elements of manual/visual language, like pervasive iconicity and scalar features—that only occur to a minimal extent in oral/auditory language. However different my analysis from Stokoe's, I am indebted to him for his early, ground-breaking work.

Much recent work on ASL and other sign languages—especially by American linguists (including the author)—has concentrated on showing the similarities between oral and visual language. Initially, it seemed necessary to do this in order to 'prove' that ASL and other sign languages were really languages. It was a common but unfortunate misconception for many years that sign languages were agrammatical derivatives of the oral languages of the communities in which they existed. However, even after that view had been successfully combatted, the practice of concentrating on similarities persisted to such an extent that facts about the properties and structure of visual language were obscured. One of the purposes of the present work is to consider the
differences as well as the similarities between oral and visual lan-
guage.

I want to thank those who helped facilitate my research on ASL: William C. Stokoe, Jr. for hiring me as a research associate at the Linguistics Research Laboratory, Gallaudet College in 1972 and 1973, and for guiding me through my initial research on ASL; the National Endowment for the Humanities for awarding me a grant (in 1973) to study the phonological structure of ASL; the Danforth Foundation for financial support during my years as a graduate student; the Linguistics Department, U.C. Berkeley, for hiring me to teach a course on the structure of ASL, and the students of that class who, through their incisive questions and criticisms, enthusiasm, and creativity, changed many of my ideas about ASL. Their work and ideas are fundamental to the present form of my work.

I would like to thank my dissertation committee: Charles J. Fillmore, chairman, John J. Ohala, and Paul Kay--for their valuable comments and criticisms on earlier versions of the thesis. I am grateful to Paul Kay for his incisive criticisms of the thesis and for giving me help when it was very much needed. I thank John J. Ohala for guiding me through my early work on the 'phonetics' and 'phonology' of ASL, for being my faculty consultant during the period of my NEH grant, for his consistent demands for excellence and accuracy in experimental design and research and for his support and faith in my abilities to carry out this work.

I am deeply indebted to Charles J. Fillmore, who more than anyone else is responsible for my growth as a linguist. Throughout the years
as my graduate advisor, he encouraged me, criticized my work, and made 'impossible' demands that turned out to be not only possible but necessary. He required, although I did not always meet his standards, the same high quality of investigation and analysis in my work that is so apparent in his own. I am proud to have been his student.

I am very grateful to the people whose knowledge of and about their own language, whose patience in elicitation sessions, and whose enthusiasm made my work possible: Tommie L. Radford, Mary-Ellen Lentz, Lisa Jacobs, and Hedy Udkovitch, my primary informants during the last five years.

John Crothers provided me with much needed encouragement and critical comments throughout the period of research and writing of this dissertation. He and I had extensive discussions about the data I have examined and about the relative merits of various solutions and analyses. The form of this work would have been very different without his valuable advice.

I would like to thank Mark Mandel for his helpful comments and for finding errors of fact in an earlier version of this thesis; any that remain are my responsibility. Credit and gratitude are due Meryl R. Friedman and Tommie L. Radford for the hand configuration drawings which grace Chapter 2. I am grateful also to Eileen Odegaard, administrative assistant, and LaRue Seegmiller, graduate secretary of the Department of Linguistics, U.C. Berkeley, for their friendship and for all the help they have given me during the last five years. Finally, I thank Arax Kizirian, whose hand is on every page.
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CHAPTER 1

1. INTRODUCTION

1.0 American Sign Language (ASL) is a manual/visual language used by over a half a million deaf (and countless hearing) people in the United States today. It is one of many sign languages; there is no one universal Sign Language. Various visual languages such as ASL, Israeli Sign Language, Chinese Sign, and Iranian Sign Languages are totally unrelated historically. Others are related—such as American and French Sign Languages—but their historical relationship does not in any way correspond to that of the oral languages spoken in the same areas.

ASL (like others sign languages) is not derivative of any oral language. Its 'phonological', syntactic, and semantic structure is unique. It is not an alphabetic code for English, although the one-handed manual alphabet is used in limited ways in ASL, for instance to borrow technical terms or names from English. These languages are not comparable to those visual codes which have been called sign languages, such as American Indian Sign Language, or Neopolitan Sign Language, which are derivative at least in part from the oral language(s) of the community.

Use of the 'sign language' of the Plains Indians

was confined to situations of fairly limited and predictable contexts. Its users always had their native languages in which to express things not covered by the sign lexicon and grammar, so that matters of moment could be referred to an interpreter or translator. (Stokoe, 1972, p. 82)

ASL, however, is capable of all the range and diversity of expression possible in any language, although the means of expression is quite different from that of oral language. The study of ASL is not

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merely an investigation of another language, but a study of the ways in which the channel of communication—the mode of the signal—can affect language. The study of ASL and other sign languages will hopefully give us a new perspective on our understanding of language in general.

1.1 American Sign Language is historically related to French Sign Language (FSL). It was introduced to the United States in 1816 by Thomas Gallaudet, founder of the American Asylum in Hartford, Connecticut. There had already existed in the U.S. various local sign languages, and it was these local 'languages' in combination with the language brought from France that produced ASL. ASL and FSL are still to some extent mutually intelligible today. The most noticeable difference is seen in linguistic borrowing from the local oral languages, English and French.

The earliest documentation of FSL comes from the records of Abbé de l'Épée, a teacher of the deaf whose career began in 1752. (Publication of his teaching theories dates from 1776.) Épée discovered that his students, although they knew no French, could communicate with each other by means of what he called 'la langue des signes naturelles'. Since his goal was to teach them French, he devised a system of 'signes méthodiques' to augment the 'language of natural signs' (or the 'natural sign language'), adding signs corresponding to grammatical elements in French that did not occur in the natural sign language.

For instance, he invented signs for some French prepositions and for plural and other inflectional affixes. He invented signs for 'le' and 'la' so that his pupils would be able to make necessary gender distinctions in French; the present-day ASL and FSL signs BOY and GIRL are derived from those signs (although the hand shapes for these signs are different), a G hand (representing the number one) at the forehead for
'le' and a G at the cheek for 'la'. Épée incorporated elements of the natural sign language when devising new forms; for example, he modified the simple past index (flat open palm (B) or extended index finger (G) facing or pointing over shoulder to space behind body to indicate past time), having one 'coup de la main' indicate past, two indicate past perfect and three pluperfect. Today, ASL retains only the simple past index. (A reduplicated index to the space representing past time indicates 'very distant past' in present-day ASL.)

It was the combination of 'la langue des signes naturelles' and Épée's 'signes méthodiques' that became the French Sign Language that was brought to the U.S. in 1816. Over time, FSL and ASL have come to lose many of Épée's 'systematic' signs and to incorporate others into the 'natural' language.¹

Educators carried FSL through Europe and the U.S. Stokoe (1972) presents the following diagram indicating its dispersal: (following Stokoe 1972, Figure 8, p. 93)
Figure A

Sign languages acquired as natural languages

FSL ca. 1760

ASL 1817

Latvian

Swedish

Irish 1846-9

Austrian 1780

Swiss

Italian

Russian 1806

Dutch

Spanish

Australian ca. 1918

African 1960

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Interestingly, the sign language or languages used in Britain developed independently and are not intelligible to signers of ASL.

1.2 The language situation involves the language of a subculture, whose members must also know the language of the larger community. The situation differs from the typical one in that here the sub-culture language is articulated and perceived in the manual/visual modality, but is not written; thus the community is one in which there is literacy only in a second language. (Friedman, 1975b, p. 940)

A fact which complicates the investigation of ASL is that in addition to ASL, there is another variety of Sign Language—Signed English—which is a pidgin of ASL and English. It is composed of signs from ASL, words from English (articulated by means of the manual alphabet), and has primarily English syntax. There are also several manual/visual codes for English, used mainly for pedagogical purposes; these codes constitute a morpheme-to-morpheme representation of English.

The literate signer, therefore, controls several visual languages, ranging from ASL to any one of a variety of visual codes for English...It is also apparent that there is no definite line of demarcation between varieties. Thus we may say that there is a continuum of visual language, and the point on the continuum chosen by a signer is determined by the sociological and sociolinguistic circumstances of the discourse. (Friedman 1975b, p. 941)

This Sign Language Continuum presents obvious problems to the investigator of only one extreme of the continuum--ASL. Educated signers can easily 'talk' at all points along the continuum, and can switch from one point to another with facility. Most linguists working on ASL are non-fluent signers, who tend to evoke Signed English; it's a lot easier for English speaking linguists to understand Signed English than to understand ASL, and signers know this. Therefore, the linguist has to be extremely careful (lucky?) to elicit ASL, rather than Signed English.
In analyzing various video-taped portions of text (discourse) and series of isolated sentences translated from English cue sentences, I have found a striking difference between the two types of elicitation, in regard to grammar. These findings are not surprising when viewed in terms of the Sign Language Continuum...

In the light of the continuum, it is easy to see why signers, when asked to translate written English sentences, might tend to produce signed strings which look remarkably like English (even with repeated instructions to the informant not to do this). In the data I have examined, elicitation of isolated sentences show a marked resemblance to English. Textual data, however, bears no resemblance to English... (Friedman, 1976, p. 127-128)

This problem and solutions to it—for instance reliance on textual data—is thoroughly discussed in Friedman (ed., in press).

1.3 Articulatory parameters of ASL

There appear to be four major articulatory parameters in ASL—and in all other manual/visual languages: (1) hand configuration—the shape of the articulator(s); (2) movement—the movement of the hands in the formation of the sign; (3) place of articulation—that area on the body, or in the articulation space defined by the body, at which or near which the sign is articulated; and (4) orientation—the orientation of the hands in relation to the body.

1.4 We can demonstrate the existence not only of these four sub-lexical parameters in ASL, but also of finite sets of distinctive features within the parameters. However, the component structure of ASL (or of any given sign language) is not entirely analogous to that of oral language structures.

The most striking difference in the manifestation of ASL (and all sign languages) is that the structure of the language—on all levels—maximizes the use of visual imagery and the use of space. Essentially,
all the differences between oral and visual language structure discussed here derive from the fact that the language completely exploits the modality in which it is manifested—it makes complete use of all the iconic cues available in the manual/visual mode.

Oral language segments are necessarily produced in a strictly linear sequence. It is impossible to articulate either two phones or two lexical items simultaneously using the oral/auditory signal. The situation with regard to linearity is quite different in language using a manual/visual signal. Sub-lexical components in sign language—units of each of the four parameters—must be articulated simultaneously within a given (simple) sign. An individual component (of a parameter) in ASL cannot be articulated separately—that is, cannot be articulated (or perceived, for that matter) when not in combination with components of the other parameters. For example, a distinctive unit of the movement parameter cannot be articulated without a component of the hand configuration and the place of articulation parameter. Clearly, this is not the case in oral language; any segment may be articulated separately. (n.b. Of course, we must bear in mind that in the actual production of oral language, segments are not entirely discrete. We perceive the characteristics of a stop, which after all entails silence, by the formant structure of the transitions from the preceding and to the following vowel. The stop can be articulated but may not be perceived if articulated alone.)

There are a number of monomorphemic signs which have two different places of articulation or which have two hand configurations (i.e. the hand shape changes during the production of the sign). In those signs, of course, there has to be a linear sequence of components. (That is,
for example, one hand shape has to come first.) However, in these signs as well as in simple signs, each place or each hand shape can only be articulated in combination with components from the other parameters. (Also, we find (see §6.21) that the two parts (syllables?) of signs like HEAD (fingertips of B hand touch first the upper cheek and then the temple) and LIKE (5 hand, facing signer at chest, closes to 8--tip of middle finger and thumb make contact) function as a unified whole (see Figure 1, §2 for hand shape drawings). For instance, in the manifestation of emphatic stress, it is the movement between the two places of articulation that changes. In signs in which the hand shape changes, the characteristic movement of those signs is the opening or closing of the hands (or bending of the joints) and the beginning or ending shapes are predictable (from the end or beginning shapes, respectively).

It is also possible to simultaneously articulate two lexical items in ASL. For instance, the sentence 'Has he eaten?' may be rendered

\[
\begin{array}{c}
R \quad \textbf{EAT} \quad \textbf{FINISH} \\
L \quad \textbf{HE} \quad \textbf{(INDEX)}
\end{array}
\]

in which the dominant hand signs EAT, the non-dominant hand signs the indexical pro-form (an extended index finger pointing to a previously established location for the 3rd person referent), while the face carries the question intonation (in this case raising the eyebrows and furrowing the forehead).² (See §6.23 for physical correlates of question intonation.)

Furthermore, I think it can be argued that word order—that is, the linear sequence of lexical items—plays an insignificant role in ASL's grammar. Edge and Herrmann (1975) come to this conclusion in their
discussion of the determination of the relation of arguments to the verb in ASL. They conclude

...that the use of space to indicate grammatical mechanisms is the basis of the grammatical structure of ASL...

A description of the grammatical structure of ASL which stops at the level of word order fails to describes many of the basic mechanisms employed in ASL—mechanisms which optimally exploit the manual/visual modality through the use of space to indicate grammatical relationships and create visual representations of those relationships. (p. 62)

The grammar of ASL need not depend on fixed word order or case markings (it has none) to indicate the relation of argument to verb. The signer is able for example to move action verbs around in space from the direction of source to the location of goal of the action. Person, location, and temporal pro-forms are established in space (in conventional locations); first and second person (the interlocutors) are always present. Non-action verbs, e.g. psych verbs, may not be moved from source to goal, as they are necessarily made at or near the body (that is, their place of articulation is always some location on the body, not in neutral space). To indicate grammatical subject (agent or experiencer) and object (patient/beneficiary) of these verbs, the signer either orients his hands away from agent and toward patient (multi-orientation verbs) or actually moves his body (or merely his head) into the previously established location for the 3rd person referents (primarily bodily-anchored verbs). Edge and Herrmann (1975) present a detailed discussion of these and other grammatical mechanisms which are only possible with a manual/visual signal (and which exploit the use of that signal).

1.5 Hockett (1966) discusses a number of features which he claims are found in all human languages but not all of which are found in non-human
communication systems. I suggest that at least three of these proposed design features are not necessary properties of language but only of language in the oral/auditory modality.

Arbitrariness. The relation between a meaningful element in language and its denotation is independent of any physical or geometrical resemblance between the two...

Discreteness. The possible messages in any language constitute a discrete repertory rather than a continuous one. (p. 10)

De Matteo (1975) briefly discusses these features in the light of facts concerning the continuous (as opposed to discrete) nature of ASL's coding system. DeMatteo's primary concern is to argue that a notion of visual imagery is crucial to an accurate grammatical representation of ASL. He proposes that much of ASL's grammar can be viewed as analogic representations of real-world continuous phenomena. Oral language, constrained to the use of discrete (and arbitrary) elements, must codify real-world continuous phenomena like movement, size, and intensity in discrete terms: there must be distinct lexical items (which rarely, if ever, resemble each other phonologically) for each variant or nuance the language chooses to distinguish. Manual/visual language is not constrained to discrete or arbitrary elements; many constructions in ASL may be viewed as a mapping of continuous code elements onto continuous real-world phenomena. DeMatteo offers as an example of analogic representation, variations of the sign glossed in English as MEET. If the signer wishes to convey for instance the sentence 'The boy and the girl met', he will normally (if this is the beginning of discourse mentioning this particular boy and girl) articulate the sign BOY and then immediately establish a pro-form representing the preceding nominal—a marker for BOY. A marker for a person is most commonly a G hand, index finger pointing upward. Then the sign for GIRL is made and a marker
established with the non-dominant hand. To convey the reciprocal meaning of the verb (i.e. 'they met'), the two markers are brought in contact with one another in the center of the signing space (about mid-chest). (Past tense may be indicated in a variety of ways, most commonly by an indexical gesture toward the space behind the signer's body, representing past time. Non-calendric temporal reference is usually made, when necessary, only at the beginning of the discourse.) However, if the signer wishes to convey 'The girl met the boy', only the marker representing GIRL moves until it 'meets' the BOY marker; in 'The boy met the girl', the BOY marker moves to come in contact with the GIRL marker.

De Matteo (1975) states that this type of phenomenon could easily be handled (as Friedman 1975b does) by referring to the location of the source and goal of the action, if it were not for the fact that there are other related expressions which do not so easily lend themselves to this analysis. Once the person markers have been established, quite a number of 'sentences' may be conveyed, distinguished by the movements of the hands. For example, the hands may move past each other without making contact, meaning something like 'they passed each other by'; the hands may approach each other and then turn away; they may make contact and then move outward while touching and then one may abruptly veer rightward ('they met and walked away; then the boy left her'). Either we claim that each of these movements (and the variations are seemingly endless) represent distinct signs, in which case

we give up all hope of placing finite bounds on the number of lexical items, and all hope of accounting for the productivity of the process, (De Matteo, p. 12)
or we view these variations as conventional representations of continuous real-world phenomena.
An examination of the formational properties (phonology) of ASL gives us further evidence that language can sustain elements that are neither discrete nor arbitrary. Analogic phonological alternation is a widespread phenomenon in ASL. As discussed in §3 no accurate description of ASL phonological structure can fail to take into account the pervasive use of non-discrete and iconic (non-arbitrary) elements. The fact is that many lexical items and sub-lexical components are iconic in some form and that in large part, (synchronic) phonological alternation depends on a direct and non-arbitrary relation between signifiant and signifié. This is not to say that all elements of ASL are iconic or non-discrete. The system sustains arbitrary and discrete elements as well as iconic and scalar components. The claim is also not that iconic signs or elements entirely depict the referent or perform the referent action; in fact, as I discuss in §3, iconicity in ASL is highly conventionalized.

Among types of non-arbitrary and non-discrete elements of ASL discussed in §3 are variations in signs like TABLE and WALK. TABLE can be altered to indicate the size of the table—a small table is simply smaller than a big table. The movement of verb signs like WALK can be altered to show manner, e.g. 'walk slowly', 'trudge', 'march', 'walk like Charlie Chaplin', etc. Whole sub-systems in ASL like (non-calendric) temporal reference rely on non-arbitrary and non-discrete components. In addition, I argue that we would be unable to felicitously account for the formation and relation among certain sets of signs, like signs for times of the day, without reference to non-arbitrary and non-discrete components.

It should be pointed out that the kinds of iconic devices available
in ASL are numerous and their inter-relationship complex. Mandel (1975) presents a discussion devoted to sorting out the complexity and giving as complete a picture as possible of the types of devices available. As he points out, iconicity and conventionality are two separate parameters. However, the relation of the two continua is implicational at least in part, in that the less conventional a sign or a construction is, the more iconic it must be, and the less iconic it is the more conventional it must be, but not the inverse. That is, a sign can be 100% iconic and 100% conventional (in Mandel's terms); also, of course, no sign may be wholly non-iconic and non-conventional (i.e. 0% iconic, 0% conventional). Briefly, Mandel divides all iconic signs and constructions into two major categories: (1) presentation, in which either the referent action is performed (mime), or a token of the referent is presented or indexed (presentation), and (2) depiction, in which a 'picture' of the sign is made, either by pretending to 'draw' the picture with all or part of the articulator (virtual depiction) or by having the articulator actually become the picture or stand or for parts of the picture (substitutive depiction). A factor cross-cutting all of these major categories is whether the presentation or the depiction in the sign or construction represents the entire referent or only a part of the referent or something commonly associated with the referent (that is, whether the surface manifestation is metonymic or non-metonymic of the signified). (See §3 for further discussion.) Edge and Herrmann's (1975) description and discussion of the manifestation of grammatical relations rests almost entirely on recognizing the non-arbitrary nature of ASL's structure. In essence, one fundamental conclusion that must be drawn from recent studies (cf. Friedman 1975c) is that iconicity and
continuity of expression (i.e. non-discreteness) are fundamental components of ASL's structure on all levels. Given these principles, and if we are in agreement that ASL and other sign languages are, in fact, languages (a conclusion that is, I believe, inescapable), then we have to conclude that total arbitrariness and discreteness are not necessary conditions for language.

I began this discussion of Hockett's design features by suggesting that three of the features are not necessary properties of languages and I have only discussed two features—arbitrariness and discreteness. The third property that is not a necessary feature of language, and about which I hope I need not argue here, is that "the channel for all linguistic communication is vocal-auditory". (Hockett, p. 8) As every study of ASL has shown, language in the manual/visual channel is not only viable, but is a highly complex and, if I may add, a most aesthetically pleasing linguistic system.

There is one other design feature that must be mentioned to complete this discussion of Hockett's proposed universals--duality of patterning. Hockett states that

every language has both a cenematic subsystem and a plerematic subsystem.

---By virtue of duality of patterning, an enormous number of minimum semantically functional elements (pleremes, morphemes) can be and are mapped into arrangements of a conveniently small number of minimum meaningless but message-differentiating elements (cenemes, phonological components). (p. 12)

It is evident that ASL has duality of patterning in that it has both a cenematic and a plerematic sub-system. Stokoe (1972), in speaking to this point, states that

ASL grammar has the same general form as other grammars. There is in this language a small closed set of distinctive features, meaningless in themselves which nevertheless combine in ways
peculiar to this language to form morphemes, i.e. signs which denote meaning as do the morphemes of other languages. (p. 94)

There is ample evidence for a sub-lexical level in ASL. However, I suggest that the degree to which ASL has duality of patterning is somewhat less than that of oral languages. I mentioned briefly above (and I discuss in more detail in §2 & §3) the fact that some sub-lexical units are iconic and thus have meaning. Frishberg and Gough (1973) discuss a large number of sets of signs which have a formational similarity and a consistent corresponding semantic similarity; that is, some hand shapes, movements, orientations, and locations have a consistent corresponding meaning. What this amounts to is that some phonemes are also morphemes, which of course entails a (partial) lack of duality. For the most part, one hand shape, for instance, corresponds to two or three meanings, rather than only and always having one meaning if it carries semantic import at all. For example, the V hand shape can have one of two meanings (although it does appear in signs in which it functions as an arbitrary element): the two extended fingers can iconically represent the eyes, in, for example SEE, LOOK-AT, and BLIND, or the fingers can represent legs, as in SIT, STAND, JUMP, and TOSS-AND-TURN ('fidget'). It is significant that when new signs are formed, or ad-hoc variations produced (in conventional phonological or grammatical ways), these semantic constants are maintained and are productively used. I do not mean to imply that all sub-lexical components of ASL have meaning; the majority do not—but are arbitrary elements. However, there are too many meaningful sub-lexical elements to dismiss the class as analogous to those troublesome sound symbolic sub-lexical elements in oral language, like sn- in 'sneeze', 'sniff', 'snicker', etc. It seems clear
that although languages in the manual/visual mode have duality of patterning, its nature is somewhat different than that in oral/auditory language.
CHAPTER 2

2. FORMATIONAL PROPERTIES

2.1 Introduction

This chapter presents a discussion of the basic formational properties of ASL. Most languages have a physical signal in the oral/auditory channel; ASL and other sign languages however are articulated and perceived in the manual/visual modality. The term 'phonology' is used throughout this chapter to cover the description and analysis of the formational properties and organization of any language, whether it has a manual/visual signal or an oral/auditory one.

2.1.1 This presentation is a departure from earlier analyses of ASL parameters in that it represents on the phonetic level, discrete units of the language. In part, my presentation is derived from Stokoe's (1960, 1965) description of the parameters. Stokoe's description and 'phonemicization'\(^1\)--the first of its kind in ASL and a momentous effort--does not in my opinion quite capture the system. (See Appendix 2 for summary of Stokoe's analysis.) I present below alternative phonetic and phonemic analyses for three parameters--hand configuration, place of articulation and orientation--and a phonetic and feature analysis of the movement parameter. The analysis of the phonological system of ASL presents a variety of problems (many of which are discussed below). In a departure from my own previous work and that of others,\(^2\) I intend to demonstrate that no phonological description of ASL, depending entirely or even in large part on the notion of discreteness...
on the phonetic level, can account for the formational structure of the language.

2.12 There appear to be four basic articulatory parameters in Sign Language: hand configuration, place of articulation, movement, and orientation (of the hands in relation to the body). A simple sign involves one hand configuration, made with both hands or with the dominant hand, combined with one place of articulation (which can be the non-dominant hand), and orientation and movement features.

2.13 There are two types of signs which involve both hands: (1) those in which both hands move, or in other words in which both act as articulators, and (2) those in which the dominant hand (the right in right-handed signers) acts as the articulator and the non-dominant hand (left) as the place of articulation. In signs of the second type, only the dominant hand moves. In signs in which both hands have a movement component, both hands must maintain the same configuration and the same movement throughout the sign (although the movement may be an alternating one, e.g. the hands alternately move up and down). There is one exception that I know of—the sign for the technical term TOTAL COMMUNICATION—in which the hand shapes differ (one has T, the other C), although the movement of the two hands is the same. However, this sign has been recently coined, and is a borrowing from English. We shall see below that loan signs tend to behave oddly, at least at the time of their entry into the language, especially in regard to hand configuration (see below, §2.23). Examples of double articulator signs are:

TALK—two 4's, facing each other, alternate toward and away from the body at the mouth (see Figure 1 for drawings of hand configurations),
Figure 1: Hand Configuration

A
(thumb-spread A)

B
(tapered 0)

B
(baby 0)

B
(thumb-spread B)

C
(angle B)

5
(bent 5 ~ claws)

F

G

X_1

X_2

L
(bent L)

H
(bent H)

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and BUT--2 G's, pointing upward, sometimes crossed, in neutral space, diverge.

In those signs in which one hand acts as the articulator and the other as the place of articulation, there are two possibilities in regard to hand shape: either (1) both hands have the same configuration, i.e. the signs are symmetric in regard to hand shape, or (2) the non-dominant or place of articulation hand assumes one of six neutral hand shapes: A, B, 5, G, C, or O. Examples of the first type are SCHOOL--B hand taps B hand twice, NAME--H hand (facing leftward) twice contacts H hand (facing rightward). Signs of the second type are HELP--B hand moves up under and makes contact with A hand, thumb up, and PRACTICE--A hand, fingers downward moves back and forth across the extended index finger of G pointing rightward. 3

2.14 Signs may also have two places of articulation. Of these, we can distinguish polymorphemic (compounds) and monomorphemic signs. Compounds such as BELIEVE and SISTER, which derive from two distinct signs--e.g. BELIEVE < THINK + JOIN, SISTER < FEMALE + SAME--are subject to regular phonological processes by which distinct hand configurations and movements of the two signs assimilate. 4

2.15 The articulation space available to the signer is functionally limited to that area at or near his body which his addressee can see. This space is limited to the area of an approximate rectangle, the limits of which are a line approximately six inches above the head, a line at the waist, the width being the extent of the arms bent at the elbows connecting the upper and lower limits. This seemingly trivial limitation imposes constraints on the phonological structure of the
language in that no sign may be made outside of this area, although it is quite possible to do so (e.g. behind one's back). 5

2.2 Hand Configuration

2.21 Figure 1 gives the discrete hand shapes of ASL. It is clear that not all physically possible configurations occur. For example, there are sixteen possible combinations of fingers extended from the fist (excluding thumb extension as a variable). That is, all fingers can be extended, or none; each of the four may be extended separately; 6 combinations of two extended fingers and 4 combinations of three are possible. Of these 16, 10 possible variations occur in ASL represented by: A, B, G, I, H, Y, W, F, 8, 7. By this example I wish to point out that there are physically possible hand shapes (and movements, place of articulation, as well) that happen not to occur in ASL--as there are sounds which do not occur in any given oral language. The extended ring finger as a hand shape does not occur in ASL but does in Chinese Sign Language.

2.22 It would be possible to analyze the hand shape parameter in terms of features. We could, for example, describe hand shapes as having spread or unspread fingers, straight or bent fingers; there could be an n-ary feature which describes thumb position--e.g. drawn inward, at the side of the hand, extended forward, extended sideward. Various feature descriptions have been (informally) suggested for the analysis of the hand shape parameter. 6 However, while the use of the diacritics ° (thumb extended to the side) and *** (bent fingers) amount to a partial feature analysis, there would appear to be little or no motivation for taking on the trappings of a full feature analysis. Except for a few cases (involving the spread thumb and finger bending, for example),
there would seem to be only arbitrary reasons for making specific choices of features. Until it can be demonstrated that generalizations about variations in hand shapes, either historical or synchronic, can best be formulated in terms of recurring features--thereby giving the feature analysis explanatory value--I don't believe we need such an analysis. It is possible to explain occurring synchronic variation in hand configuration in terms of a phonemic analysis.

2.23 The analysis presented here is not a classical phonemicization. Given sign language and its unique typology, a classical phonemic analysis is impossible. The first departure is necessitated by the fact that there is something odd about the configurations T, M, N, D, bD, E, G₂, K, I, W, and R; the shapes form a fairly large class of extrasystematic elements. These configurations are only marginally available in that they only appear in loans from English. ASL, a non-technical language, borrows items from the oral language surrounding it by relatively straight-forward means, using the existing one-handed manual alphabet, which has hand shapes for each letter of the Roman alphabet (and one for ampersand). [The reader will note that whenever possible the name given for the hand shapes in Figure 1 corresponds to the appropriate letter of the manual alphabet.] The initial letter of the English word, rendered in the manual alphabet, becomes the hand shape of the loan. This hand configuration is then usually combined with the same movement, place and orientation of an existing, semantically related sign. For example, the signs MATH, ALGEBRA, CALCULUS, and GEOMETRY are all formed using the initial letters M, A, C, and G respectively with the same movement, place and orientation of the original sign FIGURE-OUT. Name signs (signs for individual people) are usually invented (for each person)
based on some personal characteristic of the individual using the initial letter of the person's English name. For example, a recently invented name sign for Nixon uses an N, moved leftward under the mouth, based on the sign LIE (prevaricate) which has the same movement and place, but with the G shape. As the configurations T, M, N, D, bD, E, G₂, K, I, W, and R only appear in loan words, we might say that they have not been fully incorporated into the phonological system of the language. This is not to say that they should not be considered in our analysis, but only that they must be considered marginal. It is interesting to note that if we did wish to analyze hand shape in terms of features, these shapes do not conform to regular patterns apparent among the other frequently occurring configurations. With the exception of I and W, each of the 'marginal' shapes have 'features' which no other hand shape in the language has. (T, M, and N have the same 'odd' feature in common.) For example R entails the crossing of the middle finger over the index finger—no other hand shape has any finger crossing over any other; K has the thumb tip making contact with the middle finger—not at the tip which is common among regular shapes, e.g. 0, b0, F, 8--but at the middle or third joint. Whether or not we ultimately opt for a feature description of this parameter, given the distribution in the language of this class of 'loan-shapes' ('loan-phones'?), it would appear that they will have to be considered odd or marked.

2.231 There are six hand configurations which may be said to be neutral or unmarked:⁷ A (and its variant S), B, 5, G, C, and 0. These hand shapes can be classed as neutral due to various observations regarding their appearance and acquisition. These six shapes appear most frequently of all possible shapes in the language (with A, B, and G being
most prominent). They occur in all known sign languages. Presumably they are the least complex shapes the hand can assume (in terms of muscular arrangement). As further evidence, it is just these hand configurations that are first acquired by the child learning Sign. When the child overgeneralizes in regard to hand shape, she tends to use these. (She initially has only A, B, and G.) One significant aspect of the 'unmarkedness' of these configurations was mentioned above in regard to the formation of two-handed signs: in a sign which entails the use of both hands, if both do not have the same shape, one must assume one of these six neutral shapes. Also, when there is a hand shape change in the articulation of a single monomorphemic sign, the sign must either begin or end in a neutral shape, as for example in the sign CATCH (a rapid closing of 5 to S, representing grabbing), or CHOOSE (a closing of 5 to F). Given this constraint, I would prefer to analyze signs of this type as having a single hand shape and an opening or closing action. Stokoe (1960, 1965) has the elements opening and closing action in the movement parameter, with the final hand shape given for individual items. I concur with his analysis except that it would not appear to be necessary to stipulate the final (or initial for 'closing action' signs) configuration in that they are either predictable or variable (and as such of no importance to the phonemic make-up of the sign). Such insignificant variability is the case when a sign closes to a fist--it is irrelevant whether the final shape is A or S. (S is a variant of A--see below for phonemic inventory.)

2.232 Another significant departure from classical phonemic analysis is that in the analysis of ASL we need to take into account the visual picture that the sign makes--its iconicity. The iconic value of a sign
appears to have a considerable impact on its phonological structure. As I have stated above, and as I elaborate below (§3), I believe that an accurate phonological description of ASL is going to have to include principles of iconicity as well as a description of arbitrary elements, even among discrete elements such as individual hand shapes.

2.24 Phonemic Inventory

We can now proceed with a phonemic inventory of the hand configuration parameter, with the environments in which the variants of each set occur. Please refer to Figure 1 to interpret symbols. (See Table 1 for summary of phoneme sets.)

2.241 /A/. The most frequent allophone is A (A with thumb extended), occurring when contact is made with the thumb tip, in e.g. YESTERDAY and GIRL; or in signs in which the thumb extension is necessary for iconic purposes, e.g. SCIENCE, with two A hands, representing pouring something into a beaker or test tube.

Another allophone of /A/ is S, which occurs when contact of the two hands is made on the side (where the thumbs would be if the shape was A), as in SHOE(S). Clearly it's easier to make this kind of side contact if the thumbs aren't in the way. However, A occurs in signs where one hand makes contact on the thumb side, e.g. PATIENT (A hand, thumb-side in contact with mouth, moves downward). S also occurs in a few loan words such as STRIVE. As stated above (§2.231) S also occurs as a neutral final shape in signs with changing hand shape, e.g. CATCH.

2.242 /O/. Tapered 0 (flat 0) and 0 occur in free variation in all signs having /O/, e.g. EAT, NUMBER, FLOWER.

One variant of /O/ is bO (which may also be a variant of /F/—see...
§2.248), as in signs like '20' which entail a closure of the L shape to b0. Given the morpheme structure condition (given above) that signs with two different hand shapes must begin with or end in a neutral hand shape, it is reasonable to analyze some b0's as variants of /O/.

2.243 /B/. B and ə (B with extended thumb) occur in free variation in signs such as THING, CHILD, TROUBLE, the possessive index, and the future modal WILL. In fact ə seems to appear more frequently than B, so we might as easily call this phoneme /ə/. A convenient reason for calling it /B/ is that the hand shape B corresponds to the manual alphabet B.

The only condition on the occurrence of the variants of /B/ is that in signs with thumb tip contact, e.g. STUBBORN (two ə hands thumb at sides of forehead, bend to ə), only the ə variant for obvious reasons may occur.

ɨ (angle B) may be considered an allophone of /B/, occurring when the movement designation is bend from knuckles. The reduced form of the sign BOX has this shape. ɨ also occurs in highly iconic, often non-lexicalized gestures for instance, the gesture indicating the surface and sides of a table.

2.244 I want to digress for a moment to return to the discussion about motivation for a feature analysis. In both the phoneme sets /A/ and /B/ we have seen the extension of the thumb (in ɨ and ə) as a conditioned variable—A and B both occur in signs entailing thumb tip contact. With this, we have an allophonic variation based on a possible feature distinction, say ±thumb extension or as I mentioned above an n-ary feature including all four possible thumb positions. Other
evidence in support of the thumb-position feature may be found in an on­
going phonological change—the extension of the thumb on hand configura­
tions which previously did not entail the extension. Not all signs with
appropriate hand shapes have undergone the change nor do all signers
extend the thumb. Signs in which the thumb is now found in its extended
position are those which previously had the hand shapes G, H, V, V, Y,
X, R, and I, as for example in the signs RED, NAME, VOICE, BLIND, KIDS,
FRIEND, RESTAURANT, and INSTITUTION. This ongoing change results in a
'neutralization in progress' in that distinct hand shapes merge as for
example G adds the thumb extension and has the same shape as L, and V
with thumb extension merges with 3.10 Although there would seem to be
motivation for a distinctive thumb position feature, we still don't have
motivation for any other features (and one ingredient won't make the
cake).

2.245 /C/. /C/ has no variants. Signs with the shape C include DRINK
(C curves toward signer at mouth) and BASKETBALL (two C hands facing
away from signer twist upward, as if tossing a basketball into a basket).

2.246 /5/. The hand shape 4 may be considered a variant of /5/. 4, a
relatively infrequent shape, occurs for example in the signs TALK, LECH
(a metaphorical variant of DROOL which is made with G), a form of MEET
or MEETING, and in the plural pronominal index. It does not contrast
with 5 and can basically be analyzed as the non-thumb-extended variant
of /5/. There is always an element of plurality (or quantity) involved
in signs having the 4 shape: the form of TALK with two 4 hands is used
only when referring to conversation among several people. (TALK, when
referring to two people, is made with two G hands); MEET(ING) with two
4's is the 'plural' form of MEET made with two 6's. Therefore, if we view the 4 hand as having a correlating semantic constant, we might say that 4 is the 'plural' variant of /5/. Since in some signs which (in citation form) have 4, the thumb may now be extended (in free variation with its non-extension)--as it may be with other hand shapes discussed above--it is possible that the phonetic distinction between 4 and 5 may eventually be lost--or that 4 and 5 would appear in free variation.

2.247 /5/. /5/ (also called 'claw' for obvious reasons) has no variants. 5 and *5 can be shown to be distinct given the close to minimal pair CONFUSED and COLLEGE. CONFUSED has two 5 hands facing each other in neutral space making two circular motions; in COLLEGE with two 5 hands facing each other, the dominant hand starting in contact with the non-dominant hand moves upward in a circular motion, palm downward throughout.

However, a case could be made for 5 being a variant of /5/, given signs like BUG (INSECT), in which the fingers of the 5 hand (thumb tip in contact with the nose) bend during the articulation of the sign, i.e. 5 becomes *5. If we include bend or bend-fingers as an element of the movement parameter (cf. 6 above), then we would have to say the *5 is the bent variant of /5/. We would not say that the 5 in CONFUSED is the bent variant of /5/ because the movement element 'bend' does not occur in the sign (i.e. the fingers are bent throughout).

One possible solution is to have 5 be a variant of /5/ and to say that the 5 in CONFUSED is due to some kind of metaphoric iconicity of the sign in that the muscular tension entailed in the formation of 5 may represent emotional tension (or something like that) in a way that 5 could not. In support of this kind of solution, I would add that 5"
appears very infrequently, except in those signs where 5 becomes 5.

For the moment, however, it seems best to say that the 5 appearing in signs like BUG is the bent variant of /5/ and the 5 in CONFUSED is a distinct phoneme.

2.248 /F/. bO is an infrequent reduced variant of /F/ in, e.g. JOIN. The term reduced refers to those hand shapes (movements and places) and hand shape (movement and place) changes occurring in colloquial and/or rapid signing (analogue to rapid speech), or when the signer is tired. One aspect of rapid signing or 'tired signing' is that possibly non-distinctive elements of hand shape are altered. (Another prominent aspect is that neutralization of clearly distinctive elements of all parameters occurs.) The use of bO in signs which in citation form have F may be an example of such an alternation. (Note that bO is F without the extended fingers.) Reduction as a variant is discussed again below in the phoneme set /Y/.

One variant of bO (not shown in Figure 1) has the thumb over the index finger— in a sense gripping it—rather than having the fleshy parts of the fingers touching. This variant occurs when the sign's movement is a flicking, opening motion as in SURPRISE—two bO's flick open at the mid-face area, accompanied by a rapid (closing and) opening of the eyes. (cf. 8 in /#/, which has a similar variant.)

2.249 /G/. /G/ has no variants. G is one of the three most frequently occurring hand shapes, occurring in signs such as THINK (G contacts forehead) and BORING (G in twisting motion in contact with side of nose). Interestingly, G is not the shape of the letter G in the manual alphabet—G₂ is.
2.250 /X/. \(X_1\) and \(X_2\) are allophones of the phoneme /X/. \(X_2\) (the 'squished' variant) occurs when the sign entails contact on the body with the (extended) knuckle of the middle joint, as in ONION, APPLE, and KEY. \(X_1\) occurs elsewhere, in, e.g. FRIEND, TEASE, and MUST.

2.251 /L/. \(\Lambda\) may be considered an allophone of /L/ for two reasons. One is that it appears, in apparent free variation with L in signs such as BIG--two L's separated sharply in neutral space. (\(\Lambda\) appears especially in the stressed form of BIG.)\(^{13}\) The second reason for the inclusion of \(\Lambda\) in /L/ is similar to the one given above for the inclusion of \(\hat{B}\) in /B/. We may analyze signs such as RUN--two L's, the index finger of one hooked onto the thumb of the other, moving forward with the 'free' thumb and index finger bending and straightening repeatedly--as having a movement component 'bend at the fingers' (bend-fingers). Thus \(\Lambda\) occurs in signs having an /L/ shape and such a movement component.

The only other signs--mostly non-lexicalized gestures--that \(\Lambda\) occurs in are highly iconic, like for example a bent-L moved horizontally across the area in which TABLE had just been signed to indicate the amount of dirt on the tabletop. As has been pointed out above, iconicity plays an important role in the phonological structure of the language. The degree of iconicity\(^{14}\) which a sign shows may determine the degree to which the formational properties of the sign will vary from the 'conventional' phonological structure.

A variant of \(\Lambda\) (not shown in Figure 1) has the thumb bent while the index finger remains straight. This configuration appears in two types of signs. One is those in which the index finger is 'anchored' to a place of articulation on the body, e.g. COKE, an iconic representation of shooting a hypodermic needle into the upper arm. (The sign COKE,
meaning the soft drink, thus borrows the English metaphor for the same referent.) Clearly, if the index finger must maintain contact during the sign, it wouldn't bend as well. The second type of sign (and COKE really fits into this class as well) is one which iconically represents the referent as in GUN--index finger forms the barrel, the bending thumb represents the cocking of the trigger. Again, this variant need not be a problem in the phonemic analysis, if we allow for principles of iconicity to operate. (See §3 for discussion of iconicity.)

2.252 /H/. Bent-H (יו), an infrequently occurring shape, is an allophone of /H/, occurring in signs which entail contact with the palm-side of the fingers, e.g. SIT (CHAIR) in which the bent-H of the dominant hand makes palm-side contact with the H (palm toward signer) of the non-dominant hand. Given the morpheme structure condition that in two-handed signs where the non-dominant hand is place of articulation, either both hands must have the same shape, or one must assume a neutral shape, it would appear that bent-H is a member of the phoneme set /H/. Since H is not a neutral hand shape, both hand shapes must be the same—at least phonemically.

2.253 /V/, /יו/. The analysis of /יו/ presents another potential problem in that it appears to be both an allophone of /V/ and a distinct phoneme. V and V contrast in some environments, e.g. in two-handed signs in neutral space, e.g. in the signs PROBLEM (יו hand makes contact in sharp movement with V hand) and WORSE (two V's cross sharply—usually at the wrist—in neutral space). Another environment in which V and V contrast is at the eyes, for example in the near minimal pair SEE (V moves outward from the eye area) and BLIND (יו moves inward sharply to eyes).
However, with this particular pair, it may be that \( \tilde{v} \) may be considered a variant of \( v \). It has been pointed out (cf. Frishberg and Gough 1973) that the use of the hand shape \( \tilde{v} \) often correlates with the semantic notion 'difficulty'. We could analyze the BLIND as having the \( v \) phoneme if we say that BLIND is SEE + DIFFICULTY and that DIFFICULTY entails the use of the bent variant of \( v \).

In signs having \( v \) such as TRAVEL, WALK, SIT-IN-A-CIRCLE, ROLL-IN-THE-AISLES-WITH-LAUGHTER, and JUMP, \( \tilde{v} \) may also be analyzed as a variant of \( v \), in that in many signs both \( v \) and \( \tilde{v} \) iconically represent legs. Signs of this type having \( v \) include STAND, LIE (DOWN), and TOSS-AND TURN (in bed). The choice of \( v \) or \( \tilde{v} \) is determined by the shape of the legs in the referent—the bending of the fingers represents the bending of the knees. For example, when standing the legs are typically straight—thus the \( v \) shape is used; when jumping or walking the legs are typically bent or bending—JUMP has the \( \tilde{v} \) shape and WALK has \( \tilde{v} \) with fingers wiggling. TRAVEL (\( \tilde{v} \) palm downward in a circular motion in neutral space) and SIT-AROUND-IN-A-CIRCLE (\( \tilde{v} \) 'placed' several times with downward movement in circle in neutral space) are phonologically derived from SIT (bent-\( h \) makes palm-side contact with \( h \) toward signer). When two-handed signs become one-handed (in for example 'encumbered signing) the dominant hand is always used. In signs in which the non-dominant hand is the place of articulation, this 'abbreviation' results in the loss or substitution of the place of articulation. TRAVEL and SIT-AROUND-IN-A-CIRCLE entail this kind of reduction. Given the \( v \)-legs 'morpheme', we might say that \( \tilde{h} \) is a variant of \( v \) as well, when it appears in signs such as SIT.

Other evidence in support of \( \tilde{v} \) as a variant of \( v \) comes from signs
such as DOUBT and FROG in which V becomes \textsuperscript{1}V in the course of the sign. As with \textsuperscript{1}B and \textsuperscript{1}L, we could analyze the \textsuperscript{1}V shape in these signs as resulting from /V/ with a \textit{bend-fingers} movement.

It seems clear that \textsuperscript{1}V is sometimes a variant of and sometimes in contrast with /V/. Signs such as STUCK and VAMPIRE--V makes contact with center and side of neck respectively--in which either V or \textsuperscript{1}V occur in free variation, make it clear that the contrast between /V/ and /V/ is neutralized in certain environments and under certain iconic conditions.

2.254 /3/. 3 and \textsuperscript{1}3 may be analyzed in much the same way as V and \textsuperscript{1}V. \textsuperscript{1}3 appears to be an allophone of /3/ when it occurs as a result of the movement \textit{bend-fingers} in signs like BUG (a variant of the one given above with /5/)--3 with thumb tip contact at the nose sharply bends to \textsuperscript{1}3. However, 3 and \textsuperscript{1}3 are in contrast in other environments, for example in neutral space, exemplified by the signs AWKWARD (two 3's move back and forth in neutral space) and CAR (3 palm sideward moves forward and usually abruptly stops in neutral space). Thus we would want to say that \textsuperscript{1}3 is both an allophone of /3/ and a distinctive phoneme /3/.

2.255 /Y/. The phoneme /Y/ and two of its variants, \textsuperscript{1}Y and \textsuperscript{1}9, are interesting in that they demonstrate the kind of departure from the 'core' phonological structure that occurs in ASL in the presence of iconicity or reduction. The shape \textsuperscript{1}Y (open eight) occurs as a reduced form (as in colloquial or 'tired' signing) of /Y/, e.g. in the reduced form of WHY. Y reduces of its \textsuperscript{1}Y variant only in those signs in which the hand closes to Y during the sign's articulation. In citation form, WHY entails the closing of the hand (palm toward signer) to Y while it moves outward from the forehead; when reduced the hand (usually

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unmoving, in the space somewhat below the forehead) has the \( Y \) shape with the lowered middle finger wiggling. Although it is clear that \( Y \) is a reduced variant of /Y/ in this environment, in all other circumstances \( \Theta \) contrasts with /Y/. (See §2.257 for discussion.) Thus we find another case of neutralization of distinction, this time due to phonological reduction.

The shape \( \Theta \) can easily be shown to be an allophone of both /Y/ and /Y/ (see §2.256-/Y/, also). That \( \Theta \) is a variant of /Y/ can be demonstrated with the sign CALIFORNIA, a \( \Theta \) shape beginning at the ear and moving downward with a twisting motion; as the hand moves downward the extended index finger gradually lowers. The appearance of \( \Theta \) in the sign and the phenomenon of the index finger of the \( \Theta \) shape lowering, which appears only in this sign (as far as I know) can be explained as resulting from an unusual assimilation of two hand shapes. CALIFORNIA was originally an unassimilated compound composed of EARRING (thumb and index finger grasp earlobe) and GOLD (or YELLOW) (Y hand twisting in neutral space). (Signers are aware of this original compound.) The twisting motion accompanying the downward movement in the current sign is a result of an anticipation of the movement in the second part of the unassimilated compound. The beginning hand shape--\( \Theta \)--can be analyzed as a Y shape (in anticipation of the Y in GOLD) with the superimposition of the extended index finger remaining from the original first element of the compound. The prominent aspect of the hand shape in EARRING is the extension and closing (grasping) of the thumb and index finger. It would seem that the prominence of the index extension is great enough (possibly iconically) to allow it to remain an element of the assimilated form in this unusual type of phonological assimilation.17 Most
likely, eventually the \(^\dddot{Y}\) shape in CALIFORNIA will be seen as distinct from /\(\dddot{Y}\)/, as signers lose the memory of the unassimilated form. Clearly there is a potential in the language for splits as well as mergers.

The \(^\dddot{Y}\) shape also occurs in the sign AIRPLANE (hand moves across upper neutral space, palm downward). I would say that the occurrence of \(^\dddot{Y}\) in this sign is due to iconicity. The shape can easily be taken to visually represent basic elements of an airplane, i.e. the wings and fuselage, by the extension of the three digits. As I have mentioned above, the presence of iconicity or iconic elements in the structure of the sign seems to allow for relaxation of phonological restrictions. Again, it would appear that iconicity plays an important role in the phonological structure of ASL.

All other occurrences of \(^\dddot{Y}\) may be explained as allophonic variants of /\(\dddot{Y}\)/ (see below).

The Y variant occurs most frequently of the allophones of /\(\dddot{Y}\)/ in signs such as STAY, WADDLE (an iconic variant of WALK with V-legs), PLAY, MISTAKE, and TELEPHONE.

2.256 /\(\dddot{Y}\)/. That \(^\dddot{Y}\) contrasts with Y can be seen in for example the following two minimal environments: the non-dominant hand as place of articulation, e.g. in the signs THAT (Y contacts non-dominant palm) and CIGARETTE (\(^\dddot{Y}\) contacts extended index finger (G) of non-dominant hand); the lower face, e.g. SILLY (Y nods at wrist in front of nose-mid-face area) and KID (child—slang) (\(^\dddot{Y}\) palm downward twists under nose—representing wiping a runny nose).

As I mentioned above, there is an ongoing change in some hand shapes entailing the addition of the extended thumb to shapes which previously had the thumb 'tucked in'. \(^\dddot{Y}\) is one of the shapes which
sometimes add the thumb extension, forming \( \overline{T} \). Signs with \( \overline{T} \) which sometimes appear with \( \underline{T} \) include CIGARETTE, WHISKEY, and BIG-WORD (a variant of WORD, made with bent-L). It would appear that the \( \overline{T} \) variant, occurring in free variation (so far) with \( \underline{T} \) in these signs, is an allophone of \( \overline{T} \). Eventually, I would predict an across-the-board merger, with the potential loss of \( \underline{T} \) as an element of the language.

2.257 \( \overline{\theta} \). \( \overline{\theta} \) is a frequently occurring shape, appearing most prominently in verbs of feeling, both physical and emotional, e.g. TOUCH, SICK, HATE, PITY, TASTE (DELICIOUS), DEPRESSED.

It is clear that \( \overline{\theta} \) and \( \overline{\gamma} \) contrast, despite the fact that \( \overline{\theta} \) is a variant of \( \overline{\gamma} \) in the conditions described above (see \( \overline{\gamma} \)), as can be seen in the near minimal pair PITY (\( \overline{\theta} \) hand makes small circles in neutral space—orientation depends on location of agent and patient) and STAY—which also has the meaning 'uh-huh' or 'oh yeah, I got it'—(\( \overline{\gamma} \) hand, palm away from the signer, moves back and forth in small motion in neutral space).

The shape \( \overline{\theta} \) is an allophone of \( \overline{\theta} \), occurring in signs with the movement element close (hand) or open. That is, \( \overline{\theta} \) only appears in signs which open to \( \overline{\theta} \) from \( \overline{\theta} \) or close to \( \overline{\theta} \) from \( \overline{\theta} \). For example, HATE entails a flicking motion of the \( \overline{\theta} \) hand—middle flicks out from the thumb (orientation determined by location of patient); LIKE is formed by closing \( \overline{\theta} \) to \( \overline{\theta} \) at the chest. It should be noted that the \( \overline{\theta} \) shape in signs like HATE has the thumb over the middle finger (gripping it), rather than having the fleshy parts touching—presumably because of the flicking motion. (The same phonetic distinction under the same conditions appears with the shape bO—see §2.248-\( \overline{\gamma} \).)
2.258 /7/. 7, a very infrequently occurring shape, has one variant. It appears (as far as I know) in only two signs--the number 7 and a sign meaning 'obedient' or 'good boy' (usually used to describe a child or dog) which has 7 with the fingers unspread, in a slightly circular or back and forth motion in neutral space. (7 contrasts with Ø--PITY and GOOD-BOY are a minimal pair.)

2.26 Loan Phones

Loan phones are those hand shapes which only occur in loan words from English--using the hand shape corresponding to the first letter of the English word.

/T/. T occurs, for instance in the sign TRY (two T hands--in neutral space--move down and outward), derived from an original sign TRY with A. (Now, in some circles, mostly schools, there are TRY, STRIVE, and ATTEMPT. These signs differ only in hand shape. What is being done by inventing these signs, is an attempt to augment the teaching of English.)

/M/ and /N/. M and N can be made with the fingers folded down, almost making a fist (as shown in Figure 1), or with the fingers extended outward, like in Ø. Both variants of each are seen as the same element by the signer, for instance in fingerspelling. The folded variants appear in, e.g. _MONDAY (M makes a circular motion in neutral space) and _NATURE (or NATURAL) (N makes circular motion ending in contact with back of non-dominant hand). Signs having the extended variants include DOCTOR (M, for French 'médecin', contacts pulse side of wrist) and NURSE (N contacts wrist).

/D/. An example of a sign with D is DENTIST (D contacts mouth or some-
times teeth). bD is a variant of /D/ which appears in free variation with D.

/E/. E occurs in EAST (E in neutral space moves rightward). There is one sign (that I know of) which has E but is not an initial letter borrowing, the California 'dialect' sign CUTE (E hand, palm toward signer, brushes downward twice on or slightly above the chin).

/G₂/. G₂ appears in, for instance, GROUP (two G₂'s circle forward and make contact on pinky side of hand in neutral space) and GREEN (G₂ twists in neutral space). G₂ is also used in loans in which the English word begins with Q, like QUEEN (G₂ contacts contralateral shoulder and ipsilateral side of waist), because G and Q have the same shape in the manual alphabet, differing only in orientation.

/K/. K appears in loans with the initial letter K like KING (K contacts contralateral shoulder and ipsilateral side of waist), and also in those beginning in English with P like PURPLE (K twists in neutral space), because K and P (like G and Q) have the same shape in the manual alphabet (and also differing only in orientation).

/I/. I occurs in loan words whose initial letter in English is I, e.g. INSTITUTION (based on SCHOOL), and IDEA (based on THINK), or J, e.g. JAPANESE. Actually I may be considered a 'full-fledged' phoneme at present in that it also occurs in a few non-loans, e.g. SPAGETTI. In the manual alphabet, J is formed with the I shape, moving downward in a curved line, as if drawing the letter J.

/W/. W is basically a loan shape, appearing in loans in which the initial letter of the English word is W, e.g. WORLD, WEIRD, and in one
non-loan—the number 6.

/R/. R occurs in such signs as RESTAURANT, REASON, and RESTROOM. R is the only hand shape in which one finger crosses over another.

2.3 Movement

2.30 Stokoe (1960, 1965) describes the movement parameter in terms of the following distinctive elements: upward movement, downward movement, up and down movement, rightward movement, leftward movement, side to side movement, movement toward signer, movement away from signer, to and fro movement, supinating rotation (palm up), prorating rotation (palm down), twisting movement, nodding or bending action, opening action, closing action, wiggling action of fingers, circular action, convergent action (approach), contactual action (touch), linking action (grasp), crossing action, entering action, divergent action (separate), and interchanging action. (See Appendix 2.)

In this section, I present a re-analysis of the movement parameter given in terms of features. In this discussion, I am concerned with the kinds of motion the hands and arms are capable of doing, the movements that specifically occur in ASL, and the inter-relation of those movements within the structure of the language. We can analyze the movement parameter in terms of four fundamental aspects of movement: (1) whether one or both hands move and if both hands are articulators, whether they have the same movement or interact with each other; (2) whether or not the articulator makes contact with the body; (3) the direction of movement; and (4) the manner of movement.

2.31 To begin with (and as mentioned earlier in §2.13), in the citation
Table 1
Summary: Phonemic Inventory

<table>
<thead>
<tr>
<th>Phoneme</th>
<th>Variant</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>/A/</td>
<td>A</td>
<td>contact with thumb tip iconic signs</td>
</tr>
<tr>
<td></td>
<td>Æ</td>
<td>side contact loans neutral end or initial shape</td>
</tr>
<tr>
<td>/O/</td>
<td>0</td>
<td>free variation</td>
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<tr>
<td></td>
<td>tapered 0</td>
<td></td>
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<tr>
<td></td>
<td>b0</td>
<td>end shape (in double shape signs with closure of L)</td>
</tr>
<tr>
<td>/B/</td>
<td>B</td>
<td>free variation</td>
</tr>
<tr>
<td></td>
<td>Ô</td>
<td>free variation</td>
</tr>
<tr>
<td></td>
<td>Ñ</td>
<td>required in signs with thumb tip contact</td>
</tr>
<tr>
<td></td>
<td>Ñ</td>
<td>end shape in double shape signs with 'bend-knuckles' movement</td>
</tr>
<tr>
<td>/C/</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>/5/</td>
<td>4</td>
<td>plurality</td>
</tr>
<tr>
<td></td>
<td>Ù''</td>
<td>end shape in signs with 'bend-fingers' movement</td>
</tr>
<tr>
<td></td>
<td>5</td>
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<tr>
<td>/5/</td>
<td>5</td>
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<td>/F/</td>
<td>F</td>
<td>reduction</td>
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<td>/G/</td>
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<tr>
<td>/X/</td>
<td>ê1</td>
<td>contact with middle joint</td>
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<td></td>
<td>ê2</td>
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<td>/L/</td>
<td>L</td>
<td>end shape in signs with 'bend-fingers' movement</td>
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<td>Ù''</td>
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<tr>
<td></td>
<td>L w/bent thumb iconic signs anchored index finger</td>
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</tr>
<tr>
<td>Phoneme</td>
<td>Variant</td>
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<td>/H/</td>
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<td>palm side contact</td>
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<td>'H'</td>
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<td>/V/</td>
<td>V</td>
<td>iconic signs</td>
</tr>
<tr>
<td></td>
<td>'V'</td>
<td>end shape in signs with 'bend-fingers' movement</td>
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<td>assimilation</td>
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<td>/Y/</td>
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<td>/θ/</td>
<td>θ</td>
<td>close or open movement</td>
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<tr>
<td>/T/</td>
<td>T</td>
<td>unspread 7</td>
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<td>/N/</td>
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<td>/D/</td>
<td>D</td>
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<td>/E/</td>
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<td>/G₂/</td>
<td>G₂</td>
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<td>/K/</td>
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<td>Phoneme</td>
<td>Variant</td>
<td>Environment</td>
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<td>/r/</td>
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</table>
form of a given sign, either one hand (the dominant) is the articulator—in which case the non-dominant hand either acts as the place of articulation or does nothing—or both hands act as articulators. In encumbered signing only the dominant hand moves; often, for signs in which the non-dominant hand is the place of articulation in citation form, the 'lost' location is replaced by a convenient surface such as the hip, a tabletop, etc. In those signs in which both hands move, either their movements are the same or the hands interact in a relatively simple movement—e.g. alternating up and down or approaching each other. No sign requires the hands to perform different actions (like patting the head and rubbing the stomach at the same time). There are five mutually exclusive types of movement in which the hands are required to interact, all of which only occur in signs made in neutral space and thereby entail no contact with the body.

2.311 The most frequently occurring interacting movement entails an alternating or interchanging movement of the hands (ALTERNATE)—side to side, toward and away from the signer, or up and down, e.g. AWKWARD (two 3's palm downward alternately move toward and away from signer), IF (two F's palms facing each other alternately move up and down). Alternating movements always entail a straight movement in any of the three axes (two horizontal, one vertical—see below §2.33).

2.312 The approaching of the hands (APPROACH) and their separation (SEPERATE) are interacting movements which occur only in the horizontal width (side to side) axis. Approaching and separating motion differ from alternating action in that they can co-occur with movement other than straight line action (see below), i.e. circular, open, close, and wiggling
Examples of signs with approaching and separating motions are MEETING (two 5 hands close--to 0's--while approaching each other) and BUT (two G hands separate). I do not mean to designate as having approaching or separating movements those signs in which one hand moves toward or away from the other stationary hand (acting as place of articulation), like NEAR (B hand approaches B hand) or BASIC (FUNDAMENTAL) (B hand palm downward moves downward in a circular motion under B hand palm downward). The movements in these signs do not require interaction of the two hands (as only one moves); their movements can be described by stating the manner and direction of the movement of the single articulator.21

2.313 The only other interacting movements are the crossing of the hands (CROSS), e.g. MATH (two M hands, facing downward, cross, making light contact several times), and the linking or grasping of the fingers or hand (LINK), e.g. JOIN (two F hands link) and MARRY (two C hands grasp each other).

2.314 In my 1974a, b discussion of the movement parameter, I attempted to handle the movement of the hands separately in double articulator signs. I described alternating action as, for example, the upward and subsequent downward movement of the right hand while the left hand simultaneously moves downward and then upward; approach and separate were described as: [right hand moves left, left hand moves right] and [right hand moves right, left hand moves left], respectively. (This description of APPROACH and SEPARATE doesn't work in any case--the right hand can move left and the left hand move right and never approach each other.) However, the fact that the language is constrained in such a way that
the hands must have the same movement if they are both articulators--whether or not that movement entails interaction of the hands--leads me to the inescapable conclusion that the movements of the two hands ought to be treated as a single entity, be that movement interacting or non-interacting. I suggest that we analyze this aspect of movement as a single feature INTERACT with six values: ALTERNATE, APPROACH, SEPARATE, CROSS, LINK, and NON-INTERACTING. Signs with NON-INTERACTING movement include those in which both hands move but do not interact, e.g. ROAD (two B's facing each other move outward away from signer), and those in which only one hand moves, whether or not the non-dominant hand is the place of articulation.

2.32 The second fundamental aspect of movement is whether or not the hand makes contact with the body during the production of the sign. During my investigation into the physical aspects of emphatic stress, it became apparent

that the particular manifestation of stress on a given sign chosen by the signer is dependent on the nature of the movement in its citation form. (p. 2, Friedman 1974a).22

One significant aspect of the particular manifestation of stress is whether or not contact is made. One general tendency in the manifestation of stress is for CONTACT signs to become NON-CONTACT and for NON-CONTACT signs to entail CONTACT (specifically END-CONTACT--see below).23

It would appear that the feature CONTACT has six values: (1) The first of these is CONTINUOUS CONTACT:24 in which contact with the body is made and maintained throughout the sign while the articulator moves from the point-of-origin place of articulation. For example, GIRL is made with the left hand, making contact first at the upper cheek, and drawn down the side of the face toward the mouth, while continuously maintaining

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contact. (2) The second value is HOLDING CONTACT: in which one part of the articulator, usually an extended digit, starts in and maintains contact with the body throughout the sign, but in which the articulator does not move from the point-of-origin place of articulation. For example, LATER entails a bend-wrist movement with the L hand, the extended thumb maintaining contact in the same position at the palm of the non-dominant hand. (3) The third value is END CONTACT: in which the articulator makes contact with the body at the end of the sign, whereas the sign begins without contact. Examples of signs with end contact are ME--ending with index finger of G making contact with the chest, and DUMB ('stupid')--whose movement entails the palm-side contact of A, making contact with the forehead. (4) The fourth value is BEGINNING CONTACT: in which the sign begins with the articulator in contact with the body. An example is NOT, in which the A hand begins with the thumb in contact with the underside of the chin; the hand then moves outward into neutral space. (5) The fifth value of the feature CONTACT is DOUBLE CONTACT: in which the articulator makes separate contact at two different places of articulation in a monomorphemic sign. Two signs which have double contact are HEAD, in which contact is made at the temple and at the upper cheek (with the fingertips of B), and KING, in which the K hand contacts the body at the contralateral (to the dominant hand) shoulder and then at the ipsilateral side of the waist. (6) The sixth value is NON-CONTACT: in which the hand does not touch the body. All of the signs given with interacting movement are non-contact signs.

2.33 The third aspect of movement is the direction in which the hands move. We can view the possible directions of movement in terms of three spatial axes: vertical, horizontal-width--describing sideward movement,
and horizontal-depth—indicating movement direction toward and away from
the front of the body. Within each axis there are three possible move­
ments.

2.331 The vertical axis. Possible movements in the vertical axis are:
UPWARD, e.g. FEEL (\(\theta\), middle finger in continuous contact with chest,
moves upward), DOWNWARD, e.g. HUNGRY (C hand, fingertips in continuous
contact with chest, moves downward), or UP-AND-DOWN, e.g. HURRY (H hand
moves up and down in neutral space). UP-AND-DOWN movements may also
combine with ALTERNATING action, e.g. IF (F's facing each other, alter­
nately move up and down). There is a general tendency in ASL for signs' movements to be repeated once or twice; whether or not a movement is
repeated apparently depends on the type of movement (see below §2.36).
Because of this tendency, it is sometimes difficult to determine whether
the movement of a particular sign is, for instance, UP-AND-DOWN or simply
DOWN--repeated several times. (After all, the hand has to go up before
it can go down again.) However, in quite a number of signs, the type of
movement may be determined by the visual image the sign makes--its
iconicity. For example, the sign RAIN is made with two 5 hands moving
up and down; since we know that rain always moves downward, I think we
can safely say that the movement in RAIN is a repeated downward one.

2.332 The horizontal-depth axis. Movements along this axis are: move­
ment TOWARD the signer's body, e.g. ME (G hand, pointed toward signer,
moves toward and makes contact with the chest), movement AWAY from the
signer's body, e.g. DELICIOUS (\(\theta\), beginning with middle finger in
contact with mouth, moves outward with a twisting motion, and TO-AND-
FRO, either with alternating action, e.g. TALK (4's, facing each other,
alternately move back and forth at mouth area), or non-interacting, e.g. 1st person plural inclusive—'we: you and I' (V hand, palm upward, moves back and forth in the direction of addressee).

2.333 The horizontal-width axis. Movements along this axis are:
RIGHWARD, e.g. BLACK (G in continuous contact with forehead moves rightward), LEFTWARD, e.g. LIE ('prevaricate') (G brushes leftward under mouth), and SIDE-TO-SIDE, either interacting, e.g. SHOES (S's approach (and contact) and separate sideward in neutral space), or non-interacting, e.g. SONG (B moves side to side (wrist bends), pointing toward B hand palm up). (Designations for right and left are reversed for left-handed signer.)

2.334 There is a (potential) problem with these values, in that assigning values of RIGH and LEFT to a sign's movement does not always accurately describe the direction of the horizontal movement. Consider, for example, the sign WEEK--G hand (pointed upward palm away from signer) moves rightward in continuous contact with B hand, palm toward signer. It is entirely possible, if for example, the signer is facing leftward while signing (which he could be doing for a variety of rhetorical purposes), that the G-hand would move outward across the non-dominant palm to form WEEK, rather than rightward. Given that the values RIGH and LEFT do not always reflect a surface movement rightward or leftward, it would be better to define the values RIGH and LEFT as movement in the direction of the dominant side (side of the dominant hand) (and away from the non-dominant side) and in the direction of the non-dominant side (and away from the dominant side), respectively.

Given that these directions of movement are mutually exclusive, and
that they co-occur with values of the three other features proposed here, I suggest a feature DIRECTION with 10 values: UP, DOWN, UP-AND-DOWN, TOWARD, AWAY, TO-AND-FRO, RIGHT, LEFT, SIDE-TO-SIDE, and NON-DIRECTIONAL, in which there is no gross movement in space (e.g. BORING--G in contact with side of nose, twists several times).

2.34 The fourth aspect of movement is what I will refer to as the manner in which the hands move. There would appear to be two (non-significant) sub-parameters of manner of movement: one in which the joints of the hand (and wrist) move (micro movement), and one in which the entire arm is required to move (macro) -- but not in a particular direction.

2.341 We can isolate six types of micro movement which occur in ASL:

(1)-(3) The bending of the hand at the finger joints, at the knuckles, and at the wrist (BEND-FINGERS, -KNUCKLES, -WRIST). BEND-WRIST corresponds to Stokoe's element NOD (or BEND), occurring for instance in YES (A bends at wrist several times in neutral space). The values BEND-FINGERS and BEND-KNUCKLES are needed to explain the changes in hand configuration in signs like FROG (V palm down under chin sharply bends to become V) and STUBBORN (two 8 hands, thumb tip contact at sides of forehead, bend at the knuckles to become 8's). (See discussion in §2.2)

(4) The wiggling of the fingers (WIGGLE), e.g. FINGERSPELL (5 hand, with wiggling fingers, moves rightward in neutral space).

(5)-(6) The opening and closing action of the hands (OPEN, CLOSE), as in the signs BOY (C closes to 0 while moving outward from forehead) and HATE (8 opens to 5 in flicking motion--palm faces direction of patient). Opening and closing movements could be handled with changes in hand configuration. However, as mentioned earlier (§2.231), signs in which hand
shape changes occur always begin or end in a neutral and predictable shape. If we analyze opening and closing action as hand shape changes, we would be forced to add redundancy by marking predictable elements in the description. Also, the movement in signs with opening and closing action (i.e. the 'change in hand shape') is relatively rapid and would seem to contrast with changes from one shape to another in for example a non-assimilated compound.

2.342 There are three types of non-directional macro movements:
(1) STRAIGHT action, in which the hand traces a straight line from one point to another, be those points on or near the body or in neutral space (i.e. the shortest distance between two points). All alternating movements discussed above have STRAIGHT movements.
(2) The twisting of the wrist (TWIST), e.g. BORING (G twists repeatedly while in contact at the side of the nose).
(3) CIRCULAR motion of the hand and arm, e.g. CONFUSED (two '5' hands, facing each other, in alternating circular motions).

I propose a feature MANNER with nine values: STRAIGHT, CIRCULAR, TWIST, BEND-FINGERS, BEND-KNUCKLES, BEND-WRIST, WIGGLE, OPEN, CLOSE.

2.35 A case could be made for handling some of the movements described here in other ways. For example, the motion described by TWIST could be thought of as entailing a change in orientation, e.g. from palm down to palm leftward. If one's interest lies in reducing the number of features (or phonemes, for that matter) to the fewest possible, then this analysis would be appealing. However, it seems to lose something of the essential nature of the movement. In signs with a clear-
dominant B hand turns to palm up and taps the non-dominant palm again),
the movements and orientation changes are describable as discrete ele-
ments, in the sense that each has its own definite starting and ending
point. In a sign such as FRENCH (F hand twists upward in neutral space),
the movement is continuous and the twist relatively rapid. Orientation
change resulting from the twist cannot be viewed as composed of discrete
elements. Also, the twisting motion in many signs, e.g. ONION ($X_2$
twists at upper cheek) is repeated several times. This fact would seem
to be evidence for the value TWIST as a unified whole which can easily
be repeated several times.

BEND-WRIST could be re-formulated as something like UP-AND-DOWN,
WRIST. This formulation seems to lose something of the gestalt of
bending at the wrist, especially as in most signs with bend-wrist move-
ment, the nodding or bending is repeated several times (e.g. YES--A hand
nods several times in neutral space). Since the same formulation could
not be applicable to bend-fingers and bend-knuckles, because they don't
go up and down, we would lose the correlation of the three bending move-
ments (i.e. that hands can bend in these three places), if we opted for
this alternative formulation.

2.36 As I mentioned briefly above, there seems to be a general tendency
for some signs' movements to be repeated once or twice in normal produc-
tion. Whether or not the sign's movement is repeated would appear to
depend on the type of movement occurring in that sign. In general,
movements tend not to be repeated when the signs are (emphatically)
stressed, maybe because they also tend to become larger and more rapid
(and entail tense musculature) when stressed. All of the interacting
movements tend to be repeated in non-stressed production. The bending

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of the fingers, knuckles, and wrist, and the wiggling of the fingers are usually repeated, as are twisting and circular motions; opening and closing of the hand usually are not repeated. Movements involving END CONTACT and HOLDING CONTACT are generally repeated (although the contact is not re-established in HOLDING CONTACT signs); there is generally no repetition of movement in signs with CONTINUOUS, BEGINNING, or DOUBLE CONTACT. Further investigation may lead us to an explanation of this phenomenon.

2.4 Place of Articulation

2.40 In some ways, the place of articulation parameter is the most difficult to analyze in discrete terms. The basic constraints on place of articulation are not language specific, but rather articulatory and perceptual. As I stated earlier (§2.15), the articulation space available to the signer is limited to that area at or near his body which his addressee can see. This space is limited to the area of an approximate rectangle, surrounding the head and chest area. There are (rather limited) occasions when a gesture is made out of the signing space, for example in a variation of the sign BIG in which the signer conveys the meaning 'gigantic' (the arms may be extended fully to the sides), but these need not be of concern here. There is one lexicalized sign (that I know of) that is articulated outside of the signing space--the sign DOG, in which the B hand pats the thigh twice.

In addition to the area of neutral space—that area off the body (limited by the extent of the arms forward, bent at the elbows) in the center of the signing space, i.e. in the horizontal plane of the upper chest, neck, lower face region--signs may be articulated practically
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anywhere on the body area limited by the signing space (i.e. head, neck, trunk, non-dominant arm). Neutral space is the area in which the greatest number of signs are articulated— including all action verbs, e.g. GO, WALK, WORK. We can distinguish one area from another, but it is clear that there are very few clear-cut lines of demarcation. Also, we will see that iconicity plays an important role in the place of articulation parameter.

2.41 One aspect of the sub-lexical components in ASL (and in Sign Language in general) is their lack of discreteness in comparison to phonetic segments in oral language. We think of phonetic segments in oral languages as being discrete signals. Of course, we could not claim that segments are completely discrete units of sound. We know that speakers with different larynx sizes and sizes and shapes of oral and nasal cavities produce different formant structures for the same vowel, even if they speak the same phonological dialect of the same language and do not perceive these differences as distinct. The same is true of different speakers' production of tone in tone languages. However, despite this seeming lack of discreteness in sound production, speakers are able to articulate and perceive fine distinctions within a very small and discrete range of acoustic signals. The situation is quite different in visual language. In sign language, possibly due to the size of the articulators and of the articulation space, and due to the nature of visual perception, the sub-lexical units are not required to be discrete. There is certainly no need to maximize the use of the articulation space, as it is so large (as compared with the articulation space in oral language production). (In fact, this lack of discreteness allows for advantages in phonological alternation for the purpose of
semantic variation that the phonological structure of oral languages cannot allow. See §3 for a more detailed discussion.)

2.42 With this in mind, we can now proceed to discuss the place-of-articulation parameter. There appear to be four major areas of the body in regard to place of articulation: the head (including the neck), the trunk, the arm, and the hand. The salience of these major areas can be seen in morpheme structure conditions entailed in signs whose articulation involves contacting the body twice (double contact signs). Battison (in Friedman and Battison 1973) points out that for double contact signs "the observed tendency is to make both contacts within the same major areas" (p.8). There are signs in which contact points cross these boundaries, but not all possible sequences of contact which cross boundaries occur in ASL. (See §4.5 for further details)

Within each major area, we can further delimit distinctive places of articulation, as follows. (n.b. Before continuing, I should add that signs need not actually touch the body to be considered made at any given place of articulation. When describing a sign's place of articulation, we are describing that area of the body at which or near which (i.e. next to which) the sign is made. For instance, there seems to be a taboo especially among middle-aged and older women, against touching the chest. But we would still want to say that for example the sign FEEL (Ø hand, palm toward chest, middle finger is drawn upward in continuous contact with the chest) has CHEST as its place of articulation.)

2.43 Head

2.431 The WHOLE FACE, as opposed to any part of the face, is a distinctive place of articulation, occurring for example in the signs TROUBLE
(two B hands facing each other alternate in a downward movement across the face) and MIRROR (B hand, palm toward signer, in a quick twisting motion). Rather than viewing WHOLE FACE as a distinctive component of the place parameter, it might be better to think of it as the neutral or unmarked 'head area' place, lacking any further distinction in that major area. (That is, not the nose, chin, etc. specifically but the whole front of the head--and basically the front is the only part of the head than can be a component of Sign.)

If we consider WHOLE FACE as the neutral or unmarked HEAD location, then we can say that the TOP of the HEAD is its variant. Signs made at the top of the head are iconic, having to do with the top of the head or hair, e.g. HAIR (grasp hair), CUT-HAIR (V closes to H repeatedly while moving over head, representing scissors), and HAT (B hand pats head).

2.432 The UPPER FACE, including the forehead and the eyes constitutes a distinctive place. Signs articulated at the FOREHEAD include THINK (index finger of G contacts forehead) and BLACK (G moves rightward in continuous contact with forehead).

Signs made at the SIDES of the FOREHEAD are all double articulator signs--i.e. signs in which both hands act as articulators, e.g. STUBBORN (two 8's, thumb tip in contact with sides of forehead; 8's bend to 8's). In other words, the variant SIDE-FOREHEAD occurs in double articulator signs.

Signs made at or near the EYES are all iconic; they all have something to do with the eyes or with functions of the eyes (e.g. seeing, crying). Signs made at the EYES include SEE (V hand toward signer moves outward--in the direction of patient) and BLIND (V hand bends sharply to *V). Signs articulated at the SIDE of the EYES (sometimes at the cheek-
bone) all entail contact with the face; presumably these signs are made at the side of the eyes because no contact may be made in the eyes. SIDE-EYES signs include ONION (onions make the eyes tear) ($X_2$ hand--middle joint in contact at side of eyes or upper cheek--twists repeatedly), CRY (two $G$ hands move downward quickly as if tracing the path of the tears), and CHINESE (slanted eyes) ($G$ hand, contact with index finger--twists repeatedly).

In Stokoe's (1960, 1965) analysis, the EYES place is a variant of his MID-FACE (or NOSE) 'chereme'. However, EYES and NOSE contrast, as can be seen in the minimal pair CHINESE and BORING ($G$ hand twists at side of nose).

2.433 The NOSE place of articulation has three variants: CENTER, SIDE(S), and UNDER. Signs made UNDER the NOSE are iconic, having to do with a runny nose, for example KIDS (slang; refers to kids wiping their noses with finger) ($\uparrow^\prime$, index finger pointing rightward twists under nose) and COLD (the sickness) ($X$ with thumb extended moves downward under nose and closes to $A$, imitating blowing nose).

Signs made at the SIDE of the NOSE are either double contact signs, e.g. FLOWER ($0$ hand contacts both sides of the nose) or have a twisting movement, e.g. BORING ($G$ hand twists repeatedly), and DON'T-CARE ($G$ hand moves outward with a twist).

All other signs with the NOSE place of articulation are made in contact with or near the center of the nose. CENTER-NOSE signs include BUG (insect) ($5$ hand, thumb touching tip of nose, bends to $5$), SMELL ($B$ hand, palm toward signer moves upward twice at nose), and FUNNY ($H$ hand, palm downward, brushes past nose twice).
2.434 THE LOWER FACE area includes the MOUTH and the CHIN. Signs that are made at the mouth all have referents having to do with the mouth or (real or metaphoric) functions of the mouth, e.g. eating, talking, smoking. Examples of signs made at the mouth include EAT (O contacts mouth), ICE-CREAM (A hand in circular motion), DELICIOUS (Ø contacts mouth and twist outward), LIP-READ (V in circular motion), SAY (G, pointing leftward at mouth makes circular motion), and DEAF (G contacts mouth and upper cheek near ear, representing the non-functional mouth and ear).

There is evidence supporting the claim that the MOUTH and the CHIN are variants of the same distinctive area in that signs requiring contact at the mouth are never made at the mouth by many women but rather lowered to the chin (presumably so as not to mess up their lipstick).

All other signs of the LOWER FACE are made at the CHIN, e.g. OLD (C, toward signer, closes while moving downward), PATIENT (A in thumb-side contact at chin moves downward), MOTHER (5 hand, fingers wiggling, thumb contacts chin), COLOR (5, palm toward chin, fingers wiggle), TALK (4's facing each other at chin, alternately move to and fro), WRONG (¥ hand, palm toward signer, contacts chin).

2.435 A relatively small number of signs are made UNDER the CHIN, including NOT (Å hand, contact with thumb, moves sharply outward), FROG (V palm downward under chin bends to V twice, representing the frog's pulsating throat) and DIRTY (5 hand palm down under chin with wiggling fingers). UNDER-CHIN must be considered a distinctive place of articulation, as there are no conditions which would allow it to be considered a variant of LOWER FACE. (Although, since there are so few signs made under the chin, there are no contrasting environments either. That is,
there are no signs made on the lower face which have the same hand shape, orientation, and movement that signs made under the chin have.)

2.436 The CHEEK is a distinctive place of articulation. Specific place of articulation within the cheek area depends on hand configuration and in some cases on the meaning of the referent. (That is, iconic signs look like what they refer to, whether or not they violate phonological constraints.) In signs with thumb tip contact at the CHEEK, the sign is made at the side of the cheek, near or at the jaw, e.g. GIRL (A, thumb in continuous contact, moves down the side of the cheek), and YESTERDAY (A hand contacts side cheek twice, moving backward along the time line).

Most CHEEK signs are made in the center of the cheek (the unmarked cheek location), including CANDY (G hand, finger in contact, twists several times)--which contrasts with SOUR (same hand shape, movement, made at the chin)--and BLUSH (B hand moves up cheek, back of hand in continuous contact). The contrast CHEEK and EYE (UPPER FACE) is seen in the minimal pair APPLE ($X_2$ twists in contact with cheek) and ONION ($X_2$ twists at side of eye). HEAD is a double contact sign--B hand first touches the upper cheek and then the temple. The fact that the sign is made at the upper cheek may be due to anticipatory assimilation to the location of the second contact point.

The EAR may be considered a variant of CHEEK. All signs made at the EAR are iconic and refer to the ear in some way, e.g. EAR, HEAR, EARRING, and an assimilated compound of EARRING and GOLD, meaning CALIFORNIA. Evidence for ear as a variant of CHEEK may be found in the sign DEAF (G hand contacts mouth and upper cheek). The sign originally entailed the contact of the G hand at the mouth (as in the paralinguistic gesture for 'hush') and again at the ear (to indicate the
'hushing' of the ear). In the assimilated form, the second contact is at the upper cheek, which would seem to indicate that the cheek and ear locations are not distinctive (except that signs having to do with 'ear' are made at the ear).

2.437 Relatively few signs are made at the distinctive location NECK. Most of those that are made at the neck have a meaning related to the neck or the throat, including NECK, VOICE (V hand palm down, moves upward along neck), THIRSTY (C hand moves down neck), and REPRESS (one's feelings, i.e. keep them down) (C hand closes while moving sharply downward). However, there are signs made at the neck which are not iconic (or at least not in any obvious way), for example CURIOUS (I hand grasps neck and moves up and down; this could represent the movement of the larynx while swallowing, but the relation of this to 'curious' eludes me) and STUCK (also slang for 'pregnant') (fingers of V hand sharply contact center of neck).

There is one (clearly iconic) sign made at the side of the neck--VAMPIRE (fingers of V hand sharply contact side of neck). Since VAMPIRE and STUCK have the same form except for their location, one might want to say that the center and side of the neck were distinctive locations. However, given the nature of iconicity and its effect on the phonological structure, and given the fact that VAMPIRE is the only sign made at the side of the neck, it seems more appropriate to ignore the contrast.

2.44 Trunk or chest

2.440 There are far fewer distinctions in place of articulation made on the chest than on the face; only four phonetic distinctions may be made: the center of the chest (CHEST), the shoulder, the stomach, and the
waist. (The greater number of distinctive places of articulation on the face as opposed to the other major areas may be accounted for in the light of information regarding visual acuity. See §4.14 for details.)

2.441 The greatest number of signs made on the trunk are made at what may be considered the neutral or unmarked trunk location, the center of the CHEST. Signs made at the chest include FEEL, LOVE, ME (1st person index), LIVE, SCARED, and WHITE.

There are a number of signs made at the lower chest—in the area of the stomach. However, the stomach area may be considered a non-distinctive variant of CHEST, in that all signs made there iconically represent something to do with that area, either the stomach or the womb. Examples of lower chest signs include PREGNANT, BORN, BABY, CRAMPS (menstrual), BELLY-LAUGH, and STOMACH-ACHE.

2.442 The SHOULDER or shoulder area is a distinctive place of articulation. Both shoulders are contacted in double articulator signs like VACATION—two L hands make thumb tip contact with mid shoulder area. Signs made at one shoulder include COP (C hand contacts contralateral shoulder), LAZY (L contacts contralateral shoulder), PAST-CONTINUOUS aspectual marker (usually translates as 'have been' or 'up to now' in English) (two G hands move outward from contact at dominant shoulder), and RECENTLY (B hand contacts ipsilateral shoulder). It should be pointed out that the shoulder location is odd in that all signs made at the shoulder(s) show a high degree of iconicity. For example, RECENTLY and PAST-CONTINUOUS make use of the visual time line—an imaginary plane running alongside the body: the body (and the area immediately in front of it) represents present time, the space behind the body past, and the
area in front of the body future time. RECENTLY indexes the near past by touching the past 'border'--the shoulder; PAST-CONTINUOUS traces a line from the past to the present. VACATION represents pulling at suspenders (like the farmer with a piece of corn silk in his mouth). COP places a C hand at the place where the policeman's badge would be. KING--a K hand touching first the contralateral shoulder and then the ipsilateral side of the waist--represents the image of a king's sash. Because no 'arbitrary' (non-iconic) signs are made at the shoulder, we might want to consider SHOULDER a somewhat marginal distinction.

2.443 The WAIST is an extremely infrequent place of articulation, also occurring only in iconic signs like KING, HIPS (outlining hips with B hands), and RUSSIAN (B hands contact waist twice, representing typical dancer's pose). Because of the iconicity of signs made there, it might be best to consider WAIST a non-distinctive variant of CHEST.

2.45 Arm

2.451 The UPPER ARM is a distinctive place of articulation, occurring in signs such as HOSPITAL (H hand traces cross on upper arm), COKE (both cola and cocaine) (index finger of L hand contacts upper arm, thumb bends repeatedly; represents insertion of hypodermic needle), and SCOTLAND (4 hand moves down and then rightward, tracing tartan). No distinction is made between what I will call the dorsal side (outside surface) and the ventral side (inside surface) of the upper arm--the choice of dorsal or ventral depends on either the picture the sign makes, or the physical constraints imposed by the hand shape and movement. For example, the red cross suggested by the sign HOSPITAL typically appears on the outside of the sleeve, hence it is made on the dorsal portion of
the arm; it would be very difficult to make contact with the L hand in COKE at any other location than the inside (ventral) part of the arm.

2.452 The ELBOW is also a distinctive location on the arm, occurring relatively infrequently. Signs having the elbow as place of articulation include POOR (hand surrounding elbow closes to 0 while moving downward) and PUNISH (G hand brushes past elbow).

2.453 Unlike the upper arm, there are two distinctive locations on the FOREARM—DORSAL side and VENTRAL side. I should point out that the place of articulation may be dorsal forearm or ventral forearm regardless of the arm's orientation in space (e.g. ventral side up or down). Signs whose place of articulation is the dorsal side of the forearm include LONG (G finger moves upward along arm) and IMPROVE (B hand, toward signer, moves upward along arm); ventral forearm signs include BRIDGE (V hand makes fingertip contact in two places on ventral side, which is facing downward), and STEAL (V bends to V while moving toward hand on ventral side of crooked arm).

2.454 Relatively few signs are made at either the ventral or dorsal side of the wrist. It seems that the dorsal side of the wrist is a distinctive place of articulation (distinct from the forearm), occurring in signs such as TIME (G taps wrist), and POTATO (V taps wrist). The ventral side of the wrist must also be considered distinct, occurring in signs such as DOCTOR (M contacts ventral wrist, as if taking pulse) and LOCK (A hand turns over and contacts ventral side of wrist, facing upward).

However, both dorsal and ventral wrist ought to be considered only marginal locations, in that most of the signs made at the wrist have
referents with something to do with the wrist, e.g. TIME (points to imaginary wristwatch, or real one if there is one), DOCTOR (takes pulse). LOCK and POTATO are notable exceptions in that they are not iconic signs; it is because of these signs that we have to consider the two sides of the wrist as two distinct locations.

2.46 Hand

Theoretically, the non-dominant hand can assume any configuration that the dominant hand can. However, as mentioned earlier, there are several conditions restricting the shape of the non-dominant hand.

In double articulator signs, in which both hands have a movement component, both hands must have the same configuration, as well as the same movement. Signs of this type include IF (two F hands alternate in an up and down movement) and ROAD (two B hands, facing each other, move forward).

In signs in which the non-dominant hand acts as place of articulation there are two possibilities in regard to the shape that hand can assume. One possibility is that both the articulator and the hand acting as location have the same shape. Signs which are symmetric in regard to hand shape include NAME (H hand taps H hand twice) and SCHOOL (palm of B hand taps palm of B twice). The second possibility is one in which the non-dominant place of articulation hand assumes one of six neutral hand shapes: A, B, 5, G, C, O. Examples of this type are HELP (B hand palm upward moves upward to contact A), PRACTICE (A brushes back and forth across extended index finger of G) and TEA (F hand palm downward in circular motion over 0).
<table>
<thead>
<tr>
<th>Place of Articulation</th>
<th>Conditions of Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neutral Space</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Head</strong></td>
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</tr>
<tr>
<td><strong>Whole Face</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Whole Face</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Top of Head</strong></td>
</tr>
<tr>
<td><strong>Upper Face</strong></td>
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<tr>
<td><strong>Forehead</strong></td>
<td><strong>Double articulator signs</strong></td>
</tr>
<tr>
<td><strong>Side-Forehead</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Eyes</strong></td>
<td><strong>Iconic signs</strong></td>
</tr>
<tr>
<td><strong>Side-Eyes</strong></td>
<td><strong>Contact</strong></td>
</tr>
<tr>
<td><strong>Nose</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Iconic signs</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Double contact; twist</strong></td>
</tr>
<tr>
<td><strong>Lower Face</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Chin</strong></td>
<td><strong>Iconic signs</strong></td>
</tr>
<tr>
<td><strong>Mouth (Under-Chin)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cheek</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Thumb tip contact</strong></td>
</tr>
<tr>
<td><strong>Ear</strong></td>
<td><strong>Iconic signs</strong></td>
</tr>
<tr>
<td>Place</td>
<td>Conditions of Occurrence</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>NECK CENTER</td>
<td>iconic signs</td>
</tr>
<tr>
<td>SIDE</td>
<td></td>
</tr>
<tr>
<td>TRUNK CHEST</td>
<td></td>
</tr>
<tr>
<td>CENTER</td>
<td></td>
</tr>
<tr>
<td>STOMACH</td>
<td>iconic signs</td>
</tr>
<tr>
<td>WAIST</td>
<td>iconic signs</td>
</tr>
<tr>
<td>SHOULDER</td>
<td></td>
</tr>
<tr>
<td>ARM UPPERM</td>
<td></td>
</tr>
<tr>
<td>UPPER ARM</td>
<td></td>
</tr>
<tr>
<td>ELBOW</td>
<td></td>
</tr>
<tr>
<td>DORSAL FOREARM</td>
<td></td>
</tr>
<tr>
<td>VENTRAL FOREARM</td>
<td></td>
</tr>
<tr>
<td>DORSAL WRIST</td>
<td></td>
</tr>
<tr>
<td>VENTRAL WRIST</td>
<td></td>
</tr>
</tbody>
</table>
2.5 Orientation

2.50 The components of the orientation parameter describe the relation in space of the hand to the signer's body. With the B hand, for example, the hand (palm) can be said to be oriented TOWARD the signer, AWAY from the signer, UP, DOWN, to the LEFT, or some combination of directions, like to the LEFT and UP. Only the left hand can have its palm facing rightward. We know that the hands' orientation is an essential aspect of the sign's description, given pairs of signs whose only difference lies in their orientation. The sign DANGER (A hand toward signer--bends at wrist while in contact with the non-dominant arm, palm downward) differs from BEAT (DEFEAT) (A hand away from signer--bends at wrist while in contact with arm palm downward) only in the orientation of the articulating hand. SCHOOL has two B hands tapping twice--non-dominant palm up, dominant palm down; MONEY also has two B hands tapping twice and the non-dominant palm up, but has the dominant hand palm up.

2.51 Orientation has to be defined for each hand shape, so that we know which part of the hand is 'facing' which direction in relation to the body. Many hand shapes can be marked for two orientations: one for the direction that the palm faces, and one for the direction that the extended fingers point toward. For example, the G hands in the sign SOCKS can be said to be oriented downward and away from the signer--the palm sides face downward and the extended fingers away from the signer. (SOCKS has two G hands in an alternating to and fro movement in neutral space). Table 4 defines orientation in terms of each hand configuration. Orientation of the arm is defined as the direction that the ventral side of the arm faces.
<table>
<thead>
<tr>
<th>Hand Configuration</th>
<th>Orientation is Direction of...</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>finger or palm side</td>
</tr>
<tr>
<td>O</td>
<td>finger tips (palm)</td>
</tr>
<tr>
<td>B</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>B^</td>
<td>palm</td>
</tr>
<tr>
<td>C</td>
<td>palm</td>
</tr>
<tr>
<td>5</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>4</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>3^</td>
<td>palm</td>
</tr>
<tr>
<td>F</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>G</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>X</td>
<td>palm</td>
</tr>
<tr>
<td>L</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>H</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>V</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>V^</td>
<td>palm</td>
</tr>
<tr>
<td>3</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>3^</td>
<td>palm</td>
</tr>
<tr>
<td>Y</td>
<td>palm</td>
</tr>
<tr>
<td>8</td>
<td>palm</td>
</tr>
<tr>
<td>7</td>
<td>palm</td>
</tr>
<tr>
<td>M</td>
<td>finger or palm side</td>
</tr>
<tr>
<td>D</td>
<td>finger tips (palm)</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Hand Configuration</th>
<th>Orientation is Direction of...</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>palm</td>
</tr>
<tr>
<td>G₂</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>K</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>I</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>W</td>
<td>palm and/or finger tips</td>
</tr>
<tr>
<td>R</td>
<td>palm and/or finger tips</td>
</tr>
</tbody>
</table>

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2.52 It is clear that for many signs the designations TOWARD, AWAY, UP, DOWN, RIGHT, and LEFT (and combinations of the six) are not sufficient descriptions. I discussed earlier a similar problem in regard to components of the movement parameter (§2.334), giving as an example the sign WEEK (G hand facing B moves across non-dominant palm toward fingers). A description of the movement in WEEK as rightward will not account for the movement if the hands are oriented slightly differently, say with the fingers of the B hand pointing slightly away from the signer, in which case the G hand would move outward and not to the right. I attempted to solve this problem by defining rightward and leftward movement as movement toward the dominant and the non-dominant side of the body respectively. Describing the hands' orientation in WEEK presents the same problem—the designations PALM TOWARD for the non-dominant B hand and PALM AWAY for the dominant G hand will not account for non-distinctive variations in orientation as when the hands are held horizontally.

2.53 A related problem arises in orientation specifications for signs with one hand as location like NAME and LAW, or in signs made on the face like GIRL and ONION. Discrete designations which accurately describe orientation cannot be given for these and many other signs. NAME is made with two H hands—dominant hand taps non-dominant hand twice; an accurate description of the hands' orientation would be something like: (palm of) right hand faces half way between the directions LEFT and TOWARD signer, left hand faces half way between RIGHT and TOWARD signer. However, how then do we account for a non-distinctive variation of NAME in which the right hand is TOWARD the signer and the left faces RIGHTWARD? LAW is formed by having the L hand (palm away, pointing upward) make contact sharply with the palm of the B hand, facing away from the signer. Given
discrete orientation components, we would be unable to indicate that variations in orientation in these instances are irrelevant and are neither phonologically nor semantically distinctive. Discrete specifications for orientations are even more difficult to give for signs like GIRL and ONION. GIRL entails thumb tip contact of A on the cheek, and a downward movement in continuous contact; ONION is formed with a twisting movement of X₂, the middle joint in contact at the side of the eye. We could say that the orientation in GIRL is AWAY (from the signer) and in ONION is DOWN and/or AWAY. However, these descriptions are not only inaccurate but they don't seem to grasp the significant aspects of the hands' relation to the body. I suggest that the essential feature of the hands' relation to the signer's body in these signs is not the hands' orientation in space but rather which parts of the hand make contact with the body. Therefore, I propose that we add to the orientation parameter the notion of what I will call POINT of CONTACT, giving designations as to which part of the hand makes contact with the body.

Some evidence for the need for point of contact specification comes from examining the hand configuration parameter. For example, the condition for the occurrence of A and B (in non-iconic signs) is that signs with these shapes entail contact with the tip of the thumb.

I propose that for signs in which the hand(s) make(s) contact with the body (contact signs), the orientation specification designate the point of contact—that part of the hand which touches the body. For non-contact signs—those in which the hands do not make contact anywhere on the body—there is, of course, no point of contact; specifications for orientation have to be marked as above, i.e. palm facing or extended finger pointing RIGHT, LEFT, UP, DOWN, TOWARD, AWAY.
2.54 We can now reconsider the signs mentioned above in terms of point of contact. Instead of trying to account for all possible (non-distinctive) variations of the hands' spatial orientation, WEEK can be analyzed as having a PALM-SIDE contact point: the palm-side of the G hand contacts the palm-side of the B hand; G moves toward fingers in continuous contact with B. Variations in orientations in NAME can be accounted for with reference to the H hands' point of contact—the SIDE of the fingers: the SIDE of the dominant H hand makes contact with the SIDE of the non-dominant H hand. In LAW, the dorsal (back) side of the L hand sharply contacts the PALM of the non-dominant B. GIRL has the thumb tip of the A hand making continuous contact down along the cheek. ONION entails middle joint contact of $X_2$ at the side of the eyes with a twisting movement.

2.55 The following points of contact may be isolated as elements of contact signs:

2.551 FINGER TIP(S). The signs HEAD (with B), EAT (with O), THINK (G), COKE (L), POTATO (V), and FEEL (Ø) all have the finger tip(s) as point of contact.

It is clear that finger tip and the other points of contact have to be defined for each hand shape. For example, finger tip contact with the Ø hand involves touching the bent middle finger to the body. Since the Ø shape allows for no other point of contact, we are justified in defining finger tip contact as mid-finger-tip contact. Not all hand shapes allow for all points of contact. For instance, no finger tip contact may be made with the A hand or any of its variants. Table 5 gives all possible points of contact for each distinctive hand shape.
and examples of each contact point.

One hand shape—$X_2$—always and only makes contact with the middle joint of the bent finger. With no other hand shape is this part of the hand the point of contact. We can loosely define finger tip contact as contact with the end of the extended finger. Since the middle joint is the end point of the extension of the bent index finger of $X_2$, we can characterize point of contact in $X_2$ as a variant of finger tip contact.

2.552 THUMB TIP. That thumb tip and finger tip contact contrast can be seen in signs which have, for example, the L shape. L allows for both finger and thumb tip contact, in for instance COKE (index finger contacts upper arm) and LATER (thumb contact, palm of non-dominant hand). Other signs with thumb tip as point of contact include GIRL (with A), STUBBORN (B), MOTHER (5), COW (Y), and BUG (5).

2.553 PALM—the palm or fleshy side of the hand. Examples of signs with palmside contact are SCHOOL (with B), RED (G), TRAIN (H), TELEPHONE (Y), and WITH (A). Palmside contact of A is defined as contact with the 'finger side' of the fist as opposed to the back of the hand).

2.554 SIDE—the edge of the fingers or hand. Examples include HOT (B), BOY (C closes to O), COP (C), LECH (4) (in the manner of a 'dirty old man'), KIDS (4'), and PATIENT (A).

2.555 DORSAL—the back of the hand. Signs in which the dorsal side of the hand makes contact with the body include BLUSH (B), LAW (L), and FROG (V→V).

2.56 As stated above, contact points must be defined for each hand shape. In order to complete this discussion of point of contact, I
present here a brief description of contact points of hand shapes for which the labels given above are not obvious. (Refer to Figure 1 for hand configurations.)

1. PALM of A = the finger side of the closed fist. There can be no finger tip contact with A as no fingers are extended.
2. SIDE of A = thumb or pinky side of closed fist.
3. FINGER TIP of C = tips of all fingers and thumb.
4. FINGER TIP of D = tips of thumb and fingers in contact with thumb. The tip of the extended index finger never occurs as point of contact with D.
5. FINGER TIP of F = tips of thumb and index finger (in contact with thumb). The tips of the extended fingers of F are never points of contact.

With hand shapes in which the thumb tip touches the finger tip(s) (cf. O, bO, D, bD, F, W, 8, 7), the tips of the remaining extended fingers (those not touching the thumb) are never points of contact.

6. FINGER TIP of Θ = the tip of the bent middle finger.
7. FINGER TIP of X₂ = the extended knuckle or joint of the bent index finger.
<table>
<thead>
<tr>
<th>Fingertip</th>
<th>Thumb Tip</th>
<th>Palm</th>
<th>Side</th>
<th>Dorsal</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>---</td>
<td>GIRL</td>
<td>WITH</td>
<td>PATIENT</td>
</tr>
<tr>
<td>0</td>
<td>EAT</td>
<td>---</td>
<td>---</td>
<td>BOY</td>
</tr>
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<td>B</td>
<td>HEAD</td>
<td>STUBBORN</td>
<td>SCHOOL</td>
<td>HOT</td>
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<tr>
<td>C</td>
<td>x</td>
<td>DRINK</td>
<td>---</td>
<td>COP</td>
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<td>x</td>
<td>MOTHER</td>
<td>COLOR</td>
<td>LECH (4)</td>
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<td>&quot;5&quot;</td>
<td>COOKIE</td>
<td>x</td>
<td>---</td>
<td>x</td>
</tr>
<tr>
<td>F</td>
<td>INDIAN</td>
<td>---</td>
<td>---</td>
<td>IMPORTANT</td>
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<td>THINK</td>
<td>---</td>
<td>RED</td>
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<td>FRIEND</td>
<td>HOT</td>
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<tr>
<td>X₂</td>
<td>ONION</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>L</td>
<td>COKE</td>
<td>LATER</td>
<td>LYNN (name sign)</td>
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<tr>
<td>H</td>
<td>x</td>
<td>---</td>
<td>TRAIN</td>
<td>NAME</td>
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Key: --- = impossible, x = not occurring
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<td>VICKI</td>
<td>STUPID</td>
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<tr>
<td>V</td>
<td>POTATO</td>
<td>---</td>
<td>---</td>
<td>x</td>
<td>TOSS-AND-TURN</td>
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<tr>
<td>3</td>
<td>x</td>
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<td>3-WEEKS</td>
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</tr>
<tr>
<td>3</td>
<td>x</td>
<td>DEVIL</td>
<td>---</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>y</td>
<td>x</td>
<td>COW</td>
<td>MISTAKE</td>
<td>SHAVE</td>
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<td>4</td>
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<td>x</td>
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<td>---</td>
<td>x</td>
<td>x</td>
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<td>T</td>
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<td>NIXON</td>
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<td>DENTIST</td>
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<td>x</td>
<td>x</td>
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<td>E</td>
<td>---</td>
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<td>CUTE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>K</td>
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<td>KING</td>
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**Key:** --- = impossible, x = not occurring
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<thead>
<tr>
<th>Location</th>
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<th>Reason</th>
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</thead>
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<tr>
<td>Fingertip</td>
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<td></td>
</tr>
<tr>
<td>Thumb Tip</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Dorsal</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Side</td>
<td>x</td>
<td>WATER</td>
</tr>
<tr>
<td>Palm</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Key: --- = impossible, x = not occurring
3. ICONICITY AND NON-DISCRETENESS

3.0 In the preceding chapter, I have demonstrated the existence not only of sub-lexical components in ASL (i.e. the four articulatory parameters) but also of finite sets of distinctive units within the parameters. However, it is evident that the component structure of ASL (or of any visual language) is not entirely analogous to that of oral language structures.

It is clear that although there are certainly finite sets of arbitrary elements in the language, a crucial element of ASL's formational structure lies in the nature of visual representation or suggestion of referents or parts of referents— in its iconicity. In this section, I will discuss the role that iconicity plays in the formational structure and some principles of iconicity in the language that must be included in an accurate phonological description. If we fail to consider the role of iconicity and insist on analyzing ASL only with reference to its arbitrary elements, then we will fail to grasp the essential nature of its formational properties.

3.1 In §2 we were concerned not only with the arbitrary but also the discrete elements of ASL's phonological structure. One significant aspect of ASL's structure is that nuance of meaning can be conveyed by means of systematic phonological alternation. Mandel (1975) discusses among iconic devices in ASL that which he calls depiction—basically making a picture of the referent or part of or something associated with
the referent. There are two types of depiction—one in which the signer 'draws' the picture using his articulator (e.g. hand, finger, arm) as an implement (leaving an imaginary trace), e.g. HOSPITAL, in which the H hand draws a cross on the arm, and TABLE--B hands move sideward and down 'drawing' the top and sides of the table; one in which the signer uses his articulator as a substitute for the referent, e.g. WALK--in which the B hands, representing the feet, move back and forth, and BIRD--L hand closes to B0 at mouth, representing the bird's beak opening and closing. Signs which may be phonologically altered to convey nuance of meaning are non-metonymic depictive signs—that is they depict the whole referent as opposed to some part of the referent. The signer may alter the shape of these signs by mapping "a continuous semantic feature continuously onto a continuous code feature" (Mandel, p. 12).\(^1\) Such analogic (as opposed to digital) processes not only allow for lexical variation of the sort under consideration here, but also appear to be a major aspect of the grammar.\(^2\) By this analogic process, a sign like TABLE can be altered to indicate the size of the table—a big table is simply bigger than a small table. However, a metonymic sign like HOSPITAL cannot be altered to indicate for instance 'big hospital', even though the sign is depictive. The sign depicts a cross on the sleeve conveying the meaning 'hospital' by convention and does not depict the whole concept 'hospital'; if the signer made the sign HOSPITAL larger, he would merely convey something like 'big cross'. WALK may be phonologically altered to convey a variety of meanings including 'walk fast', 'walk slowly', 'trot', 'trudge', and 'march' because the referent action may be continuously mapped onto the action of the articulators, substituting for the referent feet. However, no such alternation is possible for BIRD
because only the bird's beak is depicted in the sign.

To be sure, oral language has the ability to phonologically alter the shape of lexical items to convey degrees of meaning, but only in limited ways. In some languages, for example English, one can intensify the degree of an item (usually a surface adjective or durative verb) by stressing it, as for example in the sentence 'The fish was big!'. In other languages, for example Hoysan, intensification or lessening of degree can be conveyed by various types of reduplication. In Hoysan [hugJ] 'red' when reduplicated with a rising tone followed by a low level tone [hugJ hugJ] means 'very red'; when reduplicated and the tones are reversed [hugJ hugJ] the meaning is 'slightly red'. To some extent, onomatopoetic lexical items can be altered to represent real-world phenomena, for instance by lengthening the vocalic portion of a word like 'tweet' or by imitating long vs. short or loud vs. soft sounds in both onomatopoetic and non-onomatopoetic items. However, phonological processes to show degree are quite limited in oral language.

In sign language, analogic phonological alternation is a widespread phenomenon. Visual language has the advantage of being able to use a much less discrete signal than can oral language. Any oral language is bound by its phonological structure: it must form its words from available, acceptable (in the language) phones, in acceptable combinations. If a speaker wishes to convey various degrees of meaning (except in those cases cited above), he must carefully choose the lexical item which conveys that nuance, which rarely bears any resemblance to any other semantically related item.

3.2 Another striking example of the scalar (as opposed to segmental) properties of ASL's structure can be found in indexic locative and...
temporal expressions. Space, time, and person reference in ASL is achieved by the use of indexing, which entails the use of a neutral hand shape (usually G, B, or A) articulated in neutral space, pointed or oriented in given directions. The signer first establishes a frame of reference in the space in front of his body, and then he establishes points of reference within that space identified with the objects, persons, and locations to which he intends to refer.³

The relative distance of a locative referent from the signer in the real world is indicated by the relative angle of the extended finger in relation to the ground. The greater the angle of the hand in relation to the ground (up to but not including 90°), the higher the arm is raised, and the greater the length of the extension of the arm, the further the distance of the locative referent is from the signer. There are no definite lines of demarcation. In fact, a very distant location can be indexed by the superimposition of tense, sharp movement in which the arm is extended fully on the index (i.e. stress). (Friedman 1975b, p. 949)

Relative distance from the signer from 'close to' to 'far from' the signer is indicated by a range of movements and orientations.

It may be well to analyse the locative reference system as a continuum ranging from 'here' to 'very far from here'... [ASL makes] use of all possible visual cues and spatial reality to form locative expressions. ASL appears to have less need for arbitrary combination of segments...to indicate semantic components that can be (visually) iconically or metaphorically represented. (Friedman 1975b, p. 949.)

All temporal reference (excepting reference to calendric periods for which there are lexical items or time adverbial phrases, e.g. YESTERDAY, LAST-WEEK) is made by indexic reference to points along an imaginary time 'line'--a vertical plane running along the side of the body. The area of space coincident with and immediately in front of the signer's body represents present time; the area behind the body represents past time; the space in front of the body represents future time. By indexing various points along the time line, closer to and farther

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away from the body, the signer may indicate temporal reference relatively closer to and farther away from present time.

Given the type of analogic phonological alternation that is so prevalent in ASL, it seems clear that an analysis of ASL's phonology cannot depend solely on a description of discrete segments, the conditions of their occurrence and their possible combination. I suggest that a phonological description of ASL has to include mapping or analogue rules of the sort mentioned here to account for the kind of variation found in the language. It is not sufficient to describe WALK for example as two B hands, palms downward or toward signer, with an alternating to and fro movement. Such a description fails to grasp the depictive aspects of the sign, and more importantly fails to relate the movement of the articulators--and the variations of that movement possible in the same sign--to the corresponding movement of the referent. My claim is not that the articulators actually perform the referent action or exactly depict the referent--such an action would be pantomime and such depiction would be drawing. I doubt that a language could sustain such a large amount of nonconventional elements. The fact is that the iconicity and iconic phonological and grammatical mechanisms in ASL and in other sign languages are highly conventionalized. Iconicity, at least is Sign Language, does not in any way indicate lack of conventionality.\(^4\)

3.3 Given a description of the component parts of ASL and even given the notion of analogic representation, we would still not be able to account for the formation and relation of certain signs and sets of signs (paradigms?) without reference to further principles of iconicity.

3.31 Consider for instance the set of signs for times of the day. All
signs for times of the day, and various signs like DAY and OVERSLEEP are based on an icon showing the typical position of the sun in relation to the horizon for any given time of day. The position of the dominant hand indicates the sun's position in the sky; the horizontal non-dominant forearm depicts the horizon. NOON has the elbow of the dominant arm resting on the non-dominant hand (orientation of the left hand is irrelevant), the dominant arm perpendicular to the non-dominant arm—which places the dominant hand in 'high-noon' position, that is directly above the non-dominant arm. In MORNING the right (dominant) arm, facing the signer, makes contact with the left arm at about the middle of the right forearm; the sun represented by the right hand is in its typical morning position—about 45° from the horizon. EARLY-MORNING can be expressed by having the right arm's contact point be closer to the wrist—thus depicting the sun in a lower position in the sky. AFTERNOON reverses the orientation of the right arm—the sun is going down: contact with the non-dominant 'horizon' arm is made at the middle of the right forearm which is facing away from the signer. Again the sun is in its typical afternoon position—at about 45° from the horizon on the other side of the sky. Clearly the sun's rising is depicted as coming toward the signer and its setting as moving away from the signer. NIGHT has the wrist of the right hand with the B shape (facing downward) making contact with the left wrist or hand; that the sun is below the horizon is depicted by placing the right hand below the left arm. ALL-NIGHT is formed by moving the B hand around the underside left 'horizon' arm—starting in the position for NIGHT; the sun moves around the earth 'under' the horizon during the night. ALL-AFTERNOON is made by moving the right arm from the NOON position to that of NIGHT—or almost to the
NIGHT position. Similarly ALL-MORNING may be expressed by sliding the right forearm upward from the MORNING position until the left hand touches the crook of the right elbow.

In DAY, the right forearm, starting approximately perpendicular to the left arm, moves downward until it lies flat against the left arm. OVERSLEEP uses the F hand shape which moves up from under the left arm until the right forearm contacts the left arm; the sign depicts the sun's movement as it reaches the mid-morning position.

There are two reasons why I would like to treat this set of signs differently from signs discussed in chapter 2. One, possibly insignificant reason is that the points of contact of the dominant arm in MORNING and AFTERNOON (and their variants) do not occur elsewhere; in no other signs is the forearm of the articulator the point of contact. It would be simple enough to add the forearm to the list of possible points of contact, but possibly a more elucidating solution would be to view the odd points of contact as incidental to the signs' depiction. I suggest that the depiction be systematically described and allow that description to account for the signs' formation rather than attempt to account for the formation in terms of discrete components of the four parameters.

Perhaps a more significant consideration in regard to the times of day set is that if we describe these signs merely in terms of their component parts—that is their discrete 'phonetic' make-up—then we would fail to show the relation among the signs of the set—a relation based on the visual image the signs present. It seems counterproductive to describe all elements of a sign language—a language that makes full use of all possible visual cues, as well as of its lack of discreteness—
solely in terms of arbitrary (and discrete) components. As an alternative, I suggest the following type of description:

Signs for times of the day are based on an iconic representation (depiction) of the position of the sun in relation to the horizon: the dominant hand—in the B shape—represents the sun; the non-dominant arm in a horizontal position in neutral space represents the horizon. The rising sun (the sun's position in the Eastern sky) is depicted by having the hand (and forearm) face the signer, the setting sun (in the Western sky) by having the arm face away from the signer. Lexicalized distinctions: EARLY-MORNING, MORNING, ALL-MORNING, NOON, AFTERNOON, LATE-AFTERNOON, ALL-AFTERNOON, NIGHT, ALL-NIGHT. Variations: (e.g.) DAY—the dominant arm moves to the side and down rather than upward (for ALL-MORNING) or vertically downward (ALL-AFTERNOON).

3.32 Another example of a set of signs that may be more felicitously described in terms of the icon represented is the set including CHILD, TEENAGER, ADULT, and GROW-UP (people). These signs are based on a depiction of people's typical heights at certain ages. In CHILD, the dominant B hand palm downward is placed in neutral space at about waist level, indicating the typical height of a small child—a short person. In ADULT, the B hand is placed at head (eye) level or above, indicating the height of an adult. TEENAGER has the B hand at about shoulder level, somewhat nearer to adult than to child level. (It would appear that the sign TEENAGER can only occur in conjunction with CHILD or ADULT or both and never in an isolated construction.) Although varying heights of third person referents may be indicated by various placements of the hand (i.e. 'Sarah was very tall, and her friend Matilda was really short'), the placement of the hand in CHILD, TEENAGER, and ADULT indicates nothing about the actual height of the referent individual. That is, the sign ADULT means 'adult', regardless of height. In the verb sign GROW-UP the B hand moves approximately from the waist to the top of the head. It is also possible to indicate 'grow to teenage-hood' and

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'grow from adolescence to adulthood' by moving the hand from waist to shoulder and from shoulder to head respectively, but only in the context where both expressions are used.

Although we can easily describe this set solely in terms of arbitrary elements of each parameter (e.g. CHILD = B hand, palm down at waist), in doing so we would fail to relate the signs to each other and to the visual icon they present. Instead, I suggest that the phonological description of these and all depictive signs include a systematic description of their iconicity.

3.4 In order to indicate the extent to which the description of iconic aspects of the language is essential to an accurate phonological description, I offer the following summary of Mandel's (1975) taxonomy of iconic devices and some ways in which the description of various types of iconic signs can be incorporated into a phonological analysis.

According to Mandel, there are two primary iconic devices operative in ASL in single lexical items: presentation and depiction. As mentioned above, depiction entails making a picture of the referent--either by 'drawing' the picture using the articulator as an implement or by using the articulator as a substitute for the referent. Presentation basically entails presenting a token of the referent, like pointing to or grasping the signer's own hair to make the sign HAIR, or by presenting a token of the referent action, e.g. BASEBALL, in which the signer mimes swinging a bat, clearly a representative token action of 'baseball'.

In all iconic signs, the image or picture that is articulated is not, of course, the referent itself but a conventionalized representation of the referent--(and following Mandel, I include under the cover term referent "actions, states, entire events, relationships, and in general
all 'meanings', not just those of nominals" (Mandel, p. 8). The articulated image of a given sign may represent the entire referent—in signs like HAIR or TABLE—or may represent a part of the meaning of the referent or something (or some action) typically associated with the referent—in signs like BASEBALL or HOSPITAL. In the latter signs, the gestures produced can be said to be metonymically iconic of their referents. That which the gesture describes directly (the hair, the swinging of a bat, the cross in HOSPITAL, the table) is the base of the sign. Thus we can say that in metonymic signs, transfer of meaning from referent to sign is mediated by the relation of metonymy. I noted above (§3.1) that only non-metonymic depictive signs allow for scalar phonological alternation to show degrees of meaning.

According to Mandel, there are two basic types of presentation: mime and indexical presentation. Mime entails a presentation of a token of the referent action, like in BASEBALL, WRITE (b0 hand—index and thumb-tip form tapered circle—'writes' on non-dominant palm) or COFFEE (A horizontally circles non-dominant A, as if grinding coffee). Mimic signs may be metonymic—like BASEBALL and COFFEE, or non-metonymic—like WRITE. In indexical presentation the signer merely points to a token of the referent or to something typically associated with the referent. Examples of non-metonymic indexical presentation include HAIR (point to or grasp hair) and NOSE (point to nose); metonymic signs of this type include HEAR (point to ear), and THINK (point to forehead). As Mandel points out, lexical signs of this type must have bases that are always available to the signer, like body parts which make up the majority of such bases.

There are also two basic types of depiction: virtual and
substitutive. In virtual depiction the signer "pretends that his articulator (i.e. hand, finger, arm...) leaves a trace as it moves, and he draws the picture with this imaginary trace". (Mandel, p. 11) Signs produced by virtual depiction include HOUSE and TABLE (in which the typical shapes of the referents are drawn with B hands), HOSPITAL (H hand draws cross on upper arm), BOX (B hands outline sides of box), and OLD (C hand closes while moving downward from chin—outlining a beard). Signs using the virtual depiction device may or may not be metonymically iconic, e.g. HOSPITAL and OLD are metonymic, HOUSE and BOX are not.7

In substitutive depiction "the signer's articulator actually becomes the picture" (Mandel, p. 11)—he uses his articulator as a substitute for the referent or part of the referent. For instance, in TREE, the elbow of the dominant arm contacts the non-dominant palm, as the dominant B hand twists repeatedly: representing a tree (dominant arm) on the ground (non-dominant arm) with its leaves fluttering (dominant hand). BIRD has a metonymic mediating relation between referent and base: the L closing to B0 at the mouth (contact with back of hand) represents the action of the bird's beak. One sign for WALK uses the B hands representing feet to convey various speeds and styles of walking.

3.5 It is my contention that an accurate (and certainly a more appealing) phonological description of iconic signs in ASL—of all types—must make reference to the iconicity (of those signs) itself and to principles governing the form that the iconicity takes in sign production. Consider now iconic signs of each type in Mandel's taxonomy of simple icon devices and how we might best incorporate their iconicity into a phonological analysis.
3.51 Presentation

3.511 Mime

A description of the sign BASEBALL in terms of the phonemic analysis given in chapter 2 (that is in discrete phonological segments) would look like the following:

BASEBALL: dominant A in (pinky)-side contact with thumb-side of non-dominant A at shoulder: both hands move sharply away from signer (while remaining in contact).

or as it is more commonly seen in rapid production:

BASEBALL: A hands in contact in neutral space: both hands bend at the wrist repeatedly.

These are, of course, accurate descriptions—as far as they go. But what is missing is that in articulating the sign, the signer mimes an action typically associated with the referent: the sign is a conventionalized metonymic mime (=mimic presentation). By describing the sign's iconic elements as well as how the iconicity is realized within the phonological system, we are able to predict not only that the sign may have phonological variations dependent on semantic variations but how those variations will be realized. Consider the following kind of description:

BASEBALL: a metonymic mimic presentation of batting a ball: A hand on A hand move outward from shoulder area. rapid form: wrists bend in neutral space. variations: speed, style of batting, hesitations, corresponding only to real-world batter's action.

Of course, since the sign is metonymic, the only possible variations are those which relate to the action presented itself. In other words, there's no way (that I know of) to convey 'world series' by altering the movement in BASEBALL.8

The variations of a sign like WRITE—which is a non-metonymic mimic
presentation—are more easily predictable in #2 than in #1.

1. WRITE: fingertip contact of b0 on non-dominant palm; hand moves side to side repeatedly.

2. WRITE: mimic presentation of writing: dominant hand in b0 representing hand holding writing implement moves side to side (=writing) on non-dominant palm (=unmarked surface, e.g. paper). variations: durative (e.g. writing dissertation), fast (e.g. short note), iterative, style (e.g. baroque, meticulous), etc.

3.512 Indexical presentation

Although there is very little ad-hoc variation possible with indexical presentation signs—(although verbs may be altered with conventional aspectual markings—see below)—and these signs may be easily described in terms of arbitrary (phonetic) elements, it would seem that since their iconicity is so crucial to their formation, it would be best to include the iconicity in the phonological description.

NOSE is a non-metonymic indexical presentation: the fingertip of the G hand points to or makes contact with the tip of the nose. The sign may be altered so that the signer may convey for example 'big nose' (à la Jimmy Durante or Pinocchio); if this is done, then the sign is at least in part depictive and no longer only presentative. Since the G hand is clearly the unmarked shape for all indexical purposes (including most locative and nominal and some temporal indexical pro-forms), and since the sign's formation merely entails an indexical presentation to a token of the referent, an adequate description of NOSE could be as follows:

NOSE: (non-metonymic) indexical presentation.

Similarly THINK (fingertip of G contacts forehead), which is a metonymic indexical presentation, might best be described as follows:
THINK: metonymic indexical presentation. base= forehead--area in which thinking is done.

(Recall that signs are typically made at the front of the body, so that they are readily visible; given this constraint, it is not odd that the forehead is indexed as the location of the brain rather than for instance the side of the head.) As THINK is a verb, it may have aspectual markers like the durative marker, entailing a slow circular motion with the G hand at the forehead, meaning 'thinking'. Ultimately it would be best to isolate all the different kinds of metonymy operating in the language so that we may include this classification in the phonological description.

3.52 Depiction

3.521 Substitutive depiction

The sign TREE may be described in terms of arbitrary elements as follows:

TREE: dominant elbow in contact with non-dominant hand (either palm or back), dominant arm in vertical position; (dominant) 5 hand twists repeatedly.

However, given that the sign is highly iconic, the above description fails in two respects: (1) in that it in no way indicates that iconicity and (2) in that it does not enable us to predict the kind of lexical and ad-hoc variation of TREE that can and does occur. If, instead the description of TREE were:

TREE: (non-metonymic) substitutive depiction: non-dominant arm held horizontally= unmarked ground; dominant arm held vertically, crooked at elbow in contact with 'ground'= tree; forearm= trunk, 5 hand= leaves. 5 hand twists repeatedly= leaves' movement in wind.

then we would be able to predict the properties of lexical signs like CHOP-TREE and ad-hoc modifications like one meaning 'haul away a tree'.

The verb CHOP (B hand makes chopping motion) belongs to a class of verbs
which may be said to incorporate objects; that is, the place of articulation for CHOP is determined by the location of its object. Since we know that CHOP is object-incorporating, that TREE is a substitutive depiction, and that trees are typically chopped at the lower portion of their trunks, we can predict that in the sign CHOP-TREE the 'chopping' hand will make a to-and-fro movement (i.e. in the horizontal-depth axis) making contact at the forearm of the 'tree' arm. (The 'tree' arm may even fall forward at the end of the sign.) In order to say 'haul the tree away' after it fell, the signer might grasp the 'tree' forearm (now horizontal) with the dominant articulator and move the arms to the non-dominant side.

We have seen (§2.253) that the V (~\text{\small V}) hand shape is often used as a substitute for legs in signs such as STAND, SIT, LIE (DOWN), KNEEL, JUMP, ROLL-IN-THE- AISLES- WITH- LAUGHTER, WALK, and COPULATE (two V's make palm-side contact). We may best show the relation among these signs if our phonological description allows for the recognition that the V hand shape is a substitutive depiction of legs. All possible variations are based on the relation between the configuration and motion of the hand as a conventionalized substitute for the real world configuration and movement of the legs.

Consider also the sign BIRD which is a metonymic substitutive depiction; the dominant hand--L closes to b0, dorsal portion in contact with the mouth--represents the bird's beak. Because BIRD is metonymic, it does not allow for the kind of phonological alternation that would enable one to say 'big bird' by enlarging the sign's movement--making the sign bigger might only mean something like 'big beak'. However, some alternation is possible and it can only be predicted if the form of the
sign's iconicity is taken into account. For instance, DUCK is made exactly like BIRD, except that it has the $\hat{H}$ shape ($H$ with thumb extended) instead of $L$—thereby indicating the duck's typically wider beak.

3.522 Virtual depiction

We have seen that non-metonymic virtually depictive signs like TABLE (cf. §3.1) can be phonologically altered to indicate semantic variation. Consider, as another example of this phenomenon, the sign HOUSE which may be described as:

1. HOUSE: two $\hat{B}$ hands with fingertip contact in neutral space move sideward; $\hat{B}$'s become $B$ and move downward.

When viewed as a virtual depiction, the sign may alternately be described in this way:

2. HOUSE: (non-metonymic) virtual depiction of typical house—indicating planar surface of slanted roof and walls (along vertical axis) with $B$ hands.

Mandel (1975) in discussing the use of various hand shapes in virtual depiction, states that planar surfaces (as opposed to linear) are usually indicated by the use of an open-hand shape—i.e. $B$, $\hat{B}$, and 5. Therefore, since the hand shape in signs like HOUSE is predictable, it would appear that the description need not make mention of it.

The fact that HOUSE may be altered so that peculiarities of size and shape may be conveyed (e.g. 'tall victorian house' or 'wide barracks') is predictable only from the kind of description given in #2, as #1 indicates nothing about the relation of form and meaning.

Consider one final example of the desirability of including the nature of signs' iconicity in the phonological description: the sign VALLEY. Stated simply, this virtually depictive sign entails the movement of one or two $B$ hands in the typical shape of a valley in neutral
space. Stokoe (1965) describes the sign as: (1) the downward and leftward, and subsequent upward and leftward movement of the B hand, palm downward or (2) the simultaneous convergence and downward movement of two B hands, palm downward.12

One might also go further and describe the orientation changes as well as the movement in this way:

VALLEY: 1. B hand palm down moves downward; becomes palm rightward in downward movement; becomes palm downward and moves leftward; becomes palm leftward and moves up and leftward.

2. Two B hands palm downward become palms rightward (dominant) and leftward (non-dominant) as approach and move downward; become palms downward as approach and contact.

Actually neither of these descriptions accurately describe the signs: the hand or hands really trace a parabola of sorts and certainly not a shape with sharp edges as the descriptions suggest. I do not mean to imply that it is the fault of either Stokoe's or my phonetic inventory that the sign cannot be described in discrete terms; it is simply that the sign is an iconic representation of a real-world phenomenon and an adequate phonological description must take this into account. Of more significance, however, is the fact that movements of this kind—or even oblique movements as Stokoe's description indicates—do not occur in signs whose form is arbitrary but only in iconic signs. This in itself would seem to indicate that iconic signs must be treated differently—and with reference to their iconicity. The phonetic description of arbitrary elements is not lacking; there would appear to be a need for two 'separate but equal' phonological systems to adequately account for ASL's structure: one describing arbitrary phonetic elements and one treating iconicity.

It is easy to see that a description of VALLEY which relies on
arbitrary and discrete elements cannot compare to the first simple description of the sign given above. A description stating that the sign is a virtual depiction of the two-dimensional surface of a typical valley is not only adequate but I believe more elucidating than one which attempts to describe it in discrete terms.

3.6 I mentioned earlier (§1.5) Mandel's (1975) discussion of iconicity and conventionality as two separate parameters. The two continua are partially implicational in that the less iconic a gesture is (lexicalized or not), the more conventional it must be, and the less conventional, the more iconic, but not the inverse. A sign can be 100% iconic and 100% conventional, but not totally non-iconic and non-conventional.

Throughout §2 and §3 we have seen that the more iconic a sign is, the less it is constrained by the conventional phonological structure. (See examples in, e.g. §2.2 and §2.4.) In the signs for times of the day, the points of contact at the mid-forearm are at least highly marked, and are certainly non-occurring elements of the (conventional) arbitrary phonological system described in §2. This chapter is primarily concerned with lexicalized forms and with systematic phonological alternation of these forms; however, it is worth pointing out here that ad-hoc gestures—which must be iconic since they are necessarily non-conventional--also often violate conventional phonological constraints. The following example clearly indicates not only this fact, but also the strength of the same constraints as the ad-hoc gesture becomes conventionalized.

During an elicitation session, an informant—when translating a story (from English to ASL)—needed to express the word 'whale'. As
ASL has no lexical item meaning 'whale', an ad-hoc expression was required. He first signed BIG FISH (two B hands in neutral space, fingertips of non-dominant hand in contact with ventral wrist of dominant hand; dominant hand twists as hands move in winding motion away from signer), followed by an ad-hoc gesture in which the C hand moved upward alongside the head to the arm's full extent (and well out of the 'signing space') and then curved forward—clearly depicting a whale's spout. After receiving confirmation that his gesture was understood (by appropriate nods—and laughter), and before continuing to relate the whale's activities, he signed 'whale' again with no hesitation and without any prompting: BIG FISH SPOUT. This time in articulating SPOUT, the C hand moved upward from the mid-chest area (in neutral space) and curved away from the signer at about mouth level—scaled to the iconic sign FISH and in the appropriate location just above that place where FISH had been made. Several days later, the same informant was seen showing another signer the new sign he'd invented—and offering no explanation other than making the construction with 'spout' in the signing space. The friend immediately recognized the gesture as meaning 'whale'.

3.7 Conclusion

3.70 I have attempted to present a comprehensive view of the component structure of ASL—a phonetic and phonemic description which takes into account the widespread iconicity of the language's formational properties. It seem clear that we cannot attempt to treat the phonology of a sign language exactly as we would treat that of an oral language, in that language in the manual/visual modality avails itself of all
possible visual cues in its formation. It is clear that humans derive much of their conceptual framework through visual stimulus and visual imagery. It is because of this high sense of awareness of visual stimuli that language in the visual mode tends to enhance its structure in ways that oral language cannot.

3.71 In de Saussure's definition of the nature of the linguistic sign, his first principle is that the sign be arbitrary. He states that the "bond between the signifier and the signified is arbitrary...the linguistic sign is arbitrary" (p. 67, 1959). It would appear that in many respects ASL does not follow this principle. Must we then say that ASL is not a language comparable to languages in the oral/auditory mode?

It is evident that de Saussure was not considering sign language (as a natural language) in his description of the nature of the linguistic sign. It is true that in oral language, the sign is arbitrary for the most part. He did not take into consideration (which is understandable in the light of claims made about sign languages at the time of his writing) the possibility of a language in the visual mode, in which it is common and indeed natural to use all available visual cues to convey meaning. It is no longer necessary for us to prove that sign languages are viable and true languages. De Saussure's first principle applies only to those languages in which arbitrariness is an essential feature, namely oral language. It is important to remember in a discussion of the 'phonology' of a sign language, that manual/visual language in many ways is not entirely comparable or analogous to oral/auditory language, with respect to both structural advantages and deficiencies.

The formational structure of ASL consists of conventional arbitrary...
and non-arbitrary elements, as well as discrete and non-discrete components. The language makes full use of the possibilities of iconicity--available because of the visual modality--within the constraints of conventionality. It would be unnatural, given the nature of man--in terms of his reliance on visual imagery in thought--and the nature of language if both iconicity and arbitrariness and both discreteness and non-discreteness did not exist in any manual/visual language.
4. CONSTRAINTS

4.1 The reasons for the evolutionary choice of an oral/auditory system of communication for man are abundantly clear if we consider the strictly practical deficiencies of language in a manual/visual mode. I wish to make it clear that these deficiencies are of a practical and not of a linguistic nature. In fact, we have seen (§3) that language in the visual modality has in various ways far greater potentialities for means of expression than oral language.

4.11 The signer and the addressee must maintain visual contact throughout the communicating period. The participants need to be close enough to see each other's signs. That is to say that a visual language cannot be communicated around corners, nor if the participants are in a darkened area, nor on the telephone. This is a practical, and in linguistic terms a trivial, limitation. One would note that it is impossible for oral language to be communicated in an extremely noisy area, for example in a boiler room.

Possibly less trivial, but still of a functional rather than of a linguistic nature, is the fact that the addressee cannot cover his eyes or at any time look away from the signer. This limitation which imposes restrictions on such non-linguistic functions as gestural indexing and demonstration (of for example how to construct a model airplane) while simultaneously performing linguistic acts, strikes me as being a major reason why the oral/auditory modality evolved as the modality for the
vast majority of human languages.

A fact which may be less obvious is that the signer cannot cover his eyes during the communicating period. That is to say that there are no signs in ASL in which the signer must obstruct his vision. He has to be able to monitor his addressee in order to be able to perceive any interruption or lack of understanding on the addressee's part. (He does, of course, momentarily close his eyes, as when blinking, etc.) The signer does look away at times, for instance to look at his own pronominal indices, but he may still monitor the addressee with his peripheral vision.

4.12 The signer cannot perform a linguistic act when both of his hands are otherwise occupied. It should be made clear, however, that he may communicate with only one hand. This is clearly another major functional deficiency of visual language. It is more practical to be able to talk and simultaneously use one's hands to an entirely different end. However, I would point out that a speaker of an oral language cannot talk and eat simultaneously (or at least cannot talk and swallow at the same time), although I do not mean to imply that this limitation imposes the same magnitude of restriction as does the inability to use one's hands for a non-linguistic and a linguistic function simultaneously.

4.13 No sign is acceptable in ASL which is not visible to the addressee, although it is physically possible to articulate signs which are not visible to the addressee. It is possible to articulate signs for example behind one's back or under a table when seated or inside a cupped hand or any other enclosure or for that matter while the addressee is looking away, for example, at a road map.
Similarly it possible to talk in an empty room or in a forest with no one else present or during a rock concert or an avalanche, but no communication would ensue and therefore no linguistic act has taken place (if we consider as a necessary function of a linguistic act that communication between at least two people—the speaker and the addressee—must occur).

Although language in the two modalities is similar in this respect, it must be noted that in the case of visual language, this seemingly trivial limitation imposes constraints on the phonological structure of the language itself whereas no similar constraint is made on oral language phonologies (due to the same cause). The articulation space available to the signer is functionally limited to that area at or near his body which his addressee can see.

4.14 In terms of the place of articulation parameter, there are perceptual constraints imposed on the number of significant or distinctive places of articulation within a given body part. For example, there are many more distinctions in place of articulation made on the face than on the torso. There are six distinctive places of articulation on the head (i.e. whole face, upper face, nose, cheek, lower face, neck), whereas there are only two on the chest (i.e. chest and shoulder). (There are, of course, phonologically non-distinctive variants for each of these places of articulation.) Siple (1973) discusses this observation in the light of information regarding visual acuity. It is known that the addressee primarily focuses on the signer's face during the communicating period and derives all linguistic information with a modicum of eye movement to other areas. She states that
visual acuity is not uniform across the visual field. Acuity is best at the point of fixation and drops off rapidly as the distance from that point increases. If a person stands six feet from a signer and stares at his nose and eyes, that is the area of greatest acuity. (p. 1.)

She goes on to offer this as an explanation for the relatively greater fineness of distinction in the area of the face than in any other area of the body. Also, we would expect to find (and do find) that in the area of high acuity

...small differences in position, in number of fingers and in overall hand shape are easily detected... (p. 2.)

The farther away from the area of highest acuity in which a sign is articulated, the grosser the distinctions in hand configuration, place of articulation, and movement.

Siple also points out that in order to increase information content in low acuity areas, signs tend to increase in size. However, large motions tend to "...detract (sic) from information received in areas of high acuity...". (p. 2). Therefore, we find relatively small movements in areas of high acuity, namely at or near the face. Also, the distinctive areas are smaller (physically) on the face.

In addition to the relationship described by Siple between visual acuity and fineness of distinction in place of articulation in the facial area, I would point out that the physical properties of the body itself in terms of articulation space would tend to impose this difference in fineness or number of distinctions (and in fact might tend to 'force' the necessity of the addressee's focus on the face). Human beings are constructed in such a way as to have many more obvious physical 'landmarks' on the face than on the chest (or any other body part). That is to say that on the face there are the forehead, the mouth, the nose, the cheek, etc., while on the chest besides breasts on a female (and there is a
definite taboo against touching them in signing), the only obvious landmarks are the chest itself and the shoulder area. In fact, any oral language will demonstrate the fineness of distinction of body parts in the choice and number of lexical items for body parts. Therefore, it is reasonable that a language in a visual mode would tend to use those already present and perceptible distinctions to construct and constrain its phonology.

4.2 Beyond functional limitations imposed by the visual modality, there are obvious gross physiological constraints on the production of the signal.

4.21 Signs are constrained by the possible movements of the joints and muscles of the hands and arms. For example, no sign may be articulated in which the signer is forced to bend his fingers backwards, even if he is capable of doing so with his other hand. (The important point being that he cannot do so simply with one hand.) More importantly, no sign is made which would or would tend to cause bodily injury. Not unnaturally, the signer is never obliged to stick his fingers in his eyes or scratch his arm, etc.

A most important ramification of this constraint is in the area of stress manifestation (see §6.2.5.4 for further detail). When signs, which in citation form make contact with the body at the final point of articulation (i.e. end contact signs), are stressed, in most cases the end contact is lost. I make the assumption (see §6) that the loss of contact in these fundamentally end contact signs is presumably due to the desire on the part of the signer not to cause himself bodily injury. These signs, when stressed, have movements which are relatively more
rapid and larger and more thrusting than their movements in citation form and entail tense musculature. If the signs were to be articulated with these additional features and the signs maintained end contact status, the articulation would tend to cause pain to the signer. As an example, consider the sign VAMPIRE, which in citation form is made with the V hand (index and middle fingers extended and bent), palm downward, and which makes contact with the ipsilateral (to the dominant hand) side of the neck. In stressed form, the sign has a thrusting action with a rapid, large movement. If the signer were to make contact at the neck when stressing the sign, he would obviously cause himself pain. The significance, then, of this physiological constraint is that it imposes constraints on and alters the phonological structure of the language.

4.22 It is possible, because each signer has two articulators (hands), to simultaneously sign two lexical items. However, in addition to an apparent conceptual constraint which would allow for only two semantically related items to be simultaneously articulated, perceptual constraints would not allow for the articulation of two lexical items placed at arm's length. That is to say that in articulating two distinct lexical items simultaneously, the signer may not spread his arms to their fullest extent and expect to have the addressee perceive both items. Clearly this is due to the fact that the addressee's visual acuity is low at such a distance from the face and the fact that he would be obliged to distinguish two fine articulations which are spatially distant.

4.3 As stated above, a simple sign involves one hand configuration, made with one or both hands, combined with one place of articulation, a specification for orientation of hand, and a movement of the
articulator(s). For those signs made with two hands there are several articulatory constraints.

There are two types of signs which entail the use of both hands. One is that class of signs in which both hands move, or in other words in which both hands simultaneously act as articulators. In the other class, the dominant hand is the articulator and the non-dominant is the place of articulation.

4.31 Signs in which both hands are articulators are constrained in such a way as to allow for only one possibility: that both hands must have the same hand configuration and the same movement throughout the sign (although the movement may be an alternating one, as for example, if the hands alternately move toward and away from the body). (This and other morpheme structure conditions are discussed in §4.5.) Moreover, the movement must be a relatively simple one, e.g. straight action. In fact, signs (especially compounds) have been formed in such a way as to violate this constraint, but through historical change come to obey the constraint. Frishberg (1975b) discusses what she calls the historical tendency for fluidity or the tendency toward smoothing of movement or transitions between parts of compound signs, while assimilating hand-shape and/or orientation. (p. 707)

She discusses the process of what I would refer to as assimilation in this case rather than fluidity, by which compounds originally made up of two distinct signs with different hand shapes and movements, become single monomorphemic signs, in which there is one movement and one hand configuration (with possibly one or two places of articulation). She gives as an example the sign INFORM, which derives from the two signs KNOW (a one-handed sign) and BRING (two-handed). Today INFORM is a
single, two-handed sign combining the forehead place of articulation from KNOW and the neutral space location from BRING, in which the hand at the forehead moves downward to join the other hand in neutral space, while both hands simultaneously have a movement entailing the opening motion of the hands, which appears in neither BRING nor KNOW. Another example is that of the sign BELIEVE, which derives from THINK (index finger (G) moves to center forehead) and what we might gloss as JOIN (B's clasp--the present day sign for MARRY). Today BELIEVE is a two-handed double place of articulation sign, in which both hands have the same shape. The dominant hand with a B or Ń hand begins at the forehead and moves down to clasp the non-dominant hand in neutral space. (The relation between this type of assimilation and that of oral language is discussed in §5.) There can obviously be no articulatory constraints such as the one described here in which both articulators must have the same hand configuration in oral language, as we have only one tongue, mouth, larynx, etc. (i.e. one articulator).

As to an explanation for this phenomenon, the simplest (and the most obvious) one would be ease of articulation. It is more difficult to perform two different simultaneous actions with two hands than to perform the same one with both hands. By way of analogy, consider the relative difficulty of patting the head with one hand and rubbing the stomach in a circular motion with the other.

In regard to two handed signs in which both act as articulators, Siple reports that

another variable which will increase the amount of information obtained from a low-acuity area is the redundancy of presented information. (p. 3)

I remind the reader that the area in which most double articulator signs
are made is neutral space—an area of low acuity. Siple states that this desire for redundancy in the signal results in a duplication of material presented in half the visual field in the other half, thereby causing "the probability of receiving that information [to be] increased". 
(p. 3) This general principle would tend to cause signs made in a low acuity area to be two handed and cause two handed signs to be symmetrical.

Frishberg lends support to this theory with the historical evidence that signs made in neutral space which originally were one-handed, like ANGRY (one hand at the waist), DIE (B hand, palm upwards moving to palm downward) and HURRY (H hand--palm leftward, moves up and down), have become two handed symmetrical signs.

4.32 In the case of signs in which the non-dominant hand acts as place of articulation, the non-dominant hand does not move. For this class of signs there are two and only two possibilities in regard to hand configuration of the two hands. One possibility is that both the articulator and hand acting as place of articulation have the same hand shape. That is to say the signs are symmetric in regard to hand configuration. (e.g. SCHOOL--B's, NAME--H's, WORK--A's). The second type of construction is one in which the non-dominant hand, or place of articulation, assumes the shape of one of six neutral hand shapes: A, B, 5, G, C, 0 (cf. §2.231). This would lead us to believe that just in those cases where the symmetry condition was not met, there is a constraint against using any but highly unmarked configurations. I suggest that if the symmetry condition which provides redundancies in a low acuity area is not met, the only other possibility which exists is for the non-dominant hand to assume a shape that neither adds additional information which would tend to lower redundancy and thereby hinder perception, nor
detracts (perceptually) from the hand shape of the articulator, which is presumably providing the more salient information. Also in terms of articulatory ease, if the signer needs to assume two different hand configurations, surely he is more apt to shape the non-dominant hand, not acting as an articulator in this case, in one of the least complicated shapes (physiologically).

4.4 There would appear to be some kind of complexity trade-off in combination of parameters. That is to say that the fineness of complexity of articulation has an inverse relation to the complexity of movement. Similarly, a sign with two places of articulation would tend to have a relatively simple movement. I have already pointed out that, synchronically, in double contact signs (those one-handed signs having two places of articulation) the same hand configuration is maintained throughout the sign (whether originally the same or derived through assimilation). For example, consider KING (K hand configuration making contact first with the contralateral shoulder and then near the ipsilateral side of the waist), HEAD (B palm downward, contacting with the fingertips first the temple and then the upper cheek) and YESTERDAY (Â hand, thumb contacts the lower cheek and then further back toward the cheekbone).

In fact, there is ample evidence for the strength of this constraint in double contact signs in which assimilation of hand configuration has taken place. The sign BELIEVE was mentioned above, in which by anticipatory assimilation that part of the sign made at the forehead assumed the B (or B) shape of the second part of the sign. Another example is the present day sign SISTER. It is derived from a compound composed of GIRL (extended thumb of Â contacts and is drawn down cheek) and SAME
(dominant hand in G palm downward in neutral space joins non-dominant hand with the same shape). Today the double contact sign is made with the same hand configuration throughout—G. (It occasionally may be seen as the original compound in citation form only; signers are aware of its derivation.)

The inverse relation between complexity in the movement and hand configuration parameters can be exemplified by fingerspelling. Finger-spelling (the spelling out of oral language words through the use of the manual alphabet) entails highly complex and rapidly changing hand configurations, and entails no gross movement of the hand (other than to change from one shape (letter) to another). Moreover, we find that whenever complex hand configurations are used in a sign, the movement tends to be unmarked or uncomplicated and in high acuity areas, small. The reverse, in which complex movements tend to combine with relatively neutral hand shapes, is equally true.

Again, Siple's observations in regard to visual acuity and perception lend evidence to this observation. We expect to find (and do find) relatively more fine detail in areas of high visual acuity. Furthermore, we expect small and relatively simple movements in these areas. "Small motions enhance" the information received of fine distinctions of hand configuration and place of articulation in high acuity areas. On the other hand, relatively uncomplicated hand configuration and complex, larger movements are to be found in low acuity areas.

The language is presumably structured in such a way as to minimize perceptual difficulties and maximize the efficiency of articulation in order to maximize information received.
4.5 Morpheme Structure Conditions

4.50 In combining hand configurations, movements, locations and orientations certain combinations are arbitrarily allowed or disallowed in the same way that in any given oral language certain combinations of phones are allowable or not. I present here several known morpheme structure conditions in ASL.

Battison (in Friedman and Battison 1973) describes several morpheme structure constraints, both physiologically motivated and unmotivated (arbitrary). To summarize his findings:

4.51 Symmetry Condition:

If both hands have a movement component for a given sign (as opposed to being static), then specifications for hand configuration, movement and location must be identical and therefore symmetrical. (p. 7)

As I discussed above (§4.31), there are clear-cut articulatory and perceptual motivations for the condition of symmetricity in a modality of language which allows for the use of two articulators.

4.52 Dominance Condition:

If the hand configurations of a given sign are non-identical, then one hand must remain stationary while the other hand, usually the dominant hand, executes the movement. (p. 7)

This condition not only reflects the physiological fact of hand preference (or handedness) but also the difficulty of simultaneously articulating two different configurations and perceiving two different signals in a low acuity area. (All signs of this type are made in neutral space.)

In addition, the reader will recall that only six neutral configurations may be used for the stationary hand. The motivation here may be
either articulatory and perceptual or both.

As discussed in §2.4, Battison divides the place of articulation parameter into four formally significant areas of the body: the head and neck area, the trunk (from shoulders to hips), the arm (from shoulder to wrist), and the hand. These significantly distinct boundaries are operative in two morpheme structure conditions.

4.53 For signs whose articulation involves contacting the body twice rather than just once, the observed tendency is to make both contacts within the same major area. (p. 8)

There are, however, signs in which contact points cross these boundaries. However, not all possible sequences of contact which cross boundaries are allowable in ASL. Battison finds that only 56% of all possible sequence types are utilized. Of the allowable sequences are those in which contact is first made on the head area and then on the trunk (e.g. GENTLEMAN), first head then arm (e.g. DAUGHTER), first head then hand (e.g. SISTER), first hand then head (e.g. LEARN), but disallowed are first trunk then head, arm, or hand, first arm then head, trunk or hand, or first hand then trunk or arm. Thus we find that only when the first contact is made at the head area can the second contact be made at any other major area.

4.54 A second condition involving double contact signs entails a neutralization of place of articulation distinctions within major areas. Battison observes that the second contact is constrained to a fixed, neutralized position, such that internal distinctions within a major area are lost. (p. 10)

This condition would allow for the sign WOMAN which is made by contacting the thumb tip of the 5 hand first at the chin and then at the center of
the chest, but would disallow a double contact sign which first touches
the chin and then for example the shoulder.

These conditions reflect that which I have discussed earlier—the
inverse relation of complexity in combination of parameters. Battison
states

that a relative complexity (double contact as opposed to a
simple single contact) is counteracted by a reduction of
complexity...due to the neutralizing effects of the sequen-
tial morpheme structure constraints. (p. 10)
5. PHONOLOGICAL PROCESSES

5.0 This chapter presents a discussion of types of phonological processes—synchronic and historical—that occur in ASL as compared with those of oral language. Presented below are types of processes that occur in both oral and visual language, those which cannot occur in visual language, and those which cannot occur in oral language, due to the nature of the physical signals.

5.1 The process of phonological assimilation occurs as readily in visual language as it does in oral language. There are countless examples of assimilation in oral language—historical and synchronic: place assimilation—e.g. palatalization, labialization, vowel harmony, nasal assimilation (to following stop), etc.; manner assimilation—e.g. nasalization of vowel (preceding nasal), consonant gradation (e.g. Finnish voiceless stops become voiced intervocalically), devoicing, fricativization (medially), etc. The types are numerous and the number of occurrences endless. In visual language comparable types of assimilation occur. The following are examples of types of phonological assimilation which occur in ASL.

I discussed above (§4.31) what Frishberg (1975b) calls 'fluidity' as a historical phonological change in ASL; primarily the term refers to processes of assimilation. However, the tendency toward fluidity is possibly broader in scope than assimilation. One aspect of 'fluidity' is that movements in signs and transitions between the two parts of
compounds tend to become 'smooth'. Frishberg offers as an example of the change toward smoothness the sign ANY. This sign 60 years ago was articulated with an "ague-like shaking motion". Today the sign is made with the fist, thumb extended palm toward signer with a quick movement in which the hand is turned so that the palm is away from the signer, while the hand moves rightward. The Old French sign FOR (Fr. 'pour') consisted in two parts—first touching the extended index finger to the forehead and then pointing outward to the object. Today FOR entails a single movement from the forehead outward. If we examined the possible cause for such changes, we might refer to this aspect of 'fluidity' as a change for the purpose of ease of articulation. This type of change in ASL most closely corresponds to manner assimilation in oral language in which a segment is altered in its manner of articulation for the primary purpose of ease of articulation—e.g. the voicing of voiceless stops in intervocalic position. The change in movement described here represents a change from a more complex to a simple movement, caused presumably by the signer's desire for simplification of effort.

The second type of 'fluidity' described by Frishberg very clearly amounts to assimilatory processes. The sign INFORM was originally composed of a compound of KNOW plus BRING. Today the sign is monomorphemic and 'monosyllabic'. The sign is made by an opening motion of the two hands, one at the forehead and one in neutral space. That part of the sign in which the hand is at the forehead is derived from the original KNOW (bent palm toward signer, fingers touching forehead), but the ending hand configuration, orientation (palm away from signer in INFORM) and movement is derived by means of anticipatory assimilation to the sign BRING (two hands in neutral space, moving outward, palms upward). As
another example consider the sign WIFE earlier a compound of GIRL (Â hand grazes cheek) and MARRY (û hand clasps Î hand). Currently WIFE entails a downward movement of the Î hand from the cheek to the non-dominant palm. Again the change in WIFE represents an anticipatory assimilation of hand configuration. Another example of assimilation can be seen in the sign TOMATO, derived from the compound RED (index finger extended, palm inward, drawn downward along mouth) and a form of SLICE (side of dominant hand—open palm—drawn downward along side of non-dominant hand—in fist shape). The current sign TOMATO entails an anticipatory assimilation of the orientation of the hand in the first part from the orientation in SLICE and a perseveration of the hand configuration of RED (index finger extended) which remains constant throughout the sign.

5.11 Synchronically, we find numerous examples of unintended assimilation, particularly hand shape assimilation. As an example consider the phrase TEMPT STEAL 'tempted to steal'. In citation form TEMPT is made with the bent extended index finger (X) tapping the elbow of the crooked non-dominant arm. STEAL uses the V hand shape, bent sharply as the hand is moved along the underside of the crooked (non-dominant) forearm toward the hand. I have witnessed the unintended anticipatory assimilation of the V hand shape from STEAL to the sign TEMPT—so that TEMPT is made with the V shape rather than the X shape.

There are countless examples of this type of unintended anticipatory assimilation of hand shape. This is not surprising in the light of the following evidence in regard to hand configuration and place of articulation in signs in which the non-dominant hand acts as the place of articulation. It would appear that, in general, the onset of appearance of hand configuration and place of articulation (where location = non-
dominant hand) are not simultaneous as previously supposed. From evidence gathered from video taped portions of normal signing, we find that hand configuration of the articulator of a given sign is formed first, and only then is the hand shape of the place of articulation hand shaped or even brought into the signing space. In addition, we find that in connected discourse, the hand shape of the articulator anticipates the following sign, while the shape of the place of articulation hand lags or perseverates the shape of the previous sign. In most cases, this does not cause assimilation--that is to say that the anticipation comes after the previous sign has already been formed correctly and the preseveration does not remain throughout the following sign. However this tendency for hand shape to anticipate the following sign's hand shape and for shape of place of articulation hand to perseverate shape of the previous sign would tend to cause unintentional assimilation in rapid signing and would thereby be a viable explanation for the type of assimilation discussed here. For example, consider the phrase SCHOOL SAVE 'school saves'. The sign SCHOOL is made with two B hand shapes. The dominant hand taps the palm of the non-dominant hand twice. SAVE is made by touching the palm-up side of V to the underside of A, thumb upward. In connected discourse, rather than signing each sign as in citation form, the signer first makes the sign for SCHOOL, then as he moves the dominant hand around to the underside of the non-dominant hand (for SAVE) he changes the B shape to the V shape of SAVE while maintaining the B shape of the non-dominant hand from SCHOOL. Only after the dominant hand has come into position for the articulation of SAVE does the shape of the non-dominant place of articulation hand change to the A shape required for SAVE. The fact that this type of anticipation-lag process occurs
consistently in the language can be unambiguously supported by evidence from video tapes, when viewed frame by frame.

This type of process is hardly surprising. The anticipation of following and perseveration of preceding segments occurs often in oral language and is the basis for the explanation of assimilatory change in speech production. As an example consider the evidence of nasalization of vowels in English caused by early lowering of the velum in anticipation of the following nasal. Another example of the anticipation-lag syndrome of signal production is the introduction of an epenthetic stop between a liquid and a fricative as when the English word [pals] becomes [pəlts]. The dental stop is introduced due to the fact that the speaker cannot make the transition in place of articulation from [l] to [s] quickly enough. In the articulation of [l] the tongue tip is on the alveolar ridge, sides of the tongue not touching. Production of [s] entails the reverse articulation—sides of the tongue making contact with the ridge, tip not in contact. In making the transition from [l] to [s], the speaker makes complete closure producing the stop [t]. Thus the tongue tip contact of [l] perseverates and the side closure of [s] is anticipated.

(n.b. We find that in spoken language the incidence of anticipatory assimilation far outnumbers the incidence of perseverative assimilation. Interestingly, the same is true in ASL. I mention this because although as far as I know there is no explanation, either articulatory or perceptual, for this phenomenon, the explanation must lie outside of the realm of interference due to the production of the speech signal (because the same occurs in visual language).)

5.2 The second phonological process to be discussed here is
neutralization. Neutralization in oral language entails the loss of distinction of two or more phones in a particular environment in a given language (e.g. loss of voice and voiceless distinction in final stops in German). By far the most common neutralizations in ASL are caused by what Frishberg calls 'centralization' (the terms are not synonymous by any means).

The locations of a number of signs have moved historically to more central locations. It would appear that the center of the signing space is the hollow of the throat. By the process of centralization, the location of signs tends to move townward from the face, inward from the sides of the body, and upward from the waist. Frishberg offers the following examples. The sign DON'T-CARE which was originally made at the forehead, is now made at the nose. The locations for NOTHING, DENY and WRONG have all moved from the area of the upper lip in Old French Sign to below the chin in present day ASL. The signs for YOUNG and WILL (FUTURE) have changed such that the original waist level place of articulation has become one near the shoulders. The signs FEEL, LOVE, PLEASE (and other signs related to emotions 'of the heart') have centralized to center chest (to the line of bilateral symmetry) from a location on the left side of the chest (over the heart).

Basically centralization is caused by the signer's desire to lessen effort (i.e. ease of articulation). It causes less physical energy to maintain the relatively smaller signing space resulting from a move of location from the extremities to a more central position.

What might also be called a tendency toward centralization can be seen in changes that occur in rapid signing (analogue of rapid speech). In rapid or colloquial signing or when the signer is tired, the tendency is to centralize location of signs. Again, locations tend to move downward,
inward and upward to a more central location and outward to neutral space—that is, off the body. One functional result of the tendency for location to move off the body is loss of contact in contact signs. CONTACT is a distinctive feature of the movement parameter (cf. §2.32 and §6.254). By means of the centralization process (expanded in definition here), the loss of this distinction occurs at times. Moreover, loss of place of articulation distinction occurs in rapid signing, when for example the distinction between the locations forehead and neutral space are lost when both are articulated in neutral space. For example, the sign THINK—index finger (G) on forehead—is often signed in neutral space, having moved downward and off the body in rapid signing. Thus we could state that the functional load of centralization is neutralization.

ASL has several morpheme structure conditions (cf. §4.5), one of which entails, in double contact signs (signs in which there are two places of articulation), that a. the choice of the location of the second contact is limited (and dependent on the location of the first contact) and b. that a neutralization of distinction occurs in the major location area of the second contact. That is, for example, that the choice of location of second contact may be at the central chest, but not at the shoulder. In this constraint, we also find a neutralization of distinction in the place of articulation parameter.

One striking example of neutralization in ASL is the addition of the extended thumb to hand configurations which previously did not entail this extension. (cf. §2.244) The change is ongoing. Not all signs have this change nor do all signers extend the thumb. Thus we find a neutralization in progress. Signs to which the extended thumb is added are those which previously had G, H, V, W, Y, X, R and I. When the G hand
shape adds the extended thumb, it has the same shape as the L shape, which is distinctive. The change which entails the addition of the extended thumb to the H shape makes it resemble the 3 hand shape. The change in V allows it to merge with 3. Thus the change in these shapes causes a neutralization of distinctive features of the hand configuration parameter. Examples of signs which exhibit this change include RED (G hand drawn down mouth), VOICE (V hand moves up neck) and NAME (H hand taps H hand).  

5.3 A third phonological process that occurs in both oral and visual language is deletion. In oral language, a segment may be deleted--with or without compensatory change (e.g. loss of nasal following nasalization of preceding vowel as in French) or inserted (e.g. intrusive stop, epenthetic vowels, etc.). In visual language, however, the simultaneity (simultaneous articulation) of components and the necessity for one unit from each of the four parameters to be present in each sign prevent the deletion (actually make it impossible) of one component. Deletion occurs in ASL, but what is deleted is whole units or items.

Frishberg (1975b) discusses the historical deletion of parts of compound signs and of facial expression and gross bodily movement when used for segmental purposes (as opposed to suprasegmental or prosodic use). The sign BIRD (an iconic representation of a beak) originally was a compound of a sign for beak and one for wings. The 'wing' portion has been deleted. Another example is the sign DARK which was originally composed of the present day sign BLACK plus the present day sign DARK.

Many signs originally required the use of facial expression and gross body movement for non-prosodic purposes. In the present phonological structure of ASL, only the hands may articulate segmental portions.
The face and body are used extensively for the superimposition of prosodic features. 3

As an example of this change, which we might term deletion (of facial expression and body movement component, with compensatory change), consider the sign (BE)PATIENT, originally entailing pressing the forefinger against the lips and bowing "the head as if in resignation". 4 Today the sign is made with the fist shape and the articulator (thumb toward signer) moves downward in the mouth area. The head does not move.

I have also discussed above the deletion or loss of contact that results from centralization in rapid signing.

Another striking type of deletion occurs in the deletion of one hand of a double articulator (two-handed) sign in rapid or colloquial signing. It is possible, in colloquial signing to articulate all signs which are two-handed in citation form with only one hand. The deletion of one hand occurs either when the signer is tired or more commonly when one hand is otherwise occupied (e.g. holding a book, etc.). When this type of deletion occurs in a double articulator sign, (when both hands move), it is always the non-dominant hand which is deleted. When one hand acts as the place of articulation, that hand is the non-dominant one. In rapid or encumbered signing (i.e. when one hand is otherwise occupied) it is the non-dominant place of articulation hand which is deleted. It is with the second type of sign that compensation is made subsequent to deletion, in that another unmarked place of articulation must be added (to account for the loss of the hand as location). This new location may be any convenient surface--e.g. table top, chair, thigh, etc.--if the signer is seated or, for example the hip or the book (or whatever) in the non-dominant hand if the signer is standing. I have witnessed the sign YEAR
(normally made with two A's--dominant hand circles, then makes contact with non-dominant hand) made only with the single fist of the dominant hand, in a circular action in neutral space and then making contact with the signer's hip. This type of deletion is clearly the most common form of synchronic phonological alternation.

5.4 In regard to addition (or insertion), I have given the example above of the addition of the extended thumb on a number of hand configurations. Again, I remind the reader of the impossibility in visual language of word internal insertion.

5.5 There are various types of phonological processes that occur in oral language that do not and in fact cannot occur in visual language. These include such processes as metathesis, syncope (of component or segment) and such purely segmental phonological changes as for example loss of final vowels or devoicing of final consonants. The reason for the lack of these and other similar processes in visual language is clear. All entail an alteration, or alternation in the case of metathesis, or deletion of linear segments within the word or syllable. No change can occur on the segmental portion in a visual language because there are no linear segments per se; each 'monosyllabic' sign requires one and only one component of each of the four parameters. One could hardly for example metathesize a movement and hand shape that are in addition articulated simultaneously. For those signs which entail two places of articulation or two hand configurations, one of the following must occur: a. in a double location sign the hand shape remains constant, or b. one of two hand shapes assimilates to the other, or c. in a single place of articulation sign, the hand shape change entails an opening or closing action,
always either starting from or resulting in a neutral shape (e.g. B closing to A, A opening to 5, 5 closing to F, but never for example 8 changing to F). If the sign entails a closing action, it must start with a neutral hand shape (i.e. 5 closing to F); if the sign entails an opening action, it must end in a neutral shape (i.e. 8 opening to 5). I have analyzed these signs with hand shape changes as having opening or closing movements from or to unmarked (and unspecified) hand shapes. (cf. §2.231) Any change which entails an alternation of a particular segment, conditioned by the surrounding segments (note that the concept surrounding in the linear sense is anomalous as well in ASL) cannot occur in visual language. It is conceivable however, for the components of a single parameter to metathesize across word boundaries (and only across word boundaries as there are no inflectional affixes in ASL), but this type of metathesis would not only be unintended but incidental as it would not result in permanent phonological change in a given item.

In regard to a process such as suppletion, I would suggest that although it is conceivable for suppletion to occur in visual language, it is highly unlikely due to the fact that there are no inflectional paradigms per se in visual languages. There are other types of paradigms, such as those in which, for example by means of a change in hand configuration only, the compound signs for LAST-WEEK, TWO-WEEKS-AGO or THREE-WEEKS-AGO (also TWO-, THREE-DAYS-AGO, etc.) are formed. (WEEK is made by drawing the G hand--palm away from signer, across palm of non-dominant hand; LAST-WEEK is the compound of WEEK plus an index to past time, with an assimilation of the orientation of the articulator in WEEK to that of the index; TWO-WEEKS-AGO entails the V hand shape--which is also the hand shape for the sign TWO--with the same location, movement and orientation
as for LAST-WEEK). However, I would be unwilling to call this paradigm an inflectional one. To my knowledge, there are no cases of suppletion in visual language, although I would say that the potential exists.

5.6 Various phonological processes occur in visual language which cannot occur in oral language due to the nature of the signal. Included in these processes are:

5.61 Simultaneous articulation of components. Clearly in an oral language, segments are produced in a linear order. In visual language, in every sign, at least four components are articulated simultaneously. I mentioned (cf. §1.4) that the potential exists in visual language for articulating more than one item at the same time. Of course, in oral language, it is quite common for intonational cues, e.g. question, to be superimposed on the segmental portion as for example in the echo question 'John?'. However, besides adding intonational cues by pitch variation, etc., it is clearly impossible to articulate more than one string of segments at one time—there is only one articulator. However, due to the fact that there are two articulators in languages in the manual/visual modality, it is possible and in fact common to momentaneously articulate two items with or without the addition of suprasegmental features. For example consider the Sign sentence EAT HE? in which the three morphemes EAT, HE and sentential question may all be articulated simultaneously: EAT by the dominant hand, HE by an index with the non-dominant hand, and question by raising the eyebrows and holding the signs for an extra beat. This type of construction, in terms of the physical realization, is of course impossible in oral language.

5.62 Symmetry. Frishberg (1975b) discusses the historical tendency
toward symmetry in ASL. Signs have changed in such a way as to create symmetrical action of the two articulators. The tendency toward symmetry takes two forms. One is to cause the hand configurations of the two hands in two-handed signs--either those originally monomorphemic or compound signs--to become the same. For example, the sign LAST (FINAL) originally had the index finger of the moving hand contact the extended little finger of the location hand. Today both hands have the little finger extended. (n.b. This is also an example of anticipatory assimilation.)

The second result of the symmetry tendency is to cause originally one-handed signs in low acuity areas (i.e. below the neck) to become two handed, presumably for the purpose of adding redundancy to low acuity areas. (See §4.31) The signs DIE (DEAD) and HURRY, for example, which today are articulated in citation form with two hands, derive from one-handed signs. (n.b. This might also constitute an example of phonological addition.) It is clear that the tendency toward symmetry in ASL has no analogue in oral language--a language can only insist on symmetry if there is more than one articulator.
CHAPTER 6

6. PROSODIC FEATURES

6.0 Many intonational cues in ASL are realized in the movements of facial muscles and gross bodily movement. At the present time the description of most aspects of intonation in ASL can only be given in impressionistic terms (excepting those discussed below). The signer may superimpose attitudes of anger, doubt, surprise, sarcasm, etc. on an entire sentence or on a given phrase by means of altering his facial expression, moving his eyebrows (e.g. drawing them together, raising them in surprise), pursing his lips, etc. He may also add 'intonation' by gross physical movement of the body not encompassed in the 'segmental' portion of the phonology, e.g. shaking of the head while simultaneously signing a sentence will give negative aspect without the use of an overt negative marker.

Comparatively little can be said about oral language intonation patterns in comparison with other aspects of oral language phonology, as well. Clearly the physical correlates of intonation in oral and visual language are vastly different. I will present a comparison between oral and visual language of three aspects of prosody: word internal stress, sentential and question intonation, and contrastive stress.

It would be well to differentiate in any language among three types of 'stress', categorized according to function (and form?). In English, for example, we find three different items all of which have been referred to as stress: a. word internal stress: this is clearly that which is most commonly referred to by linguists as stress (e.g. predict,
reject (v.), reject (n.)); b. intonational prominence in a sentence—corresponding to that syllable of a word which carries the peak in the intonation pattern of any sentence. In English (and in many other languages) the intonational prominence falls most typically on the predicate, which is the new information (e.g. 'He is tired'); c. emphatic or contrastive stress: this type of stress may be superimposed by means of suprasegmental features (in oral language) most typically on the syllable of that item which ordinarily would get sentential prominence. For example, the sentences 'He is tired!' as opposed to 'He is tired' display the contrast between emphatic stress and sentential intonational prominence. However, contrastive stress may of course be superimposed on any element of the sentence, as for example in 'He's tired' (as opposed to someone else).

6.1 Physical correlates of stress in oral language

6.11 Ohala (1970) discusses various theories and experimental research on the physical correlates of stress in oral language. He states that the "real physical correlates of stress are multiple and complex" (p. 111), as opposed to what linguists had originally believed—that stress was "limited to a single acoustic parameter" (p. 110). He suggests that it is the fact of the multiple correlates which caused linguists to feel impressionistically that they could recognize multiple levels of stress. They were undoubtedly lumping together variations in more than one parameter. (p. 111)

He summarizes various early attempts to isolate the physical manifestation of stress and the failure of these efforts to be proven by experimental evidence. Among theories discussed are the notion of "increased
breath force on the syllables of the word" (p. 111) whose acoustic correlate was thought to be increased loudness. (Ohala cites Sweet, 1911).

Early on, linguists assumed that

stress differences were primarily a matter of pitch change. More recent work...has confirmed that what linguists label 'stress' differences are largely due to variations in pitch, duration, vowel quality, and intensity, with pitch usually being the most effective clue." (p. 111, emphasis mine)

6.12 Intonational prominence in the sentence: sentential intonation

Lehiste (1970) discusses various theories in regard to the manifestation of intonation.

In the analysis of English intonation, there have been two schools of thought: those proposing that intonations should be specified in terms of a number of pitch levels...and those suggesting a number of significant contours or pitch configurations. (p. 96)

Both of these schools assumed that the physical correlate of stress was change in fundamental frequency.

Basically, it is agreed upon by linguists that the most salient physical correlate of intonation and of intonational prominence in the sentence (i.e. that item which carries sentential stress) is change in pitch. In addition to the fact that overall intonation pattern of a sentence carries semantic import--e.g. question intonation--most linguists agree that the location of sentential intonational prominence has semantic import in some instances, at least on a rhetorical level. In many (unmarked) declarative sentences in English, intonational prominence is given to the predicate or comment; in most of these sentences the same item is the new information. Intonational prominence may be given to other items in an English sentence, e.g. those which are the new information or the topic. For example, the unmarked reading of the sentence 'Sam is a gorilla' is one in which 'gorilla' (or specifically
the stressed second syllable of 'gorilla') receives prominence. However one can mark 'Sam' as new information by giving it intonational prominence--'Sam is a gorilla.'

6.13 Emphatic and contrastive stress

Emphatic and contrastive stress clearly carry semantic import—to intensify or emphasize an item or to contrast one item with another in discourse. It seems clear that in the case where the speaker chooses to use emphatic or contrastive stress, the item which is stressed is also the item given intonational prominence in the sentence. What I would suggest then, is that the manifestation of emphatic stress is a higher energy version of sentential stress. The difference may be exemplified by the English sentences 'He is tired' as contrasted with 'He is ___ tired!', in which the stress on the first syllable of 'tired' in the second sentence entails a much greater change in pitch, duration, and intensity than in the first sentence.

6.2 Physical correlates of stress in ASL

6.21 Word internal stress

At first glance, it might appear that there can be no correspondence to word internal stress in ASL because there is nothing that entirely corresponds to the syllable in the language. The 'segmental' components of a sign (i.e. hand configuration, place of articulation, orientation, and movement) are articulated simultaneously. In fact, we might say that segmental components in signs do not entirely correspond to (oral) phonetic segments in the respect that the components of a sign utterance are not, and for the most part cannot be, combined linearly. (Of course, the same could be said of the simultaneous features of a

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phoneme in oral language.) It is impossible in a simple sign to separate out parts of a sign at the level of syllables. It is possible, of course, to distinguish sub-lexical components of a sign, but I would say that these are not entirely analogous to segmentable phones in oral language phonetic sequences. (Of course, on the other hand, the 'segment-ability' of sound in oral language is not all that definitive either.) However, we can still talk of the segmental nature of oral language in the respect that segments function as units—that is, changes can occur to stops (i.e. change in place of articulation, manner of articulation, e.g. devoicing of final stops) without dependence or effect on the core quality of the surrounding vowels. (Also, we can, of course, articulate a stop without surrounding vowels, even if we cannot perceive it.) Therefore, one would assume that there is a certain amount of psychological reality to the notion of separate segments in spoken language. In any case, there would appear to be a functional difference in the components of a sign and those of a spoken utterance.

For the vast majority of signs, there can be no confusion in regard to word internal stress: they entail the simultaneous appearance of one unit of each of the four parameters. There is no linear sequence—we might say they are 'monosyllabic'. However, there are a number of what we may refer to as bisyllabic items of which there are two main classes: monomorphemic items and bimorphemic compounds.²

As mentioned earlier (in §2), some monomorphemic signs have two places of articulation; these signs might be thought of as bisyllabic. These signs always maintain the same hand configuration in both places of articulation. Examples include HEAD (fingertips of B contact temple and upper cheek) and KING (palm side of K contacts contralateral
shoulder and ipsilateral waist). From the evidence I have seen and analyzed, there is no stress distinction in either 'syllable' of any sign of this type. (See §6.25 for physical correlates and details of emphatic/contrastive stress.) We will see that it is in the movement of the sign where 'stress' is physically realized. The movement in these signs comes, naturally, between the two places of articulation and therefore cannot be considered as wholly a part of either half of the sign. When the sign is stressed, it is the movement which changes, and not either place of articulation. Moreover, it can be demonstrated that in these signs, the two places of articulation combined with the movement function as one unit, in that the realization of contrastive stress on signs of this type is unique (see §6.254 for details). That is, the type of change incurred depends not only on the type of movement but on the fact that the sign has two places of articulation (i.e. double contact).

6.211 Bellugi (1975) examines a large number of polymorphemic (mostly bimorphemic) compounds in ASL and reports that

our most important discovery is of a special intonational or rhythmic pattern by which compounds may be identified... characterized by a temporal compression particularly affecting the first member of a compound...characteristic reduction of movement which excludes repetitions, and reduces all movements, sometimes to only a brief contact. (p. 6)

She demonstrates that there is a significant phonological difference between signs which appear in lexicalized compounds and the same signs in non-compound phrasal relations. This difference would appear to be analogous to the stress difference between, for instance, 'boy friend' and 'boyfriend' or 'black bird' and 'blackbird' in English.³ Her results are based on the analysis of pairs of sentences in ASL in
which one sentence has a lexicalized compound and the other has the same signs in a non-compound phrasal relation, for example the pair

\[ \text{ME HAVE BLUE SPOT ARM THERE} \]
\[ 'I have a blue spot on my arm there.' \]
\[ \text{ME HAVE BLUE SPOT ARM THERE} \]
\[ 'I have a bruise on my arm there.' \]

and

\[ \text{YOU CLEAN HOUSE GOOD ENOUGH} \]
\[ 'You cleaned the house adequately.' \]
\[ \text{YOU CLEAN HOUSE GOOD ENOUGH} \]
\[ 'You cleaned the house just barely adequately' (i.e. 'with a lick and a polish') \]

To briefly summarize Bellugi's results, she finds that, regardless of which of the two signs in a bimorphemic compound is the head, the first element is always temporally reduced or compressed. For example, the signs GOOD and ENOUGH when articulated in a non-compound relation—meaning 'adequately'—take 30 fields or 15 frames (approximately \( \frac{1}{2} \) second; 30 frames/60 fields = 1 sec.), and 40 fields (2/3 sec.) respectively. When the compound GOOD ENOUGH ('just barely adequately') is signed, the entire compound takes 35 fields or approximately the same time that each of the two signs takes when not forming a compound. According to Bellugi, the average time required for 70 compounds tested was approximately 38 fields (less than 2/3 sec.) I would point out that the compounds examined in this study are all unassimilated constructions in citation form—each morpheme is clearly recognizable despite temporal reduction. I will discuss assimilated compounds in regard to stress below (§6.213).
What is striking about these data is not only that the temporal reduction takes place so that the time needed for a bimorphemic compound approximately equals that of a single monomorphemic item, but that the time required for each of the two parts of the compound is unequal.

...the first part [of the compound] was consistently shortened more radically than the second part. The time for making the first sign averaged 8 fields--just over 1/10th of a second. This was, in fact, approximately as brief as the average time for making the transition between the two signs (9 fields). The second sign of the compounds averaged more than twice the duration of the first sign, 21 fields. The timing of each sign made separately was: sign 1, 46 fields, and sign 2, 55 fields. (p. 27)

It seems obvious that the kind of temporal pattern occurring in the articulation of these compounds is a consistent intonation pattern and at least in part analogous to word internal stress in oral language. This will become especially clear when we examine the actual manifestation of the reductions in the first element in the compound (as reported by Bellugi) and its correlation to the physical manifestation of contrastive stress in monomorphemic signs (as reported in Friedman 1974a, b, and revised below).

Changes in the first element of the compound occur within all four parameters (hand shape, place, orientation, and movement), most of which entail the kind of assimilations described in §5. Excluding changes in the movement of the first sign (which I discuss below), Bellugi categorizes these changes as those in the relation between the hands, changes in hand shapes, the realization of 'features' of one hand shape in another (primarily by anticipatory assimilation), and orientation (and point of contact) assimilation.

As mentioned earlier, all signs may be classified as one-hand or two-hand signs; in two-hand signs the non-dominant hand either acts as
an articulator (in which case it reduplicates or mirrors the specification of the dominant hand) or it acts as place of articulation (in which case it has either the same hand shape as the dominant hand or one of six neutral shapes). Bellugi states

compound signs can be formed of any combination of these in any order. The particular type of combination, however, sometimes has an effect—in terms of general tendencies—on the shape of the compound which will result. (p. 32)

For instance, when both signs in a compound are two-hand signs and when the movement does not entail an interaction of the two hands (cf. §2.3), then

each sign of the compound in informal signing may reduce to a single-handed sign, as in THRILLINFORM ('news') and RAINCOAT, or SOFTGOOD ('bland diet') (p. 33)

Bellugi finds that when compounds are formed by a one-hand sign followed by a two-hand sign, typically the non-dominant hand of the second sign appears simultaneous to the first part of the compound in anticipation of the following sign.

The most significant changes occur when the compound is composed of two one-hand signs. Among those mentioned in Bellugi's study are what she refers to as 'combination hand shapes' and what I have called (cf. §2 and §5) assimilated hand shapes. I gave as an example the hand shape V (thumb, index, and pinky extended)—an assimilation of Y and G—which occurs in the now completely assimilated compound CALIFORNIA which derives from EARRING + YELLOW. The same shape occurs in other compounds, such as IDEA SAME and FOR STILL. Bellugi offers as an example the assimilation of A (fist with thumb extended) and X1 (fist with index crooked) forming a variation of the shape L (thumb extended, index extended and bent) which occurs in the compound NOT HAVE-TO; (NOT has A, HAVE-TO has X1 in citation form.)
Bellugi also reports anticipatory hand shape and orientation changes such as those discussed in §5, including for instance the anticipatory orientation change in compounds such as RED SECRET ('strawberry') as well as the addition of the extended thumb in RED in anticipation of its occurrence in SECRET and same thumb extension in THINK in anticipation of SELF in the compound THINK SELF ('suit yourself'). It is clear from these data that the type of historical phonological processes described in §5 are also crucial elements in the synchronic phonology.

6.212 Changes in movement in compound formation

What are perhaps more significant and certainly more striking when compared to my earlier study (Friedman 1974a,b) on the manifestation of contrastive stress (see §6.25) are Bellugi's findings in regard to consistent physical changes of the movement of the first element in sign compounds. She describes what she calls a 'smoothing' of the movement of the two signs in a compound as seen for example in the compound GOOD ENOUGH,

in which diagonal downward motion is replaced by a sweeping arc-like movement from one contact point to the other. (p. 36)

GOOD and ENOUGH when not forming a compound are made with an outward (and slightly downward) and a rightward movement, respectively.

The type of reduction occurring in the first sign in a compound would appear to depend on the type of movement of the sign in citation form. Many signs require a repetition of their movement in normal signing, entailing repetition of contact with the body. (I claimed in §2.36 that certain movements entail this repetition rather than the signs themselves; in any case, it is the movements (and contacts) that are repeated.) Bellugi refers to this repeated movement and contact as
'double bounce' (to be distinguished from double contact in which contact is made in two distinct locations; see §2.32 and below). She finds that the repetition is consistently lost in compounds; the movement is reduced to a single contact, "which may last as little as the duration of a single field (1/60th of a second)" (p. 30), e.g. in the compound EAT~NOON ('lunch'). (EAT = fingertips of tapered 0 contact mouth; NOON = dominant arm, hand in B, perpendicular to non-dominant 'horizon' arm, elbow on non-dominant hand.) Bellugi states that even double contact signs may reduce to a single contact, as in the compound DEAF~INSTITUTE. (DEAF made separately has the G hand making contact near the mouth—or lower cheek—and near the ear, at the upper cheek.)

Nearly all kinds of repetition are lost in the reduction of movement of the first sign of a compound. Repeated brushings, repeated openings or closings of the fingers, repeated downward or outward movements, and some circular movements disappear in the force of temporal compression. Contacts can reduce to non-contacts: a brushing can become an arc-like motion in the direction of the target; nodding and twisting movements are shortened and reduced. More complex movements may still occur but in very reduced and weakened form, as in signs made with the hands alternating in relation to one another. (p. 31)

Circular movement, as for example in CAREFUL (K in contact with K in horizontal circular movement) often reduces to 'a brief hook' in compounds, e.g. CAREFUL~BREAK ('fragile'). (BREAK = two S's, sides in contact, abruptly separate and twist outward.) Continuous contact (what Bellugi refers to as a 'brushing motion') as in GIRL--whether a single movement or a repeated one in citation form--is often reduced to a non-repeated single contact when the sign is the first element of a compound, e.g. GIRL~SERVE ('waitress') and BLACK~NAME ('bad reputation'). In fact, the movement in these signs can sometimes reduce to the extent that contact is lost completely. Bellugi states that
movement in the first sign, whatever its original full form, 
tends to reduce to toward the extreme of a single, brief 
contact [in signs which have any contact component in cita-
tion form]. (p. 32)

We will see (§6.253) that the loss of repetition, reduction of contact 
and of such movements as circular and twisting is a fundamental charac-
teristic of the manifestation of contrastive stress as well as of the 
first sign in a compound. The reason for the reduction of movement is 
clear in both cases--something has to give in the face of temporal 
compression.

6.213 Through time these compounds will undoubtedly assimilate, much 
like those assimilated compounds described in §5, such as BELIEVE (from 
THINK and JOIN) and INFORM (from KNOW and BRING). This second type of 
(synchronically) monomorphemic double contact signs (=two distinct 
places of articulation), like double contact signs such as HEAD and 
KING, display no word internal stress. The two elements of the signs 
are no longer distinguishable--as opposed to those in the unassimilated 
compounds just discussed; there is a single movement between the two 
places of articulation. For all practical purposes signs derived from 
bimorphemic compounds may be treated as monomorphemic double contact 
signs. As in signs such as HEAD, contrastive stress affects the move-
ment between the two locations in BELIEVE, INFORM, BROTHER, WIFE, etc. 
and has no effect on either place of articulation.

6.22 Sentential intonation

From evidence I have gathered (although it is not conclusive--more 
testing needs to be done), it appears that, contrary to the situation in 
oral language, there is no necessity for one item to have intonational 
prominence in every sentence in ASL. It would appear however that
intonational prominence for semantic purposes, i.e. to mark new information, can be given to an item by means of the same physical mechanisms by which emphatic or contrastive stress is manifested.

6.23 Question intonation

Interrogative constructions in all languages are of two major subtypes: a. yes-no questions--those questions which may be answered by yes or no, and b. wh- questions--those which contain a wh- or question word (e.g. who, what, which, where, why, how in English) and require an informational or propositional response. The analysis of the physical correlates of question intonation in ASL is far from complete. However through research completed to date, the following can be stated.

6.231 Simultaneous to the last sign of a yes-no string or to a wh-word, the eyebrows are raised and the forehead is furrowed. In some instances, the question intonation may be superimposed on the entire string. What strikes me as interesting is the parallel (albeit far-fetched, in that these two physical manifestations are not analogous) between the raising of pitch sentence finally in questioned utterances in most oral language and the raising of the eyebrows in ASL. Surely the raising of the eyebrows and the furrowed brow iconically suggest a visual representation of uncertainty, even as a paralinguistic gesture accompanying questioned utterance in oral language.

6.232 In any string with question intonation, the last sign of the string is held at least an extra 30-40 fields (500-667 msec.) (field = 1/60th second). In other words, the sign is at least one-half second longer in duration than a sign in a non-questioned utterance. (According to data I collected in my 1973 study, a sign is normally approximately 40-45
fields or 2/3 second in duration.

6.233 The final sign in a questioned string is raised slightly, unless the ending position of the sign does not allow for the raising. For example, the sign FEEL (normally made by drawing the middle finger of the hand up the center of the chest), when the final sign in a question, is lifted from the chest and extended outward slightly.

Signs normally made with a downward movement, e.g. NOW (articulated by extending the thumb and little finger from closed hands palm upward, and moving downward directly in front of the body), when questioned or when in final position in a questioned sentence, are either not lowered, or first lowered and then raised. (Friedman and Battison 1973, p. 15)

In wh- questions, the question intonation described above may or may not occur on the entire sentence. The wh- word may appear in various positions in the sentence: initial or final position or both initially and finally. If the wh- word appears in initial position, it has question intonation but the final sign of the sentence need not. For example, consider the sentence 'Why are you depressed?'. This sentence may be rendered in ASL as WHY? YOU DEPRESSED, in which DEPRESSED is not questioned. (The question mark indicates question intonation on the preceding sign.) Question intonation can appear several times in one ASL--on the final word and/or on any wh- word.

6.24 Contrastive stress

In 1973, I developed a number of procedures designed to elicit emphatic and contrastive stress in ASL. Data were elicited and recorded on video tape from two primary informants and results were later compared with data from two other informants with the same tendencies apparent in both sets of data. The results obtained are given below.
6.241 There were three tasks given to the two informants on which the original analysis was based. The first of these required each informant to translate and sign 30 English sentences; signs under investigation appeared sentence finally followed by an exclamation mark in the script given to the informants. Both informants had fluent knowledge of written English. The signs investigated in this first study were chosen because they represented all the distinctive movements given in Stokoe's (1960, 1965) phonemic analysis of ASL. (As discussed in §2, I have reanalyzed the phonemic structure of ASL and will account for this reanalysis in the results given below.) Written instructions were given as follows:

Please translate the following to Sign (real Sign Language). Remember, we don't want English. In each of these sentences the last word is the important one. Emphasize it. Sign at your normal pace as if you were signing to another deaf person. Thanks!

I would add that the desired result was not always forthcoming for all sentences and repeated efforts were made until at least one sign (and in most cases two or more in subsequent elicitations) with each distinctive movement appeared in the sample. The English sentences were relatively simple constructions, e.g. 'No, it's not a girl; that baby is a boy!', 'That shelf is so high!', 'I'm only 22!', 'Wow, is it hot!'

6.242 In the second procedure, I devised a short 'fairy tale' in English in which key words and concepts were repeated several times, each time with different (rather elaborate) modifiers. The informants were instructed, again in written English as follows:

Please read this [story] and memorize it as well as possible. Then tell the story as if you were talking to either a deaf younster who couldn't read yet or a deaf adult who has no English. Translate to real Sign. If there isn't a sign
for a particular word or if a sentence is different in Sign—change the story. Don't sign in English. Sign at your normal pace.

The English story was removed before the informants told their versions. Each informant told the story twice, alternating performances.

6.243 The third procedure was basically an undirected corpus in which one informant acted as my confederate, primed in advance with instructions not given to the other. The discourse topic chosen was the game of basketball, primarily because it was something the 'innocent' informant knew a lot about and was interested in. First a list of basketball terminology was obtained (on video-tape) so that there would be a record of citation forms of these items. The naive informant was then asked to explain the game to the other woman. My prior instructions to the confederate were basically to pretend to understand nothing of what she was told. The goal was to rattle her partner so as to force her to repeat again and again the same information with presumably more and more emphatic stress at each repetition. Actually, the elicitation was quite successful; the desired results were clearly obtained and are included in the following analysis.

6.244 Before presenting the results of this study, it is necessary to distinguish between what I have been referring to as contrastive and/or emphatic stress and the kind of phonological alternation (for the purposes of semantic variation) discussed in §3. First of all, it seems to me that there is no absolutely clear-cut line of demarcation between the two types of phonological alternation. For instance, the contrastive form of TABLE is identical to a variation of TABLE meaning 'big table' which is not in contrast. Whether or not the form meaning 'big table'
can be said to be emphatic is unclear to me; that is, it may be possible to consider a form emphatic if the corresponding meaning of that form conveys some 'intensification' of the core semantic element of the referent (whatever that is). I am aware that these thoughts are rather vague, but I have no clear answers. However, the physical manifestation of signs having contrastive stress—that is, signs which occur in the semantic environment NOT Y, BUT X—is not only predictable from the structure (especially the movement) of those signs in citation form, but is also distinct from other kinds of phonological alternation which depend on the meaning as well as the form of those signs. Thus, what follows is a description of the physical correlates of contrastive stress which happen to be identical to some 'emphatic' form of most signs in the language but which are not equivalent to the manifestation of alternation due to semantic variation.

6.25 Physical correlates of contrastive stress

To the non-native signer, contrastive stress is fairly easily perceived—non-instrumentally. Its manifestation is noted primarily as rapidity of movement (i.e. more rapid than in citation form) and tense-ness of brachial musculature.

As I stated previously (Friedman 1974a), it can be demonstrated that the particular manifestation of stress on a given sign is dependent on the nature of the movement of that sign in its citation form; that is, the manifestation of stress is predictable from the movement of the unstressed sign. (Please refer to Table 2 and §2.3 for movement features.)

6.251 The movements of the overwhelming majority of signs generally
become significantly larger and more rapid when stressed. Signs which have straight movement—either retained from citation form or becoming straight when stressed (see below for details of changes in manner of movement)—become both large and rapid. Due to the simultaneity of the relative largeness and rapidity, the stressed movement entails tension of the brachial musculature.

In order to move the articulator over a larger space in a time shorter than the movement which covers a smaller space, it is physiologically impossible not to contract the muscles on both sides of the arm and hand, producing...muscular tension. (Friedman 1974a, p. 8)

It is striking that muscular tension appears to be an aspect of the physical manifestation of stress in both oral and visual language. While all non-straight movements do not entail both an increase in size and speed in stress production, all do entail muscular tension. The values twist and bend-wrist generally entail the stress features large and rapid; circular, bend-fingers, bend-knuckles, open, and close tend to retain the size of normal production but entail muscular tension and rapidity of movement. (Wiggle becomes straight in stressed forms—see below.)

6.252 Measurements of speed and size were taken in my 1973 study. For many signs, whether produced in citation or as part of a string, there appear to be three distinct parts: a 'hold' or 'steady-state' (in which the hands are held still), a movement, and a second hold. (Of course, there are transitions to and from signs; transition time is not included in data presented here.) Usually these three parts cannot be seen clearly (as distinct) unless the production has been video-taped and tape is manually turned so that each field is visible. (There are 60 fields per second of real time.) In some signs, the hands are held...
still only after the movement portion; in a smaller number of signs, the
hands are still only before the movement. A very few signs only have a
movement—the hands are never still during the sign's production.
Figures given in Table 6 represent the average duration (in fields and
in msec.) of stressed and unstressed signs. Figures are broken down to
show: the average duration of the four different types of signs (hold-
move-hold, move-hold, hold-move, and move), the average duration of each
part of each type, the total average time of each type, and the total
average time of all signs tested. (Figures tabulated for 41 stressed
and 37 unstressed signs; stressed: 16 hold-move-hold, 13 hold-move,
5 move-hold, 7 move; unstressed: 8 hold-move-hold, 8 hold-move, 8 move-
hold, 13 move) Also included are the total average durations of both
the initial and final 'holds' and the movement portion for all signs
tested.

As can be seen on examination of the duration figures, there are
really two significant temporal differences between stressed and un-
stressed signs. (Duration figures for signs whose movements become
slower when stressed are given below in §6.2544) We can see that
although the total average time of stressed signs is approximately twice
that of unstressed signs (50:22 fields, 833:366 msec.), the average
duration of the movement portion of stressed signs is just slightly over
half that of unstressed signs (9:16 fields, 150:267 msec.). The extra
time needed for stressed signs occurs in the 'holds' which when occur-
ring before the movement average over twice the duration of holding in
unstressed signs (22:9 fields, 367:150 msec.), and when occurring after
the movement average six times that of unstressed signs (37:6 fields,
617:100 msec.). We can see by these results that the extra long
Table 6
Duration Figures - Average Fields* (and Msec.)

<table>
<thead>
<tr>
<th></th>
<th>STRESSED</th>
<th>UNSTRESSED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>64</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>(1067)</td>
<td>(467)</td>
</tr>
<tr>
<td>T V F</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>(833)</td>
<td>(417)</td>
</tr>
<tr>
<td>O E I</td>
<td>36</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>(600)</td>
<td>(383)</td>
</tr>
<tr>
<td>T R E</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>(100)</td>
<td>(283)</td>
</tr>
<tr>
<td>A A L</td>
<td>TOTAL AVERAGE--ALL SIGNS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>(833)</td>
<td>(366)</td>
</tr>
<tr>
<td>L G D</td>
<td>#___#</td>
<td>HOLD</td>
</tr>
<tr>
<td></td>
<td>MOVE</td>
<td>MOVE</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>(600)</td>
<td>(100)</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>(350)</td>
<td>(183)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>12</td>
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<td>(133)</td>
<td>(200)</td>
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</tr>
<tr>
<td></td>
<td>(600)</td>
<td>(83)</td>
</tr>
<tr>
<td></td>
<td>TOTAL AVERAGE--INITIAL HOLD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>(617)</td>
<td>(100)</td>
</tr>
<tr>
<td></td>
<td>TOTAL AVERAGE--FINAL HOLD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>(150)</td>
<td>(267)</td>
</tr>
<tr>
<td></td>
<td>MOVE</td>
<td>MOVE</td>
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<td>6</td>
<td>17</td>
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<td></td>
<td>(100)</td>
<td>(283)</td>
</tr>
<tr>
<td>KEY:</td>
<td>#___# = HOLD-MOVE-HOLD SIGNS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>___# = MOVE-HOLD SIGNS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#___ = HOLD-MOVE SIGNS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>____ = MOVE SIGNS</td>
<td></td>
</tr>
<tr>
<td>*rounded to nearest whole number</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
hold--either before or after the movement portion--is also a feature of stress manifestation. Stress rules entailing change in relative speed of movement refer to the core movement portions of each sign.

6.253 I discussed earlier (§2.36) the tendency for some signs' movements to be repeated once or twice in normal (=unstressed) production. The types of movement which entail this repetition are: all interacting movements, the bending of the fingers, knuckles, and wrist (=Stokoe's nod), the wiggling of the fingers, twisting and circular motions, and those movements having end and holding contact (although the contact is not re-established in holding contact signs). Openings and closings of the hand are usually not repeated, nor is there generally repetition of movement in signs with continuous, beginning, or double contact.

One of the most notable movement changes during stress affects those movements which are repeated in normal production: the repetition does not occur when the signs are stressed.

6.2531 Interaction

All movements entailing interaction of the two hands are prone to repetition in normal production. When signs having interacting movements are stressed, there is no repetition. In stressed form, the movements approach, separate, and cross remain unchanged except that they are not repeated and that as they are straight action signs, they become larger and more rapid. The change in alternating movement is more extreme in that the alternation itself is lost (when the sign is stressed) as a result of the general tendency of the loss of repetition. Alternating movement becomes a larger and more rapid (and tense)
movement in one direction along the appropriate axis. That is, alternating up and down movement becomes a downward movement, and alternating to and fro movement becomes a movement away from the signer. It seems appropriate, because of the form this change takes, to think of the movements down and away as the unmarked values of their respective axes (vertical and horizontal-depth). Signs with alternating movement remain two-handed when stressed. Thus, IF (two F hands facing each other alternate up and down) when stressed has the hands move rapidly in a large parallel downward movement and in stressed AWKWARD (two 3's palms downward, alternate to and fro) the hands move in a large, rapid (parallel) movement away from the signer.

Stressed forms of signs which entail the linking of the hands (in unstressed form) start out with the hands (or fingers) linked and have the linked hands move away from the signer in a single large rapid motion.

6.2532 Direction

The direction of movement remains unchanged in the stressed form from that of the citation form. However, like alternating movements along the vertical and horizontal axes, non-alternating up-and-down, side-to-side, and to-and-fro movements (made with either one or two hands) become single (=non-repeated) large, rapid movements in the 'unmarked' direction along the appropriate axis in stressed form. Movement to the non-dominant side (=leftward) replaces side-to-side movement in stressed form, and signs with up-and-down and to-and-fro movements have downward movement and motion away from the signer, respectively when stressed—like signs having alternating movement along these axes. For example, the sign HURRY (H hand palm left, moves up and down
repeatedly in neutral space) is rendered as a single large, rapid downward movement when stressed; the stressed form of SONG (B hand--finger-tips pointed downward non-dominant palm--moves side to side several times along palm) is a single stroke of the dominant B hand across the non-dominant palm toward the non-dominant side of the body (=leftward); the stressed form of DAILY (A hand--palm toward cheek--brushes outward several times along the cheek) is made with a single thrust of the A hand outward from the cheek.

6.2533 Manner

As just noted above, twisting, circular, and wiggling movements as well as the bending of the fingers, knuckles, and wrist tend to be repeated in normal sign production. (Opening and closing movements are usually not repeated.) When signs with these movements are stressed all repetition is lost in the following manner:

a. The movements bend-fingers, -knuckles, and -wrist occur only once; the movements are relatively more rapid than in citation form and the muscles are tense.

b. Circular motion is not repeated and is often reduced to a partial circle (cf. Bellugi's 'brief hook'); muscular tension is exhibited in a relatively more rapid movement than in citation forms. One example is the sign CONFUSED (two 'O's facing each other move in alternate circles) in which the hands only make half or even quarter circles in opposite directions when the sign is stressed.

c. The repeated twisting motion in citation forms is reduced to a single tense twist with a relatively large (and rapid) movement out of
the twist. For example, the stressed form of O N I O N (X₂--bent middle joint in contact--twists repeatedly at upper cheek) is made with a tense upward twist of X₂; the hand moves up and outward at the end of the twist.

d. The wiggling of the fingers in signs such as FINGERSPELL (5 moves right in neutral space with wiggling fingers) and DIRTY (5 with wiggling fingers palm down--back of hand in contact under chin) is replaced by a single straight movement (the direction being dependent on the direction in the citation form). The change of the wiggling movements can be viewed as the ultimate in loss of repetition--not only is the repetition of the wiggling lost, but the individual movements of each finger--the wiggling itself--is lost as well. By becoming straight action, these signs also entail a relatively larger and more rapid movement when stressed.

There are a number of pairs of semantically related signs which have been considered to be related to each other by a single derivational process. The second member of each pair was thought to be derived from the first by a(n undefined) morphological process. Frishberg and Gough (1973) discuss a very productive variation between what might be called 'wiggling' and 'spritzing' fingers, where the former is the neutral variant and the latter the sharp. (p. 6)

Pairs of this type include STUDY/CRAM, DIRTY/FILTHY, and BURN (FIRE)/BURST-INTO-FLAME. In each pair the first sign has a wiggling movement and the second a straight movement. (Both wiggling and straight are values of the manner feature as in the analysis presented in §2.3.) The sign STUDY is made using the non-dominant hand, palm upward in neutral
space, as a reference point; the dominant hand is positioned with fingers downward over the non-dominant palm, palm toward signer, with the fingers wiggling. In CRAM the hands have the same configuration and orientation with respect to each other and the body, but the dominant hand is thrust downward toward the non-dominant hand, the fingers held rigid (i.e. not wiggling). I would suggest that these pairs do not represent a morphological derivational process, but a phonological one in which the second member of each pair is merely the stressed or emphatic form of the first member. The fact that members of the pairs may be glossed in English as two distinct lexical items has no relevance to the description in ASL.

I discussed earlier the fact that in English the sentence 'He is tired' may be realized with 'tired' merely having intonational prominence or with 'tired' being given emphatic stress. The speaker may alternately choose to say 'He is exhausted' or 'He is exhausted', with emphatic stress on 'exhausted' in the second sentence. Surely there is a semantic difference in the choice in each pair. A question might be raised as to how the signer differentiates the stressed form of, for example STUDY and an unstressed form of CRAM. The answer is simple: what has been translated as CRAM is the stressed form of STUDY, and there is no lexical distinction between the two forms. The distinction is that of an unmarked and an intensified (=emphatic) or contrasted form of the same lexical item. The fact that there is no four-way distinction among the pairs of this class—as there is in English (e.g. tired, tired, exhausted, exhausted)—merely reflects a lexical disparity between English and ASL and not a hitch in the analysis of the phonological process by which emphatic and contrastive forms are physically realized.
6.2534 It seems significant that the loss of repetition which is so salient an aspect of the manifestation of contrastive stress is also an aspect of the realization of the 'temporal compression' occurring on the first element of compounds (cf. Bellugi 1975). In both cases, the loss of the kind of repetition which consistently occurs in normal production and other types of phonological reduction (see §6.254 for further discussion of stress manifestation) clearly results from the relatively more rapid production of relevant forms: the rapidity causes these regular phonological changes. I think we can safely say that the 'temporal compression' or rapidity of movement is the most salient aspect of stress manifestation as well as of compound formation.

6.254 Other effects of contrastive stress

6.2541 A number of signs entail a thrusting action of the arm or hand (= ballistic) concomitant to the rapidity and largeness of movement in stress production. Signs which are ballistic when stressed include: all signs that retain straight movement (see §6.2547 for those that don't), most signs whose movements become straight (e.g. wiggle → straight), and many signs with upward, downward, and outward movement but which are non-straight; non-straight movements which allow for ballistic movement are twist and bend-wrist. Examples include HIGH, NOT, and LATER.

6.2542 Signs which in citation form have movement away from the body or upward movement entail (when stressed) a stretching of the arm to its full extent (= extended). Examples include HIGH, NOT, THING, and FINGERSPELL.
When signs with double contact are stressed, the hands trace a perceptible arc between the two places of articulation (= arc). For example, YESTERDAY in citation form is articulated with the A hand, thumb tip making contact at two places on the cheek, first near the mouth and then further back near or under the cheekbone. When stressed, the movement of the hand between the two contacts describes an arc, whereas in citation form, the hand moves in a straight line between the two points. To many signs with end contact and some with beginning contact, the feature arc is also added in stressed forms. Examples of the addition of arc can be seen in the signs NOT and DUMB. NOT is made by brushing the thumb tip of the A hand under the chin and outward, away from the signer; when NOT is stressed, the movement away from the body describes an arc from the chin outward and down toward the waist. DUMB is articulated with the A hand, palm side making contact with the forehead; when stressed, the movement toward the forehead from neutral space traces an arc. In the stressed form of both of these signs, the movement is also large and rapid.

Signs which have a continuous contact become relatively slower when stressed (= slow) (e.g. HOT, GIRL). The average duration of the movement portion of stressed continuous contact signs is 28 fields (467 msec.) (compared to 16 (267 msec.) in unstressed signs). The relative slowness of movement in the stressed form of these signs is most definitely exceptional; in the vast majority of signs, the movement becomes more rapid when stressed. In either case we find that relative duration is being used as an articulatory factor in stress realization. It is interesting to note that duration of vocalic segments is also one of the physical correlates of stress in oral language.
A number of interesting changes occur in the value of the movement feature contact during stress production.

6.2545 a. Many signs which in citation form do not entail contact with the body (= non-contact), do make contact at the end of the sign when stressed (i.e. become end contact signs). This change entails the addition of a place of articulation in stressed form—either the body part at which the sign is made in citation form, or in the case of signs made in neutral space, the palm of the non-dominant hand or a table top or other convenient location. It would appear that non-contact becomes end-contact in those signs which do not alternate (but they need not be non-interacting) which have a straight movement and which have a directional movement (i.e. not non-directional). There are to be sure, signs which meet these criteria which do not add a final place of articulation. This rule is to be regarded as a general tendency—not as an absolute. For the most part, signs which are thus affected have a downward movement or a movement toward or away from the body as exemplified by the signs MUST, SCARED, and NOTHING. MUST is made by drawing the X١ hand sharply downward in neutral space; SCARE has two 5 hands, palms toward signer's chest, approach each other sharply at the chest; NOTHING is made with the 0 hand, moving from the chin area outward to neutral space. When the signs are stressed, the articulator in MUST and NOTHING makes end contact with (usually) the palm of the non-dominant hand; in SCARE the fingers of the 5 hands make end contact with the chest. As the signs have straight movements, their movements are also large and rapid when stressed.

I suggest that for those signs in which the stressed form entails making contact with the non-dominant hand—a contact which does not
occur in citation form—the apparent gain of contact does not represent a gain but instead a vestige of an original citation form in which there in fact was contact with the non-dominant hand. This speculation has plausibility in light of the fact that contact signs tend to lose contact in colloquial, rapid signing (in unstressed forms). (cf. §5.2.) If this is true, it suggests that a concept of abstract form for signs is needed, with rules for stress manifestation and rules for changes in rapid signing.

6.2545 b. In much the same way that non-contact signs tend to become end-contact, beginning contact signs have a tendency to become double contact when stressed. Again, this value change of the contact feature amounts to adding a place of articulation. This added location, not at all present in the citation form of these signs, becomes the place where the second contact is made. An example of this phenomenon is the sign FUNNY which in citation form begins with the H hand, palm down, brushing the tip of the nose (usually repeated once or twice) and ends in the upper portion of neutral space; when stressed the sign ends with the extended fingers making contact with the palm or back of the non-dominant hand. In effect, the feature changes in stress production which occur to non-contact and beginning contact signs both describe the same phenomenon which may be stated as a general tendency for non-end-contact signs to become end-contact.

6.2546 What is interesting however is that many end-contact signs become non-contact when stressed. Signs which when unstressed make contact with the body at the final point of articulation, do not make contact when stressed. Among numerous examples of this change are the
signs DUMB, which in citation form has the A hand making contact with the forehead, MOTHER, which is normally articulated with thumb of the 5 hand--fingers wiggling--making contact with the chin, and VAMPIRE, which when unstressed entails contact of the fingertips of V on the ipsilateral (to the dominant hand) side of the neck.

As stated above, a tenseness of musculature and sharpness of movement generally accompany stress realization. An explanation for loss of contact in signs that realize stress with a sharp, rapid movement is presumably simply the desire on the part of the signer not to injure himself, which he would do if he made contact when stressing these signs.

The one condition under which the loss of final contact does not occur is in those signs in which the final place of articulation is the non-dominant hand or part of the hand (finger, wrist, etc.). Signs such as SCHOOL, NAME, and RIGHT ('correct') all begin in neutral space and have an end contact at the non-dominant hand (or fingers of the hand) in citation and in stressed form. I would suppose that it is because with just those end contact locations that sharp contact would not cause bodily injury that these end contacts are allowed in stressed forms.

6.2547 A small but significant number of signs which have straight movement in citation form take on a circular or side-to-side movement when stressed. For the most part, these signs have end contact at the non-dominant hand in citation form and retain it when stressed. As an example, consider the sign LAST which in citation form is made with a straight movement in which the extended 'pinky' of the I hand moves downward to contact the extended 'pinky' of the non-dominant hand; when the sign is stressed, the dominant hand describes a circular motion in
neutral space before making contact with the non-dominant hand.

Other signs in which stress manifestation entails such a change from straight movement but which are not end contact signs include OLD which, when stressed, changes a straight downward movement from the chin (with C closing to S) to a circular or side to side downward motion. I would speculate that the side-to-side movement exhibited here is merely a variant of circular motion in that it is difficult to move the hand in a circular motion while simultaneously moving it downward (or outward or upward, etc.) without 'making sharp edges' on the circles. Clearly the movement portion of these signs is considerably slower when stressed than in unstressed form; the average duration of the movement of signs of this type is 82 fields (1367 msec.).

I have discussed three distinct realizations of stress for end-contact signs. We can predict which of those signs which are [straight, end-contact] in citation form become [straight, non-contact] (and [rapid, large]), and which maintain the values straight and end-contact, with reference to the location of the final place of articulation in citation form. Those signs which have the non-dominant hand as their final place of articulation tend to maintain end contact; those which have any other place as the final place of articulation tend to lose that end contact.

For those signs which maintain end contact, there are two variations: those which maintain the straight movement of citation form and those in which the movement is circular when the signs are stressed. The choice of type of stress manifestation in signs which maintain end contact cannot be predicted or explained at this time; if no further evidence were forthcoming which would explain these differences in type
of stress realization, I would suggest that the choice is an arbitrary, idiomatic one.

6.2548 Signs which in unstressed form entail a holding contact lose contact when stressed. We have seen above that some signs become ballistic when stressed (i.e. a thrusting action of the hand or arm). Signs with holding contact for the most part have a nodding (=bend-wrist) or twisting movement and as such entail the thrusting action when stressed. For example, the sign LATER is citation form has the L hand, thumb in holding contact with the palm of the non-dominant hand, bend repeatedly at the wrist; when stressed, the hand thrusts outward from the non-dominant hand in neutral space with a large, rapid movement. As a partial explanation for the loss of holding contact in stressed form, I suggest the physical difficulty of maintaining a non-anchored contact while attempting to thrust the arm and/or hand forward.

It is striking that a number of feature changes that occur in stress manifestation entail a sort of 'feature switch' that might seem to cause some insurmountable problems. That, for instance, signs which have no end contact tend to add a final place of articulation when stressed, and that signs which have end contact in citation form lose that contact (with the noted exceptions) and that some non-straight movements become straight, and some straight movements become non-straight might appear to cause an unsupportable amount of 'homophony'. However, this is simply not the case. One might ask whether in fact these features are distinctive in ASL. We can easily prove that they are by noting minimal pairs in which these distinctions are displayed. For example, the signs TREE and NOON differ only in that TREE has a wiggling movement and NOON does not; the signs LANGUAGE and LARGE are
identical except for the fact that LANGUAGE has a twisting movement, while LARGE has a straight motion. I would imagine that in the case where a change in movement according to the rules given above would cause two distinct forms to become homophonous, those forms would be just the ones which do not follow the rules.

6.3 It seems clear that the type of changes in the 'phonetic' shape during stress manifestation are quite different in oral and visual language. Clearly the differences in phonetic make-up of language in the two modalities is sufficient reason to expect almost no similarity. However we find that similar physical correlates at least play a role in stress realization in both oral and visual language. In both, we find a change in duration, a change in intensity, if we consider the change of size in Sign as an analogue to amplitude in oral language, and a change in 'pitch', if we consider pitch as a function of the tension-relaxation parameter. In order for the fundamental frequency to rise (or lower), the laryngeal muscular tension must be increased (or decreased). In order for the vast majority of signs to be stressed, the brachial muscles must be tensed.

In other words, although the physical structures of oral and visual language are vastly different, we find striking parallels between the form and function of phonological distinctions in speech and in sign production.
Table 7
Summary: Stress Rules

<table>
<thead>
<tr>
<th>Straight</th>
<th>Twist</th>
<th>Bend-wrist</th>
<th>Rapid, large, tense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular</td>
<td>Bend-fingers</td>
<td>Bend-knuckles</td>
<td>Rapid, tense</td>
</tr>
<tr>
<td>Approach</td>
<td>Separate</td>
<td>Cross</td>
<td>Link</td>
</tr>
<tr>
<td>Alternate</td>
<td>Bend-fingers</td>
<td>Bend-knuckles</td>
<td>Bend-wrist</td>
</tr>
<tr>
<td>Link</td>
<td>Movement away from signer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate</td>
<td>Non-alternate</td>
<td>(Movement in unmarked direction along appropriate axis)</td>
<td></td>
</tr>
<tr>
<td>Up and down</td>
<td>To and fro</td>
<td>Side to side</td>
<td>Movement in unmarked direction along appropriate axis</td>
</tr>
<tr>
<td>Wiggle</td>
<td>Straight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Away</td>
<td>Up</td>
<td>Ballistic</td>
<td></td>
</tr>
<tr>
<td>Away</td>
<td>Up</td>
<td>Extended</td>
<td></td>
</tr>
</tbody>
</table>
double contact $\rightarrow$ arc

end contact
beginning contact $\rightarrow$ arc

continuous contact $\rightarrow$ slow, (tense)

non-contact
straight $\rightarrow$ end contact
+directional

beginning contact $\rightarrow$ double contact

end contact $\rightarrow$ non-contact
(except those whose final place is the non-dominant hand)

straight
end contact
(final contact at non-dominant hand) $\rightarrow$ circular

straight $\rightarrow$ circular ~ side-to-side

holding contact $\rightarrow$ non-contact

Key
$\rightarrow$ = becomes
$\sim\rightarrow$ = tends to become
$\sim\sim\rightarrow$ = some become
FOOTNOTES

Chapter 1

1 For further discussion of FSL and historical change see Stokoe 1972, Frishberg 1975a, 1975b, Fischer 1973b, 1975.

2 Friedman 1975b presents a fuller discussion of this kind of simultaneous articulation.

3 Friedman 1976 comes to the same conclusion.

4 See Mandel (1975) and Edge and Herrmann (1975) for discussion of markers in ASL.

Chapter 2

1 Stokoe calls the units of ASL chers ([keyuz]) and phonemes cheremes ([keyulymz]).


3 For further discussion and explanation of these and other morpheme structure conditions, see §4.5.

4 See Frishberg 1975a, b; Friedman 1974b, 1975a and §5 for detailed discussion of phonological processes.

5 For further detail on this and other trivial and non-trivial constraints imposed by the modality of communication see §4.

6 By Friedman, Battison.

7 Unmarked in relation to all other shapes; however, they are distinct from each other.

8 See §5 for discussion of points of contact on the hand.

9 See Mandel (1975) for discussion lexical vs. non-lexical gesture.

10 The variation and its ongoing change are discussed in Battison et. al. 1973. Neutralization in ASL is discussed in Friedman 1975a and in §5.
See Mandel 1975, De Matteo 1975.

Phonological changes in rapid signing are discussed in Friedman 1975a and in §5.

For details of stress manifestation see Friedman 1974a, b, and §6.

See below, §3, for more detailed discussion.

See Mandel 1975 for further discussion of V-legs.

For more detailed discussion see Friedman 1975a and §5.

See Friedman 1975a and Frishberg 1975a, b, for discussion of phonological change in ASL. See also §5.

The analysis presented here differs drastically from my analysis of the movement parameter derived from my preliminary study of the physical manifestation of emphatic stress (Friedman and Battison 1973, Friedman 1974a, b). As I now believe that analysis to be incorrect, I won't burden the reader with any discussion of it.

Unless of course two signs are simultaneously produced, as for example when the non-dominant hand indexes a third person referent while the dominant hand identifies it or comments on it.

All signs may be 'abbreviated' to become one-handed in rapid, or more commonly 'encumbered' signing (when one hand is otherwise occupied).

Stokoe describes signs of this type as having approaching or separating action.

See §6 for discussion of stress manifestation. Also see Friedman and Battison 1973, Friedman 1974a, b.

See §6 for details.

I called this value CONTIGUOUS in 1974.

There are, of course, constraints—perceptual, articulatory, and language specific—for instance that APPROACH and SEPARATE only co-occur
with movement in the width dimension.

26. There must be some perceptual reason for this phenomenon, but I don't know what it is.

27. See §6 for further discussion.

Chapter 3

1. This process is discussed in some detail in Mandel 1975 and DeMatteo 1975.

2. See DeMatteo (1975) for discussion of analogic rules.

3. For discussion of space, time, and person reference in ASL see Friedman 1975b; indexing is discussed in regard to iconicity in Mandel 1975.

4. Mandel (1975) presents a detailed discussion of iconicity and conventionality and their implicational interrelation in ASL.

5. **GROW** for plants is an entirely different sign.


7. Mandel distinguishes three types of virtual depiction—sketching, stamping, and measuring—depending on how the image is formed—which are not crucial to this discussion.

8. There are aspectual markers which will allow one to say, for instance, 'a long, tedious game' but these are not the province of this discussion. See Fischer 1973a for discussion of aspectual markers (e.g. iterative, durative) in ASL.


10. For further discussion see Friedman 1975b, 1976. Other verbs of this class include WASH, CUT (with scissors), CUT (with knife), OPEN, CLOSE.
This ad-hoc modification of TREE was produced during an elicitation session in 1975 conducted by M. Mandel.


Chapter 5

1 Frishberg quotes from Long, 1918, reprinted 1949.

2 This variation and its ongoing change in ASL is discussed in detail in Battison et. al., 1973.

3 For further discussion of prosodic features see §6.

4 Frishberg quotes from Long, 1918.

5 See Friedman 1975b for further details.

6 For further discussion of question intonation in ASL see §6.23.

Chapter 6

1 In effect, I mistakenly said as much in Friedman 1974b.

2 Bellugi 1975 reports a small number of polymorphemic compounds, as well.

3 Bellugi's findings contradict earlier statements by Schlesinger and Presser (1970)—in regard to Israeli Sign Language—who dismiss the possibility of defining compounds by any anologue to intonation. They state, "we do not know of other paralinguistic [sic] features in terms of which compounds might be defined". (p. 3)

4 These and other durations given below were measured by counting fields which are visible on a VTR monitor when the tape is manually turned.

5 We can hardly even call CALIFORNIA a compound, as it acts like a single monomorphemic sign.

6 Bellugi uses the term two-touch signs to refer to what I call double contact.

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Material cited below from my earlier work as reported in Friedman and Battison 1973 and Friedman 1974a, b.

All four informants are deaf. Of the first two female subjects one was born deaf of deaf parents, the other became deaf at age 16 months; they were aged 16 and approximately 40, respectively at the time of the study. The second two (male) were also born deaf of deaf parents.

This presentation is a revised version of my earlier studies (Friedman and Battison 1973, Friedman 1974a, b) based on my re-analysis of the movement parameter as given in §2.3.

I had been working with both informants for 13 months prior to this investigation and feel confident that they were well primed for this investigation. I did not, however, explain the nature of this investigation to them until all the procedures were completed.

The suggestion was made to me by C.J. Fillmore.
## Appendix I: Transcription Symbols and Conventions

### Hand Configuration

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Symbol</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Work</td>
<td>V</td>
<td>Problem</td>
</tr>
<tr>
<td>å</td>
<td>Girl</td>
<td>3</td>
<td>Car</td>
</tr>
<tr>
<td>S</td>
<td>Shoes</td>
<td>3*</td>
<td>Awkward</td>
</tr>
<tr>
<td>O</td>
<td>Eat</td>
<td>Y</td>
<td>Why, Yellow, Play</td>
</tr>
<tr>
<td>t0</td>
<td></td>
<td>4</td>
<td>Kid</td>
</tr>
<tr>
<td>b0</td>
<td></td>
<td>Ø</td>
<td>Taste, Pity, Delicious</td>
</tr>
<tr>
<td>B</td>
<td>Trouble</td>
<td>8</td>
<td>Like, Hate</td>
</tr>
<tr>
<td>ô</td>
<td>Stubborn</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>ô</td>
<td>Box</td>
<td>T</td>
<td>Try</td>
</tr>
<tr>
<td>C</td>
<td>Basketball</td>
<td>M</td>
<td>Monday</td>
</tr>
<tr>
<td>5</td>
<td>Meeting</td>
<td>N</td>
<td>Nurse</td>
</tr>
<tr>
<td>4</td>
<td>Talk</td>
<td>D</td>
<td>Dentist</td>
</tr>
<tr>
<td>5*</td>
<td>Confused</td>
<td>bD</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>If</td>
<td>E</td>
<td>East, Cute</td>
</tr>
<tr>
<td>G</td>
<td>Think, Boring</td>
<td>G₂</td>
<td>Green, Queen</td>
</tr>
<tr>
<td>X₁</td>
<td>Friend, Must</td>
<td>K</td>
<td>King</td>
</tr>
<tr>
<td>X₂</td>
<td>Onion, Apple</td>
<td>I</td>
<td>Idea</td>
</tr>
<tr>
<td>L</td>
<td>Language</td>
<td>W</td>
<td>World</td>
</tr>
<tr>
<td>L</td>
<td>Run</td>
<td>R</td>
<td>Restaurant</td>
</tr>
<tr>
<td>H</td>
<td>Name, Hurry</td>
<td></td>
<td>diacritics:</td>
</tr>
<tr>
<td>H</td>
<td>Chair</td>
<td></td>
<td>*** = bent</td>
</tr>
<tr>
<td>V</td>
<td>Stand</td>
<td></td>
<td>* = thumb-spread</td>
</tr>
</tbody>
</table>

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### Movement

#### (superscripts)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>☞</td>
<td>Alternate</td>
<td>IF</td>
<td>➤</td>
<td>Continuous</td>
<td>Girl</td>
</tr>
<tr>
<td>☼</td>
<td>Approach</td>
<td>Meeting</td>
<td>☼</td>
<td>Holding</td>
<td>Later</td>
</tr>
<tr>
<td>☼</td>
<td>Separate</td>
<td>But</td>
<td>➣</td>
<td>End</td>
<td>Dumb</td>
</tr>
<tr>
<td>☼</td>
<td>Cross</td>
<td>Math</td>
<td>➣</td>
<td>Beginning</td>
<td>Not</td>
</tr>
<tr>
<td>☺</td>
<td>Link</td>
<td>Join (F)</td>
<td>➣</td>
<td>Double</td>
<td>Head</td>
</tr>
<tr>
<td></td>
<td>Non-Interacting (unmarked)</td>
<td></td>
<td>➣</td>
<td>Non-Contact (unmarked)</td>
<td></td>
</tr>
</tbody>
</table>

#### Direction

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>^</td>
<td>Upward</td>
<td>Feel</td>
<td>☥</td>
<td>Twist</td>
<td>Boring</td>
</tr>
<tr>
<td>⌈</td>
<td>Downward</td>
<td>Hungry</td>
<td>⌈</td>
<td>Circular</td>
<td>Confused</td>
</tr>
<tr>
<td>▼</td>
<td>Up-and-down</td>
<td>Hurry</td>
<td>☮</td>
<td>Bore</td>
<td>Confused</td>
</tr>
<tr>
<td>➥</td>
<td>Right</td>
<td>Black</td>
<td>➥</td>
<td>Bend-fingers</td>
<td>Frog</td>
</tr>
<tr>
<td>&lt;</td>
<td>Left</td>
<td>Lie</td>
<td>➤</td>
<td>Bend-Knuckles</td>
<td>Stubborn</td>
</tr>
<tr>
<td>≦</td>
<td>Side-to-side</td>
<td>Song</td>
<td>➤</td>
<td>Bend-Wrist</td>
<td>Yes</td>
</tr>
<tr>
<td>≧</td>
<td>Toward</td>
<td>Me</td>
<td>□</td>
<td>Open</td>
<td>Hate</td>
</tr>
<tr>
<td>⊥</td>
<td>Away</td>
<td>Delicious</td>
<td>♫</td>
<td>Close</td>
<td>Boy</td>
</tr>
<tr>
<td>⊥</td>
<td>To-and-fro</td>
<td>Talk</td>
<td>✊</td>
<td>Wiggle</td>
<td>Fingerspell</td>
</tr>
</tbody>
</table>

#### Manner

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-Directional (unmarked)</td>
<td></td>
<td></td>
<td>diacritics:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>sharp</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>repeat</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø</td>
<td>NEUTRAL SPACE</td>
<td>SCHOOL</td>
<td>[ ]</td>
<td>TRUNK</td>
<td></td>
</tr>
<tr>
<td>o</td>
<td>HEAD</td>
<td></td>
<td>[ ]</td>
<td>CHEST</td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>WHOLE FACE</td>
<td>TROUBLE</td>
<td>[ ]</td>
<td>CENTER</td>
<td>WHITE</td>
</tr>
<tr>
<td>ø</td>
<td>TOP OF HEAD</td>
<td>HAIR</td>
<td>[•]</td>
<td>STOMACH</td>
<td>PREGNANT</td>
</tr>
<tr>
<td>ø</td>
<td>UPPER FACE</td>
<td></td>
<td>[ ]</td>
<td>WAIST</td>
<td>RUSSIAN</td>
</tr>
<tr>
<td>ø</td>
<td>FOREHEAD</td>
<td>THINK</td>
<td>[ ]</td>
<td>SHOULDER</td>
<td>VACATION</td>
</tr>
<tr>
<td>ø</td>
<td>SIDE-FOREHEAD</td>
<td>STUBBORN</td>
<td></td>
<td></td>
<td>ARM</td>
</tr>
<tr>
<td>ø</td>
<td>EYES</td>
<td>SEE</td>
<td>[()</td>
<td>UPPER ARM</td>
<td>HOSPITAL</td>
</tr>
<tr>
<td>ø</td>
<td>SIDE EYES</td>
<td>ONION</td>
<td>[()</td>
<td>ELBOW</td>
<td>POOR</td>
</tr>
<tr>
<td>ø</td>
<td>NOSE</td>
<td></td>
<td>[()</td>
<td>DORSAL ARM</td>
<td>LONG</td>
</tr>
<tr>
<td>ø</td>
<td>CENTER</td>
<td>FUNNY</td>
<td>[()</td>
<td>VENTRAL ARM</td>
<td>BRIDGE</td>
</tr>
<tr>
<td>ø</td>
<td>UNDER</td>
<td>KIDS</td>
<td>[()</td>
<td>DORSAL WRIST</td>
<td>TIME</td>
</tr>
<tr>
<td>ø</td>
<td>SIDE</td>
<td>BORING</td>
<td>[()</td>
<td>VENTRAL WRIST</td>
<td>DOCTOR</td>
</tr>
<tr>
<td>ø</td>
<td>LOWER FACE</td>
<td></td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>CHIN</td>
<td>MOTHER</td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>MOUTH</td>
<td>EAR</td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>(UNDER CHIN)</td>
<td>DIRTY</td>
<td>[()</td>
<td></td>
<td>HAND (marked with hand configuration symbols)</td>
</tr>
<tr>
<td>ø</td>
<td>CHEEK</td>
<td></td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>CENTER</td>
<td>CANDY</td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>SIDE</td>
<td>GIRL</td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>EAR</td>
<td>CALIFORNIA</td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>NECK</td>
<td></td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>CENTER</td>
<td>THIRSTY</td>
<td>[()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø</td>
<td>SIDE</td>
<td>VAMPIRE</td>
<td>[()</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diacritics:
- \(\) (over)
- \(\) (under)
- \(\) (dominant side)
- \(\) (non-dominant side)

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**ORIENTATION/POINT OF CONTACT**  
*(subscripts)*

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TOWARD</td>
<td>MIRROR</td>
</tr>
<tr>
<td>↓</td>
<td>AWAY</td>
<td>BAD</td>
</tr>
<tr>
<td>∧</td>
<td>UP</td>
<td>DIE</td>
</tr>
<tr>
<td>∨</td>
<td>DOWN</td>
<td>FUNDAMENTAL</td>
</tr>
<tr>
<td>➔</td>
<td>RIGHT</td>
<td>(left hand)</td>
</tr>
<tr>
<td>≪</td>
<td>LEFT</td>
<td>SONG</td>
</tr>
</tbody>
</table>

may be used in combination  
e.g. up and right (for indexic reference)

| 1      | FINGERTIPS | HEAD, FEEL, THINK   |
| ←      | THUMB-TIP  | STUBBORN, MOTHER    |
| ○      | PALM       | SCHOOL, RED         |
| ⊥      | SIDE       | HOT, KIDS, PATIENT  |
| ♣      | DORSAL     | BLUSH, LAW, FROG    |

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Conventions

1. The following elements and features are unmarked:
   straight
   non-interacting
   non-contact
   non-directional
   neutral space
   orientation, if point of contact marked
   orientation, in signs with twisting movement
   final hand configuration in signs with open movement
   beginning hand configuration in signs with close movement
   (i.e. symbol # after hand configuration indicates 'close to preceding shape')

2. Position of elements:
   a. Place of articulation (except when unmarked) appears first - whether a location on the body or the non-dominant hand.
   b. Hand configuration follows.
   c. Movements appear as superscripts following hand shape.
   d. Orientations or points of contact appear as subscripts following hand shape.

3. If the hand configuration of both articulators must be indicated, the first symbol represents the shape of the non-dominant hand, the second the dominant hand - whether the non-dominant hand acts as an articulator or as a place of articulation. In one-handed signs in which the non-dominant hand is neither an articulator nor the place
of articulation, only the shape of the dominant hand is indicated.

4. In double articulator signs (in which both hands move), both hand shapes are enclosed in parentheses (to indicate 'the quality of the two articulators move'), e.g. ROAD = (B>B) - B hands, palms facing each other move away from signer - as opposed to SCHOOL = BxBB+ - dominant B makes palmside contact with palm of non-dominant B.

5. Orientation specifications for forearm or wrist are marked by a subscript following the place symbol, indicating direction of ventral portion of arm, e.g. LONG = G G - G hand drawn upward along dorsal forearm, ventral portion oriented downward - and DOCTOR = QM - palmside contact of M on ventral wrist oriented upward.

6. If two orientation specifications are needed, direction of palm appears first, direction fingers point toward second. Symbols are separated by a hyphen (-), e.g. BUT = (GG) - two G hands, palm away, pointed upward, separate.

   For specification of combination orientation, e.g. to the right and upward, at oblique angle, the two orientation symbols are juxtaposed without a hyphen. The only common occurrence of this type of orientation is in locative and person indexical pro-forms.
Examples

WORK \( A_{\alpha} A_{\alpha}^{x^x} \)
TROUBLE \( C (B_{\alpha} B_{\alpha})^{v^y} \)
STUBBORN \( \wedge (BB)^{P_{\alpha}} \)
CONFUSED \( \wedge (F_{\alpha} F_{\alpha})^{P_{\alpha}} \)
IF \( (F_{\alpha} F_{\alpha})^{P_{\alpha}} \)
THINK \( \wedge G_{\alpha}^\omega \)
ONION \( \wedge X \otimes \omega \)
LANGUAGE \( (LL)^{\omega^\omega} \)
NAME \( H_{\alpha} H_{\alpha}^{x^x} \)
CAR \( 3^\wedge \)
AWKWARD \( (3^3)^{x^x} \)
PLAY \( C Y \omega^\wedge \)
KID \( \wedge Y \omega^\wedge \)
DELICIOUS \( \wedge B_{\alpha}^{x^x} \omega (L) \)
HATE \( \wedge (\text{open from 8}) \)
LIKE \( [ ] 8_{\alpha}^{x^x} \)
KING \( [ ] ^{x^x} \)
BUT \( (GG)^{L^A} \)
JOIN \( (FF)^{\tau} \)
GIRL \( \wedge B_{\alpha}^{x^x} \)
LATER \( B_{\alpha}^{x^x} \)
HEAD \( \wedge B_{\alpha}^{x^x} \)
FEEL \( [ ] B_{\alpha}^{x^x} \)
HURRY \( (H_{\alpha} H_{\alpha})^{\wedge} \)
LIE (prevaricate) \( \wedge G_{\alpha}^\omega \)
SONG \( B_{\alpha} B_{\alpha}^{x^x} \)
TALK \( \wedge (44)^{x^x} \)
FROG \( \wedge V_{\alpha}^x \)
BOY \( \wedge 0_{\alpha}^{x^x} \)
FINGERSPELL \( 5_{\alpha}^\wedge \)
FLOWER \( [ ] 0_{\alpha}^{x^x} \)
OLD \( \wedge V_{\alpha}^x \)
DIRTY \( \wedge 5_{\alpha}^\wedge \)
CANDY \( 3 G_{\alpha}^{\otimes \omega} \)
THIRSTY \( \Pi C_{\alpha}^{x^x} \)
WHITE \( [ ] 0_{\alpha}^{x^x} \)
VACATION \( [ ] (LL)^{x^x} \)
POOR \( \wedge 0_{\alpha}^{x^x} \)
LONG \( \wedge V_{\alpha}^x \)
BRIDGE \( [ ] V_{\alpha}^x \)
TIME \( \Pi C_{\alpha}^{x^x} \)
DOCTOR \( A_{\alpha} M_{\alpha}^{x^x} \)
MIRROR \( \wedge B_{\alpha}^\omega \)
BAD \( \wedge B_{\alpha}^\omega \)
FUNDAMENTAL \( B_{\alpha} B_{\alpha}^{x^x} \)
RED \( \wedge G_{\alpha}^x \)
HOT \( \wedge C_{\alpha}^* \)
LAW \( BL^x \)

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## APPENDIX II: STOKOE (1960, 1965) CHEREMIC ANALYSIS

**TAB: PLACE OF ARTICULATION**

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>φ</td>
<td>NEUTRAL SPACE</td>
</tr>
<tr>
<td>○</td>
<td>WHOLE FACE</td>
</tr>
<tr>
<td>▲</td>
<td>UPPER FACE OR BROW</td>
</tr>
<tr>
<td>△</td>
<td>MID-FACE, NOSE, EYES</td>
</tr>
<tr>
<td>▼</td>
<td>LOWER FACE, CHIN</td>
</tr>
<tr>
<td>▷</td>
<td>CHEEK, SIDE-FACE, TEMPLE</td>
</tr>
<tr>
<td>Π</td>
<td>NECK</td>
</tr>
<tr>
<td>[ ]</td>
<td>TRUNK, SHOULDER, HIPS</td>
</tr>
<tr>
<td>~</td>
<td>UPPER ARM</td>
</tr>
<tr>
<td>≈</td>
<td>ELBOW, UPRaised ARM</td>
</tr>
<tr>
<td>α</td>
<td>SUPINE ARM, WAIST</td>
</tr>
<tr>
<td>⊙</td>
<td>PRONE ARM, WRIST</td>
</tr>
</tbody>
</table>
# DEZ: HAND CONFIGURATION

<table>
<thead>
<tr>
<th>CHEREME</th>
<th>ALLOCHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>K</td>
<td>K</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>X</td>
<td>X&lt;sub&gt;1&lt;/sub&gt; X&lt;sub&gt;2&lt;/sub&gt;</td>
</tr>
<tr>
<td>Y</td>
<td>ε</td>
</tr>
</tbody>
</table>

*in free variation*
SIG: MOVEMENT

\[ \wedge \text{UPWARD} \]
\[ \vee \text{DOWNWARD} \]
\[ \triangledown \text{UP-AND-DOWN} \]
\[ \triangleright \text{RIGHTWARD} \]
\[ \triangleleft \text{LEFTWARD} \]
\[ \approx \text{SIDE-TO-SIDE} \]

\[ \Uparrow \text{TOWARD} \]
\[ \Downarrow \text{AWAY} \]
\[ \rightarrow \text{TO-AND-FRO} \]

\[ \alpha \text{SUPINATING ROTATION} \]
\[ \vartheta \text{PRONATING ROTATION} \]
\[ \omega \text{TWIST} \]

\[ \odot \text{CIRCULAR} \]
\[ \blacklozenge \text{NOD ~ BEND} \]
\[ \# \text{CLOSE} \]
\[ \square \text{OPEN} \]
\[ \varepsilon \text{WIGGLE} \]

GRAZE (not in 1965)

\[ \succ \text{APPROACH} \]
\[ \times \text{TOUCH} \]
\[ \blacklozenge \text{LINK} \]
\[ \dagger \text{CROSS} \]
\[ \odot \text{ENTER} \]
\[ \div \text{SEPARATE} \]
\[ \odot \odot \text{INTERCHANGE} \]

---

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1. Stokoe uses the following terms:

- chereme \([\text{keyoiym}]\), (cher - 'handy', Homeric Greek)
- allocher
- cherology

Corresponding to phoneme, allophone, and phonology

- tab (tabula) = place of articulation
- dez (designator) = hand configuration
- sig (signation) = movement

2. Stokoe does not formally analyze the orientation parameter, but does refer to 'aspects' that the hand can assume.

3. The data I have collected suggests a very different phonemic and allophonic distribution; unfortunately, for the most part, Stokoe does not indicate the conditions for the occurrence of allophones, so that I cannot adequately argue with his analysis.

4. By comparing the two analyses, we find that Stokoe does not note various contrasts in each parameter. In the place of articulation parameter, dorsal forearm and ventral forearm phonemes are not indicated nor are they distinguished from dorsal and ventral wrist; shoulder is considered an allophone of trunk (no conditions of occurrence are given). In the movement parameter, Stokoe does not mention bend-fingers and bend-knuckles, nor does he distinguish the five values of the feature contact (given in chapter 2). In the hand configuration parameter, Stokoe's analysis has B and 5 as members of the same phoneme set (without conditions), as well as C, O, and E and Y, \(\emptyset\), \(\Upsilon\), and \(\Upsilon\); (while it is true that \(\emptyset\) is a variant of Y in reduced forms, it also
contrasts with Y (as indicated in chapter 2); \( \text{\textbeta} \) is considered in allophone of M instead of B; D is considered an allophone of G; \( X_1 \) and \( X_2 \) are said to be in free variation, as opposed to being conditioned variants (conditions of occurrence given in chapter 2); the following phonemes are not mentioned: \( \text{"5", "V", 3, "3", 7, } \) and the loan phones N and G_2.

5. The analysis differs in 3 other main respects: (1) discussion of the role of iconicity, (2) separation of extrasystematic elements, i.e. loan phones, (3) recognition of regular phonological processes, e.g. addition of thumb-extension and resulting neutralization (a neutralization in progress).
REFERENCES


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Si pie, Patricia. 1973. Constraints for a sign language from visual perception data. ms. The Salk Institute for Biological Studies. La Jolla, California.


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