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By

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Dedicated to

my teachers

the Deaf

and

my family

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CHAPTER I

INTRODUCTION

I.A General Introduction

I.A.1 Thesis and arrangement of the dissertation

The thesis of this dissertation is that an adequate description of the phonology of American Sign Language (ASL) requires an inventory of descriptive terms that superficially is highly redundant. Previous phonological analyses, based only on surface forms of signs or of individual phonemes ("primes"), on perception, or on acquisition, have followed the reductionist route of generative phonology, with the result that the phonemes or features proposed as adequate to describe one type of data are not adequate to other types. Unlike the organs of speech, which produce their signal through a complex aerodynamic process, the organs of signing can be directly monitored by the producer and receiver. Furthermore, signer and viewer can direct their attention (either in or out of awareness) to many different aspects of the space in which signing takes place and the larger physical environment that includes them and their surroundings, and ASL refers directly to many of these aspects.

Failure to take these facts into account has led to false economies in previous phonological analyses. Attention to them permits the formulation of an analysis in which all aspects of ASL can be given adequate phonological description. The approach to such an analysis is initially to admit any terms of description that appear necessary, letting the redundancies fall where they may. Some of the terms of description may later be eliminated, but we should not rule anything out at the start. I have taken the step of inclusion, looking to variation, morphology, language change, and especially phonotactics to suggest parameters of description that would be needed or useful. The second step of eliminating redundancies I have largely left for future work.

The next section is a very brief setting-in-context of ASL itself. The rest of this introductory chapter is devoted to presenting the generally accepted framework of ASL phonology. That consists of the accepted parameters of description of signs, each with a (non-exhaustive) inventory: the notational system used (Stokoe notation) and the justification for using it; and some discussion of Stokoe's theory of ASL phonology and later divergences from it and additions to it. In the second chapter I propose a "multi-based" phonology on the principles just stated, admitting many parameters with a great deal of redundancy in the inventory. For the accepted parameter of Hand Configuration I propose a feature analysis based on a newly enunciated principle, the "Selected Finger Constraint." Much of the accepted parameter of Movement is reanalyzed in terms of a new Proximity parameter, and the possibility of treating many signs as a sequence of two states.

The remaining chapters are largely in the way of providing support for Chapter II. Chapter III is a study of surface phonotactics, with special attention to the role of Focus as a predictor of Hand Configuration. The main tool of Chapter III is statistical comparison of the occurrence of different primes in a given environment, based primarily on the Dictionary of American Sign Language on Linguistic Principles (Stokoe, Casterline, & Croneberg, 1965/1976, hereafter abbreviated to "DASL"). Chapter III is largely independent of the rest of the dissertation, as its statistical conclusions are drawn directly from the data and most of its theoretical conclusions are drawn directly from the statistics. Chapter IV is an analysis of some of Supalla & Newport's morphophonological findings (Supalla, 1978; Supalla & Newport, 1978; Supalla, 1980; Newport, 1981) in the phonological terms of Chapter II. All Figures and Tables are collected at the end of the text; they are meant to be bound separately for ready reference, especially to the summaries of phonological elements and notation.

I.A.2 American Sign Language

American Sign Language -- ASL -- is the primary language of an estimated half million deaf Americans (Baker & Padden, 1978). Although perhaps the fourth commonest language in the United States, it is subject to much ignorance and misunderstanding. It seems necessary, therefore, to discuss very briefly what ASL is not, as well as what it is. This section is meant as background for the linguistic discussion of a language, a sign language: American Sign Language.

ASL is gestural-visual rather than vocal-auditory. Its "sign stream" consists of gestures of the hands and arms with some non-manual concomitants (Baker & Padden, 1978b; Liddell, 1976, 1977; Coulter, 1979), constrained within the universe of possible gestures as the speech stream of a spoken language is constrained within the universe of possible vocal sounds. The name for the constraints on the form of speech, "phonology," is commonly generalized to gestural language as well.

ASL should be distinguished from the English-based signing activities that are also common in the United States. These consist of English sentences calqued into manual representations in the naturally evolved contact vernacular (called variously Pidgin Sign English, sign English, or signed English) or according to any of several contrived systems. The lexicons of these systems are based on ASL, with varying amounts of coined signs. All of these varieties of "Manually Coded English" (MCE)

(Wilbur, 1979) distort and misrepresent English in varying degrees, according to both the system and the signer. ASL syntax, lexicon, and phonology have been influenced by English, in large part via MCE, but these changes have not made it a form of English, any more than the events of 1066 and since have made English a Romance language.

Another English-based manual system that should be distinguished from ASL is not a signing activity at all. Fingerspelling consists of the representation of English words by individual hand configurations (arrangements of the thumb and fingers), one for each letter of the alphabet. Fingerspelling has also influenced ASL phonology and lexicon (Battison, 1978; Woodward, 1978).

"Sign language" is often popularly conceived of as pictorial or universal. Although certain aspects of syntax and morphology may well be common to all sign languages, signed discourse is no more universally comprehensible than spoken (Battison & Jordan, 1976; Jordan & Battison, 1976). And, while individual signs in citation form may seem pictorial to the observer, the non-signer generally cannot guess their meanings (Hoemann, 1975; Klima & Bellugi, 1979b) and their iconicity is ignored by many morphological processes (Klima & Bellugi, 1979b; Supalla & Newport, 1978; Klima, Bellugi, & Pedersen, 1979). Iconicity does play an important role in ASL, but that role seems to be concentrated in etymology (including neologism), morphology, and syntax (Chapter IV).

Fuller presentations of the history and current situation of ASL can be found in Stokoe (1960/1978), DASL, Frishberg (1976), Lane (1977), and Wilbur (1979), to name a few. Baker & Padden (1978a) is a good, popularly-written but scientifically accurate introduction.

I.B. The Elements of ASL Phonology

I.B.1 Overview

Most work in ASL phonology has developed within the tradition founded by Stokoe (1960/78, 1965/76), so I will describe the common elements of that tradition before getting specific about any of the individual approaches, including the founder's. The statements in the following paragraph, though not without exceptions, form a generally agreed on phonological framework within which most theories of ASL grammar are developed.

A sign, like a spoken word, can be analyzed into a number of units, each of which recurs in other lexical items, generally with no common element of meaning. But while a word can fruitfully be segmented in time into sequential units -- a first, a last, and intermediate ones each having a single neighbor on each side -- the units of a sign are for the most part realized simultaneously.[1] The major types of phonological unit in ASL are the configuration of the hand (handshape, or hand configuration, abbreviated HC), the location at which the sign is articulated, and the movement performed by the hand(s). Subsidiary units include the orientation of the hand(s); the part of a hand ("focus") that touches or faces another surface or leads in movement; the number of hands involved in the sign; and (if two) the distribution of activity and the spatial relation between them. Each of these classes contains a finite number of distinctive members; for at least the first three classes (handshape, location, movement), the members are a proper subset of the anatomical and linguistic possibilities: e.g., just as English phonology excludes voiceless nasals (which are used in Welsh), ASL phonology excludes the "dualF̈" handshape shown in Fig. 1-1, which is used in Japanese Sign Language.

After some introductory notes, the following sections present the individual parameters, still for the purpose of a general framework and very briefly to compare the ASL inventory with the universal one. Underlying forms will not be discussed, and redundancy only generally and insofar as it affects surface predictability.

I.B.1.a Introductory notes

I.B.1.a.i On terminology

Stokoe has always referred to the classes of elements as *aspects* of a sign, their member units as *cheremes* with *allochers* (/ker/), and the study of the formational level of sign language as *cherology* (DASL:xxviii, 1978:26). Most other researchers have preferred to generalize *phon-* and speak of ASL phonology. (The occasionally remarked-on incongruity of "soundless phonology" is a matter of habituation, and is in any case no odder than "voiceless sonorant" for [r̥, l̥] or "glide" for [h].) The classes are more generally termed *parameters* and their members *primes* (Bellugi, 1972). I shall follow the general usage even in discussing Stokoe, not to misrepresent him -- he has recently clarified a theoretical difference underlying the terminological one (1978:81-86) -- but only to maintain consistency.

I.B.1.a.ii On direction (Which side are you on?)

There are several ways of referring to sides of the body and the associated directions. The most obvious is the least useful. Right and left are distinctive only in signs such as RIGHT and LEFT, where they have the same function as any other deictically determined direction: NORTH, SOUTH, EAST, and WEST are also signed in the appropriate direction when it is known.

For each hand, the sides of the body can be distinguished as that hand's own side and the opposite side: ipsilateral and contralateral. With reference to the right hand, right is ipsilateral and left is contralateral, and vice versa for the left hand. These terms are useful for contrasting such signs as BEAR (the animal), in which each hand touches the contralateral chest, and YOUNG, in which each hand touches the ipsilateral chest. They also figure in a constraint on circular movement in signs with both hands independently active: for example, in MINGLE the hands move ipsilateral at the same time, and contralateral at the same time.

In signs with two hands, both can be moving or one can be stationary while the other moves. In the latter type of sign, the stationary hand is called the passive or base hand, while the other hand is active. Stokoe's term tab for the place of articulation of a sign may be employed here in referring to the stationary hand, and dez for the active hand. (These are Stokoe's abbreviations for his Latinate coinages tabula and designator (DASL:vii), which have never caught on in the literature. The corresponding term for the movement of a sign is sig, for the likewise unused signation.)

The other generally useful side distinction is dominant vs. nondominant. Battison (1978:27) defines dominant as "the hand preferred for most motor tasks." Kegl & Wilbur (1976, and via Wilbur 1979:29) consider both hands dominant in a sign if both are active. But active will do nicely for their sense, and morphological and syntactic considerations impel me to modify Battison's definition as follows: Dominance applies over different scopes. Battison's definition is the widest scope, an individual's preference for most motor tasks. Theoretically someone might be generally left-handed but sign right-handed, just as some people write left-handed at a blackboard but right-handed on a horizontal piece of paper. In practice, signers often reverse their signing handedness in mid-discourse for reasons of deixis, subordination, style, or tiredness, a phenomenon which Frishberg has named <u>dominance</u> <u>reversal</u> (1979b). Objectively, diagnosis of dominance reversal is made possible by signers' general consistency in using the same hand in the active role in signs with one hand active (about 65% of the lexicon in DASL [Klima & Bellugi, 1975, verified by my own count]).

Historical change and synchronic variation also produce opposite-handed versions of a single sign; see (1) for examples.

(1) LEAD $B^{\mathrm{I}}B^{\perp} \; > \; {}^{(\emptyset)\ddot{}}\ddot{B}B^{\underset{\perp}{\circ}}$

SHOW $B^{\prime}G_{<}^{\perp} \sim G_{>}^{\prime}B^{\perp}$

HELP[1d] (1) $\checkmark B_{a}^{\wedge}$ $\longrightarrow$ (2) $\underline{A}\,B_{a}^{\wedge}$ $\longrightarrow$ (3) $\bar{B}_{a}A^{\wedge}$

$\downarrow$

(4) $\underline{A}\,.\,B_{a}^{x\cdot\cdot}$ $\longrightarrow$ (5) $\bar{B}_{a}.A^{x\cdot\cdot}$

Battison (1978b "Historical bases") calls such cases examples of historical "movement metathesis" and "handshape metathesis," but the change can be more generally called <u>dominance</u> <u>metathesis</u>: the sign is switched to its mirror image (defined by dominant-nondominant, not left-right). Such changes often ease articulation. HELP(3), as a change from HELP(2), puts the nondominant hand underneath the dominant, where its lower position requires less transitional movement to or from an adjacent one-handed sign, and less muscular effort overall. HELP (4) and (5) are related similarly. The dominance metathesis in LEAD allows the nondominant hand to be pushed by the dominant rather than having to provide its own muscle power or be pulled (which requires the dominant hand to grip it). Similarly, in HELP (4) as compared with HELP(2) the nondominant hand becomes stationary and need not move at all.

In the following sections, expecially in dealing with movement and orientation, a distinction will appear between two ways of defining direction. One way refers to the internal anatomy of the hand and arm: forearm supine, wrist flexed, thumb extended. The other refers to the geometry of the signing space, defined in terms of the signer's body: up, forward, contralateral. I will call these frames of reference respectively Internal (or articular) and External (or geometrical). (Later on, the External frame will be expanded to include objects and locations other than the signer's body.)

I.B.1.a.iii On references

A number of sources are cited so frequently, either throughout or in certain sections, that I will abbreviate their citations beyond the usual Name (Date) format. "DASL" for Stokoe, Casterline, & Croneberg (1965/1976) has already been introduced. Klima & Bellugi, besides being the chief authors of Signs of Language (1979), are co-authors with up to three others of many of the articles in that volume. To give proper credit in place I will abbreviate references to the form "K, B, & ..." rather than use "et al.", as well as using "K&B" for "Klima and Bellugi." "Kegl & Wilbur (1976)" will generally be shortened to "K&W." Other abbreviations used only in a single section will be presented as needed.

Newport and Supalla work together, though they often publish under one name or the other. Theirs is the discovery of ASL's rich morphophonology of spatial representation as a rule-governed system, which they continue to elucidate. Chapter IV of this dissertation is built on their work. In Chapter II, the Movement subparameters of Manner and Directionality are due to them (Supalla & Newport, 1978), as are parts of Frequency and most of Shape. Their morphophonological analysis of Hand Configuration (Supalla, 1978) also provided supportive evidence for my novel feature analysis. I will cite them jointly as "S&N," referring thus to the material in Supalla (1978), Supalla & Newport (1978), Supalla (1980), and Newport (1981).

Several historical and comparative sources are cited fairly often. Long (1918) and Higgins (1923) provide documentary evidence of relatively early ASL, and Oléron (1974/1978) gives many signs of modern French Sign Language.[2]

I.B.1.b Handshape

Handshape refers to the attitude and relations of the five digits (i.e. the four fingers and the thumb) to the hand and each other. Many ASL handshapes, though far from all, are identical or similar to handshapes used in American fingerspelling or ASL numeration, and have therefore long been called by the name of the corresponding letter or digit. Diacritics devised by Stokoe and others supplement these symbols to name the remaining handshapes. (Symbols for primes of other parameters are not so widely or conveniently used.) ASL appears to be richer in handshapes than some other sign languages (e.g. Enga SL: Kendon to appear). But ASL in turn lacks some handshapes found in other sign languages, such as dual$\ddot{\text{F}}$ (Fig. 1-1).

I.B.1.c Location

Many signs are articulated on or near different parts of the body: the forehead, the cheek, the chest, the upper portion of the contralateral arm, and others. Many other signs are articulated by one hand on or near the other, and even more in the space in front of the signer (Kendon, to appear: Table 6). Not all accessible parts of the body are used:

the back of the head is never a location, nor is the underarm, though both are used in other sign languages (Kendon, t.a.; Wayne H. Smith, pers. comm., Taiwan SL). (Here and in the immediately following sections, I exclude jokes, which often deliberately violate phonological restrictions of normal signing (K, B, & Lentz, 1979).) The space in front of and beside the signer ("neutral space") is also used, but again, not all of it: the arms are never fully extended. The boundaries of ASL "signing space" are approximately at the waist and the top of the head; a couple of handbreadths to the sides of the shoulders; at the plane that divides the front and back halves of the body, and a forearm's length (elbow to fingertips) forward from that plane. (See Fig. 1-2.)

I.B.1.d Movement

Signs have distinctive movements. The hand(s) may move to or from a place of articulation; in a specified direction such as up or forward, and either straight or with a curve; by nodding the wrist or rotating the forearm; by moving the digits (thus changing the handshape); or by a combination of these movements. They may also interact, with or without touching, as by approaching or separating. As with handshape and location, not all physical possibilities are admissible. Movements that would take the hands out of signing space are excluded, as are some digital movements that are used in other sign languages. For example, Chinese Sign Language uses an alternate extension of the thumb and pinky from the fist, alternating the handshapes thumbȦ and I. ASL also has these handshapes, but does not permit that movement.

I.B.1.e Minor parameters

K, B, Newkirk, & Battison (1979:45) group handshape, location, and movement together as major parameters, each bearing the large functional load of distinguishing a great many signs, while orientation, hand arrangement, and spatial relation create few lexical distinctions by themselves, but display considerable variety not predictable from the major parameters (which immediately suggests itself as a source of redundancy), as well as conveying a great deal of morphological information. The major parameters also have a certain historical primacy, since Stokoe's three aspects were presented as consisting basically of them (see sec. I.B.1.a.ii), though DASL recognized all the minor parameters to some degree in the notation as well as the supplementary prose descriptions.

The hand's orientation is its position in space (aeronautically, its "attitude"). It can be described by naming two directions, for instance: the way the palm is facing and the way the ends of the metacarpals, or palm bones, are pointing. It can also be described anatomically in terms of forearm rotation -- prone, supine, or intermediate ("semiprone") -- and positions of the wrist, elbow, and shoulder joints. Some combinations are impossible, either geometrically (palm up, metacarpals down) or anatomically within ASL's signing space as defined in section I.B.1.c (palm backward, metacarpals ipsilateral). Other combinations are simply unused, or are marginal (palm up, metacarpals backward or ipsilateral; palm ipsilateral with any metacarpal direction). These cases strain the limits of signing space or articulatory comfort, so we can probably consider ASL's use of the anatomical universe of orientations to be limited only by the constraints already described for other parameters.

The admittedly opaque term focus (K & B 1979:45) includes that part of the hand which points to or faces another object or leads in motion in a direction. For example, the signs in Figure 1-3 all use a B handshape with palm focus. In SCHOOL the palm contacts the opposite palm, in CONFRONT it approaches it, and in CHILDREN it faces downward as the hand moves downward. All parts of the hand are used as focus in ASL, but individual handshapes are limited in possible foci. Some of these limitations are anatomical -- for example, the S handshape (clenched fist) cannot have a palm focus -- but others are language-specific. The F hand in ASL uses as focus the joined tips or edge of the thumb and index finger, and marginally the side of the middle finger or the back of the hand or fingers: never the tips of the extended middle, ring, or pinky fingers. But in Chinese SL and Japanese SL these tips often make contact (Fig. 1-4).

A sign can involve one hand or both; if both, they may both be active, or one may be the base for the other's action. (K, B, Newkirk, & Battison, 1979:48) call this set of possibilities hand arrangement and consider it as a minor parameter. All of these possibilities are found both with a body location and in neutral space, though the combination of body location and base hand is marginal (Table 1-1).

When both hands are used in a sign their directional relation must be considered. One hand may be in any direction from the other. The hands may be touching, close together, or separated; and if touching they may be linked in various ways. ASL seems to use all the combinations of these that anatomy and focal restrictions allow. (E.g., F may link via the joined thumb and forefinger, but not the three extended fingers; see Fig. 1-5.)

I.B.1.f Redundancies between parameters

Hand arrangement and location are connected by the near-complementary distribution of body location and base hand (Table 1-1). In most base-hand signs, the base hand functions as the location: the active hand moves to it, from it, along it, or in some other way best described with respect to it. Hand arrangement is also linked to handshape, orientation, movement, and location by two very general conditions first stated by Battison (1974; 1978:33-5) and temporarily somewhat simplified here:

The Symmetry Condition: If both hands move independently, they must share handshape, movement, location, and orientation.

The Dominance Condition: If the two hands in a two-handed sign have different handshapes, then

a) One hand must function as base for the other hand's movement, and

b) The base hand's handshape is restricted to the small set of relatively unmarked handshapes shown in Fig. 1-6.

These conditions were not known to Stokoe in 1965, but they are so much a part of the background of later research that I include them in this section.

Not only are the minor parameters most often redundant to the major ones, in not distinguishing one sign from another after handshape, location, and movement are specified, but to a large extent they are also jointly redundant. In the sign TIME in Table 1-1, any two of the parameters of orientation, focus, and spatial relation will suffice to predict the third (Fig. 1-7). The redundancy is incomplete because focus and spatial relation together can predict only half of orientation, i.e. one of the two specifications required for each hand.

I.B.2 Transcribing sign language

Sign language has been represented on the page in pictures (Long, 1918; Higgins, 1923; Riekehof, 1963; O'Rourke, 1973; Fant, 1972; Kuschel, 1974; Frishberg, 1975; Hagerty, 1976; Kegl & Wilbur, 1976; S & N: Supalla, 1978; S & N 1978; K & B 1979a [all articles], Humphries, Padden, & O'Rourke, 1980, and uncountable others); in more or less systematic prose (Higgins & Madsen, 1972; Mandel, 1977, and many others); in specially devised notations (Stokoe, Kakumasu, 1968, Sutton, 1977; Cohen, Namir & Schlesinger, 1977); and glosses, i.e. words or phrases of some oral language standing for specific signs as translation-equivalents (Fant, 1972; Friedman, 1975; Frishberg, 1975, 1976; K & W, 1976; S & N; K & B, 1979a [all articles], and most of the linguistic literature). Glosses are most convenient but least illuminating; they are totally opaque to phonology and tend to be misleading with respect to semantics and syntax. Pictures require a lot of space and producer effort; they are very precise on the static elements of a sign -- in fact, they allow no abstraction of them -- but cannot represent movement except through abstract conventions. Prose can represent almost any level of abstraction, but is not as good as pictures for narrow phonetics (at least for static elements) and requires as much definition as a notation for unambiguous abstraction, with the disadvantage that its familiarity can easily lead the user to include unformalized elements. Finally, notation must be learned by the writer and reader, may be difficult to use in text (though no more so than pictures), and, of course, requires a theory.

I will use all of these methods, as exposition and convenience allow. Especially in the early stages, prose and pictures are invaluable in presenting the elements of sign language phonology. Glosses are worthless for phonology unless each is precisely defined, which is seldom the case. (Sign language textbooks are better in this regard than linguists' productions: Fant, 1972; Higgins.) But they are useful for discussing variant pronunciations which the notation cannot capture in a single form; cf. such (unpronounceable) expressions as "the two pronunciations of economics."

For much of the representation of signs I will use notation. Some notations (Sutton; Cohen, et al.) are based on dance notation. Sutton's is particularly interesting because it is partly pictographic, combining emicized diagrams of articulatory elements with arbitrary symbols. But it is copyrighted and can only be learned in a course from Sutton or one of her teachers. Cohen et al.'s describes the angle of each joint in the upper limb -- it is purely articular (Internal), ignoring the need for a geometrical description of direction -- and is generally poorly suited to sign language. Kakumasu's notation is totally arbitrary and hopelessly unwieldy, as he admits: its main purpose was to demonstrate that the sign language for which he used it (Urubú SL, from Maranhão State, Brazil) was dually patterned.

Stokoe's notation (1960/1978, DASL) was devised expressly for ASL and embodies a theory of ASL phonology that has been proved basically correct: the aspectual or parametric analysis (compared to Cohen et al.'s the two are equivalent). The phonemic theory it is based on requires broad abstraction, but it can easily be adapted to other theories (e.g., Friedman, 1976), or phonetic description (Anderson, 1976a and forthcoming). Since DASL appeared, every sign language researcher has had to be at least acquainted with it; no other system is widely known in the field. It has been used for other sign languages and systems (Kendon, forthcoming; Meissner & Philpott, 1975a, b). It contains many unfamiliar symbols, but most of these are diagrammatically suggestive of the units they stand for.

Glosses -- names of signs -- are written entirely in capitals, e.g. UNDERSTAND. When more than one word is required to name a sign, the words are hyphenated together, e.g. GO-TO-BED. Some signs are initialized, i.e. they use a handshape equivalent to a letter of the manual alphabet for the purpose of providing an exact sign equivalent of an English word using that letter (usually the first letter). Such signs are often coined by educators to "improve sign language" or teach English to deaf children, and some have worked their way into common use outside the school situation. Initialized signs, regardless of origin, are glossed with the English word, underlining the letter used: <u>T</u>IME. Compounds are glossed by joining the components' glosses with a plus sign: GOOD+ENOUGH 'barely adequate.' Other conventions will be introduced as needed.

I.B.3 Notation

I will present the approximate inventory of primes simultaneously with their notation. Since that is due basically to Stokoe I will often be discussing his theory of ASL phonology (which is accessible in detail primarily via his notation) as well. I will refer to the notation used in DASL as "DASL notation," using the name "Stokoe notation" to cover DASL notation and all the variations that have been devised. I will sometimes explicitly mark a piece of notation as a quotation from DASL by a prefixed "(D)", or as not being from DASL (especially when not in DASL notation) by a prefixed "(Ø)."

The representation of a sign in DASL notation is organized by the three "aspects": tab (location), dez (the active hand[s]), and sig (movement), in that order. The three aspects are of course present simultaneously, but the use of an arbitrary left-to-right order allows a canonical form and some economies of notation. The most general schema is TD^{S}: first the tab (location), then the dez (active hand[s]), and last the sig (movement), written superscript. Although aspect ≠ major parameter, I will take the three major parameters in this order. In In addition to the three variables just introduced for tab, dez, and sig, I will occasionally use h for any handshape symbol (Fig. 1-8), s (lower-case) for any single movement symbol, and b for any symbol representing a location on the body (Fig. 1-9). Table 1-2, reproduced from DASL, summarizes the symbols.

I.B.3.a Location

There are three classes of location: on the body, on the (nondominant) hand, and in the space before and beside the signer.

I.B.3.a.i Body locations

The body as a class of locations includes the head, the neck, the trunk, and the (nondominant) arm. The forearm and wrist are borderline between body and hand; here I will treat them with body for convenience. Stokoe divides the body into eleven distinctive tabs (Fig. 1-9).

I.B.3.a.ii Hand locations

When one hand is used as the passive base for the other hand's action, DASL treats the base hand as location. The notation uses the symbol for the base hand's handshape as the tab in the schema $h\ h^{S}$. Sometimes the inactive hand's handshape appears to be indeterminate, very lax, and not readily assignable to any of the handshapes used by the active hand. These are generally treated as a or D (supine or prone hand/wrist). The spatial relation between the hands will be treated in its own section.

I.B.3.a.iii Neutral space

Stokoe represents neutral space with a tab symbol of its own: Ø. It is often omitted: thus OTHER may be written as $Ø\dot{A}^{a}$ or simply $\dot{A}^{a}$.

I.B.3.a.iv Graphical ambiguities

A potential for ambiguity arises when a sign is written as two handshapes and a movement: Is the first handshape the location (a "tab-hand") or are both handshapes active ("double dez") and the location an unwritten Ø? DASL resolves the ambiguity with a blank between a tab-hand and the active-hand that follows, so the two possibilities appear as $h\ h^{S}$ (tab hand) and hh^{S} (double dez). POSTPONE, for example, is given in two pronunciations: one with a tab-hand as location, $F\ F^{\perp}$ (one F-hand moves forward from next to the other), and one with two active hands, $FF^{\perp}$ (two F-hands move forward together in neutral space). I find the distinction easy to miss in reading and in writing. Others seem to agree: Friedman introduces a special convention (1976a:172), and Wilbur (1979: 51-52) consistently omits the blank in the seven tabhand signs appearing in a list that also includes about twelve double-dez signs. Throughout this dissertation I will use a period in place of the blank, thus: hh^{S} (two active hands) and $h.h^{S}$ (location-hand). So the schema hh^{S} will be equivalent (as in DASL) to $Øhh^{S}$, two active hands in neutral space; while $h.h^{S}$ will be equivalent to DASL's $h\ h^{S}$, one hand (written first) as base for the other's action.

The same usage will distinguish $\surd$ "forearm," used as location, from its use prefixal to a handshape symbol to indicate that the hand is held with the forearm prominent. In DASL the prefixal $\surd$ is simply written closer to the handshape symbol or overlapped with it: $\surd B_{\perp}^{D\cdot}$ 'lecture' vs. $\surd\ B_{\top}^{x\cdot\cdot}$ 'improve,' here written $\surd B_{\perp}^{D\cdot}$ and $\surd.B_{\top}^{x\cdot\cdot}$. In both cases the insertion of the period is purely graphical and context-free, and will be done automatically in quoting DASL or in referring to a transcription as "DASL notation."

I.B.3.a.v Spatial relation with location

When the location of a sign is the nondominant hand, spatial relationship becomes important and is often noted explicitly; that usage will be treated below. DASL sometimes uses relationship symbols even with body tabs, e.g. $\underline{\smile} B_{D<}{}^{D\cdot}$ 'pig,' location "lower face," relation "below," to indicate that the prone B-hand is under the chin rather than on the front of the chin or mouth as it is in $\smile B_{D}\overset{<}{\times}$ 'a lie, tell a lie,' $\underline{\triangle}$ "below" "midface" is similarly used for the upper lip: $\underline{\triangle} G_{<}{}^{\omega}$ 'kid, child (colloq. or slang).' Less transparently (and therefore explicitly, DASL:201), $\underline{\surd}$ "below" "forearm" for the elbow (outside, not crease): $\underline{\surd}.X^{x\cdot}$ 'tempt.'

I.B.3.b Handshape

On page vii of DASL Stokoe defines dez as "the active hand," but his usage elsewhere on that page and throughout DASL led to <u>dez</u> being generally understood as meaning 'handshape.' The dez position in Stokoe notation (the D in TD^{S}) may include information about orientation, focus, spatial relation, and indirectly even location as well as handshape. I will leave most of these for their own sections. In this work, dez will be restricted to the spirit of Stokoe's definition as the articulator(s) of a sign: the active hand, or both hands if both are active, and possibly the forearm. It will not refer specifically to the arrangement of the digits: that will be called handshape or, equivalently, hand configuration (HC) (sect. I.B.1.b).

Figure 1-8 shows the major handshapes used in ASL. There is some variety in notation: for instance, Stokoe uses A_s and A_t where many later researchers use simply S and T. In his analysis they are allophones of the "compact hand," which he notates as A: /A/ includes [A], [S], and [T]. In writing Stokoe notation I will keep to DASL's handshape symbols plus "horns" (see next section), though with extra diacritics as needed. In textual reference other symbols will be used when appropriate.

I.B.3.b.i Handshape diacritics

In addition to Stokoe's 19 basic handshape symbols and the others that have come into use (such as Y and 4), there are several diacritical marks indicating modification of a handshape. The best known are Stokoe's "dot" and "triple mark." A dot above a handshape symbol denotes extension of the thumb; it is most often seen in Ȧ and Ẏ. The "triple mark," three small ticks above a symbol, is used in DASL for bent knuckles. The fingers may be bent at the metacarpophalangeal joint (which I call the inner joint (see Fig. 2-8)) and/or the proximal interphalangeal joint (midjoint). (The distal interphalangeal joint (endjoint) generally agrees in flexion with the midjoint.) Stokoe considers these nondistinctive. $\dddot{B}$ is the commonest "bent" symbol. (In an occasional "idiomatic" usage, over C or E, whose fingers are already bent, it seems to refer to spreading of the fingers.)

Stokoe occasionally subscripts the movement symbols $\square$ ("opening movement") and # ("closing movement") to handshape symbols to show "open" or "closed" variations of handshapes, e.g. in FROG, $\underline{\smile}\ddot{V}_{\#}{}^{\dot{a}}$. Anderson (1978) uses it specifically for forms in which the thumb and fingertips are close but not touching.

Friedman (1976a) introduced the "angle" diacritic ^ to help distinguish the kinds of bending: it denotes bending at the first knuckle only, keeping the second and third straight. Her $\hat{B}$ is an angled hand. In $\hat{O}$ the second knuckle may be bent slightly, but not significantly: $\hat{O}$ (Friedman's "tapered O") is phonetically distinguished from the circular [$\overset{\frown}{O}$]. Anderson has suggested a cedilla for "hooked" handshapes, bent at the second and third knuckle but not the first. An arc written above the symbol can be used for bending at all knuckles, forming a visually round form. (This is homographous with "upper-head location," but would be written above a handshape symbol, as location would never be.) In referring to these handshapes in text I will follow Wilbur's usage (1979) and redundantly prefix a word describing the effect of the diacritic, e.g. "thumbȦ" or "round$\overset{\frown}{F}$."

A lowercase b prefixed to a symbol indicates a "baby" form (McIntire, 1974) using only the index finger instead of all four: most commonly bO (which is tapered, not round, so that in narrow phonetic notation [bO] should be written [b$\hat{O}$]).

Anderson suggests a diacritic for abducted thumb, i.e. projecting perpendicular to the plane of the palm. This is most useful for a handshape which DASL treats as a predictable form of L, not even acknowledging its phonetic distinctness; it can be written [L_{j}] or theoretically also [G_{j}].[3]

I.B.3.b.ii The 'forearm prominent' prefix

The prefixal use of $\checkmark$ "forearm" has been mentioned above (sect. I.B.3.a.iv). In 1965, Stokoe defined it simply as "forearm prominent" (DASL:xiii); later he sharpened the definition to "forearm near vertical" (1978:68), though that is not correct for all occurrences in DASL, e.g. $[\,]\checkmark B_{v}{}^{?\cdot}_{\mathrm{T}}$ 'late; not yet,' in which the upper arm is abducted sideward so that the elbow juts out and the forearm is actually directed forward or downward (Fig. 1-11). Prefixal $\checkmark$ can often be viewed as a coding of location -- frequently what DASL calls "high neutral space," i.e. at or above chin level -- into the dez symbolization. In some cases, e.g. $\bar{B}_{a}\cdot\checkmark B_{\wedge}^{\omega}$ 'tree' or $\checkmark\bar{B}_{a}\cdot\checkmark B_{a}^{\wr}$ 'baby,' the forearm is clearly being used as an articulator.

I.B.3.c Movement

Stokoe analyzes movement into 24 primes, which can occur individually or in clusters, plus several diacritical modifications. His presentation of them appears in Table 1-2; they are reclassified in Table 1-3.

Seven of the movement primes (and one diacritic) represent interactive movement in which the hands' activity is mutually defined, or one hand acts on the other (or on a body location). The others apply to a single hand, or to both hands acting in parallel, and (with one exception) fall neatly into two classes, corresponding to the External vs. Internal distinction mentioned above. This division is crossed by another which divides both groups into unidirectional and bidirectional movement, the distinction made by S & N's Directionality subparameter of movement (S & N, 1978).

The External movement primes need little explanation. Movement in lexical signs tends to stay in the directions of the cardinal planes (K, B, Newkirk, & Battison, 1979), notated with the first twelve movement symbols plus "circling." The Internal movement primes are as follows. Forearm rotation: when the hands are in front of the body and the elbows at the sides, the forearms are supine when the palms face up, prome when they face down. Note that when you pat yourself on the head, shoulder, or back the position is supine even though the palms face down. Supination (ɑ) and pronation (ʋ) are the rotations of the forearm to supine or prone position. (I find I need a mnemonic to distinguish the symbols: the little protruding curl or tick represents the hair on the back of the hand, which in normal "front-of-body" position is down in supination and up in pronation.) A minute observer standing on your right elbow and sighting toward your hand would see supination as clockwise movement and pronation as counterclockwise, regardless of the palm direction. (The opposite, of course, on the left elbow.) "Opening" movement (◻) is generally the extension of one or more knuckles of the fingers, as in changing from S or O handshape to C, V, or 5; "closing" (#) is the reverse. (The same symbols occasionally refer to abduction and adduction of the fingers: spreading them apart, as from R to V, or bringing them parallel, as from V to H.) "Wiggle" (ℓ) is most often bending the first knuckles of all extended fingers in alternation, producing a rippling effect from pinky to index; sometimes it is a single quick bending of the second and third knuckles of all extended fingers simultaneously. "Bend, nod" (ŋ) is flexing or extending the second knuckle, the first, the wrist, or even the elbow: Stokoe considers these nondistinctive, as there are no minimal pairs and some allowable variation between these joints. (Friedman reserved "bend" for wrist action, distinguishing first-knuckle bending as $\ulcorner$ and second-knuckle bending as Γ .) Stokoe considers all circular movement ($\circlearrowleft$) phonemically equivalent, regardless of plane, direction, size, or articulating joint(s).

Movement elements occur singly or in clusters, which may be sequential, simultaneous, or complex. Horizontally-written movement sequences are executed in left-to-right order, and vertical clusters are simultaneous. (DASL's graphic conventions forbid stacking simultaneous clusters higher than two, but triple simultaneous clusters exist, as in $^{(P)}B_a.X^{>}_{\frac{I}{x}}$, a formal pronunciation of WRITE, which is more commonly pronounced $^{(D)}B_a.X^{>\cdot}_{x}$.) (The following examples are illustrated in Fig. 1-12.) The sequential cluster in $\}B_D{}^{x\vee x}$, 'head,' written horizontally, consists of a touch (on the side of the head, $\}$), a downward movement, and another touch at the lower position. The simultaneous cluster in $\smile G^{\vee\cdot}_{x}$ 'red' -- downward movement and contact -- is to be understood as a brushing movement: the G-hand moves down across the lips or chin while maintaining contact. The complex cluster in $[]K^{x\vee x}_{>}$ 'king' has a touch (on the trunk -- specifically, near the nondominant shoulder), a diagonal movement downward toward the dominant side, and a second touch there. The complex cluster in $B_a.B_D{}^{x\wedge}_{\circlearrowleft}$ 'college' consists of a touch (on the upturned non-dominant palm) followed by an upward movement with a circular shape.

I.B.3.c.i Movement diacritics

Repetition of a movement (cluster) is shown by a dot written after it: $S\cdot$. (Recall that in these schemas upper-case S represent any movement or cluster, while lower-case s represent a single symbol.) Two dots

(S'') indicate multiple fast repetitions (Stokoe, 1978). A direction symbol below the first dot indicates that the repetition is displaced in that direction; the displacement is repeated in subsequent repetitions. Thus $\checkmark\!\cdot B^{\times\dot{\cdot}}_{\top}{}'$ 'improve' (Fig. 1-13). But a dot above a movement symbol (or simultaneous cluster) indicates "short, sharp, tense, or checked movement" (DASL:xiii): $G^{\dot{>}}_{v}$ 'damn'.

Opening or closing movement changes the handshape; the resulting handshape may be shown in brackets after the movement (cluster), as in $[\,]5_{<}\overset{\#}{\perp}{}^{[\gamma]}$ 'to like'; cf. $[\,]5_{<}\overset{\#}{\perp}{}^{[O]}$ 'white,' differing only in the final handshape.

The movement symbol ʻʼ 'interchange,' besides representing a movement in itself, is also used diacritically in two-handed signs to indicate that the preceding movement (cluster) is repeated, but with the hands changing roles. Compare $\bar{B}_{a}B_{\mathfrak{p}}{}^{\text{ʻʼ}}$ 'become' with $B'\gamma^{\times\text{ʻʼ}}$ 'Jesus.'

The symbol ~ "alternate" is used only as a diacritic with repeated or bidirectional (up-and-down, forward-and-back, side-to-side, or forearm twist) movement in two-handed signs.

I.B.3.d Orientation

As mentioned above, orientation can be described with respect to either space ("Externally") or the joints of the articulators ("Internally"). DASL does both. Movement symbols for unidirectional movement and forearm rotation (^ , v , > , < , ⊤ , ⊥ , a , ɒ) are subscripted to handshape symbols to indicate orientation. These symbols refer to the direction of the extended finger(s) and secondarily the palm. Rotational symbols are ambiguous in DASL, referring either to palm direction or forearm rotation. When the hand is in central neutral space, in front of the body, "supine" equals "palm up" and "prone" equals "palm down," but in other locations -- depending on forearm and wrist position -- this correspondence may fail, and DASL's use of rotational orientation may refer either to palm direction or forearm rotation. E.g., $\pi B_{\top D}{}^{\times}$ 'broke, out of funds,' with "supine" orientation, has forearm supine and palm down; $\surd G_{a}{}^{\wedge}$ 'always' has forearm supine and palm facing any way from up to backwards, depending on the variable longitudinal attitude of the forearm (forward to up). (See Fig. 1-14.)

About 15% of the signs in DASL leave orientation unwritten for at least one hand. Usually the unwritten orientation is one best described articularly: forearm semiprone, wrist straight. This is the neutral position of the forearm, in which all muscles are evenly balanced; it is the most favorable position for wrist and finger activity (Steindler, 1955:528). When the two hands are together in central neutral space, this articulation often produces a geometrical orientation that is oblique, contrary to the prevailing tendency to concentrate direction on the three cardinal axes (K, B, Newkirk, & Battison, 1979).

The application of directional symbols for orientation in DASL is contextual, depending on the handshape and the presence of other orientation symbols. They may apply to the fingers, thumb, metacarpals, or palm. Friedman (1976) proposed a convention for uniform and unambiguous anatomical directional specification of orientation: two symbols are used, separated by a hyphen. The first denotes the direction of the palm, the second that of the metacarpals, so $B_{\perp\text{-}\wedge}$ means a B hand with palm forward and metacarpals up (which with B also means extended fingers up). But this convention should be used in awareness of the phonological tencency to bend the innerjoint, maintaining finger orientation at the cost of palm-metacarpal orientation (section III.B.2).

I.B.3.e Directional relation

The relation between the hands also tends to gravitate to the cardinal axes of signing space. Stokoe could have used the same symbols for relation as for directional movement and orientation, but he chose to introduce separate symbols, which I will stay with (Table 1-4). This minor parameter also includes modes of contact between the hands: grasp, insertion, and cross. Cross is both contactual and directional: "dominant crossed with nondominant" ($h\ddagger h$) is to "nondominant-side direction" ($<$) as, e.g., "dominant above nondominant" ($\bar{h}h$) is to "upward direction" ($\wedge$).

Finding no lexical minimal pairs to distinguish them, Stokoe combined the two sagittal relations, "in front of" and "in back of" into a single relation that he called "tandem," with the symbol ϙ . When I need to make this distinction I will use the symbols shown in the lower portion of Table 1-4, which are visually reminiscent of ϙ and distinguished from each other as $\perp$ and $\top$ are.

Directional relation is often omitted in DASL. The graphically unmarked relation is side-by-side but not close: the symbol ' marks proximity or contact (here as in movement often neutralized) as well as direction. In some cases a different relation is implied: when the location is B_a (supine B-hand), the active hand is usually above it. The few instances in DASL of explicit "above" relation with this location ($\bar{B}_a$) are apparently no different from the majority in which the bar is omitted.

I.B.3.f Focus

As Wilbur observes (1979:56), point of contact, or focus, has received very little attention. In DASL it is relegated to the prose descriptive notes, with only one explicit exception: The handshape diacritic consisting of a dot above the symbol, normally "thumb extended," sometimes appears on a handshape whose thumb is already extended, denoting thumb contact.

Friedman (1976:71-78) noted the need to specify point of contact, as a solution to many cases in which orientation is subject to considerable variation which is difficult to constrain correctly within Stokoe's theory. She proposed five values, notating each with a graphic symbol in the spirit of Stokoe's symbols: finger tip(s), thumb tip, palm (including the dorsal surface of fingers folded over the palm in handshapes such as A and V), side or edge, and dorsal. Focus plays a somewhat different role in my analysis and requires somewhat different description and symbolization (sect. III.B.6).

I.B.4 A morphological note: classifiers

The morphological term classifier will be used a number of times before the detailed discussion in Chapter IV. Most simply put, a classifier in ASL is a hand representing an object, that can be combined with other morphemes that represent the location, orientation, and movement of the object. The handshape of the classifier is itself a morpheme, classifying the object in much the same way as the morphemes called "classifiers" in many oral languages (Allan, 1977); by shape (e.g. 'long and thin,' 'hollow,' 'wide and curved'), non-visual semantic category (e.g. 'vehicle,' 'small animal') or number (singular, dual, trial, plural). For instance, the G handshape (with just the index finger extended) is used as a classifier for objects that are linear (or "saliently one-dimensional," in Allan's terminology), such as a toothbrush or a pole. It also has a specialized reference to persons. G contrasts as a shape with B (all four fingers extended and touching), which is used for planar, or "saliently two-dimensional," objects such as a piece of paper, a door, or the ground. The 3 handshape is a classifier for vehicles. The numerical handshapes G '1,' V '2,' 3 '3,' and 5/4 'many' are often used as classifiers for '(so many) long thin objects,' especially '(so many) persons,' and in some ordinal constructions for '(so many) objects' regardless of shape, including even abstract objects such as topics of discussion. S & N have studied them extensively. K & W, Kegl (1976), and Wilbur (1979) are also valuable sources. In Mandel (1977) I studied them from an iconic point of view; much that is there called productive iconicity I would now call morphology (see Chap. IV).

Notes to Chapter One

1. Sequentiality in ASL is actually drawing considerable attention as an important characteristic that was (perhaps necessarily) ignored in earlier work (see Ellenberger 1977, Chinchor 1978b, Kegl 1981). The two-state form of analysis presented in Chapter II is an attempt to capture some of ASL's grosser phonological sequential characteristics.

1a. We know HELP (1) is the ancestral form from historical evidence (Frishberg 1976: 74, sect. 3.2.7) and comparison with French SL (Oléron 1974). HELP (2,3,4) are listed in DASL while HELP (5) is newer than the others.

2. My thanks to Jack DuBois for lending me his copy of Higgins.

3. Anderson (1978) proposes a horizontal line, thus: L_. Following a suggestion of mine he has since adopted the "ĵ" instead, which is consistent with his use of capital J for the flat hand with abducted thumb.

CHAPTER II

PHONOLOGY

II.A Introduction

II.A.1 The rationale for a multi-based phonology

Each of the four phonological paramaters recognized since 1974 -- HC, location, movement, and orientation -- is of underlying importance in at least some portions of the grammar of ASL. But other parameters, most notably focus, are often more useful than these in setting up underlying forms that economically and consistently predict observed forms and in describing and explaining variation and historical change.

I say "observed" rather than "surface" forms because in most cases that I will discuss, the "underlying form" that I propose is not buried. For example, DASL describes EMPHASIZE $B'\dot{A}_{D}{}^{\perp}$ (Fig. 2-1) as having a nondominant /B/ HC (implicitly held semiprone with palm contralateral) and a dominant /A/ HC, with thumb prominent, held prone, the two hands close or touching side-by-side and moving forward. My description is that the nondominant palm and the dominant thumbtip touch throughout the sign without relative motion, while the two hands as a unit move forward. In both analyses the implicit location is neutral space in front of the signer's torso. Both descriptions are surface-true, and each allows prediction of the facts made explicit in the other. But by allowing region-of-contact, or <u>focus</u>, to figure as a predicting variable rather than always as a predicted one, it is possible to capture many significant generalizations about ASL that cannot be stated in an analysis restricted to Stokoe notation's three major and two minor parameters (location, HC, and movement; orientation and spatial relationship of the hands). A /B/-hand can make contact at about ten regions, but the palm of any hand can be contacted only if the hand has a /B/ HC. Half a dozen HCs can make thumbtip contact, but thumbȦ is the commonest. Thus the description of the sign that uses Focus incorporates a markedness statement that the former does not. (But DASL's "thumb prominent," which yields thumbtip contact in that analysis, is included in the second description's "thumbtip focus.")

EMPHASIZE and RIDE $O^{\mathrm{o}}V^{\perp}$ (Fig. 2-2) violate the Dominance Condition (as formulated by Battison, 1978:34-35) by using different HCs while both hands move; the Condition can be reformulated to include this kind of case, but it becomes more complicated. The phonology proposed below distinguishes movement of one hand relative to the other from movement through space of the hands as a unit. The revised Symmetry Condition covers EMPHASIZE and RIDE in the same terms as other signs: "The non-dominant hand may not be specified for movement <u>with respect to the dominant hand</u> unless <u>all</u> its specifications (including movement) are the same for the dominant hand's, or opposite in direction."

None of the traditional parameters are ousted in the approach proposed here, for all are necessary. Some are severely reanalyzed; HC especially almost disappears as an inventory of handshapes, to be replaced by feature matrices that usually are only partially filled. In fact, many signs can be underlyingly described in more than one way, each description then being completed in terms of other parameters by redundancies that produce the same observed form. Some of these varieties and redundancies hold between parameters. The foci of COST $B^{\mid}, X_{X}^{v}$ (Fig. 2-3), dominant knuckle and nondominant palm, predict the HCs, orientations, and spatial relationship of the hands. Many of the same phonotactic redundancies exist in DANCE $B_{\alpha}.V_{v}^{\gtrless}$ (Fig. 2-4), and the sign as a lexical item should be described in the same terms so as to reflect them; but unlike COST, DANCE bears clear synchronic morphophonological relationships to other signs via its HCs and orientations: B 'flat surface', B_{a} 'flat horizontal surface', V_{v} 'legs (and, by semantic derivation, [usually] human activity involving the legs)'. We must be able to specify HC and orientation to describe the morphophonological system that produces this sign and is still productive of indefinitely many novel constructions (S & N), but we must also be able to specify focus to capture the phonotactic constraints on lexical signs, including signs like DANCE that originated within the morphophonological system but are now "frozen" as signs and are treated as part of the lexicon rather than the morphology.

Some redundancies consist of different ways to describe a single parameter of an observed form. CATCH/GET-HOLD-OF has two forms, $G_{\wedge}.\dddot{V}_{T}^{I}$ and $\dot{A}.\dddot{V}_{T}^{I}$, with tab focus on the index finger and thumb respectively. DASL writes orientation only for the G-tab, implicitly stating that the thumbȦ is held with forearm semiprone. "thumbȦ semiprone" is correct for describing the phonotactic neutrality of this orientation. But to describe the connection between the forms we have to say that in both the single extended digit points upward, and for that we must say "thumbȦ with thumb up." This is quite different from "thumbȦ semiprone." In mid-neutral space they coincide, but near the ipsilateral shoulder, "thumbȦ semiprone" (as in REFUSE $[]\dot{A}^{\top}$ or GIRL $\rfloor\dot{A}^{\dot{\perp}}_{\times}$) points backward over the shoulder, and "thumbȦ with thumb up" (as in BETTER $\smile B_{<}{}^{\#[A]}_{\wedge}$ or the final state of TOMORROW ʒ$A\overset{\perp}{a}$) is supine.

Since all the parameter values are manifest in the observed form, the question of which to choose as "underlying" is a matter of usefulness. The location of ESTABLISH Ʋ$\dot{A}^{\frown\times}$ and INSTITUTE Ʋ$I^{\frown\times}$ ~ Ʋ$I^{\times\cdot}$ is morphologically meaningful: (Fig. 2-5) back-of-hand 'external space' (Frishberg & Gough, 1973). Like many others, this morpheme contains a frozen icon (sect. IV.A): the back of the hand is horizontal, with the dominant hand above it (the ground is horizontal and things are on top of it), and the hand is therefore palm-down. But the signs can be described as frozen lexical items without recourse to iconic or morphological information, using only the phonotactics of ASL: Distributionally, the two commonest Directional Relationships between the hands are dominant-above and dominant-beside (i.e., on the dominant side of the nondominant hand). The nondominant's Focus must face the dominant to make contact with it. It is relatively difficult to turn the back of the nondominant toward the dominant side of the body, so dominant-above is the remaining least-marked DR. If the dominant is above the back of the nondominant, the nondominant must be palm-down, which in mid-neutral space equals Internal prone Orientation.

But INSTITUTION has a newer form in which the nondominant hand has assimilated to the dominant in HC and Orientation, shifting its Focus to the radial edge: $\bar{I}.I^{\times\cdot}$. In this newer pronunciation, edge Focus is simply a result of the dominant-above-nondominant DR and the articulatorily neutral semiprone Orientation of both hands. So the set of parameters that must be specified and that affect the nondominant hand has shifted. In the sign's morphological origin it was nondominant Focus and Orientation, and Directional Relationship; then in the frozen lexical item, phonologically, Focus (with unmarked DR an the Orientation determined by those); and in the innovative form, a phonological equating of the nondominant hand to the dominant in HC and articulatorily-neutral Orientation (with unmarked DR and the resultant Focus).

Different combinations of underlying parameters and of terms of specification within parameters are necessary to describe and explain different sets of facts in sign language: synchronic phonotactics, etymological, inflectional, and derivational morphology, historical change, variation, acquisition, and cross-linguistic distribution. The type of analysis that suffices in one corner of the field is often inadequate in another. For that reason I am attempting to construct a <u>multi-based</u> phonology of ASL. This work is very far from being a complete statement of such a phonology, but I hope that it will prove useful and encourage other students of of sign language structure to use it and develop it according to their needs.

II.A.2 Arrangement of Chapter II

The rest of this chapter presents a multi-based analysis of the manual portion of ASL phonology. Section II.B is divided according to parameters, plus a section each on scale, state, and direction. (Scale and state are analytic divisions of signs, each of which can be applied to many parameters. Direction is used in the specifications of Movement and Orientation.) The last part of II.B, on Movement, is arranged by subparameters. Hand Configuration is analyzed in considerably more detail than the other parameters; that analysis, and a discussion of previous features analysis of HC, is presented separately as section II.C.

Section II.D is a brief presentation of three processes that are mentioned in various places through this dissertation: Compression, Expansion, and Condensation. Section II.E is a similarly brief presentation of reinterpretation, which mediates much phonological change in ASL. The chapter concludes with a number of phonological examples, analyses of observed sign forms in terms of the minimal specifications that phonotactics makes possible.

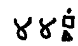
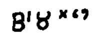
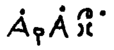
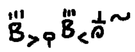
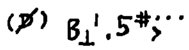
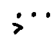
II.B The Parameters

None of the parameters used in this analysis is entirely new, but some of the distinctions within them are new. I have added two parameters to Stokoe notation's five: Focus and Proximity (which includes contact). Battison (1978), Wilbur (1979), and K, B, Newkirk & Battison (1979) have recognized the significance of focus, and Friedman (1976) formally gave it parameter status, replacing orientation when the sign includes contact. Friedman established values for contact as a feature of movement; those values, as well as some information that DASL distributes across movement and directional relation, are included in my Proximity parameter. The Articulators parameter is adapted from K, B, Newkirk, & Battison's Hand

Arrangement. Movement is divided into a number of semi-independent subparameters: Shape, Pivot, Direction, Directionality, Frequency, Manner, Symmetry, and Phase. And all of these parameters are cross-cut by two further dimensions of classification, Scale and State.

II.B.1 Scale

Many of the same principles can be observed to govern ASL phonology on several different scales of interaction. Internal interactions are those within a single articulator: the positions of the thumb and fingers (HC), their movements, and the positions and movements of the wrist, forearm (rotation), elbow, and shoulder. External interactions take place between the two hands (Dyadic scale) and between the hand(s) and the signer's body and the space and objects around it (Spatial scale). These scales should be taken less as a rigid way of applying parameters than as a heuristic for generalizations and a way of organizing data.

In TINY  , the Movement is Internal, and the Orientation can be specified either Internally, as supine, or Externally, as palm-up: in mid-neutral space the two are equivalent, and there is no basis for choosing between them (see Fig. 2-6). (HC is always Internal, though External parameters may affect it.) In HATE  Orientation is External, defined in terms of the spatial location assigned to the object of the verb. The Movement has both Internal and Spatial (External) components. The hands do not interact: they act in parallel but independently, and the only Dyadic relationships result automatically from the Internal and Spatial specifications (DR: dominant ipsilateral of non-dominant; Proximity: Middle-distance). In JESUS  the Movement is Dyadic: contact with the other hand, followed by a reversal of dominance roles. COST involves the hands Dyadically with no role reversal. And in CHASE  , PROGRESS  , and EMPHASIZE the hands interact with each other (Dyadically) while the manual dyad moves as a whole through space (Spatially). Rarely are all three levels needed for a lexical sign without inflection (aside from HC specification -- when needed -- on the Internal scale). But inflections for person, location, aspect, and temporal and spatial distribution, which impose Spatial movements, can produce such complex articulations: e.g., TAKE-PICTURES-OF-EACH  (where the notation  "moving repetitions" is an ad hoc expression of the lateral movement of the whole sign, including the tab hand, as the dez repeats its Internal Movement).

II.B.2 State: Initial and final specifications

Battison (1978) stated a "metric constraint" on signs that change location or HC (it also applies to orientation): they are limited to at most two values of the changing parameter, i.e. the movement can include only a single change from one state to another (with possible repetitions). Stokoe notation easily accommodates such change-of-state movements when the change is one of HC or orientation, or a change of location within a single tab, but it has to treat signs with larger changes of location as compounds regardless of their morphological structure, e.g. NUN $\supset B_{\mathfrak{d}}B_{\mathfrak{d}}{}^{\times} \,\vdots\, [\,]\, B_{\mathfrak{d}}B_{\mathfrak{d}}{}^{\times}$. In fact, what we call the parameter of movement can always be viewed at the phonetic level as change in one or more other parameters. It is not phonologically fruitful to treat all movements in this way -- for example, circling movement is better characterized by its shape than as a sequence of locations -- but for many movements a two-state analysis is possible and useful. In a changing-location sign like NUN, all other parameter specifications are the same in both states. The contact (described in the Proximity parameter) is the simplest possible in each state, a single touch; Focus is Fingertip(s); and the only HC specification is [4 Fingers]. (It is also specified for double dez: nondominant hand active, specified equal to dominant hand for all parameters.) UNDERSTAND $\wedge X_{\tau}{}^{\mathfrak{a}[G]}$ which changes only in HC, is specified for Final HC [1 Finger] (which defaults to G) and steady-state values in all other parameters. (See Fig. 2-7.) The predictability of changing HC values (discussed in detail in Chapter III) permits an underlying unspecified Initial HC. DEAD $B_{\mathfrak{d}}B_{\alpha}{}^{a}_{\mathfrak{d}} \equiv B_{\alpha}B_{\mathfrak{d}}{}^{\mathfrak{d}}_{a}$ has double dez, like NUN, and a specified B HC ([4 Fingers, -Bent]), parallel Symmetry, and Final Orientation horizontal. In some signs -- FLOWER $\triangle O^{\times>\times} \equiv \triangle O^{\times<\times}$, PARENTS $\supset \dot{5}^{\times\wedge\times} \equiv \supset \dot{5}^{\times\vee\times}$ (MOTHER and FATHER compounded), and PIE $\bar{B}_a . B^{TT}_{<>} \equiv \bar{B}_a . B^{TT}_{><}$ among them -- the elements can occur nondistinctively in either order. Then the states are arbitrarily labeled State A and State B rather than Initial and Final.

By convention, any specification not labeled as belonging to one state is constant throughout. This reflects the assumption that a changing value is more complex than a constant one. And since changing state is generally more marked than steady state, we will also assume that a specification of state for a prime or feature value, such as "Initial Location: Lower-face," "Final HC: [1Finger]," or "State-A Orientation: Supine," implies a different value for the other state. (Contact is a partial exception to these conventions and will be discussed in its own place.)

Friedman (1976) considered a two-state description for signs, like FINISH $B^{\dot{\vartheta}}$, that change orientation as their movement, but she rejected it as missing the essential characteristic: the movement itself. A multi-based analysis can describe movement in terms of states where that is helpful without giving up the ability to describe it dynamically in cases like FINISH.

II.B.3 Articulators

K, B, Newkirk, & Battison's (1979) minor parameter of <u>Hand Arrangement</u> figures in this analysis as an easy way of summing up part of the relationship between the dominant and nondominant hands: either only one is involved in the sign (by definition, the dominant hand), or both are involved and active, or one is active and the other functions as basehand. In this analysis the use of the (by definition) nondominant hand as base is shown as the specification [Dyadic Location: Other Hand],

and the Articulators parameter describes only how many hands are active, one (<u>Single-dez</u>) or both (<u>Double-dez</u>). (Usually only one Location specification is needed and the "Dyadic" will be omitted. Single-dez includes signs with and without nondominant basehand.) Theoretically the Articulators parameter also operates on the Internal scale, specifying the digits involved on the hand, but that function is so linked with HC that I have placed it in the HC features for Number-of-fingers, selection of individual fingers, and thumb involvement.

II.B.3.a Use of the forearm

The forearm can participate in a sign as Location or articulator. DASL distinguishes Elbow from Forearm as Location by the Directional Relationship diacritic "under" (_); Friedman lists it separately and distinguishes the top and bottom of the forearm. These are simply different sides: Proximal, Dorsal, and Palmar respectively.[1] They can be specified for Focus and Orientation just as the sides of the hand can. BRIDGE $\checkmark.V^{\times>\times}$ has [Location: Forearm; Focus: Palmar; Directional Relation: Under], and SHEEP $\checkmark.V_{\alpha<}^{\#\cdot\cdot}$ has [Location: Forearm].

Things get more interesting when the forearm is involved as an articulator. DASL codes it with the "forearm prominent" prefix, as in $\bar{B}_{a}.\checkmark B_{\wedge}^{\omega}$ TREE, where the forearm is a morphophoneme indicating a long, straight object (Supalla, 1978). But prefixal $\checkmark$ is also used when forearm prominence is only phonetic, as in $[]\checkmark B_{\vee\top}^{?\cdot}$ NOT-YET, in which the forearm is "prominent" only as a result of the unusual Location beside the trunk. What the morpheme in TREE requires is a specification that the forearm is oriented Distal-up and the wrist is straight. (In his version of "Jabberwocky," Lou Fant translates "tum-tum tree" by a form of TREE in which the forearm is erect as in the normal sign, but the wrist is bent so that the hand is palm-down: $\bar{B}_a . \checkmark B_v{}^{\omega}$.) Odd though it may seem, the articular position of the wrist belongs with HC. Perhaps HC ought to be renamed "Joint Positions," as the repository of all Internal information about the sign except Movement. Prone and supine orientations (as distinguished from Palm-Up and Palm-Down) are internal to the articulators and belong here too. But the position of joints outside the hand is so rarely required in an underlying specification that I would rather keep an established name for the great bulk of this parameter's content.

The forearm's Orientation can even be more significant than the hand's. DASL also writes TREE as $\checkmark\bar{B}_a . \checkmark B_{\wedge}{}^{\omega}$, reflecting the way the nondominant forearm lies across the signing space. But the nondominant hand can actually be prone or supine. At that height, below the sternum, it is in the borderlands of low visual acuity for the viewer (Siple, 1978), and the forearm's gross lateral Orientation is much more prominent than the Internal rotational Orientation of the forearm and hand.

II.B.4 Location

The analysis of Location presented here is the least changed of all the parameters. Not that no changes or improvements can be made -- K & W offer a feature analysis of location, and Poizner & Lane (1978) provide the beginnings of a perceptually-based feature analysis -- but while my studies of HC, Focus, and Movement have interlocked and forced each other forward, they have provided little insight toward a revised view of Location. My presentation of Location is not formalized or advanced, but its relation to the rest of the analysis should be able to accommodate future findings easily.

The phonotactic data about Type 3 (Dominance Condition) signs presented in Chapter III does open an interesting possibility that could find practical application in devising a sign language orthography. These are signs with different Hand Configurations on the two hands; the Dominance Condition requires that one hand serve passively as the base for the other's action. The data in Chapter III demonstrate that the Focus of such a basehand accurately predicts its HC in most cases, and in fact is more informative than specification of basehand HC. Therefore, the Location of such signs could be specified simply as the Focus of the basehand. This approach would put Palm, Edge, Finger, etc. (see section II.B.6, below) on a par with DASL's inside-of-wrist (a), Forearm ($\surd$), Lower-face ($\smile$), etc. The active hand too could often (though not as often as basehand) be sufficiently specified by its Focus alone.

Internal Location is not very useful. If anything, it corresponds to the finger selection features of HC. Dyadic Location is the nondominant hand used as Location ("hand tab" or "basehand"); such a hand is most often specifiable either as identical to the active hand in all respects, or by a single value for the Focus parameter, possibly along with a specification for the parameter of Directional Relationship (DR).

Spatial Location includes all body tabs plus several in Stokoe's "neutral space." The major changes here vis-à-vis DASL are the explicit phonological acceptance of morphophonological variables and nonphysical locations in neutral space, for neither of which I can take credit. DASL notes under $G^{\perp[>,<]}$ HE/SHE/YOU/THEY (non-1st-person index) that direction varies with deictic referent, and Fischer & Gough have examined verb deixis in considerable detail as it is used both for identifying and distinguishing referents (the sense to which I will restrict "deixis" hereafter) and for specifying the involvement of a body-part in a verb. Another example of deixis (narrow sense) is $O_a{}^{\Delta}$, PERSON-GIVE-TO-PERSON. Using deictic locations in a two-state analysis, we can say that the direction of this sign's movement is determined by its locations, [Initial Location: Agent, Final Location: Beneficiary]. (See sect. II.B.7, "The treatment of direction.") An example of body-part incorporation is $\frown G_{>} G_{<}{}^{x\cdot}$ HEADACHE vs. $\smile G_{>} G_{<}{}^{x\cdot}$ TOOTHACHE. The nonphysical locations are imaginary planes and deictic points in space, discussed by Lacy (1974), K, B, Newkirk, & Battison (1979), and S & N (Supalla, 1978). There is a vertical plane in front of the signer, oriented frontally ($\surd A_{D} \surd A_{D}{}^{\frown\sim}$ WASH-VERTICAL-SURFACE), and a horizontal one at mid-trunk level (${}^{(\emptyset)}3_{\perp T}.3_{\perp}{}^{\dot{v}\dot{\top}}$ CARS-BACKED-UP and $O_{v}O_{v}{}^{\perp}$ MOVE).

II.B.5 Hand configuration

HC can profitably be analyzed by dealing separately with the fingers that are involved in a sign and the position and action of those fingers. The features used for this analysis will be discussed in detail after the discussion of the other parameters, since they involve considerably more detail and I would like to compare them to previously proposed feature analyses of HC. They render possible the elimination of a great deal of HC specification that is unavoidable in any analysis that starts with an inventory of HCs. This is accomplished by the use of partially specified matrices where regular variation and distribution show precision to be spurious (e.g., [5] and [B], and the analogous [V] and [H]), and by the use of redundancy rules, both between features of HC and from other parameters (especially Movement and Focus) to HC.

Inasmuchas a HC can be described in terms of attitude, proximity, and contact of specified parts of the hand, the parameter of HC could be formulated wholly as Orientation, Proximity, and Location on the Internal scale. Such a formulation captures certain generalities of movement. Closing signs generally close the fingertips to contact, either with the thumbtip (opposition) or with the palm (closed HC, final [S]); final bent HC with near-opposition or near-closure is unusual.[2] This is the Internal-scale analog of the high frequency of signs with final contact and the comparative rarity of signs in which the dez approaches the tab (or the two dezes approach each other) but does not (do not) make contact. The generalization is described by making simple Contact (which is realized as end-contact) the least-marked specified value for Proximity and treating HC in the way outlines. But the HC features I will propose below are framed in more familiar terms, for comprehension and for comparison with other accounts.

II.B.6 Focus

Wilbur (1979) comments that the lack of agreed-on features for region of contact, which are necessary for a generative statement of her analysis of the distribution of Stokoe's /A/, points up the little importance theretofore attached to this parameter. Friedman (1976) had proposed a set of values based on surface distribution. This analysis includes more values for Focus, but I believe the descriptive advantages to be gained are worth the enlarged inventory. Focus actually analyzes the hand from several points of view (Fig. 2-8): parts of the hand (fingers, thumb, and midhand); sides of the hand (the back, the palmside, the ulnar and radial edges, the distal and proximal ends);[3] combinations of these (back of the thumb, edge of the fingers, etc.); and highlights of the "handscape" that exist or are accessible only with certain HCs (angle between spread digits, inside of a curve formed by bent digits, knuckle of bent digits, "bunch" formed by opposed thumb- and fingertips).

Like many factor analyses, this one is better as a guide than as a restriction. The palmar side of the /B/-hand is an extremely frequent focus, and the specification of "Palm" (the palm itself) seems at least as likely to be psychologically real as a set of specifications for HC and Focal handpart and side: [HC: all fingers fully extended; Side: Palmar; Handpart: Midhand(+ optionally Fingers)]. So Back (of hand) and Palm appear as Focus primes by themselves. Edge as Focus implies B-hand unless some HC features are specified that would conflict with B (and therefore force some other HC), e.g. [+Round], which requires C, O, or some other Round HC (sect. IV.B.1). The choice between Radial and Ulnar is almost always automatic, conditioned by ease of articulation or HC-specific constraints. Palmar and Dorsal sides often form a similar group, which I call the Flat of the hand.

I have almost never found it necessary to specify Distal side. Thumb- and fingertip(s), knuckle(s), and angle(s), which are the distal sides of fully-extended digits, flexed digits, and midhand respectively, each have much more tactile and visual integrity than the generality of their direction with respect to the metacarpals. As for the other pairs of sides, all HCs have Edges -- the existence of an Edge is immune to the position of the digits, so that Edge is not very informative as to HC -- but closed or bent fingers or a fronted thumb can distort or cover the Palmar side. That is probably why the Edges function usefully as a single Focus, but the Distal side is only rarely useful to the analyst (and, presumably, to the signer). The Palmar side of the dominant hand, whether specified as such or not, is very frequently involved, because it includes the Tips of bent fingers, the Bunch of an opposed hand, and the Inside of bent non-opposed HCs (C, X, bentV).

These are the Focus primes:

Finger (i.e. "Finger or Fingers"): the selected finger or fingers of the hand, seen as a whole: the "trunk(s)" of the finger(s).

Fingertip: just the tip(s) of the selected finger(s). Even in contact the finger "points," touching at a right or acute angle, not flat.

Thumb: the whole thumb.

Thumbtip: just the tip of the thumb, at an angle.

Digit: generic for "Finger" or "Thumb": used for alternations.

Tip: similarly generic for "Fingertip" or "Thumbtip."

Palm: the palm of the hand; physically accessible only when fingers are open (usually all fingers), and phonologically accessible only when they are extended at the innerjoint (usually fully extended, i.e. at all joints). Palm focus often "spreads out" to include the Palmar side of the extended fingers.

Back: the back of the hand: Dorsal side of midhand. This can "spread" to the fingers in the same way as Palm, but the tendency to flex the fingers under gravity and muscle relaxation in prone position often isolates the midhand visually and tactually when Back or Dorsal is the tab focus. Palm and Back are the Flats.

Edge: the radial or ulnar edge of the hand, from wrist to fingertip(s). It is straight if the index or pinky is straight, curved or compact if the finger is curved or closed. Radial edge includes the thumb if the thumb is in the plane of the index finger perpendicular to the palm, otherwise not (i.e., not if it is extended, as in 5, or folded across the palm and/or closed fingers, as in S).

Inside: the space enclosed by bent fingers, the palm, and the thumb if fronted (with or without opposition). In hooked HCs ([+Bent, +Closed], mainly X and bentV̈), the space inside the "hook": the closed fingers fill the space near the palm. This does not include the angle between two digits, but does include, as a special (marked) case, the compressed space inside a fist: S or (in one sign) I.

Angle: the space(s) between the digits, primarily between the fingers. Anatomically, this requires at least partial extension at the innerjoint. Focus on the thumb-index angle is derived from finger-angle focus in the few signs where it occurs.

Bunch: the surface of the joined thumb- and fingertip(s) in an opposed HC.

Knuckle: the (dorsal surface of the) midjoint and midphalanx of bent selected fingers.

Wrist: the wrist and the very base (extreme proximal part) of the hand.

All of these Foci can be the tab Focus in a Type 3 sign, i.e. with HC different from that of the active hand. Thumb and Thumbtip occur in that environment only as morphological variants of Finger and Fingertip, Bunch is infrequent, and Knuckle is found in only one sign in DASL. I will show in Chapter III that in most such signs Focus provides adequate information to predict the base HC.

II.B.7 The treatment of direction

Stokoe defined direction in signing space by four oppositions: up/down, right/left (i.e., dominant/nondominant), toward/away from the signer, and (primarily with both hands involved) toward (together)/away from (apart). The first three have often been taken as Cartesian, defining three mutually perpendicular lines, but "toward/away from signer" can also be read as polar (Fig. 2-9).

In the analysis presented here, as in DASL, direction is a defining element of several parameters: Orientation, Movement, and Directional Relationship. Its terms are different in the three scales. Spatial direction has, in the first instance, the three Cartesian oppositions, Up/Down, Forward/Backward, Ipsi(lateral)/Contra(lateral), and perhaps also the polar-coordinate opposition In/Out. Each of these pairs has a cover term that can be used to incorporate facts of markedness into the underlying description and in describing symmetrical movement: respectively, Vertical, Sagittal, Lateral, and Polar. For instance, in Directional Relationship the dominant hand is above the nondominant far more often than it is below it, so [DR: Above] can be treated as the unmarked value and the specification made as [DR: Vertical]. Or again, when the hands' Movement Directions are symmetrical and sagittal, as in HIGHWAY (Ø) $V_{\upsilon\top} V_{\upsilon\perp} \dot{\dot{\perp}}$ and HYPOCRITE (Ø) [ ] $/F_{\top} /F_{\perp} \dot{\dot{\perp}}$, the dominant generally moves Forward and the nondominant Backward, so [Symmetry: Symmetrical, Dir: Sagittal] can be specified in the Movement parameter. Sometimes the lateral directions are best specified in terms based on the use of both hands rather than of each individually, as Dominant/Nondominant instead of Ipsi/Contra, as in SAILOR (Ø) [ ] $B_v B_v^{x>x}$ and UP-TILL-NOW [ ] $G_v G_v \hat{a}$, in which the hands act on the same side of the body rather than in bilateral symmetry. "Horizontal" can also be specified: a finger can be horizontal, as in LAST $I_{>} . I \overset{\vee}{x}$ (Fig. 2-10) or WINDMILL (Ø) $G_{>}'. 5^{\omega}$, or the midhand or fingers may lie in a horizontal plane, as in LEVEL-SURFACE $B_{\upsilon}' B_{\upsilon} \div$ or LIMIT $B_{\top} B_{\top} \overset{\upsilon}{\perp}$.

In addition, any referent can be made a deictic object, and its direction will be morphophonologically distinctive in that discourse even if it would be unacceptable or nondistinctive in a lexical sign (Friedman, 1975). Since deictic directions can be distinguished much more subtly than nondeictic directions (Lacy, 1974), and since they tend to maintain their deictic tie to the referent and their anaphoric function regardless of how the signer turns or the referent moves about, it would be futile and unproductive to attempt to describe them beyond the phonetics of a single sign purely in the signing-space terms used for lexical signs. Therefore I have introduced another pair of directions: Toward/Away-from a deictic object. The symbols Δ and ∇ are useful to indicate these directions in Stokoe notation, e.g. INDEX(singular) $G_{\Delta}{}^{\Delta}$. (Mnemonically, capital delta stands for deixis.) An underlying definition of Orientation, Movement, Location, or Directional Relationship in terms of Agent, Beneficiary, or other words that smack of case grammar, or the word "Deictic," is a morphophonological incorporation of the direction or location of a deictic object into the sign. To these we can add <u>Across deictic object</u>. It occurs in native ASL plurals, such as YOU-PL., YOUR-PL., GIVE-TO-MANY, and GIVE-TO-EACH-OF-MANY (Fig. 2-11), which could be written as $G_{\Delta}{}^{\triangleright}$, $B_{\Delta}{}^{\triangleright}$, $O_{\alpha}{}^{\Delta\triangleright}$, and $O_{\alpha}{}^{\Delta\dot{\triangleright}\cdot}$, and the loan sign from fingerspelling #ALL $A^{\sqsupset}_{\triangleright}{}^{[L]}$ (Battison, 1978), which sweeps across its deictic object in the same way. Across-deictic-object need not move horizontally, but follows the distribution of its object, as in READ-DOWN-A-LIST $V_{\mathfrak{v}\perp}{}^{\vee}$. Toward-deictic-object seems to be more frequent than Away-from-deictic-object, so use of a deictic term without a preposition can mean toward that location: e.g., STUDY $B_{\alpha}\cdot 5_{\vee}{}^{\Omega}$ with [Dominant Orientation: Other Hand] (see next paragraph), BORROW $\tilde{K}K^{\Delta}$ with [Movement Direction: Goal].

Dyadic direction is defined in terms of the opposite hand (OH). Toward and Away-from are common to all scales, but dyadic direction has in addition directions defined by the sides of the other hand: OH-Distal (WEEK $B_{a} . G_{\text{v}} \overset{>}{\times}$), OH-Edgeward (VARIOUS $5 . G^{\times \ddot{}}_{\text{v}}\,^{\cdot}$), and perhaps others. When a Focus is specified for the other hand, OH-Toward and OH-Away are centered on it, otherwise on the other hand as a whole.

Two kinds of direction have Internal components. Stokoe analyzes change of HC as opening or closing, which are almost always in the direction of extension and flexion. (Spreading vs. alignment or crossing of the fingers is another dimension of finger movement, distinct from flexion/extension but infrequently used.) Flexion and extension of the wrist are also internal directions, as are supination and pronation of the forearm. All of these movements take place within the articulator without occasioning any gross movement through space. (The spatial movement caused by wrist and forearm action is not always significant; when it is, it can be treated separately as Spatial direction.) Two of these Internal movements can occur simultaneously: in BEAUTIFUL $\circlearrowright 5_{\mathrm{T}}{}^{a}_{\#}$, forearm supination and finger flexion to opposition; in QUESTION $G_{\perp}^{\dot{\ell}}$, finger extension and wrist flexion (Fig. 2-12).

The hands can also move spatially in directions defined by their own parts and sides: Tipward, Dorsal, Palmward, etc. (K & W treat all directional movements this way.) When it is necessary to use such directions they can be treated as Spatial.

One handpart that does not occur as a Focus is needed for this type of directional specification: the Base of the fingers. (Part of the Angle is at the base of the fingers, but the interaction there is always in the space between the fingers, never on the finger itself.) More generally this could be called Proximal, but in signs like THIEF $\smile H_{>} H_{<} \div$ (Fig. 2-13) or LINE $I_{>} I_{<} \div$, in which the innerjoint can be flexed, the hand moves in the line of the extended finger(s), not the line of the metacarpals whose Proximal end is the wrist. Using a separate term makes this distinction clear. Tip and Base collectively are the Ends, as Palm and Back are Flats and Radial and Ulnar are Edges. (Endward movement may be limited to morphologically-derived signs, including frozen ones (Chapter IV).)

II.B.8 Orientation

Orientation can be defined briefly in terms already established. Internal Orientation within the hand is subsumed into HC; in the wrist and especially the forearm it can be useful in stating articulatory constraints. S & N describe the forearm as a classifier morphophoneme meaning 'long', as in $\sqrt{V}$-'ladder'; in classifiers that use this morphophoneme the wrist position is significant and must be specified, as "extended" in the example. Each specification of External Orientation consists of two terms, a handpart or aspect and a direction. The handpart is normally the same as the Focus (if any), in which case it need not be specified explicitly; the direction can be Dyadic or Spatial.

From a purely geometrical viewpoint, an object in space requires two specifications to describe its orientation completely. DASL sometimes gives two specifications, one for palm direction and one for finger direction; Friedman (1976) and K & W theoretically always do, taking palm and metacarpals as the standard handparts. But a palm-plus-metacarpals description -- Palmar and Digital aspects -- while phonetically adequate, can be misleading. The dez of BOTHER $B_{q}.B^{\times\cdot\cdot}$ (Fig. 2-14) has Edge Focus: its Edge faces the object of the verb and the tab hand (which is between the dez and the object), and serves as the region of contact with the tab hand. Defining this orientation in terms of the palm and metacarpals will obscure the connection between morphology and phonology rather than clarify it.

To take another example, the basic pronoun INDEX $G_{\Delta}{}^{\wedge}$ points the index fingertip at the referent and moves in that direction. It is often assumed that the extended finger continues the line of the metacarpals, but in fact articulatory constraints frequently cause it to be flexed at one joint or another. (See Section III.C.2.b on "bent" HCs.) $G_{<}{}^{<}$ INDEX(contra) and $[\,]G_{\top}{}^{\top}$ INDEX(1st singular)/I/ME use [angledĜ], bent at the innerjoint, and the finger direction (which carries the deictic information) is not equal to the direction of the metacarpals. If we want to describe the orientation of $G_{\Delta}{}^{\wedge}$ phonologically, we should define it in terms of the finger, not the metacarpals. True, we could use the mechanisms of generative phonology to reduce the inventory of descriptive terms: "Underlyingly the innerjoint is straight and the metacarpals point in the deictically-defined direction. Then an articulatorily motivated rule flexes the innerjoint in some [defined] environments." But that formulation, by excluding the finger orientation from the description, would imply that the signer applies the deictic direction to the metacarpals and the viewer extracts it from the metacarpal direction plus the innerjoint angle. That would be improbably roundabout processing and complicated formalism, a high price to pay for a non-redundant inventory. It is preferable to assume that the signer applies the deictic orientation directly to the finger and the viewer extracts it from the finger orientation, and that the metacarpals lie where they may.

II.B.9 Directional relationship (DR)

This parameter belongs primarily to the Dyadic scale, in which it describes the direction from the nondominant hand, whether tab or co-articulating dez, to the dominant. Stokoe notation sometimes borrows DR diacritics as modifiers for body-tabs, e.g. $\underline{\smile}$ "under the chin," $\underline{\checkmark}$ "elbow" (both in DASL), $\overline{\wedge}$ "top of head" (Deuchar, 1978, for British SL) (Spatial DR); and Internal DR can be specified in HC to distinguish such pairs as the f and t of FSL fingerspelling (Fig. 2-15). The DR of the hands is usually defined in Spatial terms, in the Cartesian directions: Above, Below, Ipsi, Contra, In-front-of, and Behind. (DASL combines the last two into Tandem, symbol ♀.) DASL's DR symbol ' , as in WITH $A'A^{x}$, combines direction and Proximity: "side by side, close together, or touching" (DASL:xiii), while the DR value Ipsi is purely directional. Compare POSTPONE $FF^{\perp}$ and SENTENCE $F'F^{\div}$ (Fig. 2-16): both have double F dez in neutral space, with forearms semiprone, and dominant hand Ipsilateral or nondominant, but the Proximity value of POSTPONE is (unmarked) Medium distance (next section), while in SENTENCE it is Initial-Contact.

II.B.10 Proximity and its interactions with Movement

Stokoe (1960) treated various directions of what he called "brushing movement" as primes; in DASL (1965) they are reduced to simultaneous combinations of the single contact movement prime (x) and directional movement primes. A movement written as consisting just of contact, with no simultaneous movements, as in $[\,]B_{<}{}^{x}$ MY or $B_{D}{}'B_{D}{}^{x}$ FLOOR, is realized as a short movement starting with the dez close to the tab or with the two dezes close together, and moving to contact. S & N make this the phonological form of their morphophonological contact morpheme, with the meaning 'be located at'. Phonetic contact without movement (i.e., holding contact), maintained through the sign as the sole value of the Movement parameter, realizes their <u>hold morpheme</u>, meaning 'stay at'; it occurs only in the morphophonological constructions that they studied, and DASL has no notation for it as sole Movement. In the case of contact, then, changing-state is phonologically and morphophonologically less marked than constant state, when it is the sole Proximity specification of the sign. So when contact is the sole Proximity specification of the sign, changing-state is unmarked and constant-state is marked, the opposite of the situation with other parameters. (Some signs maintain holding contact with the body (Spatial scale) or between the hands (Dyadic scale) while changing Internal Proximity (changing HC) or Spatial Proximity (moving the manual dyad).)

<u>Contact</u> and <u>Non-contact</u> are values of the Proximity parameter. Non-contact is further divided into several distance values (tentatively three). <u>Medium</u> is the unmarked distance for double-dez hands that are not interacting but are acting in parallel, symmetry, or alternation on their own sides of the midline: PERSON [] KK^{v} , WINDING-ROAD $^{(a)}BB$, and JUDGE $FF^{\sim\sim}$ are examples (Fig. 2-17).[4] <u>Near</u> is the unmarked Initial Proximity implied by the simple specification Contact: a specification of simply "Proximity: Contact" implies "Initial Near, Final Contact." <u>Far</u> is used with emphasis or with Expansion, an augmentive modification (opposite to Compression) in which distances are increased, e.g., $5_{1}^{\#[o]}$ GO-AWAY (Spatial distance) and $G_{>}.Y_{b}^{x\cdot}$ BIG-WORD from $G_{>}.L^{x\cdot}$ WORD (Internal distance in the HC) (Fig. 2-18). (See K & W, 1976,[5] and II.D below.)

Non-contact is subdivided by distance; Contact is divided by relative motion. Some movement elements, including some contact types, are not amenable to a two-state analysis. Friedman's (1976) "Continuous contact" is one such.[6] Exemplified in PROUD $[\,]\dot{A}_{v}\hat{x}$, ENTHUSIASTIC $B'B_{x}^{\top\sim}$, and NAKED $DY\overset{>}{x}$, it consists of relative movement with unbroken contact so that one surface slides across the other. (See Fig. 2-19.) One might seek to formulate this contact as Initial Contact plus Final Contact, but two reasons stand against that proposal. Friedman's Double Contact, consisting of successive touches at two different locations or in two different orientations, as in FLOWER $\triangle O^{x>x} \equiv \triangle O^{x<x}$, NUN $\supset B_{v}B_{v}^{x} \,\|\, [\,]B_{v}B_{v}^{x}$, and MEANING $B_{a}.V^{xvx} \equiv B_{a}.V^{xax}$, is a natural candidate for two-state treatment.[7] Just as a single phonologically simple contact is realized as a single touch (/Contact/ becomes [Initial Non-contact, Final Contact]), double contact is realized as a touch, a lift, a move, and another touch. (Some details omitted here will be supplied later in this section.) Friedman's continuous contact differs from Double Contact in the transition between the states, just the part which two-state analysis ignores. And even if Double Contact did not pre-empt the formulation [Initial Contact, Final Contact], continuous contact feels different from touch without friction. Touch and pressure have proved significant in analyzing other parameters (for instance, in the derivation of [A] from [thumbȦ] under dorsal pressure on the thumb, sect. III.B.2.j), and I think it wise to take them into account here as well.

Combining friction with relative motion yields several analytic types of contact. <u>Sliding contact</u> is the paradigm type of Friedman's continuous contact, as in PROUD, ENTHUSIASTIC, and NAKED: one surface moves continuously across the other from one phonetic location to another, although usually within a single underlying location. In <u>Pivoting Contact</u> too is friction, but the movement rotates one or both articulators about a stationary point in their interface so that their relative orientation changes while their relative location stays the same: KEY $B^{\prime}.\chi_{<}{}^{\omega\cdot}_{x}$, CHEESE $\bar{B}_{a}.B_{v}{}^{\omega}_{x}$, COW $^{\wedge}Y{}^{?\cdot}_{x}$.[8]

Maintained contact may also be frictionless, either because there is no relative motion, as in <u>Holding Contact</u>, or because one surface rocks on the other without friction, in <u>Rocking Contact</u>. Rocking Contact usually involves Fingertip Focus and flexion at one or more finger joints, as in ANIMAL $[]\ddot{B}\ddot{B}{}^{?\cdot}_{x}$, MEDICINE $B_{a}.\forall\,{}^{\hat{o}\cdot}_{x}$ and WEAK $B_{a}.5_{v}{}^{?\cdot}_{x}$, but the movement can originate in joints outside the hand, as in PERFUME $[]\dot{A}{}^{\omega}_{x}$ (rocking on Thumbtip with forearm rotation). It goes with End-pivot Movement (sect. II.B.11.4).[9]

Holding Contact is a combination of a Proximity value, Contact, with a Manner value, Hold. Hold Manner can occur in "contact" with a virtual tab, as in S & N's examples (here using ⊠ as ad hoc Stokoe notation for hold, i.e. non-motion): $\dot{Y}_{v}{}^{⊠\triangle}$ 'fly from (place)', $\dot{Y}_{v}{}^{\triangle⊠}$ 'fly to (place)', $\dot{Y}_{v}{}^{⊠\triangle⊠}$ 'fly from (place) to (place)', and $\ddot{V}_{v}{}^{⊠}$ '(small animal) be stationary at (place)'. It is also found in Non-contact with a physical tab, as in $^{\wedge}\forall_{T}{}^{⊠}$ 'to be sick for a long time' (K, B, & Pedersen, 1979). As the examples show, Hold Manner can apply to Initial or Final State or be a steady state. Manner will be discussed in its own place, but since most lexical, non-inflectional uses of Hold Manner occur with physical contact I am keeping Friedman's useful name for the combination (Holding Contact) and discussing it at some length here. In lexical signs it is fairly common in a supporting role, maintaining the manual dyad through a Spatial or Internal movement (REQUEST $B^{\prime}B^{T}$, HELP $\underline{A}B_{a}{}^{\wedge}$; BUTTERFLY $5_{T}{}^{\#}5_{T}{}^{\ell}$, NEWSPAPER $B_{a}.L^{\#\cdot}$) or keeping the dez(es) at a body tab during an Internal movement (ACCEPT $[]55^{\#[a,o_{v}]}$, PIG $\underline{\smile}B_{v<}{}^{\flat\cdot}$).

Internal Holding Contact is part of HC: The contact between parts of the same hand in most HCs is Internal Contact, and whenever such a HC is constant in a sign there is Internal Holding Contact.

Pivoting Contact combined with underlying Focus resolves a small problem occasioned by the use of an inventory of HCs. The dez HC of APPLE (Fig. 2-20) is varyingly described as A or X, both forms being listed in DASL (p. 173). Long and Higgins both cite only the /A/ form ("'S' hand"), and Oléron shows a Modern FSL form with A or S and cites Lambert (1865) for the same. The actual HC is often intermediate, with the index innerjoint extended slightly more than the middle finger but not enough to get the finger out of the "fist" completely. We can now say that the Focus is Knuckle, and that in the underlying HC all the fingers act alike ([Uniform Fingers]): it is an /A/, i.e. the redundancies fill it in as /A/. But with Pivoting Contact and any Focus the interface is made as small as possible to reduce friction, improving efficiency and minimizing discomfort. (Other things being equal, velocity and hence friction at a point on the interface are proportional to the point's distance from the center of rotation.) The index midjoint is already "highest" in ordinary [A], and on the end of the fist; extending it a little more gives it clearance all around a small pivot point.) CHEESE $B_a . B_v {}^{\omega}_{\times}$, with its unusual phonetic focus on the heels of the hands, is derived from underlying Palm Focus in the same way.

On the Internal scale, Pivoting, Rolling, and Rocking Contact (all possible only between thumb and finger) are difficult to articulate and do not occur. The thumbtip slides across the fingertip(s) in SOIL $O_a O_a {}^{\ell}_{\chi}$ (Fig. 2-21), TINY $\dot{5}_a {}^{\sqcap}_{\wedge}\cdot$, and a few others; in DELICIOUS $\cup \gamma^{\wedge} {}^{\times}_{\perp}$ it slides along the middle finger.

In <u>Grazing Contact</u> the dez approaches the other surface, slides along it momentarily, and continues past it without noticeably slowing or changing direction. This normally requires the other surface to be parallel to the dez's line of motion, as in SLICE $A_{D}{}^{\prime}.B^{V\cdot\cdot}$, or to be flexible enough in that direction to be bent aside, as in CAN'T $G_{D}.G_{D}\overset{\check{\cdot}}{x}$ and EASY $B_{a}{}^{\prime}.B_{a}\overset{\hat{\cdot}}{x}{}^{\prime}$ (Fig. 2-22). Unlike Sliding or Holding Contact, Grazing Contact has a sequence of distinct contactual states; but unlike Initial Contact or Final Contact (= simple Contact), its sequence includes three distinct phonetic states. It is, in fact, the inverse of Double Contact: two periods of non-contact interrupted by a period of contact and unified by a single, unbroken motion. Just as Double Contact is equivalent to [Initial Contact, Final Contact], Grazing Contact is equivalent to [Initial Non-contact, Final Non-contact]. Each requires enough additional information to determine the direction of the movement, either as an explicit specification in the Direction subparameter of Movement or as an automatic consequence of some other information, e.g. Initial Directional Relationship of the hands. Just as the unmarked state-lebeling for contact is the opposite of that for specific non-contact values of Proximity and for other parameters (changing-state rather than steady-state), identical Initial and Final specifications, which for other parameters are equivalent to a steady-state specification and are therefore not used at all in coding movement, are interpreted for contact as being separated by a period of the opposite specification and united by a single, smooth movement. So [Initial Contact, Final Contact] is realized as Double Contact, consisting of touch-lift-move-touch, and [Initial Non-contact, Final Non-contact] is realized as Grazing Contact, consisting of nearness-touch-slide-depart.

The unmarked value for Non-contact, Near, is often Expanded to Medium distance under stress (Friedman, 1976a). In Double Contact the transitional movement, usually made close to the tab (Proximity: Near), is extended away from it, e.g. in COMPLETELY-DEAF ø) 3 G ˣ ⁄ ˣ ˣ (Fig. 2-23). Phonetic Initial Near at the onset of Grazing Contact often remains Near under stress, but the Medium position is infixed between the Near and the Contact; in other words, the single, smooth movement to and past contact is preceded by a reverse movement away from the tab, as in CÁN'T G_D. G_D ^ ẋ 'utterly impossible'.

II.B.11 Movement

Movement, the four-dimensional parameter of signs, is the most complex and hardest to capture. Although two-state analysis lets us isolate some of the complexity, plenty remains. K, B, & Pedersen (1979) and K, B, Newkirk, Pedersen, & Fischer (1979) have found shapes of movement in aspectual and aspect-like inflections that are not used in the lexicon of uninflected signs. Supalla & Newport (1978) have demonstrated that lexical movements are nested within inflectional movements, which themselves can be nested (with the order of nesting significant) in a way that is readily described by the phonological cycle. The analysis being proposed here does not attempt to cover such inflections, and for the most part I will not discuss them.

But simultaneous combinations of movements do occur in the uninflected lexicon. DASL notates as simultaneous clusters of Movement primes some movements that are treated here in terms of contact (in the Proximity parameter) or separated by scale: e.g., PROUD $[\,]\dot{A}_{v}\hat{x}$ and FINGERSPELL 5_{v} . Other simultaneous movement combinations, however, are harder to analyze in these terms. A repeated movement can be superimposed on a movement that carries the hand through space, displacing the iterations in a line or creating a shape that can be viewed independently of its phonetic components. In IMPROVE $\checkmark . B^{x}_{T}$ and LIST $B_{T}.B_{<}{}^{x}$ repeated contacts string out in a line; in SNAKE $\underline{B_{v}}.\checkmark G$ and GO/COME $G_{>}G_{<}$ a circular movement is superimposed on a straight-line movement resulting in helical movement in SNAKE and a rolling effect in GO/COME; and in EXAGGERATE $A_{vp}.A_{v}$ repeated bidirectional wrist-nodding superimposed on straight-line movement creates a wavy motion (Fig. 2-24).

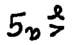
The best I have been able to do in describing Movement is to apply to it the principles already presented -- two-state analysis, separation of scales, alternate terms of analysis (especially in direction) -- and some phonotactic findings. Repetitions and their effect are handled in the Frequency subparameter. Insofar as two-state analysis is helpful it shifts the description of movement out of the Movement parameter entirely, as in DEAD $B_{ɒ}B_{a}{}^{a}_{ɒ}$ or $B_{a}B_{ɒ}{}^{ɒ}_{a}$, GIVE $O_{a}{}^{\triangle}$, PARENTS $\overset{\frown}{\smile}\dot{5}^{\times\vee\times}$ or $\overset{\frown}{\smile}\dot{5}^{\times\wedge\times}$, and MISUNDERSTAND ${}^{\frown}V^{\times a\times}$ or ${}^{\frown}V^{\times ɒ\times}$. Of course, in a multi-based phonology the use of two states to describe a sign does not preclude its description in terms of Movement, and such descriptions (e.g. deriving a Direction of Movement from two Locations) may be necessary for relating different forms of a sign or different occurrences of a morpheme, or a sign's historical development. Pivot refers to the part of the articulator at which a movement is "hinged": usually, but not always, a joint. (See next section.) I have attempted to segregate into the Manner subparameter (based in large part on S & N's work, especially Supalla, 1978 and S & N, 1978) as much as possible of the variety that signs display in tension and pacing. Phase is the same as Stokoe's "alternating movement" ($\sim$) or its absence (synchronous movement) in a double-dez sign.

Stokoe's analysis specifies movement for the sign as a whole, to be read as applying to both hands in double-dez signs and to the active hand alone in one-hand and tab-hand signs. When the hands move in opposite directions, Stokoe describes their movement as "approaching" (or "contacting," "grasping," and "crossing") or "separating," which avoids the issue of direction altogether. Parallel rotation of the hands appears as the peculiar specification ${}^{a}_{ɒ}$ or ${}^{ɒ}_{a}$, "simultaneous pronation and supination," as in DEAD. In this analysis Movement is specified separately for each hand (except the subparameters Symmetry and Phase, which apply to the whole movement). The nondominant hand's Movement, like its other parameter values, can be specified as equal to the dominant's or (for Direction) opposite.

Some of the characteristics of Movement that I am calling subparameters could just as easily be called features (e.g., Friedman, 1976). My only reason for not calling them that is that I think of features as being more systematized and redundancy-free than these descriptive subparameters are; cf. the HC features in section II.C.

II.B.11.a Shape

It is tempting to try to divide combined shapes of movement into a smaller and a larger component: in other words, to analyze them by scale. Friedman (1976) distinguished "micro" from "macro" movements according to the "height" of the joint from which they pivoted.[10] Her "micro" movements are midjoint, innerjoint, and wrist; her macro movements are linear, circular, and forearm rotation, flexion, wiggling the fingers, and opening and closing the hand. (I have translated her terminology to that used here.) But the micro/macro distinction does not hold as an absolute. Wrist nodding and forearm rotation can function as either the smaller or the larger component of a "complex-shape" movement: smaller in EXAGGERATE and SPIRIT $O^{\circ}\cdot F\hat{\omega}$, larger in ASK-A-QUESTION $G_{\#}^{\circ}{}^{\square}$ and BEAUTIFUL. About all that can be done is to describe each component in its own terms, Externally as shape or Internally as articular movement, and describe if necessary the relation between them. My subparameter Pivot distinguishes Friedman's first three "micro" movements.

When both movements are Internal this relationship is straightforward, with only one possibility: for example, supination and sequential closing of the fingers to opposition (in BEAUTIFUL) do not interact and there are no alternatives in doing both simultaneously. Similarly an Internal and an External movement do not interfere with each other, e.g. FINGERSPELL  with simultaneous finger wiggling and straight-line movement. But circular movement can relate to straight-line movement in two ways, as exemplified in SNAKE and GO/COME. The circular movement in SNAKE takes the direction of the linear movement as an axis, while the circling in GO/COME is tangential to the straight line. This distinction could be coded indirectly in terms of the directions of the two movements -- SNAKE has frontal-plane circling and forward linear movement, while GO/COME has circling in the deictic+vertical plane and deictic linear movement. But that gives no description of the overall shape of the movement, the difference between a spiral and a "rolling" effect, so I will distinguish these by tagging the circling as "axial" (e.g. for SNAKE) or "tangential" (e.g. for GO/COME) to the linear movement.

That rather fudgy solution doesn't fit well with the general organization of the Movement subparameters, but circling movement is unusual in several ways. Besides relating in different ways to linear movement, circular movement can itself be specified for direction, in two ways. Every circle exists in a plane, and a line through its center perpendicular to that plane is its axis. The plane may be defined by the Cartesian directions or by the use of a single joint as a pivot. (K, B, Newkirk, & Battison, 1979:52 find that circling tends to be in one or another of the nonphysical Cartesian planes of signing space. But K, B, Newkirt, Pedersen, & Fischer, 1979:397n8 find that some inflectional circling is pivot-defined and some is plane-defined. Some lexical circling is also pivot-defined, e.g. ALWAYS  .) In addition, a circling movement must go one way or the other around that axis, clockwise or counterclockwise as seen from some arbitrary vantage: this is its sense of rotation. Both can be significant, though not necessarily with direct morphophonological motivation. WASH-WALL and WASH-FLOOR are distinguished by their virtual Location planes, which appear in the observed forms in hand Orientation and plane of circling; VISIT-SOMEONE and BE-VISITED differ only in sense of rotation. These distinctions will be handled as Direction.

The Shape values that seem most likely to be useful are those that S & N have found to be morphophonologically significant. Linear (the simplest, and least marked) and Arc effect movement from one location to another or in a direction; Circular moves the hand in a single Location (though in low-level phonetic terms the Location changes cyclically); and End-pivot and Mid-pivot change Orientation, keeping stationary either one end (or side) of the articulator, or its middle. S & N's other two morphophonological movement shapes, Contact and Hold, are slight movements at a single Location, and can be viewed either as shapes or as State and Proximity specifications (sect. II.B.10).

Phonetically, circular movement also requires specification of plane and sense of rotation (section II.B.11.c); circling defined by Pivot (next section) has its plane determined by the articulator's orientation. Double-dez circular movement also can differ in Phase (section II.B.11.h), but that is almost entirely predictable (section III.D). Often the plane of circling can be described or predicted by Focus. With Flat (Palmar or Dorsal) Focus, circling is in the plane of the Flat (Palmar PLEASE , Dorsal PROSTITUTE); with Digit Focus, the axis of circling is parallel to the thumb or finger (Thumb MINGLE , Finger TRAVEL , and ALWAYS).

End-pivot and Mid-pivot movement shapes can be further specified either for Direction of pivoting or for the initial and final orientations, and End-pivot additionally requires specification of the stationary point. Usually that is the Proximal end -- the wrist, or the elbow if the forearm is included in the articulation (an example is illustrated in Fig. 4-1h) -- but the Tip or Edge can be the pivot if it is held against another surface with Rocking Contact (sect. II.B.10), as in TIRED []B̈vB̈v$^{a}_{x}$, ANIMAL []B̈B̈$^{\eta\cdot}_{x}$, BOOK B'B$^{a\cdot}$ (all with B), and MEDICINE Ba·Y$^{?}_{x}$ (with Y). E.G., DEAD $B_a B_\upsilon$ $^{\upsilon}_{a}$ or $B_\upsilon B_a$ $^{a}_{\upsilon}$ requires [Final Ori: Midhand Horizontal], but COOL ◌̑ $B_{\wedge T} B_{\wedge T}$ $^{\eta\cdot}_{T}$ is better described as [Directionality: Bidirectional; Direction: Palmar-Dorsal].

II.B.11.b Pivot

Anderson (1978) and Frishberg (1976) have observed a historical tendency of signs to "lighten" (Anderson's term), shifting from articulation at the shoulder distalward to articulation at the elbow, from the elbow to the wrist, and from the wrist to the forearm (rotation). This requires a way to specify the joint from which the movement is made. Additionally, the End-pivot shape of movement can "hinge" at the edge or tip of the hand with Rocking Contact (sect. II.B.10). I propose therefore the following values for Pivot: the joints Shoulder, Elbow, Wrist (referring to flexion and extension), Forearm (referring to rotation: supination and pronation), Innerjoint, and Midjoint; the foci Tip and Edge (allowing the possible distinction of Radial and Ulnar). (The shoulder can rotate the upper arm and move it in two directions, forward-backward and sideward-inward. I do not know if Shoulder pivot is ever specified underlyingly; if, as I think, it is only needed as a resultant value, predictable from the specifications that are underlying, then the distinctions between these motions may not be necessary.)

II.B.11.c Direction

Direction for most movement shapes can be specified in the terms described above (sect. II.B.7). When the movement is determined by Proximity or Location in two states, Direction need not be specified at all. For example (Fig. 2-25), FRUSTRATED $\smile B_{\perp}{}^{\dot{x}}$ moves Backward (or in polar-coordinate terms Inward), but that is predictable from the Proximity specification, End-contact (= [Prox: (Init Near), Final Contact]), and the Location specification, Lower-face. LADY $\smile \dot{S}^{x} \| [\,] \dot{S}^{x}$, with Double Contact at the Lower-face and then the Trunk, has a resultant Direction Down. (Each of the states -- i.e., each of the individual contacts -- also has a resultant Direction of Inward-Backward.)

Arc phonetically requires specification of the direction in which the movement deviates from the linear shape: e.g., for such a sign as GIVE $O_{x}^{\wedge}$, [Location: Init: Source, Fin: Goal; Mvt Shape: Arc, Up]. But this direction of arc is probably predictable.

Circular movement requires specification of plane -- frontal (parallel to the chest, vertical and side-to-side), sagittal (vertical and front-back), or horizontal -- and within a plane it may require specification of <u>sense of rotation</u>. This is the direction of circling, either clockwise or counterclockwise from some arbitrary vantage; in many cases it may be predictable or freely-varying, but in some cases it is distinctive. I will classify these both under Direction. For example, RIDE-BICYCLE $A_{v}A_{v}\,\bot^{\circ\sim}$ is specified for Movement as [Shape: Circling; Direction: Sagittal plane, Top-Forward sense; (Phase: Alternating)]; VIDEOTAPE-RECORDER $^{(\emptyset)}G_{v}G_{v}{}^{\circ}$ is [Shape: Circling; Direction: Horizontal plane, Contra-Backward sense; (Phase: Synchronous)]; and SCIENCE Á˅Á˅ $\overset{\circ}{\vee}$~ is [Shape: Circling; Direction: Frontal plane, Top-Contra sense; Phase: Alternating]. (Phase is predictable for the first two, but not for SCIENCE; see sect. III.D.) VISIT is deictically inflected by sense of rotation: in DASL's spellings, VISIT N_a✓V_a $\overset{\circ}{\perp}$~ contrasts with BE-VISITED ✓V_a✓V_a $\overset{\circ}{\top}$~. This is distinguishable as Top-Forward or Top-Backward sense; morphologically, Top-Toward-Goal. Superficially, any "side" of the hand's orbit could be chosen for the sense specification -- e.g. in RIDE-BICYCLE we could just as well say "Front-Down," "Bottom-Backward," or "Back-Up" -- but morphology supports using the top of a sagittal-plane orbit.

II.B.11.d Directionality

S & N (1978) found a phonological distinction between <u>unidirectional</u> and <u>bidirectional</u> movements in noun and verb derivation and inflection. They defined the distinction by whether the hands move in one direction or both in the unrepeated root of the sign. I will revise their definition slightly: since the movement parameter is specified for each hand, movement is bidirectional only if each hand viewed individually moves in both directions in the unrepeated root. Circular movement is automatically bidirectional. In specifications, I will abbreviate Directionality as "Dir'y" to distinguish it from Direction, "Dir."

In addition to fitting better with my description of movement, the revised definition of directionality removes some irregularities that S & N found under the original definition. Hold Manner generally occurs only with unidirectional movement, but PUT-ON-GLOVES $\bar{B}_v.B_v\overset{I}{x}$'' was an exception, with bidirectional hold manner. Redefining directionality in this way captures directionality's essential characteristic of "primary inertia" (S & N: Newport, pers. comm.): Bidirectional movement is felt as primary in both directions, while unidirectional movement has primary movement in one direction and a recovery or transition in the other. (The preliminary findings of Battison 1978c indicate confirmation of this intuition.) PUT-ON-GLOVES can then be reanalyzed as phonologically regular and unidirectional, and morphologically Dual.

II.B.11.e Frequency

Stokoe's diacritics $S^{\cdot}$ and $S^{\cdots}$ for repetition and multiple fast repetition (the latter made explicit only in Stokoe, 1978) indicate frequency. More complex distinctions appear in inflection (Fischer, 1973; S & N, 1978; K, B, Newkirk, Pedersen, & Fischer, 1979), but I will not attempt to describe those here, though I believe my analysis will encompass them. Another type of complex repetition does require discussion: displaced repetition, in which each iteration is at a different place, as in IMPROVE $/.B^{x\dot{\cdot}\cdots}_{\top}$, CARS-BACKED-UP $3_{\rho}.3^{\vee\dot{\cdot}\cdot}_{\top}$, and CHILDREN $B_{D}{}^{\vee}{}_{>}^{\dot{\cdot}\cdot}$ (Fig. 2-26). I will describe these sets of repetitions as nested within a larger movement. That is usually Linear in shape and thus requires only a Direction specification, but it can be more complex for morphological reasons.

II.B.11.f Manner

I am using this parameter to describe differences in the speed, pacing (e.g. slow start followed by acceleration, or sudden stop at the end), and muscle tension of movements that have the same Location(s) and Shape. The name Manner is taken from S & N. They found (1978) a three-way distinction, with regular morphological meaning, between <u>Continuous</u>

movement, which is unchecked and comes to an easy halt at the end of its course, <u>End-hold</u> movement (originally called <u>Hold</u>), which is stopped suddenly by contact with a physical surface or by a sudden tensing of the muscles in space, and <u>Restrained</u> movement, which stops suddenly and bounces back toward its point of origin. In a sign like THAT, which moves the hand downward in space, Continuous movement may pivot at the elbow, the wrist, or both, while End-hold and Restrained can only use one joint. They later found that Hold Manner, defined as a period of motionlessness, can occur at the beginning of a movement as well as the end, or at both, or constitute the entire Movement (in which case there is no motion at all). Initial- and End-Hold Manner are easily accommodated within this analysis as Hold Manner in Initial or Final state. Hold Manner can occur in "contact" with a nonphysical tab, as in S & N's examples (here using ⊠ as ad hoc Stokoe notation for hold): 'fly from (place) $\dot{\Psi}_{D}{}^{\boxtimes\triangle}$, 'fly to (place)' $\dot{\Psi}_{D}{}^{\triangle\boxtimes}$, 'fly from (place) to (place)' $\dot{\Psi}_{D}{}^{\boxtimes\triangle\boxtimes}$ and $\dddot{V}_{D}{}^{\boxtimes}$ '(small animal) be stationary at (place)'. It is also found in Non-contact with a physical tab, as in $\frown\text{Ɣ}_{T}{}^{\boxtimes}$ 'to be sick for a long time' (K, B, & Pedersen, 1979).

But these are not the only values I am assigning to Manner. Stokoe used the diacritic of a dot above a Movement symbol to indicate "short, sharp, tense, or checked movement" (DASL:xiii). Frishberg & Gough (1973) observed a widespread two- or three-way distinction between plain movement and movement that was either "sharp," as in Stokoe's dot-above, or "soft." DASL also occasionally notes Manner in the prose notes to a sign, e.g., for $5_{T}.5^{\odot}$ 'infiltrate, permeate', "sig [i.e. movement] is slow." K, B, & Pedersen (1979) and K, B, Newkirk, Pedersen, & Fischer (1979) found over a dozen aspectual and distributional inflections differing in Manner as well as other subparameters of Movement. So the inventory for Manner is particularly imcomplete. It includes Plain (the unmarked value, not normally specified), Sharp, Soft, Restrained, and Hold, plus a number of others not discussed here, and probably more not yet discovered.

The previous subparameters of Movement apply to each hand separately. The last two, Symmetry and Phase, apply to the Movement as a whole.

II.B.11.g Symmetry

In double-dez signs (both hands active), the Symmetry Condition allows the movements of the hands to be symmetrical or parallel. (Battison speaks of "symmetrical" and "identical"; I prefer "parallel" to "identical" because symmetrical movements can be, and usually are, identical in a muscular sense. Cf. DEAD and BET, below.) Much of the difference between parallel and symmetrical movement or location can be captured by proper choice of directional terms: e.g., in SPAIN $[]X_{T}X_{T}\overset{e}{x}$, each hand is at the ipsilateral shoulder, in UP-TILL-NOW $[]G_{v}G_{v}\overset{a}{\perp}$, both hands are at the dominant shoulder. (See Fig. 2-27.) But not all movements have a Direction that can be so described, for instance DEAD $B_{a}B_{v}\overset{v}{a}$ or $B_{v}B_{a}\overset{a}{v}$ vs. BET $B_{a}B_{a}{}^{v}$, and the difference between symmetrical and parallel movements should be directly describeable. So Symmetry has the values Symmetrical and Parallel, specified for the whole sign rather than each hand.

II.B.11.h Phase

Stokoe's diacritic ~ indicates "that the sig action of the hands in a double-dez sign is done first by one, then by the other" (DASL:xiv). In this analysis, Alternation is one value of the Phase subparameter of Movement, affecting the whole sign rather than each hand. For instance, each hand's action in JUDGE $FF^{N\sim}$ can be described without respect to the other hand. The single datum of their phase relationship applies to the whole sign. The other value of Phase is Synchronous; it is unmarked, and not normally mentioned in an underlying specification.

That is the most common use of the Phase subparameter: an External definition applying to the relationship between the hands. But Phase has an Internal application as well. The movement most often coded in DASL as "wiggling" movement ($^{\ell}$) consists of flexing and extending the fingers in sequence, with a rippling effect from pinky to index finger when all four fingers are involved, or simply in alternation when only the index and middle fingers are involved. This is distinct from simultaneous extension or flexion, and the difference is Phase.

K & W point out a connection between Phase on the Internal scale and Phase on the External scale. In their analysis of classifiers, $V_v\overset{\ell}{\Delta}$ 'walk (a specified route)' is derived from $B_{vT}B_{vT}{}^{I\sim}$ WALK when the location (route) to be described with WALK would violate phonological constraints such as the limits of signing space. WALK and WALK-ROUTE are totally different phonologically in the Stokoean analysis, but in this analysis they share Alternating Phase. In addition, the number of articulators in WALK (2) can be matched to the Number of Fingers in WALK-ROUTE ([HC: 2 Fingers, +Closed]).

Friedman (1976) states that Alternating movement can become Synchronous under stress (including emphatic forms), and she cites JUDGE and DECIDE $FF^{\dot{v}}$. The change of <u>wiggle</u> to <u>spritz</u> 104 in the same environment is unrelated in Stokoe's analysis, but the same process in this view: under stress (or emphasis), Phase takes on the unmarked value, Synchronous.

II.C The analysis of Hand Configuration

This section presents a revised analysis of Hand Configuration. The first part is a review of previous feature analyses of the parameter; then follow the goals of this analysis and a statement of its defining principle. Parts 4 through 8 describe the feature system itself and the anatomically-motivated hierarchies associated with it. A particular challenge -- the analysis of the handshape K -- is met in section 9. Section 10 describes the method of filling in an underlying matrix, and section 11 lists some of the implications involved. Finally, section 12 gives the derivations of the HCs.

II.C.1 Previous feature analyses of Hand Configuration

Previous feature analyses of ASL handshapes (see list below) have dealt with handshapes in isolation. Friedman (1976, 1977) includes some observations of environmental conditioning, as do Stokoe, Casterline, & Croneberg (1965/1976, e.g. p. 111); but only Wilbur (1979:48-59) has begun to relate underlying to surface forms. One goal of the present work is to integrate handshape features into the rest of the sign. Handshapes in isolation, as described in this section, are of course not integrated, but the features and conventions are designed to mesh with morphological specifications of particular fingers, and with morphological and phonological specifications of point-of-contact, and to embody certain assumptions about sign language phonology.

I know of seven published or circulated featural or quasi-featural analyses of ASL handshapes: Battison, Friedman, & Zambrano (1972), used by Woodward (1973) (hereafter abbreviated BFZ/W); Boyes (1973); Tjapkes (1976); Lane, Boyes-Braem, & Bellugi (1979; LBB); Kegl & Wilbur (1976; K & W);[11] Stungis (1978); and Anderson (1978). Anderson's proposal for an IPA of handshape, while not strictly a featural analysis, is so exhaustive a study of cross-classified phonetic possibilities as to merit inclusion in any discussion of handshape features.

Comparison of these analyses reveals two opposing tendencies which could be labeled (among many possibilities) "emicist and eticist," "reductionist and objectivist," "gestalt and detail," or "significance and specificity." I prefer the last pair as most descriptive and least emotionally loaded. Each analyst has faced, at least implicitly, the question of whether to describe handshapes in some phonetic detail or to attempt to capture only those differences that are evidently significant in ASL.

Their solutions depend on their goals. Boyes, seeking to describe childhood acquisition of handshape, is at the extreme of specificity, describing each handshape with a two-dimensional (partly three-dimensional) matrix in which most features apply to each finger individually, and some to each joint. Anderson, who in constructing his IPA of handshapes makes many distinctions of thumb position, finger flexion, and combination of fingers in use, is near the same extreme. BFZ/W, making the first feature analysis of ASL handshapes, are only somewhat less specifist, and include a feature for each finger that is extended or bent (though no exact definitions are given and they are not immediately recoverable from the matrices); they cover more handshapes than K & W, LBB, or Stungis, and their features could be used to describe unambiguously many handshapes that ASL does not use, and even some that I believe no sign language uses. LBB and Stungis (whose analysis is based on his enlarged replication of LBB's experiment; he calls his feature system "LBB2") limit themselves to the minimum feature inventory necessary to describe ASL signers' perceptual confusions of ASL handshapes. They have finger features only for extended index and pinky, and fall near the pole of significance. K & W, also preferring significance, use fewer features and describe a somewhat different set of handshapes. (I know Tjapkes's analysis only through Wilbur's report and therefore will not discuss it further.)

It is noticeable that the reduced feature sets of the significantist analyses tend to include some detail, or specifist, features, and some features that seem less salient and intuitive than others. For example, LBB's [+compact] is "no fingers [fully] extended," while [+ulnar] is "pinky extended" and [+index] is "index [partly or fully] extended, all other fingers closed." Stungis's [+bent] is "exactly one finger bent at inner or middle knuckle." Adding more handshapes would require more features with fine detail, or with boolean or numerical definitions. Pure significantism is evidently unworkable; at least some specifics demand attention.

The reason is that the hands' four analogous fingers and partly-analogous thumb are capable of a variety of postures, partly independently and partly in mutual dependence. When they act together the results can be described in terms of the whole hand, but the results of independent activity require a finer-grained description. As long as the scope of a feature system is limited to twenty or twenty-five ASL handshapes in citation form, a small number of features, mostly significantist or "gestalty," will suffice; but if we want to describe conditioned variants and write the rules to derive them, or if we aspire to eventually describe handshapes used in other sign languages but not in ASL, we need to make finer discriminations. But then, if we use such fine details for handshapes we consider to be relatively unmarked -- as describing the handshape [5] one finger at a time, each finger one joint at a time -- we feel that we are overloading the system by describing more detail than the signer or the language can possibly be referring to in so simple a case. Boyes, applying a "specifist" feature system to a practical problem, uses abbreviatory conventions that facilitate presentation and suggest degrees of complexity; but these last, though well discussed in her text, are never brought formally into the description.

This paradox can be resolved with the formal mechanism of markedness. Although the term has been used in ASL phonology, especially with respect to handshapes (Battison, 1978:36-38; LBB, 1979:175; K & W 1976:382; Wilbur, 1979:29), it has never been strongly incorporated into a featural analysis.

K & W approach a formalization of markedness. They apparently assume that every handshape is specified for their features *extended* and *closed*, which define four major classes, and that all other features are negative unless specified positive; but beyond the two basic features there is no pattern to correspond to functional markedness (as defined in terms of handshapes' or features' frequency, order of acquisition, apparent complexity, etc.). Table 2-1 shows the 22 handshapes analyzed by K & W, arranged by major group and number of pluses outside the two basic features. It is incongruous that bentB, which is not very common and almost certainly seldom underlying, outranks 5, F, C, and V in unmarkedness. If we take Wilbur's suggestion and declare the unmarked value of *spread* to be positive, the arrangement improves, but we do not (as she claims) automatically get 5 as least-marked in its class unless we "unmark" [+thumb] as well. This puts bent5 ahead of B; but we can fix that by considering the unmarked value of *thumb* to be whatever the value of *spread* is. Of course, all or some of the manipulations have to be limited to the environment [+extended, -closed] to avoid such undesirable consequences as making thumbW (which is nearly nonexistent in ASL even at the phonetic level, though used in Japanese and British [Anderson, 1979] numeration) less marked than W.

What we have done is to introduce a set of markedness conventions constrained by environment. No longer is minus the unmarked value of all features except *extended* and *closed*; nor can we even say that minus is unmarked for one feature and plus is unmarked for another. (Of course this is no theoretical innovation, but is exactly the type of mechanism proposed for spoken languages in the Epilogue of Chomsky & Halle (1968).) But such conventions will also enable us to escape the paradox of significance and specificity. In the articulatorily simplest condition, where the fingers act together, such features as spreading and bending can apply to them all. When they act independently the handshape can be so specified, but independent specification will be more costly in markedness than uniform action.

Other markedness conventions can be derived from articulatory and perceptual constraints. As K & W observe (1976:382), "The feature spread is only relevant to [+extended] handshapes, [-extended] is redundantly [-spread]."[12] Less obvious is the anatomical fact that the index and pinky fingers have individual muscles to extend them, extensor proprius indicis and extensor proprius digiti minimi, while the middle and ring fingers do not and must rely exclusively on their divisions of the common extensor. The individual extensors allow the index and pinky considerable freedom to be extended while their neighbors are flexed, a fact which affects intra- and cross-linguistic frequency, privileges of occurrence, and acquisition, and which should be incorporated in any analysis claiming physical reality.

II.C.2 Goals of this analysis

The following analysis of HC has several specific purposes in addition to my general phonological goals of facilitating the description of variation, historical change, and morphophonology. I will attempt to achieve the significantist goals of describing HCs underlyingly primarily in terms of their general configuration, leaving as much of the detail as possible to anatomical and perceptual requirements. These are isolated as separate hierarchies or rules that act on the underlying general specifications to determine just which fingers are to be used, and to some extent what positions they are to assume. Much of the specification work is left to Focus.

The next section states the Finger Position Constraint, which defines the terms of the entire analysis. It is followed by an overview of the features and definitions of the features themselves. Then come the hierarchies and rules that fill in the underlying matrix to the full specifications of a HC. The last part of this analysis consists of derivations of the HCs from a minimal underlying matrix to a full specification.

II.C.3 The Finger Position Constraint: Selected vs. other fingers

This analysis used features on two levels that relate directly to HC. In addition, the parameter of focus frequently determines HC or severely constrains it, as described in Chap. III. First I will describe the general features of HC, then the detail features.

The concept of selected finger is pivotal in this analysis of HC.[13] It is derived from the observation that, while a finger may take many different positions in a HC -- closed to the palm (or as close to it as comfort and the limits of the tendons allow), straight and extended, smoothly curved, angled, or hooked; touching the thumb, crossed with another finger -- the allowable combinations of these positions on different fingers in a single HC are severaly restricted. In any HC the fingers can be exhaustively divided into no more than two groups. One group, the <u>selected fingers</u>, can be in any of the positions mentioned except closed, but they must all be in the same position. The <u>unselected fingers</u> (or <u>other fingers</u>) may only be all extended or all closed. No HC may require, for example, that the index finger be hooked while the middle, ring, and pinky are opposed to the thumb forming a ring. Such a HC (call it [χ_d]) is perfectly possible anatomically and may even feel easier to an American signer than some real HCs of foreign sign languages, such as the extended ring finger (which can be written ʎ, "anti-7) of Japanese and Taiwan SLs; but it cannot be required by any sign of ASL.

If this <u>Finger Position Constraint</u> (FPC) is universal, then we will have the curious situation of a HC which is admissable in SLs in general being articulatorily more difficult than a prohibited one. Then we must ask why. If we compare the fingers of a HC to a painting, the FPC states that there can be a background and a foreground, but no "third ground" (maximum of two groups of fingers); that the foreground must be of a single color (selected fingers in the same position); and that the background can be darker or lighter than the foreground, but cannot have any subtler degrees of color (other fingers only closed or extended). These seem to be reasonable perceptual requirements for a distinctive configuration, whether of colors or of fingers.[14]

The selected/other distinction of fingers on the Internal scale is comparable to the External distinction between active hand(s) and passive or uninvolved hand. The active hand, the dez, is the foreground hand. It can have any hand configuration in the inventory. In basehand signs, the dez is often closer to the visual center of signing space (Siple, 1978b) than the basehand and seldom further away: often above the basehand, rarely below it; often inward of it (i.e., toward the signer), less often outward of it. The basehand, besides being spatially less central, is greatly limited in HC (the Dominance Condition) and movement. In one-handed signs, the nondominant hand stays in the lower reaches of signing space, well out of the "picture" and the action. Similarly, in the hand, the selected fingers can take any position except the closed position, in which they would merge with the outline of the midhand and lose their identity as fingers. They can make contact or near-contact, they can move, and they can point. The other fingers can only stay out of the picture, either by merging with the midhand (closing) or, if the selected fingers are bent, by going the other way to full extension. They are out of the action: they cannot make contact or near-contact, cannot move, and cannot point.

The FPC as expressed needs two qualifications. Forst, there are nondistinctive phonetic adjustments. For example, Y often appears with the index, middle, and ring fingers (to abbreviate: <u>imr</u>) angled, i.e. bent to an approximate right angle at the innerjoint and straight at the midjoint, while the pinky is fully extended, or more likely somewhat bent at the innerjoint. Does this violate the FPC? Only superficially: the difference between this phonetic [angled$\hat{Y}$] and a formal citation-form [Y] with <u>imr</u> bent down as close as possible to the palm is never distinctive or required. What is important to this HC is that they are more bent than the extended pinky. (This example is taken in isolation, i.e. without reference to movement or focus. When fingers move or are in focus the selected/other distinction can be derived from that.)

The second qualification is a point of greater vulnerability. The HCs of Stokoe's /K/ all have rp closed, and im straight at the midjoint but differentially extended at the innerjoint. This configuration directly contradicts the FPC. But if the difference between /K/ and some HC obeying the FPC can be attributed to other factors that have independent support, then the FPC can be maintained at a deeper level. I will do that below.

II.C.4 Overview of the feature system

The general features presented here belong to the significantist end of the spectrum described in section II.C.1. Most of the finger position features are highly general and apply to all and only the selected fingers: they determine the color of the foreground. (Closed, Spread, and Interrupted Extension are partial exceptions.) The finger selection features determine the fingers the position features apply to: the number and location of foreground elements. A single feature, Closed, determines the position of the fingers not selected: dark or light background. The thumb has features of its own, which are related to the finger position features. The hierarchies, though not among the features, link the underlying form to the observed HC.

The selected fingers are relevant to morphophonology, Focus, and Movement as well as to HC: only the selected Fingers may be in Focus, or be part of the iconic foreground in a morphophonological morpheme. Thus the present analysis of HC establishes a general link between this parameter, Orientation, Movement, and contact. As far as I know this has not been done before.

The system of general features is intended for phonological, not phonetic, description. Given a HC extracted from a stream of ASL discourse and presented in isolation, it may be impossible to assign a unique description in general features. My chief goal here is to construct underlying forms that will allow clear expression of phonological and morphological relationships and constraints within ASL. Such relationships do not usually involve isolated HCs, but rather signs used in full linguistic and social context, all of which the signer and viewer can use to connect the phonetic object before their senses of sight and touch with the phonological object in their mind.

The general features are also not meant to describe all the HCs that can possibly be used distinctively. The signer and viewer of a HC can attend to an individual joint, angle, or contact within it separately from the overall position of the hand. To continue the pictorial metaphor, a picture _can_ indeed be painted with more than one foreground color—or with colors in the background. Such HCs can be devised: [χ_d] is one, the "I-R-L-Y" HC (for "_I_ _r_eally _l_ove _y_ou," Fig. 2-29) is another. FSL _ROI_ 'king' uses a similar "monogram" of R, O, and I, and the Korean manual _t_ (at least in citation form) requires differential spreading of the extended fingers (Fig. 2-30). How should they be handled?

We have returned to the dilemma of significantism and specifism. For such high-resolution HCs, and also for some regular subphonemic changes in HC, we need _detail features_. The most flexible formulation has a feature for each degree of freedom of each joint. Whereas the general features are closest in spirit to K & W's significantist analysis, the detail features are very much like Boyes's specifist ones. Any sign's HC can be exhaustively described using detail features. However, using such a description in the underlying form implies that no simpler description is possible, and therefore that the HC is a complex one that the general features and their associated markedness rules cannot handle. Detail features should be costly. They are used only as a last resort, generally in combination with general features to block the action of a markedness rule that the general feature specifications would otherwise invoke. It is predicted that phonological change should move away from detail features and toward HCs wholly describable in general features, and that high-resolution HCs should arise only through morphological processes and coinage (such as "I really love you").

The detail features also help resolve the specifist-significantist dilemma in the filling-in of underlying matrices. For example, the index finger is anatomically easiest to extend, regardless of whether it is phonologically selected. The general-feature descriptions [-Bent] and [-Closed] both refer to extension of fingers, but of selected fingers in the first case and (generally) of other fingers in the second. However, the descriptions translate into comparable detail-feature terms, which ignore the selected/other distinction, using the detail feature-family *extended.finger*. This in turn is linked to the information about comparative ease of extension, in the form of an *extension hierarchy*, enabling the same fact to be used in producing the HCs G (with a derived specification [-Bent]) and Ɣ (with an underlying specification [-Closed]) as the least-marked realizations of their respective underlying minimal matrices.

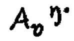
In the filling-in procedure a feature value that is not originally provided can be either *forced* or *defaulted to*. A forcement results from the exclusion of all alternatives but one; a default is the use of the least-marked of several available alternatives. Forcements occur as soon as every possibility but one has been ruled out, but defaults can be ordered and have to wait their turns. General features have strict definitions in detail terms, though these definitions may be complex, involving propositional calculus with quantifiers and arithmetic (since there are four fingers to consider). Combinations of general features can force detail-feature values, which can recombine to force other general-feature values.

II.C.5 The general features

II.C.5.a Finger selection features

There are five finger selection features: Number of Fingers (abbreviated Fg) and four finger features, Index (Ind), Middle (Mdl), Ring (Rg), and Pinky (Pky). Unlike BFZ/W's and K & W's features of the same names, the finger features do not refer to the finger's being in a particular position, but rather state that the finger is selected (plus) or other (minus). The only limitation they place on finger position is the defining limitation that a selected finger cannot be closed except in fists (see below) and in Internal Movement that changes the HC. (The frequent qualifying phrase "in isolation" refers to this condition and to the specification of HC features without regard to focus.) The thumb, which is also part of the "picture" and can be in the foreground or background, has a similar selection feature, Thumb (Th). A digit that is specified as in Focus is automatically selected.

Number of Fingers takes integer values from 0 to 4. The only [0FG] Hcs are the fists: A, S, and thumbȦ. [(1-3)Fg] HCs (i.e., [1Fg], [2Fg], or [3Fg]) must, in the fully specified matrix, be specified plus for the correct number of finger features and <u>minus</u> for the rest. The selected fingers, i.e. those whose finger features (Index, etc.) have <u>plus</u> values, are often determined by markedness rules, including hierarchies for different finger positions: as soon as the number of plus-valued finger features reaches the value of Number of Fingers, the rest are automatically marked minus by a redundancy rule.

[0Fg] and [4Fg] form a natural class in opposition to the intermediate value range, [(1-3)Fg]. When the whole "picture" is one "color," there is no foreground/background distinction. To name this natural class, the feature Uniform is defined in terms of Number of Fingers: [+Uniform] = [0Fg] or [4Fg], [-Uniform] = [(1-3)Fg]. When the fingers are uniform but not in focus, for example in YES  , and in phonological rules that depend on uniformity of fingers but not the selected/other distinction, for example spreading under extension, there is no point in trying to decide whether the picture is all background or all foreground. But when the thumb is specified as being in the "foreground" or the "background," or when the fingers are in focus and so must be "foreground," it may make sense to distinguish "four selected fingers," [4Fg] (as in MOTHER ), from "four unselected fingers," [0Fg] (as in SURGERY ).

II.C.5.b Finger position features

The finger position features describe the entire HC, not individual fingers (only the costly detail features can do that). They are Bent, Straight, Extended, Opposed, Crossed, Closed, Spread, and Interrupted Extension. Straight and Extended are subordinate to Bent. Closed, Spread, and Interrupted Extension can refer to selected or other fingers, the other position features only to selected fingers.

Bent (Bt): With [+Bent] all selected fingers are flexed -- at the innerjoint, the midjoint, or both -- without being closed. With [-Bent] they are fully extended. [-Bent] is the default, or generally unmarked, value: selected fingers are more often extended than bent. Bent covers two subsidiary features that are occasionally needed, _Straight_ and _Extended_.

Straight (Str): With [+Straight] the selected fingers are straight at the midjoint; with [-Straight] they are flexed at the midjoint. Straight says nothing about innerjoint flexion.

Extended (Ext): With [+Extended] the selected fingers are straight at the innerjoint; with [-Extended] they are flexed at the innerjoint. Extended says nothing about midjoint flexion.

[+Bent] = [-Straight] _or_ [-Extended], and [-Bent] = [+Straight] _and_ [+Extended]. [+Bent] is marked, but within [+Bent], [-Straight] and [-Extended] are unmarked. In other words, [+Bent] _forces_ at least one joint of the selected fingers to be flexed, but does not specify which, or both; its _default_ is that both are bent, but that can be overridden. Particular values for Straight and Extended _can_ be specified, or they may be required or declared unmarked in certain environments. "Angled" HCs such as angled$\hat{5}$, angled$\hat{B}$ are [+Str, -Ext], while "hooked" HCs such as X and bent$\ddot{V}$ are [-Str, +Ext]. These combinations can also be specified as [+Bent, -Ext] for "angled," and [+Bent, -Str] for "hooked": since [+Bent] requires a plus value on either Extended or Straight, [+Bent] with a minus value on either one forces a plus value on the other. The remaining combination, [+Str, +Ext], is "curved."

Morphophonological considerations (sect. IV.B.1) call for a feature similar to Bent but distinct from it, namely Round (Rd), defined perceptually: the hand must curve in approximately a circle or an arc of a circle. In the unmarked case the thumb is included, and must then be fronted. The size of the circle ranges from zero or tiny (e.g., a quarter-inch: the "crossedF" HC, sect. IV.B.1) to larger than the fully-spread 5-hand (S & N: Supalla, 1978), and the corresponding range of HCs defies uniform description in the articulatory-perceptual terms heretofore adequate for the non-morphophonological lexicon. This feature will not be mentioned again until Chapter IV.

<u>Opposed</u> (Opp): With [+Opposed] at least one selected finger is visibly opposed to the thumb, i.e. touches it without covering it; with [-Opposed] no selected finger is opposed (and of course no "other" finger may ever be opposed). The normal opposition is tip-to-tip, but this definition includes opposition of the thumbtip to a fingerjoint (as in K) or of a fingertip to the "trunk" of the thumb (as in E). The default value is [-Opposed]: no HC is [+Opposed] unless specified as such.

The possibility of variation among the selected fingers, with only one or two participating in the position, comes from the conflict of two articulatory forces. /O/ is [4Fg, +Opp]. To oppose all the fingertips uniformly to the thumbtip you must cluster them around it, forming a conical or bud shape sometimes called the "<u>and</u> hand," from its being the final HC of the sign AND: Anderson (1978) symbolizes it as [&]. But in this clustering the fingers overlap, touching each other on different surfaces, which produces nonuniform tactual feedback; and they form a curved surface rather than a flat one in the radial-ulnar direction, decreasing the visual similarity of their positions. For the fingers of an /O/ to form a smooth, uniform plane they must all be side-by-side without overlap. But in that arrangement only two of them at most can touch the thumbtip; generally the index does, with or without the middle.

Crossed (Cr): With [+Crossed], there are at least two adjacent selected fingers, one is an "outer" finger (index or pinky), and they are crossed. Middle-ring crossing is difficult and probably occurs nowhere in the world. Ring-pinky crossing is rare (Woodward, 1979b), but may occur in Taiwan SL (Wayne H. Smith, pers. comm.) and is sometimes found humorously in ASL, in both languages combined with index-middle crossing to make a "double-cross" or "RR" hand. The normal direction of crossing is with the outer finger on the palmar side of the inner one. The only crossing in (normal) ASL is R, with index-middle crossing. Compare the oral-language feature Lateral, which in English and many Indo-European languages is plus for only one phoneme, /l/.

The variety of positions taken by the ring finger and pinky in ASL fingerspelled R is remarkable (Reich & Bick, 1977). It is understandable from the viewpoint of this analysis of HC. If the "other" fingers can vary only by being more open or more closed than the selected fingers, and if the position of the selected fingers is sufficient to distinguish the HC from all others even without specifying Number of (selected) Fingers or the position of the "other" fingers, then the "other" fingers can go almost anywhere without danger of confusion. English /l/ varies non-distinctively (though not freely, being conditioned) between "dark" velarized and "light" palatalized allophones, and between voiced and voiceless (e.g. after /s/) allophones.

Bent (including Straight and Extended), Opposed, and Crossed affect only selected fingers. The next three features can affect "other" fingers. They are Closed, Spread, and Interrupted Extension.

Closed (Cl): Since the other fingers, which establish the "background" of a HC, can only be (distinctively) extended or closed, a single binary feature is enough to determine their position. Because a background can only exist relative to a foreground, when no fingers or all four are selected (i.e., the HC is [+Uniform]), Closed applies to all the fingers. Since [-Uniform] selected fingers cannot be closed, and other fingers *must* be closed when the selected fingers are fully extended, only a [+Bent] HC (i.e. with selected fingers bent) or a [+Uniform] one can be [-Closed]. Further discussion of Closed follows the presentation of the features.

Spread (Spr): For Spread to have any value, either plus or minus, at least two fingers (whether selected or other) have to be nonclosed and nonopposed: i.e., their tips have to be "free." The [+Spread] means that all such fingers are saliently separated from their neighbors, and [-Spread] means that they are not separated but aligned, in contact or near-contact. The spread fingers may be abducted in the plane of the midhand, as in 5, and/or differentially extended ("stairstepped"), as in K, F, or ɣ.

Spread is a low-level feature, not always distinctive. DASL registers a lot of variation between 5 and B, which are not phonemically distinct in DASL's analysis, and between V and H, which generally are. The HCs whose other fingers are extended and (at least two of them) adjacent could imaginably distinguish spread from nonspread forms, but in fact they don't: ASL F, ɣ, 8, 7, and 6 usually have spread fingers, but an unspread form would not be distinctive. To align unselected fingers requires attention at the detail level, and such a HC will not easily force its way into common use. To express this in the analysis, there is a convention barring underlying specification of [-Spread] if the unselected fingers are extended: i.e., [-Spread] may be underlyingly specified only for selected fingers. This is formally accomplished by allowing it to have a value only if the other fingers are closed or all the fingers are selected:

$$\text{NOT} \quad \begin{bmatrix} \text{-Spread} \\ \text{-Closed} \\ \text{4 Fingers} \end{bmatrix} \quad \text{in underlying matrix.}$$

([-Closed, 4Fg]) defines the class including B and 5, in which spreading can be distinctive.)

<u>Interrupted</u> <u>Extension</u> (IntEx): A [+IntEx] HC has two more-extended fingers separated by at least one bent or closed finger. (This feature does not apply to particular fingers, as the others do, but to the whole HC.) The "outer" fingers, index and pinky, are usually extended: always in ASL, but not universally (e.g. Taiwan SL: Wayne H. Smith, pers. comm.). The extended fingers may be either selected or other. If the latter, then the middle and/or ring finger must be selected; and since selected fingers cannot be closed, the HC (in isolation) must be [+Bent]. In isolated and thumb the outer fingers <u>ip</u> are selected; in , 8, and 7 an inner finger is.

Interrupted Extension has perceptual and articulatory reality. Perceptually a [+IntEx] HC presents a gap in the array of prominent fingers. Articulatorily it allows the use of the extensor proprius muscles that are peculiar to the index finger and pinky (Gray, 1901/1977:400), extending them without directly affecting any other fingers. The feature also requires the use of at least one of these muscles to hold the index or pinky up against the drag of its flexed neighbor. By not having a feature of "Interrupted Flexion" we recognize the lack of "flexor proprius" muscles; and by using Interrupted Extension with extension of other as well as selected fingers we recognize the usefulness of the extensores proprii in keeping unselected outer fingers up while their inner neighbors are flexed. Since flexion of each finger is accomplished mainly by its section of the common flexor muscles, and these sections are bound to each other (although the index has considerable freedom: Gray:393), the extensores proprii are the primary means of keeping the background of the picture light when the foreground, consisting (one or both of) the inner fingers, is to be dark (bent).

Japanese SL uses a HC with opposed straight middle and ring fingers and extended straight index and pinky. Since "other" fingers cannot be opposed, we must call this HC [2Fg, +Mdl, +Rg, +Opp, -Closed]. Focus on the index or pinky -- i.e., contact, near-contact, pointing, or movement -- would be evidence against this feature analysis. In fact, however, the HC is used with no evident focus, simply posed in space (S & N's <u>hold manner</u>): this is the sign for 'fox'. The same HC sometimes appears in ASL in TELL-STORY, normally $55^{I}\underset{*}{\div}\cdot\cdot[00]$, in place of the citation-form O (or 8 or F), by bringing both inner fingers <u>mr</u> into opposition in the movement instead of all four or just one.

II.C.6 The detail features

The detail features are not concerned with the selected/other distinction. They apply to any finger in the hand; but except in unusual cases, their values are not underlyingly specified, but result from specifications for the general features and their interactions with each other and the finger position hierarchies.

II.C.6.a Format and notation

These features are very close to Boyes's (1973). Some of her details are predictable in ASL, such as outerjoint flexion, which I have not used.[15] I have changed the names and plus-minus polarity of some features vis-a-vis Boyes to mesh with the general feature names, in which I have tended to follow K & W, Stokoe, and Friedman: for instance, Boyes's [-close] corresponds to my [+spread.f].

The detail features are arranged in "families": each family contains one feature for each finger. Two families are cover features for Boolean combinations of other feature families. Each feature, applying to an individual finger, ends with the name of that finger or its abbreviation: index, middle, ring, pinky. For example, the detail features used in the formal definition of the general feature Straight (Str) are straight.index, straight.middle, straight.ring, and straight.pinky (str.i, str.m, str.r, str.p). This "suffixed" form of name, together with the use of lowercase initial letters for detail features and uppercase for general features, helps in keeping the two levels distinct while showing their relationship feature by feature. The suffix f is a variable ranging over the four fingers, to avoid the need of stating each definition four times, and to name the entire feature family.

II.C.6.b Feature definitions

closed.f (cl.f): A HC with [+closed.f] has the finger f touching the palm, or flexed as close to it as the rest of the sign will allow; with [-closed.f], f is not touching/close in this way. This detail feature applies to all fingers in [+Uniform] HCs, but in [-Uniform] HCs only to "other" fingers.

flexed.f (fl.f): With [+flexed.f], f is flexed at the inner- or midjoint, or both; with [-flexed.f] it is extended at both joints, i.e. fully extended. flexed.f does not correspond fully to Bent, because a [+fl.f] finger can be closed but a selected finger in a [+Bent] HC cannot. flexed.f is a cover feature for the next two detail features.

extended.f (ext.f): With [+ext.f] the finger f is extended at the innerjoint; with [-ext.f] it is bent at the innerjoint.

straight.f (str.f): With [+str.f] f is extended at the midjoint; with [-str.f] it is bent at the midjoint. Table 2-2 shows the relation between ext.f, str.f, and fl.f. A finger closed down to the palm is [+flexed.f].

opposed.f (opp.f): This feature family covers the next two feature families. It corresponds to the general feature Opposed.

opposed-tip.f (opp/t.f): With [+opp/t.f], the tip of f touched (some part of) the thumb; with [-opp/t.f] there is no such contact.

opposed-knuckle.f (opp/k.f): With [+opp/k.f], the thumbtip touches some part of f other than the fingertip; with [-opp/k.f] there is no such contact. (Contact needn't be at the knuckle itself, but just any part of the finger other than the tip: the "trunk.")

Note that [+opp/t.f] and [+opp/k.f] are mutually exclusive (with the same finger). opposed.f covers these two in the same way Bent covers Straight and Extended, although the features do not correspond point for point: With [+opp.f] f is either tip-opposed ([+opp/t.f], fingertip to thumb) or knuckle-opposed ([+opp/k.f], thumbtip to finger "trunk"); with [-opp.f] it is not opposed. Not all contact is opposition, since [+opp.f] requires either the finger*tip* or the thumb*tip* to make contact. The "inserted" HCs T, N, and M are not [+Opposed]: in detail features, not [+opposed.f] for any finger.

spread.f (spr.f): With [+spr.f] f is saliently separated from its neighbor on the side toward the middle finger; with [-spr.f] f is touching or nearly touching that neighbor. The musculature that abducts and adducts the fingers -- spreads them and brings them together in the radial-ulnar direction -- takes the middle finger as the center, so there is no feature spread.middle. This detail feature family corresponds to the general feature Spread.

crossed.f (cr.f): With [+cr.f] f is crossed with its inner neighbor if it is an outer finger, or vice versa; with [-cr.f] f is not crossed. The special redundancies and implications of this feature were discussed under the general feature Crossed.

II.C.7 Thumb features

Because the thumb can work either as a finger or separately and differently, it has different features from them; because the selected/ other and general/detail distinctions arise from their being four fingers, and the thumb is unique on the hand, it participates differently in these distinctions. Bringing the thumb fully into the HC analysis I am proposing is complicated, and I do not claim to have succeeded fully. The thumb has a selection feature, Thumb (Th) (comparable to Index, Middle, Ring, and Pinky), and four position features: Thumbbent (Tbent), Thumbside (Tside), Thumbfront (Tfr), and Thumbout (Tout).

Thumbbent defines flexion at the midjoint (= outerjoint). Thumbside, which refers to extension of the thumb in the plane of the midhand, is best defined by starting with the negative value: With [-Thumbside] the thumb is in front of the midhand, i.e. "in line with" the index finger (which could thus make tip-to-tip opposition by flexing toward the thumb without any further motion by the thumb itself) or even further across the palm. The thumb may be touching the midhand or not: the $B_{\flat}$ HC of fingerspelling, C, and S are all [-Thumbside]. An observer looking toward a [-Thumbside] HC with the palm directly facing him would not see a separate silhouette of the thumb: its outline, from that angle, would merge with the midhand's. With [+Thumbside] the thumb is radialwards of the midhand and would present an independent silhouette.

Thumbfront refers to the thumb's abduction, or fronting, "forward" (palmward) of the midhand. With [+Thumbfront] the thumb is abducted palmward of the midhand, not in its plane or touching it, but not necessarily in front of it; with [-Thumbfront] the thumb is in the plane of the midhand or touching the palm. ("Touching the palm" refers strictly to the palmar surface of the midhand, not its edge.) In other words, [+Tside, +Tfr] is a possible combination, defined as "thumb palmward and radialward of the midhand": e.g., the HC of French fingerspelled *f* and ASL morphophonological "crossedF" (sect. IV.B.1). ASL fingerspelled $B_{\flat}$, and some forms of K and G (not limited to fingerspelling), are [-Tfr, -Tside], "thumb touching the palm." With [+Tfr, -Tside] the thumb is in front of the palm and out from it some distance, as in S and C. With [-Tfr, +Tside] the thumb is at the side of the midhand, either touching it or not, as in 5, B, 4, 3, and L.

The last thumb feature, Thumbout, distinguishes whether or not the thumb is "free." With [+Tout] the thumb is separated from the midhand and fingers, and from some angle of view would have an independent silhouette. It may be [+Tside], [+Tfront], or both: only [-Tside, -Tfr] is excluded, since that requires the thumb to touch the palm. A is [+Tside, (-Tfr), -Tout] and thumbȦ is [+Tside, (-Tfr), +Tout]. But [+Tfr] does not imply [+Tout]; when the thumb is folded over closed fingers, as in S and one form of G, X, and V, it is [+Tfr, -Tout]. Those folded forms are also [+Tbent], but that is not sufficient to distinguish them. bC and X can both have bent thumb, and then Thumbout is needed to separate them on the basis of thumb contact with the closed fingers.[16]

II.C.8 The hierarchies and the adjacency principle

Finger position and finger selection are linked by three hierarchies that determine the least-marked (least "costly") finger(s) to select if the finger position is already determined, or conversely the least-marked position for the already-selected finger(s). These hierarchies are anatomically based and do not, in principle, distinguish selected from other fingers. Their lower ends, i.e., the less preferred or more highly marked fingers, are not clear at this date. They are not all completely ordered: two fingers may share a position. There is also a Number of Fingers Hierarchy, which states the general order of costliness for that feature. For consistency there should also be a Crossing Hierarchy, but since crossing is so isolated I have simply described its ranking under the general feature Crossed.

II.C.8.a The Opposition Hierarchy

The index finger is closest to the thumb and most opposable. The thumb's position in the neutral C handshape, fronted and unopposed, is right in front of the index finger, or nearly so. The middle finger is next. Ring and pinky order is unclear: ring is closer but weaker, and pinky has a special muscle to oppose it to the thumb (opponens digiti minimi). So the Opposition Hierarchy is: (i, m, ??).

II.C.8.b The Extension Hierarchy

This hierarchy governs <u>relative</u> extension, just as the extended or closed position of "other" fingers is defined relative to the position of the selected fingers. In bO the index finger is relatively extended even though the HC is [+Bent], [+flexed.index], and (in most bO's) [-extended. index].

The index finger is easiest to extend on its own, owing to the extensor proprius indicis muscle and the finger's relative flexory independence of the other fingers. Pinky is next: it too has its own extensor but is tied to ring, and through ring to middle. The choice between ring and middle is not so clear, but middle seems to be next, probably because of index's flexory independence, and perhaps also because the thumb can more easily hold down <u>i rp</u> (ring and pinky together, skipping index) than <u>im p</u> (index, middle, and pinky, skipping ring). This Hierarchy, then, is apparently: (i, p, m, r).

II.C.8.c The Independent Flexion Hierarchy

This hierarchy governs flexion of a finger, without opposition, relative to its neighbor -- both neighbors, for the "inner" fingers middle and ring. It depends, then, on the muscular characteristics of each finger by itself and in relation to other fingers, but without regard to the thumb. Middle seems to be the freest in this action. The extensores proprii hold up the index and pinky. The ring finger is dragged down by its ligamentous ties to middle, but middle, as the longest finger and (when flexed independently) the one bent out at the greatest angle from the palm, reaches far enough out to be clearly distinguished. Index is next freest, but ring is a close contender and may share the position.

Ring is restrained by its close ties to both of its neighbors, while index has only one neighbor. Pinky is least free. (It should be possible to combine this hierarchy with the Extension Hierarchy, but I have not been able to work out a satisfactory mechanism.) This hierarchy, then, is: (m, i, r, p) or possibly (m, i, r , p).

II.C.8.d The Number of Fingers Hierarchy

[+Uniform] hands are generally preferred to [-Uniform], so [0Fingers] and [4Fingers] together head the hierarchy. With Tip and Finger Focus, and apparently Angle Focus in dez only, that preference is reversed. The Number of Fingers Hierarchy is: [{0Fg, 4Fg}, 1Fg, 2Fg, 3Fg]. The three-finger hands are rare in ASL, occurring only in fingerspelling: M and W.

II.C.8.e The Adjacency Principle

K & W formulated an Adjacency Convention to govern the extension of fingers in the HCs they analyzed. Some of the complicating details of that convention are here isolated into the anatomically-motivated hierarchies, and the Adjacency Principle as used here is quite simple: All selected fingers are adjacent unless the specifications force non-adjacency. ȣ , 8, and 7 are "nonadjacent" in K & W's analysis, with nonadjacent fingers extended; but in this analysis those fingers are "other," and the adjacency requirement applies to selection, not extension. The only non-adjacent HCs of ASL in this analysis are Ɏ, thumbɎ̇ , and (in one sign, NAIVE), [unspread-thumb7*].

II.C.9 Closed, K, and thumb clearing

Three pairs of HCs in ASL are distinguished only by Closed: F and bO, 6 and closed$Y_{\#}$ (see below), and 8 and K. The first two pairs are straightforward, although the HC here called closed$Y_{\#}$ is infrequent; the third is more problematical.

II.C.9.a F and bO

At least four signs with bunch contact have changed their HC from bO in 1918 (Long) to F today (sect. III.B.2.e). DASL notes current variation between bO (written X) and F in STINK $\triangle X^{x} \sim \triangle F^{x}$, EARRINGS $\supset XX^{x}$ $\sim \supset FF^{x}$, and EXCHANGE $\bar{X}X^{\omega} \sim \bar{F}F^{\omega}$. In addition, Long describes EXCHANGE as having A-hands. His prose usage and illustration make it clear that he really does mean [A] -- not [S], which Stokoe's /A/ would be in this non-contact environment -- but in fact the HC is as good a bO as it is an A, with the bent index finger protruding slightly from the fist and the thumb as much within its hook as resting on its radial edge. Apparently EXCHANGE has also developed a form with F out of an older bO.

Of course, we can never be sure whether Long simply failed to include an F variant. But the consistency of these five cases -- bO but no F reported in 1918, F with or without bO in 1965 -- strongly implies a regular shift. And we may also ask, supposing that Long did exclude one form while including another, why would he have done so? One likely reason, given his didactic and conservative goals, is that he excluded forms that in his view were corrupt and failed to maintain the "original purity and beauty" of sign language ("Introduction to Second Edition," p. 10): i.e., innovative pronunciations resulting from comparatively recent change. In that case the hypothetical excluded

F-variants would just push the date of innovation back before 1918.

II.C.9.b 6 and closed$Y_{\#}$

[6], with pinky opposed to the thumb rather than closed underneath it as in [W], appears in a few non-numerical signs, usually substituting pinky for index with diminutive meaning. When the sign on which the diminutive form is based requires contact of the thumb with the selected fingertip, phonological consistency comes up against ease of articulation. For example, pinky-diminution of the base sign MORON $^{\frown}X_{T}^{\times D \times}$ (itself a Condensed diminutive of BLOCKHEAD $\supset B_{X}^{\wedge} \,\ddot{\shortparallel}\, \bar{B}_{o} B_{o} \tilde{<}$ -- cf. WALK-A-ROUTE $V_{v} \overset{\varrho}{\wedge}$ and WALK $B_{D} B_{D}^{I\sim}$, sect. II.B.11.h) produces two distinguishable pronunciations: $^{\frown}6_{T}^{\times D \times}$ (glossed here as PEA-BRAIN), with imr extended, and $^{\frown}Y_{\#T}^{\times D \times}$, in which imr are folded within the circle made by the thumb, pinky, and palm. "Closed$Y_{\#}$" is an ad hoc name and notation for this HC, which keeps the [+Closed] specification of the base sign's bO. But evidently many people find this articulation difficult, for the sign also occurs non-distinctively with a [-Closed] HC, namely 6. As long as imr are out of the way and plainly in the "background," the sign is recognizable: only the Location (Upper-head), Focus (Bunch), selected digits (Thumb and Pinky), and Movement (Double Contact, Mvt Internal Direction: Pronate) need be maintained. TINY shows the same alternation between a [+Index] form $X_{a} \overset{e}{\times}$ and a pair of Pinky-diminished forms (we can gloss them TEENY), $\dot{5}_{a} \overset{e}{\times}$ with [-Closed] and $Y_{\#a} \overset{e}{\times}$ with [+Closed].

II.C.9.c 8 and K

Some occurrences of Stokoe's /K/ alternate with /V/ (DASL:78 alludes to this alternation); they can best be derived from underlying V by the articulatory process of differential extension (sect. III.C.2.a). But in other signs with no evidence for V another derivation is possible. (I include [P] and [bD] in this group.) This derivation relates /K/ to 8 in much the same way that bO is related to F and closedY is related to 6, namely [+Closed] vs. [-Closed]. Establishing this relationship requires an additional phonological step. Although I know of no /K/-8 alternations within ASL, corresponding alternations occur consistently in comparative fingerspelling data (Anderson, 1976).

Table 2-2 shows the underlying matrices of general features for ɣ, 8, and K (including [P] and [bD]). (As usual, predictable values are parenthesized. "No value" is represented by "x" instead of zero to avoid confusion with zero as a specified value, for Number of Fingers.) Spread has no value yet for ɣ and 8, since they are [-Uniform, -Closed]; K, with only one finger selected and the others not extended, must be [xSpread] at this point.

Consider the HC demanded by the matrix for K. It requires the thumb to cross over the closed index finger, perhaps pushing it somewhat aside, to reach opposition with the middle finger, which must partially straighten against the flexory pull of both its neighbors without the thumb's aid in restraining them. A natural way to reduce the opposing tensions is to extend the index finger with the help of the extensor proprius indicis muscle. This change gets the index and thumb out of each other's way, and by extending the index helps the middle finger to partial innerjoint extension.

This is very much like what goes on in TEENY in the shift from closed$Y_{\#}$ to 6. There it gets <u>imr</u> out of the way of thumb-pinky opposition and allows the thumb and pinky to straighten their midjoints, bringing the Bunch further out from the palm into a more visible position. I call this process Thumb Clearing: When the thumb has to cross a closed other finger to reach an opposed selected finger, the finger(s) so crossed may become extended. They remain unselected and cannot be in focus.

Thumb Clearing may or may not apply in a given environment: witness its optionality in TEENY and PEA-BRAIN. It is obligatory in /K/. Since it eases articulation and possibly perception at the expense of paradigm transparency -- the Thumb-Cleared pinky-diminutives look less like their [+Index] base forms than their uncleared doublets do -- I consider Thumb Clearing to apply in the normal case. A sign that is not to be cleared should be considered marked in some way. I propose that Thumb Clearing is obligatory except where specifically blocked. [-Thumb Clearing] is then the marked value of a rule exception feature, present for some signers in TEENY and PEA-BRAIN. There are too few relevant cases at present to decide on the conditions under which Thumb Clearing is optional. Of course, it would be vacuous if applied to a [-Closed] HC.

French fingerspelling has a cleared HC not used in ASL: the letter <u>k</u> (Fig. 2-31; FSL <u>h</u> is like ASL <u>k</u>, the HC K). That HC is underlyingly [1Fg, (-Ind), (-Mdl), +Rg, (-Pky), (+Bt), +Opp, (-Cr), (xSpr), (-IntEx), +Cl, (-Tspr), (+Tfr)]; to these we add the unmarked value of the rule exception feature, [-ThClr].

One point left untouched so far is the route from the underlying matrix for K (Table 2-3) to the surface HCs [K], [P], and [bD] after the application of Thumb Clearing. In fact, Thumb Clearing will produce a HC like [bD], with thumb and middle finger opposed tip-to-tip. (It will not specify a value for Straight, so both a round $b\hat{D}$ and an angled $b\hat{D}$

can be produced in this way.) The difference between [K], [P], and [bD] is essentially one of thumb position, in variations that are not distinctive outside the manual alphabet. They should therefore be left for the detail features.

II.C.10 Filling in a HC matrix

When an underlying matrix, or a partially filled-in one, contains finger position specifications but no finger selection, the least-costly finger is determined from the appropriate hierarchy. For example, F can be specified as [1Fg, +Opp]; the specification [+Opposed] will invoke the Opposition Hierarchy. That hierarchy determines that [+opposed.index] is least costly. If [1Fg] had not been specified, the Number of Fingers Hierarchy would have first chosen [+Uniform] instead; since only fingers can be opposed, the numerical value [4Fg] would follow. A specification of [+Bent] similarly defaults to [4Fg], ultimately producing C; but [1Fg, +Bt, +Closed] produces X, because the Extension Hierarchy chooses the index finger as least costly to extend relative to the remaining fingers. Specifications of just [+Closed] and [-Closed] default to [+Uniform], producing S and B/5 respectively.

Since the unmarked value for Bent is [-Bt], [1Fg] invokes the Extension Hierarchy, extending the index finger (which thus, in a [-Bent] HC, becomes "selected") and closing mrp: the resulting HC is G. The specification for I should be related but more costly, which gives us some theoretical problems: should [+Pinky] be sufficient specification (since I is the main HC with prominent pinky), and if so how do we "charge" that one-feature specification at a higher rate than G's [1Fg]? The Number of Fingers Hierarchy provides a solution. A specification of just [+Pinky] would default to [+Uniform] (since [+Pinky] alone would not imply [-Index, -Middle, -Ring]), so I has to have [1Fg] included in its specification: [1Fg, +Pinky], a specification for two feature values, costlier by one than G's specification.

What about two-finger and three-finger HCs? V seems to be adequately specified by [2Fg, +Spread]: the lack of a [+Bent] specification implies [-Bent], e.g., selected fingers are extended, so the Extension Hierarchy picks index. With [-Bent] only the selected fingers are extended, so we now have added [+Index] and have one more finger to select. The Adjacency Principle requires us to select middle ([+Middle]), and the quota is full. H is similarly specified as [2Fg, -Spr]; and the many signs in which V and H alternate, or H is predictable from Edge Focus (section III.C.1), can be left as [2Fg]. But now the V/H alternation has just one specification in its underlying matrix, the same as S, B/5, and G, which are among the regular unmarked base handshapes: an undesirable result.

The solution is to apply the Number of Fingers Hierarchy in reverse. When a value is underlyingly specified for this feature, its "cost" will not just be one unit, but will be determined by that value's position in the hierarchy. (This is basically just an extension of marked/unmarked "costs" to multi-valued features.) The first position costs nothing: it is the least-marked case. This principle has already been implied in the omission of [+Uniform], [0Fg], and [4Fg] from underlying specifications as the default values. Even if [0Fg] and [4Fg] have to be distinguished at some point, they are still "free." Now [2Fg] costs two units, and the V/H alternation, specified as [2Fg], is one unit costlier than S, B/5, and G. [3Fg] HCs are costlier yet.

Closed and Interrupted Extension can apply to the "other" fingers, and their interactions with the hierarchies can be more complex. In [-Uniform] HCs, Closed only applies to "other" fingers. In the underlying specification [1Fg, -Closed], the [-Cl] can only mean that the "other" fingers are extended. Therefore the selected finger cannot be extended; therefore it must be bent, so the HC is [+Bent]. A HC is never [+Opposed] unless so specified, so this HC is [-Opp]; the selected finger then is not opposed, and no "other" finger can ever be opposed (by the FPC), so the Opposition Hierarchy does not apply. But if one finger is bent and the others are extended, the Independent Flexion Hierarchy must apply. It selects middle, and the resulting HC is . [1Fg, +IntEx] would produce the same HC. But I have used Interrupted Extension only to produce and thumb .

II.C.11 HC implications: defaults and forcements

The following statements describe implications that hold between feature values of HC. I am concentrating on general features. Much of what I can say at this point about detail features is trivial, such as "[+closed.f] forces [+flexed.f]", and some of it requires horrendously complicated formulations, involving predicate calculus with quantifiers and arithmetic, because of the need to take four fingers into account. (Even using prose instead of logical symbolism the statements are monstrous.) So I will bring in such statements only as needed in derivations, rather than trying to list all or many of them in one place. As stated before, a forcement unconditionally assigns a value to a feature as soon as its environment (in this notation, its left-hand side) is satisfied, while a default may be overridden by contrary specification. In the terms of Chomsky & Halle (1968), a default corresponds to a markedness convention with a <u>u</u> value on the left-hand side, while a forcement corresponds to an absolute convention without <u>u</u>'s or <u>m</u>'s. A default is shown by a blunt-headed arrow " $\rightarrow\!\!\!|$," and a forcement by an arrow with a double sharp head, " $\twoheadrightarrow$ "; mnemonically, a forcement always "goes through" but a default can be blocked. Some defaults have no environment; they specify the unmarked value of a feature in all situations, and are shown by a blunt-headed arrow emerging from a zero, "$0\rightarrow\!\!\!|$." (Many forcements describe the feature analysis or the language's irreducible physical requirements -- production, transmission, and/or reception -- more than any interesting constraints in the language itself: for instance, " [+Opposed] $\twoheadrightarrow$ [+Bent]." Compare Chomsky & Halle's "[+low] $\rightarrow$ [-high].")

I have not thoroughly examined the consequences of ordered vs. unordered application. Defaults and forcements differ here: a forcement must apply as soon as its environment is satisfied, but defaults may have to wait, i.e. be ordered. The implications are listed in approximately the order in which I apply them in derivations. I have found this order convenient, but not always necessary. The hierarchies are also implications -- defaults, to be specific -- but look different because they describe multi-valued features.

[Focus: Fingertip or Finger] —»

Number of Fingers Hierarchy = (1, 4, 2, 3)

This statement reorders the Number of Fingers Hierarchy in the environment of Focus on the Finger or Fingertip. See the phonotactic analysis in Chapter III.

Apply Number of Fingers Hierarchy

If NFg is not specified, assign the lowest value available from the (possibly reordered) hierarchy. Note: the other Hierarchies apply whenever enough information is available to allow a choice.

0Fingers —» xOpp, xBt, xExt, xStr, xCr, -IntEx

If no fingers are selected, none of the general features that can apply only to selected fingers can have any value. "x" is used here to block future value assignment, instead of "u" (for "unmarked") or "0," because "u" would leave the future open to have a value assigned to it, and "0" is an actual possible value for Number of Fingers. Interrupted Extension must be specified <u>minus</u> because it requires a distinction between two groups of fingers even though it does not state which group (extended or non-extended) contains the selected fingers.

+Uniform $\twoheadrightarrow$ -Interrupted Extension

+Opposed $\twoheadrightarrow$ +Bent

A couple of anatomical redundancy statements.

$\leq$1Fingers $\twoheadrightarrow$ -Crossed

Given that only selected fingers can be crossed, this is also a redundancy statement, in fact a tautology: one finger cannot be crossed.

+Crossed $\rightarrow$ 2Fingers

The Number of Fingers Hierarchy would set [4Fingers] as the default for [+Crossed], producing the rare "RR" handshape. Yet this implication statement enables us to specify R by the single feature value [+Crossed]. LBB's and Stungis's perceptual results suggest that this is correct, and the fact that only R is [+Crossed] makes is plausible. But this highly marked HC should not be as "cheap" as G and B. The evident solution is to "charge" more for Crossed than for the features that suffice to specify these neutral HCs; but I have not ventured into those waters.

0$\rightarrow$ -Bent

If any fingers are selected, and Bent is still unmarked (not specified *plus* or *minus* or blocked with "x"), Bent is now specified *minus*. This has the effect of making selected fingers default to extended rather than bent position.

-Bent $\twoheadrightarrow$ +Extended, +Straight

NOT [+Bent, +Extended, +Straight]

+Bent $\rightarrow$ -Extended, -Straight

The first two of these define the relationship between Bent, Straight, and Extended, and the third establishes their default relationship.

0→ -Opposed

0→ -Crossed

These simply state that no HC will be [+Opposed] or [+Crossed] unless specified as such. Opposition and crossing are highly-marked positions of the selected fingers.

+Crossed → +Straight

Crossed fingers can be flexed at the innerjoint ([-extended.f]) -- e.g., CIGAR $\smile R_{\perp}^{x}$ -- but not at the midjoint. Kendon (to appear) describes a HC in Enga SL that he calles angled$\hat{R}$, used only in a derogatory gesture used in hearing Enga society, in which the middle finger is angled and touches the back of the index finger with its tip. Until more evidence is in concerning variations of crossing, the status of this implication as a forcement rather than a default is in question. Crossed fingers are normally [+extended.f], but that is subsumed under the general default "0→ -Bent."

-Uniform, -Bent →> +Closed

This enforces the difference in position between selected and other fingers (described in the FPC) when the selected fingers are fully extended. Since the other fingers must be in another position, and they cannot be opposed or even just bent, they must be closed.

1Fg, +Opposed → -Closed

This applies to F, 8, 7, and 6. (W is distinct from 6 in this analysis, being [3Fg, (+Closed)].) bO is acquired sooner than

F (Boyes, 1973; McIntire, 1973, 1977), but seems to be relatively disfavored in adult ASL. See the discussion in section III.B.2.e. The effect of this implication on 6 is identical to that of Thumb Clearing (sect. II.C.10).

-Uniform $\rightarrow$ +Closed

If the other fingers' position has not yet been determined, they are closed. This has perceptual motivation: The selected fingers stand out more clearly if they extend from a closed "fist" than if they are bent foreward (out from the midhand plane) against a background of other fingers. This default applies effectually only to [+Bent] HCs: if the selected fingers are fully extended, the FPC forces the other fingers to be closed. This implication must be ordered after the preceding one.

+Opposed $\twoheadrightarrow$ +Thumbfront, +Thumbout, -Thumbside

By definition of opposition.

+Thumbfront $\rightarrow$ -Thumbside

+Thumbside $\rightarrow$ -Thumbfront

Discussed under the thumb features.

+Thumb $\rightarrow$ +Thumbout

The thumb should not be merged with the outline of the midhand if the thumb is in focus. However, I have left this a default rather than a forcement to leave room for treatment of T, which I have not dealt with here.

+Spread, +Thumbout $\rightarrow$ +Thumbside

This applies to 5, 3, and γ.

Many forcements that result directly from the definitions of the features have been omitted from this partial list. The relation between a general feature and the similarly-named detail feature family acts as a forcement. For example, bO is specified for [1Fg, +Opp, +Closed]. With [1Finger], [+Closed] must apply to the other fingers, so the selected finger will be relatively more extended than its neighbors. The Extension Hierarchy selects the index finger: [+Index] is now added to the matrix, and since that fills the "quota" of [1Fg], [-Middle, -Ring, -Pinky] are added too. They are "other", so the detail specifications are [+cl.mrp].) Since Opposed applies to just selected fingers, [+opp.i] is also added. ([-opp.mrp] has already been forced by [+cl.mrp].)

II.C.12 Derivations of HCs

The charts on the following pages show the derivations of the main HCs of ASL. The underlined specifications are the underlying minimal specifications of the HC. Defaults and forcements are shown as in the previous section, with blunt and double-headed sharp arrows. Detail features may "flow" down the side, but the "mainstream" - "sidestream" distinction is more graphic than rigorous. Merging arrows show where two or more features are input to an implication.

B/5

-Closed
+Uniform
-Bent

B and 5 add underlying specifications of [-Spread] and [+Spread], respectively.

A[S]

+Closed
+Uniform → +closed.index
+flexed.index
-Thumbout
+Thumbfront

thumbȦ

+Closed
+Thumb
+Uniform
+Thumbout
+Thumbside
-Thumbbent

C

+Bent
+Uniform → +flexed.index
-Opposed
+Thumbfront

O

+Opposed
+Bent
+Uniform

G

1Finger ↠ -Uniform

o→ -Bent ↠ -flexed.s

+Closed ↞ +flexed.o

Independent Extension Hier.→+Index

As f is a variable for "finger", s is for "significant finger" and "o" for "other finger". These detail features work out here the constraint expressed in general features as [-Uniform, -Bent] ↠[+Closed].

L

1Finger ↠ -Uniform

+Thumb

-Bent ↠ -flexed.s

+flexed.o ↞

+Closed«

Ind. Ext. Hier. → +Index

+Thumbout

G and L are in variation, governed by the "Rule of Thumb" (Battison, Markowicz, & Woodward 1975). G therefore should include a default to [-Thumb] in its function as a "neutral" HC in base hands, or be treated as an alternation G/L.

F

1Finger

+Opposed

-Closed

Ind. Flex. Hier. → +Index

bO

1Finger

+Opposed

+Closed

Ind. Ext. Hier. → +Index

X

1Finger → -Uniform
+Bent
+Closed
+Extended
Ind. Ext. Hier. → +Index

A [-Uniform, +Bent, +Closed] HC has to be [+Extended] if the bent finger's tip and knuckle are to be prominent "above" the fist.

bC/bentL'''

1Finger → -Uniform
+Bent
+Thumbfront
+Closed
Ind. Ext. Hier. → +Index

[+Thumbfront] should be deriveable from just [+Thumb], since bC is much less frequent than X, but I have not found a satisfactory way to do it.

8

1Finger
-Closed
+Bent
Ind. Flex. Hier. → +Middle → -Index, -Ring, -Pinky

This could also be specified as [1Finger, +Spread].

8	7	6
1Finger	1Finger	1Finger
+Opposed	+Opposed	+Opposed
+Middle	+Ring	+Pinky

As for F, but the finger must be specified.

K

1Finger

+Opposed

+Middle

+Closed

See discussion in section II.C.9.

W

3Fingers

-Pinky

o) -Bent

W and 6 are underlying quite different, though their detail feature values are similar. W has only two underlying specifications, but [3Fingers] costs three units.

V/H

2Fingers

-Thumb

o) -Bent

+Closed

-Thumbout

Ind. Ext. Hier. → +Index

Adjacency Princ. → +Middle

As with B/5, Spread is unspecified and there is variation. V and H that cannot vary are specified for [+Spread] and [-Spread] respectively, unless there is phonological reason for the non-alternation, such as Finger Edge Focus (sect. III.C.1).

3

2Fingers

+Thumb

o) -Bent

+Closed

The most commonly shown version of 3 is [+Spread], and Friedman (1976) explicitly distinguishes 3 from thumbH. Such a distinction, of course, would require additional specifications. Index and Middle are selected the same way as in V and H. Thumb and Thumbout have no default value in [-Uniform] HCs. The way to handle such variable rules as the "Rule of Thumb" in this analysis has yet to be worked out.

R

<u>+Crossed</u>
2Fingers
+Straight
+Extended
-Bent
+Closed

Perhaps [+Closed] should be considered a default here, since the "foreground color", crossed, is salient even if the other fingers are extended.

I/Y

<u>1Finger</u>
<u>+Pinky</u>
-Bent
+Closed

As for G and L or V and 3, "Rule of Thumb" alternation, and the two HCs when distinctive must have Thumb specification.

Y/thumbY

<u>2Fingers</u>
<u>+Interrupted Extension</u>
<u>+Closed</u>
Ind. Ext. Hier. +extended.index, +extended.pinky
+closed.middle, +closed.ring
-Middle, -Ring
+Index, +Pinky

"Rule of Thumb" again. These derivations are unusual in not having the fingers selected until the end, and via a chain of detail features. The specifications could as well have been 2Fingers, +Index, +Pinky .

The following derivations vary in finger-bending features from more basic HCs.

bentV̈ (hookedV)

2Fingers
+Bent
+Spread
-Thumb
+Closed
+Extended

[+Extended] is implied as in X.

flatÔ (angledÔ)

+Opposed
+Straight
+Uniform

E (cf. O)

+Opposed
+Extended
+Bent

E is a Compressed O. It should not cost less than bO, which it does in this formulation. Perhaps Extended should cost extra, or Compression should be used in the derivation.

hooked-bO

1Finger
+Opposed
+Closed
+Extended
Ind. Ext. Hier. → +Index

This Compressed form of bO occurs in TINY X bent$\dddot{5}$ (hooked5)

-Closed

+Spread

+Bent

+Extended

-Straight

+Uniform

angled$\hat{B}$

-Spread

+Bent

+Straight

+Uniform

II.D Compression, Expansion, and Condensation

In various places in this dissertation I refer to Compression, Expansion, and Condensation. The first two are phonological with a semantic correlation, but more general than the purely manual morphophonology of Chapter IV. The third is primarily phonological, but it is used with diminutive meaning in at least one case.

Compression is a diminutive process in which distances are reduced phonologically to express smallness. It can affect the distance between the hands (Dyadic), between parts of the hand (Internal), between the hands and the body (Spatial), and between other parts of the body, including the face (non-manual). Dyadic, Spatial, and non-manual Compression are discussed in section II.C.2. b. Internal Compression appears in occasional derivatives. With [+Opposed] it moves the tips closer to the palm in TINY $\chi_a{}^{\ell}_{x}$ (with bO) and in the dez of $I^{\mathrm{I}}.E^{\omega}$ 'cherry' from $G^{\mathrm{I}}.O^{\omega}$, changing Internal Proximity from unmarked Medium to Near. With Inside Focus it closes the opening: from O/C to A[S] in many signs referring to 'anus' or 'vulva' (Woodward 1979), from F to "crossedF" in the smallest of several 'round' SASSes (sect. IV.B.1). In A[S] this brings the fingertips into Contact with the palm, the closest value of Proximity. The formulation for "crossedF" is awkward; but another frequent form of this SASS is restrainedF, with the index finger curled under the thumb, with the same type of Compression as in A[S] .

Expression is an augmentative process, opposite to Compression: it increases distances. It is also discussed in sections III.C.2.b. and II.B.10. The largest 'round' SASSes have maximum or nearly maximum distance between the thumb- and fingertips: Internal Proximity has been expanded to Far. In some individual signs it affects the selection of digits: BIG-WORD (from WORD, with thumb and index, sect. II.B.10) and WADDLE $\bar{B}_a \cdot Y_{\upsilon v}\overset{\omega}{\perp}$ 'fat person walking' (from WALK-ROUTE, with index and middle, $V_v\overset{\ell}{\Delta}$). MEASURE $Y_{\infty}{}'Y_{\upsilon}{}^{x'}$ is related on the same dimension to an old sign for INCH $\overset{'''}{A}.\overset{'''}{L}{}^{x}$ (Higgins).

Condensation is primarily phonological. The shapes of two hands are combined onto one hand. It carries Number of Articulators from the Dyadic scale (Hand Arrangement) to the Internal one (Number of Fingers). Anderson (1978) has found this recurring in the reduction of two-handed manual alphabets to one-handed forms, yielding such forms as bent$\overset{'''}{V}$ from knuckle-to-knuckle X's (Modern French x). Danish SL similarly has bent$\overset{'''}{V}$ in THE-HELL! from separate X's in DEVIL/HELL (Anderson, pers. comm.). In ASL the same dimension of change may be operative in WALK-ROUTE and WALK (sect. II.B.11.h); TIPTOE $G_v G_v \overset{v}{\infty}{}^{\sim}$ and WALK-ROUTE show a similar relationship, or an opposite one, "Division". CONVERSE $\cup G_{\wedge} G_{\wedge}{}^{I\sim}$ has a Condensed form with idiomatically diminutive meaning: $\cup H_T{}^{\ell}$ 'whisper, converse privately' (Hartmut Teuber, pers. comm.).

II. E Reinterpretation

Since an observed sign form can be analyzed in many ways, it can be produced in one way and received in another. INSTITUTE, discussed in section II.A.1, has such a history. Originally morphologically specified for HC, base HC, and Directional Relation, it could be more simply described as a frozen sign with dez HC and basehand Focus. That pronunciation, however it was analyzed, required asymmetrical Orientations of the two hands, and in assimilating to the dez's Orientation the basehand assimilated in HC too. Multi-based phonology enables us to describe these shifts: different parameters are considered distinctive at different points in the sign's history. When we eliminate from the underlying inventory all information that can be predicted in one set of signs or another, we lose this descriptive ability.

HOME was originally EAT + SLEEP $\smile O^{x} \,\vdots\vdots\, \}B^{x}$, contacting first at the mouth and then at the upper cheek, with a change of handshape between the contacts. Now it is often pronounced $\}O^{x\cdot}$, with a repeated touch on the mid-cheek and only one handshape throughout. (See Frishberg 1976 for extensive discussion.) This development has proceeded by assimilation of HC and Location, and all its states have been subject to two-state description. But in this latest form the states are identical, and the pronunciation cannot be distinguished from one with repeated movement ([Movement Frequency: Repeated]). We can expect to start seeing pronunciations in which, as in other signs with repeated contact, the touch can be iterated more than two times nondistinctively.

HOME originated as a sequential compound, and INSTITUTION originally incorporated nonsequential (simultaneous) morphemes. Signs originating in the visual-geometric morphophonology discussed in Chapter IV are especially subject to reinterpretation as productively-formed constructions are lexicalized and "frozen". (See Chapter IV for further discussion.)

II. F Example Derivations

The phonological examples begin on the following page.

CAN'T $\bar{G}_{D}.G_{D}{}^{\dot{\vee}}_{\times}$

HA: Single dez
Dom: Foc: Tip
Nond: Foc: =
Prox: Grazing Contact
Mvt Dir: Downward

LAST $\ddot{I}_{>}.I^{\dot{\vee}}_{\times}$

HA: Single dez
Dom: Foc: Tip
HC: +Pinky
Ori: Semiprone
Nond: =
Prox: Grazing Contact
Mvt Dir: Downward

ANYWAY $B_{>}B_{<}{}^{\mathrm{I}}_{\times}{}^{\sim}$

HA: Double dez
Foc: Tip
HC: +Uniform
Prov: Grazing Contact
Mvt: Ph: Alternating
Freq: Repeated

Tip Focus defaults to [1Fg] , and that to G. Grazing Contact with Tip Focus, whether on dez or tab, defaults to Palmar, tab Tip Flat with Grazing Contact to Dorsal, so the dez's flexor muscles can resist impact and the tab's can yield to it. In CAN'T and ANYWAY the nondominant hand shares all the dominant's features except Movement: that is blocked by the single-dez specification. In ANYWAY, Alternating Phase causes the hands to trade dominance roles at each iteration. When both hands are [1Fg] with Finger or Tip Focus, the fingers default to being approximately perpendicular to each other to present a wide target, but [>1Fg] Tips have to be oriented so the rows of Tips meet. In LAST Orientation blocks the default Flat specification; Frishberg (1976) discusses LAST and CAN'T. In LAST and CAN'T the nondominant is specified the same as the dominant in all but Movement, which is blocked for it by the HA specification.

SCHOOL $B_a . B_v^{x\cdot}$

HA: Single dez
Dom: Foc: Palm
Nond: =
DR: Vertical
Prox: End Contact
Mvt Freq: Repeated

ON $B_v . B_v^{x}$

HA: Single dez
Dom: Foc: Palm
Nond: Foc: Back
Prox: End Contact

SIT $H_v . \dddot{H}_v^{x}$

HA: Single dez
Dom: HC: 2Fg
Foc: Flat
Nond: =
Prox: End Contact

NAME $H . H_{\ddagger}^{x\cdot}$

HA: Single dez
Dom: HC: 2Fg
Foc: Finger
Nond: =
Prox: End Contact
Mvt-Freq: Repeated

With Finger Focus in [-Uniform] HCs, Edge is the favored side: the Palmar side is less accessible because of the bulk of the fist, and the Dorsal side does not resist pressure well. Flat of a [-Uniform] HC defaults to Finger rather than Midhand. The Directional Relation is specified for SCHOOL because Beside and Above are both very frequent, though Above may be predictable here. (Below is infrequent, so Vertical defaults to Above.) In ON the Foci all but force Vertical DR. In SIT the nondominant Orientation assimilates to the dominant, which is allowed by the Focus specification of Flat; in SCHOOL such assimilation is blocked by the more specific Palm (which is least-marked [+Uniform] Focus anyway). SIT's resultant DR, Above, together with End-contact, produces a Downward Movement Direction; see next example.

SIT-FOR-A-LONG-TIME $^{(\text{Ø})}\bar{H}_{v}H_{D}{}^{v\cdot\cdot}$

HA: Double dez
HC: 2Fg
Foc: Flat
Prox: Held Contact
Mvt: Dir: Downward
Freq: Repeated

TO-NAME $H^{\ddagger}H^{\Updownarrow}$

HA: Double dez
HC: 2Fg
Dy Prox: Held Contact
Loc: Init: Agent
Fin: Patient

This aspectual inflection of SIT repeats with a Shape and Manner that are beyond the scope of this dissertation, but the Direction derives from the simple form (previous example). TO-NAME, with a similar simplification of Proximity (from changing to Steady-State), takes its Direction from deictic Locations. Dyadic scale is mentioned only to separate the contact from the locations: in all the examples so far, Proximity is Dyadic.

BEGIN $5^{o}.G^{a}$

HA: Single dez
Dom: Foc: Finger
Nond: Foc: Angle
Prox: Steady-State Contact
Mvt: Supinate

APPLY $G_{\wedge}.V^{x}$

HA: Single dez
Dom: Foc: Angle
Nond: Foc: Finger
DR: Above
Prox: End Contact

Finger Focus defaults to [1Fg], but BEGIN takes the articulatorily least-marked available HC, [+Uniform] 5, while APPLY, with "fine articulation" on the dez (Frishberg 1976), takes the minimum for Angle, [2Fg] V. BEGIN's Ipsilateral DR results from semiprone Ori on both hands.

GET-INTO-VEHICLE $O.\dddot{V}_{a}{}^{\mho\odot}$

HA: Single dez
Dom: Foc: Finger
HC: 2Fg
+Bent
Prox: End Contact
Mvt: Internal: Pronate

RIDE-IN-VEHICLE $O^{\odot}V^{\perp}$

Dom: Foc: Finger
HC: 2Fg
+Bent
Dy Prox: Holding Contact
Loc: Init: Source
Fin: Goal

Proximity simplifies as for NAME and SIT, along with explicit Movement.

POSTPONE (1) $FF^{\perp}$

HA: Double dez
HC: 1Fg
+Opp
Mvt: Dir: Forward

(2) $F^{\prime}.F^{\perp}$

HA: Single dez
Dom: HC: 1Fg
+Opp
Nond: =
Prox: Init: Near
Mvt: Dir: Forward

Proximity defaults to Medium, but hands that interact, as dez and basehand by definition do, must be specified for Proximity, and for them it is generally Near or Contact at some time. DR for double dez defaults to Ipsilateral, since the hands tend toward bilateral symmetry.

IMPROVE ✓.B×⊤·

Loc: Forearm
Foc: Edge
Prox: End Contact
Mvt Freq: Repeated] nested...
...within: Dir: Up

DETERIORATE ✓.B×⊥·

Loc: Forearm
Foc: Edge
Prox: End Contact
Mvt Freq: Repeated] nested...
...within: Dir: Down

This pair illustrates nesting of repetitions and antonymous reversal of direction (Frishberg & Gough 1973).

ELECTRICITY X>'X< ×·

HA: Double dez
Foc: Knuckle
Prox: End Contact
Mvt Freq: Repeated

GET-HOLD-OF G^.V

HA: Single dez
Dom: Foc: Inside
HC: 2Fg
Spat Mvt: Dir: Inward
Nond: Foc: Finger
Ori: Up
Spat Mvt: =
Dy Prox: End Contact

CHERRY G.Oω

HA: Single dez
Dom: Foc: Bunch
Int Mvt: Rotation
Dir'y: Bidirectional
Prox: Steady-State Contact

Dez Knuckle defaults to [1Fg] in ELECTRICITY. In GET-HOLD-OF the hands are specified the same for Spatial Movement, but only the dominant can move Dyadically, in accordance with the revised Symmetry Condition. CHERRY illustrates grasping Bunch.

HELP (2) $\underset{\smile}{A}B_a{}^{\wedge}$

HA: Single dez
Dom: Foc: Palm
     Mvt Dir: Up
Nond: HC: Closed
Mvt: =
DR: Below
Prox: Holding Contact

(4) $\underset{\smile}{A}.B_a{}^{\times\cdot\cdot}$

HA: Single dez
Dom: Foc: Palm
Nond: HC: Closed
DR: Below
Prox: End Contact
Mvt. Freq: Repeated

(5) $\overset{(\emptyset)}{B_a}.A^{\times\cdot\cdot}$

HA: Single dez
Dom: HC: Closed
Nond: Foc: Palm
Prox: End Contact
Mvt Freq: Repeated

Discussed in section I.B.1.a.ii. Notice the progressive simplification: first the loss of basehand movement, then the shift to unmarked DR.

PREGNANT 55^{x}
HA: Double dez
Foc: Finger + Angle
Prox: End Contact

PLAY-FOOTBALL $5_{\wedge}5_{\wedge}^{x\cdot}$
HA: Double dez
Foc: Finger + Angle
Ori: Up
Prox: End Contact
Mvt Freq: Repeated

MERGE $\dddot{5}_{T}\dddot{5}_{T}^{\dot{x}}$
HA: Double dez
Foc: Finger + Angle, Dorsal side
Prox: End Contact
Manner: Sharp

PLUG-IN (1) V.V$^{\odot}$
HA: Single dez
Dom: Foc: Finger + Angle
HC: 2Fg
Mvt Dir: Tipward
Nond: =
Prox: End Contact

(2) $^{(\emptyset)}$ G.V^{x}
HA: Single dez
Dom: Foc: Angle
Mvt Dir: Tipward
Nond: Foc: Finger
Prox: End Contact

Finger + Angle Focus is interlacing of the fingers. Approach from the Palmar side is default, but it is overridden in MERGE, resulting in loose bending of the fingers. (Direct tip-to-tip interlacing is hard, as is the sharp wrist angle that would otherwise be needed.) For this Focus, unlike dez Angle (see APPLY), [+Uniform] is default. PLUG-IN overrides the default for morphophonological reasons (sect. IV.B.1), but a simpler form has arisen.

FIRST-OF-TWO $V.G^{x}$
HA: Single dez
Dom: Foc: Tip
Nond: HC: 2Fg
Foc: Index Tip
Prox: End Contact

SECOND-OF-TWO $V.G^{x}$
HA: Single dez
Dom: Foc: Tip
Nond: HC: 2Fg
Foc: Middle Tip
Prox: End Contact

SUMMER-BEFORE-THIRD-YEAR $5.B_{a}\overset{\odot}{<}$
HA: Single dez
Dom: Foc: Edge
Nond: Foc: Middle-Ring Angle
Prox: End Contact

These illustrate the detailed specifications that numeral morphology can require. Fingers rarely need be specified without a morphological basis, and only pinky is needed outside numeral morphology. The last example counts from the pinky (DASL: 248).

HANG-OUT-LAUNDRY (1) $\bar{G}_{>}.F^{x}_{>}\!\!\because$
HA: Single dez
Dom: HC: 1Fg
Final +Opp
Nond: Foc: Finger
Dy Prox: End Contact
Mvt Freq: Repeated] nested...
...within: Dir: OH-Distal

(2) $\bar{B}_{>}.F^{x}_{>}\!\!\because$

HA: Single dez
Dom: HC: 1Fg
Final: +Opp
Nond: Foc: Edge
Dy Prox: End Contact
Mvt Freq: Repeated] nested...
...within: Dir: OH-Distal

The change from the morphophonological G-tab of (1) to the B-tab of (2) is mediated by the tab HC, which is not underlyingly specified: B is [+Uniform], which is articulatorily simpler than [1Fg] G.

WHITE $[\,]5_{<}{}^{\#[O]}_{\perp}$
HA: Single dez
Foc: Tip
HC: Fin: +Opp
Loc: Chest
Sp Prox: Init Contact

TO-LIKE $[\,]5_{<}{}^{\#[8]}_{\perp}$
HA: Single dez
Foc: Tip
HC: 1Fg
-Closed
Fin: +Opp
Loc: Chest
Sp Prox: Init Contact

These two signs are distinguished only by their final HC (sect. III.E). The default from Tip Focus to [1Fg] is overridden by changing HC, in which the default [+Uniform] applies (as it does in non-focus cases).

BICYCLE $A_{\text{ɒ}}A_{\text{ɒ}}\overset{\text{@}}{\perp}{}^{\sim}$

HA: Double dez
HC: +Closed
Ori: Prone
Prox: Near
Mvt: Shape: Circling
Plane: Sagittal
Sense: Top-Forward

SUNDAY $B_{\perp}B_{\perp}{}^{\text{@}}$

HA: Double dez
HC: -Closed
Ori: Palm Forward
Mvt: Shape: Circling
Plane: Palm

VIDEOTAPE-RECORDER $^{(\emptyset)}G_{v}G_{v}{}^{\text{@}}$

HA: Double dez
HC: 1Fg
Ori: Down
Mvt: Shape: Circling
Axis: Finger

Phase of two-handed circling movement is predictable: Alternating in sagittal plane, Synchronous otherwise (sect. III. D). The plane and axis of SUNDAY and VIDEOTAPE-RECORDER are probably predictable.

FEEL [ ]Ɣ8̂·

HA: Single dez
Foc: Tip
HC: -Closed
Loc: Chest
Prox: Sliding Contact
Mvt Dir: Upward

ME [ ]G_T ˣ

HA: Single dez
Foc: Tip
Loc: Chest
Prox: End Contact

BLIND ᵕV_{TD})(

HA: Single dez
Foc: Tip
HC: 2Fg
+Bent
Loc: Mid-face
Prox: Final: Near

The specifications of FEEL default to Ɣ HC; of ME, to G; of BLIND, to bent V̈. The bentness of BLIND may be predictable (sect. III.C.2).

UNDERSTAND ⌒X_T □[G]

HA: Single dez
HC: Fin: 1Fg
Loc: Upper Face
Ori: Inward

BIRD ◡$L_\perp$ #·

HA: Single dez
HC: 1Fg
+Closed
Fin: +Opp
Loc: Lower Face
Ori: Outward

HATE ȣȣ □̇ Δ [55]

HA: Double dez
HC: 1Fg
-Closed
Init: +Opp
Mvt: Intl Dir: Object
Manner: Sharp

These changes of HC are analyzed according to Table 3-11. The Internal Direction of HATE is the direction the fingers move in.

Notes to Chapter Two

1. Friedman recognizes that Dorsal and Palmar (her anatomy-derived "volar") forearm are analogous to Dorsal and Palmar hand and uses the same symbols to distinguish them.

2. But a number of signs hook the fingers, bending the midjoint only: THREE-HUNDRED $3_{\perp}^{\dot{\varrho}}$ (and the other hundreds from 200 to 500), STEAL $\checkmark . V_{\#}^{\top}$. The fingertips do not approach any possible Focus region (see next section), so this is not describeable as [Final Proximity: <u>Near</u>]. The joint-angle description is more suitable to hooked HC and hooking movement.

3. I would prefer to use the anatomical term <u>aspect</u>, but Stokoe's use of that word for each of the three quasi-parametric sections of his phonological analysis of a sign has two decades' priority in sign linguistics, and the general linguistic use of it with reference to verb semantics and morphology is needed as well (K,B, & Pedersen 1979; K,B, Newkirk, Pedersen, & Fischer 1979).

4. Friedman (1976) treats alternating movement, as in JUDGE, as a form of interaction. (See section II.B.11.h, on Phase.)

5. I owe to Hartmut Teuber the threefold gradation of distance, but he is not responsible for my use of it.

6. Friedman formalized contact as a feature of movement, with End, Continuous (called "contiguous" in 1976), and Double among its values. My analysis owes much to hers, although in generalizing two-state analysis and combining contact with distance I have shifted contact (Proximity) out of the Movement parameter into its own.

7. Friedman does not mention a sequence of two dez HCs for double contact, but signs such as MAKE-A-NOTE $B_a . O^{\times} \,\vdots\, B_a . B_{\flat}^{\times}$ should also be included in this class.

8. Rolling Contact is rotary with friction, but the axis of rotation is parallel to the interface. It is infrequent and may generally be replaced by Non-contact, with the same rotation plus a Proximity value of Near rather than steady-state Contact. In any case it is a variety of Sliding Contact, in which contact location on the tab is stable, but the dez's rotary relative motion shifts the phonetic focus. It only occurs on a single digit, ususally the

index finger (BEGIN $5^{\odot}.G^{a}$, KIDS $\triangleq Y_{<}^{\omega}$) but sometimes the thumb (AWKWARD $A^{\odot}.5^{\dot{o}}_{T}$).

9. DASL speculates that the etymological iconicity of WEAK relates to muscles, but Higgins gives it with V dez: in his (and my) opinion, from the 'legs' classifier. The change from V to 5/4 goes against the general trend, at least in the dez, from gross to fine articulation, observed by Frishberg (1976).

10. Friedman called this distinction "manner". It corresponds to Shape and Pivot in this analysis; manner is used here in the sense defined by S&N (1978).

10a. "Spritz" is a sudden snapping-out of the fingers from under the thumb (Frishberg & Gough, 1973; Friedman, 1976).

11. My understanding of K & W's analysis of handshape is derived from Kegl & Wilbur (1976) and from Wilbur's discussion (1979: 45-48). The handshape feature matrices that Wilbur credits to Kegl & Wilbur (1976) do not appear in that published version. For their other parameters Kegl & Wilbur (1976) is the fuller or only source.

12. The exact interpretation of this observation is subject to the details of the definition of their <u>extended</u>, which allows an extended finger to be bent as well. Their Adjacency Convention, which operates together with <u>extended</u>, <u>2Adjacent</u>, and <u>3Adjacent</u>, has effects comparable to those of a markedness convention: it associates index-middle extension, but not pinky-ring extension, with the feature value [+closed].

13. I owe a debt of thanks to Lloyd Anderson, whose term "significant fingers", with a somewhat different sense (1978), inspired this concept.

14. This phonological analogy was not originally intended to refer to an iconic analysis of signs, but in Chapter IV it hooks up with morphological iconicity: only the selected fingers are visually functional in iconic HC morphemes.

15. Though this feature makes part of the difference between a Chinese SL [A] and an ASL [A] : K, B, & Siple 1979b.

16. The morphophonological feature Round might be adequate for this purpose.

CHAPTER III

PHONOTACTICS

III. A Introduction

This chapter consists of several separate studies in the phonotactics of ASL. They are based on relative frequencies of occurrence in the DASL corpus and provide the basis for most of the assertions of markedness in Chapter II.

Most of the chapter is concerned with the use of Focus to predict HC. The longest section, III.B, examines Focus by itself, first in basehands and then in active hands. In III.C some combinations of Focus and other parameters together are shown to be predictive of further HC values. III.D demonstrates redundancies in two-handed circular movement. Section III. E discusses redundancies in changing-handshape signs.

III.B. Focus as a determinant of handshape

Some handshapes have limited choices of region-of-contact (abbreviated r-o-c): /8/ only with the bent middle finger, /F/ only with the tips or sides of the joined index finger and thumb. Others have many possibilities: /B/ can make contact at the palm, back, radial or ulnar edge, tips, back of the tips, heel of the palm, wrist, or elbow; with the thumb extended, it can also contact at the thumbtip and the web between the thumb and the index finger (thumbweb).[1] As Friedman observed (1976:71-72) in proposing r-o-c primes, in signs where the hands touch each other or certain parts of the body the parameter of orientation is more clearly specified, and allowable variation is more accurately covered, if orientation is defined in terms of r-o-c rather than in Stokoe's spatial and articulatory terms. (Stokoe himself (1978:82-86), from a viewpoint that denies the parametric independence of orientation as first stated by Battison, Markowicz, & Woodward (1975) and developed by later researchers, makes the related claim that spatially-defined orientation cannot be separated from r-o-c and the articulation of forearm rotation.) Since these arguments extend beyond actual contact to include the region of the hand that faces or points toward the other hand, body-area, or object of deixis, I will use the broader term <u>focus</u> (K, B, Newkirk & Battison, 1979:45).

There is a significant amount of redundancy between handshape and focus, especially in base hands.[2] The Dominance Condition (DC) defines an initial area of inquiry that is a natural class of cases and small enough to be nearly self-organizing, both of which facts can help us to avoid prejudging the issue: I refer to base hands with a different handshape than the dez. From them the inquiry extends quite naturally to base hands equal to the dez in handshape, and finally to dezes (active hands) themselves. (In the analysis of focus as a determinant of handshape, I am generally excluding signs in which one hand moves around the other. Circular movement in general will be examined separately.)

III.B.1 Focus in basehands

III.B.1.a Focus in Type 3 signs

Under the Dominance Condition, only a few handshapes (S [written A], B, 5, C, O, G), all of them "neutral" or "unmarked," can regularly appear as base hands with a different handshape from the dez, i.e. in Type 3 signs in Battison's typology (1978). (I will call this heterotab position; cf. such oral-phonology terms as "pretonic" and "heterorganic.") This list can be reduced even further by distributional criteria. Stokoe considers 5 an allophone of B, but gives it a separate symbol in DASL "for ease in writing and reading signs" (p. 247). C and O are distinctive in general, but comparison of DASL's Type 3 entries with C and O tab reveals that almost all the heterotab C's and most of the heterotab O's grasp or surround the dez. Some heterotab C's are freely variable with forms of O: "Many O-tab signs may show the tab slightly open like 'c', and some not listed [under O-tab] may be found under C-tab" (DASL: 266). In most of the remaining cases, the part of the dez that is surrounded is simply too large to close the circle, e.g. BOTH $C,V_{T}\overset{\#[H]}{\vee}$, in which the entire dez hand, initially inserted in the tab from below, has to pass down through it. This leaves four basic heterotab shapes: compact (A[S]), hollow (C/O), linear (G), and flat (B/5).

Each of these classes of neutral heterotab has one or two typical foci, which are not typical of any of the other neutral heterotabs.

An underlying lexical specification of the basehand focus together with an appropriate markedness convention in the phonology would be sufficient to determine the base handshape. Some cases require the additional specification of spatial relation, where it is a marked one, but that is no different from the DASL analysis. At the moment I only have adequate data on ASL, but other sign languages probably have similar formulations of the DC.

The heterotabs written in DASL with B overwhelmingly focus on the palm or palmar surface (including the fingers as well as the midhand).[3] Those written with 5 mostly use the angles between the fingers. C and O heterotabs, as mentioned, use the inside of the curve, if we say that a dez entering a C or O (as in GASOLINE $O.\dot{A}^{\odot}_{\vee}$ or FIND $\underset{\cdot}{C}.F^{\odot\#}_{\wedge}$ (or ... $\overset{\odot}{\underset{\#}{\wedge}}$) [DASL:57]) is approaching or contacting the inside. A number of O's also use the joined fingertips and thumbtip, a focus which I will call <u>bunch</u>. These do not alternate with C, but often do with G (tip) or F (bunch). Bunch is articulatorily and distributionally related to tip(s), but provides additional tactile feedback from the thumb and a larger contact surface. The G's use either the "trunk" of the finger (sometimes varying with B, e.g. $\bar{G}.V_{\vee}{}^{\omega}_{\times} \sim \bar{B}.V_{\vee}{}^{\omega}_{\times}$ 'hesitate, waver') or, less often, its tip (CHAMPION $\bar{G}_{\wedge}.\ddot{3}_{v}{}^{\times}$, CHERRY $G^{I}.O^{\omega}$).[4] The A[S] heterotabs focus on one end of the fist-cylinder (usually the radial end), which in more general terms is the side or edge of the hand. Since none of the other neutral heterotabs typically use it, this focus is sufficient to specify A[S].

This analysis is distributionally adequate but unsatisfying. If the connection between focus and handshape is not motivated but merely statistical, why should most heterotab shapes generally use foci that are unavailable to the others? Only O has a bunch, only 5 has an angle;

S has an inside, but it is not as accessible as C's and O's insides are; C's and O's palms are not as accessible as B's, A/S has no literal palm (although there is a surface that faces the same direction), and 5 is not distinctive from B in palm focus. And if there is some motivation behind these connections, why is A/S an exception, with a typical focus whose only recommendation, so to speak, is that no other handshape wants it, even though it is available to all of them?

Allan (1977), studying noun classifiers in over 50 spoken languages, found seven categories of classification. The category <u>shape</u> has three "major dimensional subcategories," 'saliently one-dimensional, two-dimensional, and three-dimensional': these are manifested in ASL hetero-tabs by G, B/5, and A/S. There are also three subcategories of non-dimensional shape: 'hollow' ("for container-like and pipe-like objects with a hollow interior"), 'annular' ("holes and entrances of various kinds," combined in Oriental languages with hollow), and 'prominent curved exterior', all available in the shape of C/O. Most of the typical hetero-tab foci correspond to specific salient relationships to these shapes: B palm 'on a plane', B edge 'at the edge of a plane', 5 angle 'through a plane', G "trunk" 'on a line', G tip 'at the end of a line', C/O inside 'in a hollow'. 'Prominent curved exterior' appears in a few uses of prone A[S] and in the back of the laxly curved prone hand, Ɗ.

But a saliently three-dimensional shape, whose height, width, and depth are perceived as approximately equal, has by definition no region more salient than any other for contact or for orientation. Every edge-focus heterotab A[S] in DASL is in the muscularly neutral semiprone orientation (which is literally unmarked in DASL notation) with the dez above or below it, while the other typical-focus heterotabs appear in various orientations and relations to their dezes. DASL notation reflects the correct analysis here: signs with edge-focus heterotab A[S] are underlyingly specified for handshape, namely the handshape with no salient region. Their orientation is not significant, so they take the articulatorily simplest orientation, semiprone, and the focus is determined by that and the spatial relation between the hands. This analysis, perceptually motivated from a system that many languages use to describe the world, is more satisfying than the distributional one described above, in which the preference of each handshape for a focus that is salient just for that handshape was unexplained, and edge focus was merely fortuitously "left over" and available to characterize the handshape that most prefers it. It also allows us to derive B as the unmarked heterotab with edge focus as well as with palm focus.

In the handshape-based analysis that originated with Stokoe and is still implicit in most work, these signs are considered to be specified for one of the neutral base handshapes. The typical focus of each such heterotab could then be derived by a markedness convention inverse to those I am proposing: where I suggest a convention like (1.a), the corresponding handshape-based convention would be (1.b):

(1) a: If the basehand focus is palmar, the unmarked base handshape is B.

b: If the base handshape is B, the unmarked basehand focus is palmar.

So far, no difference; but where a sign's basehand alternates between two handshapes, with the same focus in each, specification of the focus shows up the similarity between the variants. DASL (253) observes: "Signs whose sigs [i.e., Movements] involve the edge of the index finger [of the base hand] may have either G or B as tab." Compare $G_{\wedge \varphi}.B^{x\cdot}$ and

$B_{\wedge\varphi}.B^{\times\cdot}$'to frequent (a place)': whether the basehands are considered as unitary primes or as bundles of features, they have nothing in common except neutrality and full extension of at least the index finger. K & W propose that G is [+closed, +extended] while B is [-closed, +extended]; but without some mention of focus they are no closer kin to each other than to K & W's other two least-marked handshapes: G to A ([+closed, -extended]) and B to O ([-closed, -extended]), neither of which can be substituted in this sign (or in others in which G and B alternate as tab). Heterotab O seldom or never focuses on the edge; and while heterotab A typically does, the focus is deriveable from orientation and spatial relationship. So an underlying specification of basehand edge focus will produce as unmarked the base handshape feature(s) "at least one finger fully extended." That excludes A and O and includes B and G, which differ only in the number of fingers. Alternatively, the focus could be specified as the "trunk" of the finger, which predicts G handshape, and B could then be derived generatively, with the motivation that a handshape with uniform fingers is articulatorily simpler than one that treats one finger specially. This formulation uses K & W's [+extended], or my [>OFingers, -Bent], but like the other one it requires the concept of focus in order to make sense.

The neutral handshapes also occur with some other foci. In the handshape-based analysis these would have to be specified in addition to the handshape; a focus-based analysis requires no more specification than that, and allows a simplification in the case of dorsal focus (discussed below). A[S] appears as heterotab in two signs in DASL where the focus is the inside of the fist, grasping the 5-dez's extended thumb. (Signs referred to appear in Table 3-1.) Woodward (1979) gives, as well, a number of signs with this heterotab focus and dez G, thumbȦ, and I. Such signs can be lexically specified as if for O tab, with focus on the inside of the tab curve, plus the additional specification that the fingers are closed. Heterotab B has fewer than ten DASL entries each for dorsal, radial-edge, and ulnar-edge contact (but see below), and one for contact on the thumbweb. Heterotab 5 has, in addition to one contact at the wrist, a few fingertip and finger contacts, mostly involving either reference to the finger(s) per se or numeral morphology.[5] All the C heterotabs in DASL focus on the inside of the curve; the O heterotabs focus on either inside or bunch. Heterotab G focuses only on the "trunk" or tip.

Most of the basehands in DASL with focus on the back of the hand are not spelled with any specific handshape, but with the symbol $\mathcal{D}$, defined (DASL:205) as "the back of the wrist or back of the hand when the particular configuration is immaterial. The hand [...] is usually relaxed." "Immaterial" is unintentionally somewhat misleading: The relaxed handshape may alternate with A, B, or an assimilated handshape equal to that of the dez (see for instance Woodward, 1980:23 on WHISKEY), but a different nonneutral handshape, or even some of the neutral handshapes, would be incorrect. We can take $\mathcal{D}$ as alternating with B when it refers to the back of the hand, as in POTATO $\mathcal{D}\overset{\prime\prime\prime}{V}_{v}^{\times\cdot}$. $\mathcal{D}$ with edge focus (shown in DASL with the "tandem" symbol φ) alternates similarly with /A/: none of DASL's approximately fifteen separate heterotab /A/'s with edge focus are in palm-down orientation. In a focus-based analysis of basehands, underlying dorsal and edge focus in a neutral handshape surface as the lax $\mathcal{D}$ handshape if the orientation is palm-down, otherwise as B and /A/ ([S]) respectively.

($\mathcal{D}$ referring to the back of the wrist is not in consideration here. Note that a refers only to the inside of the wrist, not to the palm of the hand as it would if it were fully analogous to $\mathcal{D}$. Even when no specific handshape is lexically or morphologically required, access to the palm requires the fingers to be extended: B with palmar focus corresponds to a as "back-of-hand" $\mathcal{D}$ corresponds to "back-of-wrist $\mathcal{D}$.)

Boyes argues for /A/ as least-marked handshape, on the basis of evidence from acquisition of handshape and from hand control in (non-signing) infants. But in frequency in basehand position /A/ is heavily outnumbered by B. About as many basehands are in the B handshape as in all other handshapes combined. B also has more different regions of contact than any other handshape (above). In terms of focus, about 90% of the heterotab B's focus on the palmar surface. From these facts it appears that if any base handshape is least marked, it must be B; if any basehand focus is least marked, it must be palmar.

III.B.1.b. Type 2 signs: The source of homotabs

Of course the neutral handshapes, like most if not all others, can also occur in Type 2 signs, where the dez and tab hands have the same handshape. (I will call this homotab position.) This suggests that superficially equivalent basehands may have one origin as heterotab and another as homotab. For example, the heterotab /A/ of HELP $\underline{A}.B_{\alpha}^{x\cdot}$ may underlyingly be more like the heterotab B of DANCE $\bar{B}_{\alpha}.V_{v}^{\omega}$ than it is like the homotab /A/ of STUPID-JERK $A_{\perp ?}.A_{T}^{\dot{x}}$ (Fig. 3-1). This possibility further implies that some neutral-handshape homotabs may be, so to speak, covert heterotabs, underlyingly specified as neutral basehands and surfacing as handshapes that happen to match the dez. Evidence for or against this hypothesis cannot come just from handshape data. Focus and orientation provide the pertinent information.

III.B.1.b.i Type 2 signs with nonneutral handshapes

DASL lists about thirty separate nonneutral-handshape Type 2 signs, using handshapes thumbȦ, F, H, I, K, 3, V, W, and X (including bO). (See Table 3-2.) All but one of these obey the following condition:

(2) The Homotab Symmetry Constraint: In Type 2 signs with nonneutral handshapes: The foci of the tab and dez are either identical or symmetrical, and their orientations are either identical, or symmetrical with respect to the plane that separates them (mutually symmetrical).

(Notice the similarity of this statement to the Symmetry Condition [SC].) "Symmetrical foci" are opposite sides of the hand: the radial and ulnar edges, or the palmar and dorsal flats; a third pair will be added later. The same part of the hand is involved on each hand: $\bar{G}.G^{x\cdot}$ 'right, correct' and $G.G^{\times}_{\dagger}$ 'cross, X' both use symmetrical edge foci, but in the second sign the edges are those of the fingers, and in the first, those of the "fists."[6] "Identical orientation" is defined as in the DC: "both hands have the same orientation with respect to the body (e.g. fingers pointed out from the body and palm down)" (Battison, 1978:33).[7] "Mutually symmetrical orientation" = Battison's "symmetrical orientation" in the DC (renamed to make clear its difference from bilateral symmetry): "any orientation in which identical parts (any parts) of the two hands have mirror image orientations with respect to the plane which separates them" (Battison, 1978:33). Identical and mutually symmetrical orientation are decided as of the hands' moment of closest approach or contact. In Type 2 signs, symmetrical focus occurs only with identical orientation, and identical focus only with mutually symmetrical orientation (though the orientations in such signs may simultaneously be identical as well). This is a constraint of ASL or of signing, rather than an articulatory necessity: in the nonsign $^{*}B_{D}{}^{|}\cdot B_{a}{}^{x}$ the ulnar edge of the supine dez touches the radial edge of the prone tab, so the foci are symmetrical, but the orientations are neither identical nor mutually symmetrical.[8]

The "trunks" and tips of the thumb and fingers usually interact symmetrically -- palmar to dorsal side or ulnar to radial side -- but the choice of side is perceptually less salient than the fact that the digit, its "trunk," or its tip is being used. In LAST (Fig. 3-3), the pinky tips are focal, but just which surface of each is involved is hard to tell and is unlikely to be critical.

III.B.1.b.ii Criteria

We now have a test for the hypothesized covert heterotabs. Given a Type 2 sign with a neutral handshape (A.A, B.B, 5.5, C.C, O.O, G.G),[9] we can ask the following questions:

(3) - <u>Are the foci and orientations identical or symmetrical in the sense described above for Type 2 signs with nonneutral handshapes?</u> If they are, underlying specification of the basehand in terms of the dez would be simple and "inexpensive." If not, it would require costly additional specifications as exceptions to the canonical form of a Type 2.

- <u>Is the focus of the basehand the same as a typical focus of that handshape in Type 3 signs?</u> If so, its underlying specification could easily be in the same form as a heterotab specification, mostly or entirely in terms of focus. If not, such an inexpensive specification would be impossible or would require costly additional specifications.

If we get a "Yes" answer to the first question and a "No" answer to the second, the sign is like a typical nonneutral type 2 and we have no grounds for considering it anything else. A "No" answer to the first question together with a "Yes" to the second means that the sign is easier to describe in terms of the DC than in the SC-like terms that govern nonneutral Type 2's ((2), above). "Yes" answers to both questions mean that the sign is cheap to describe in either way; we have no grounds here for deciding, and since a sign that has both types of redundancy is probably even easier than a sign that has just one, an ideal analysis would credit it with both advantages. (I am assuming that the DC and SC are perceptually and/or articulatorily real and not just convenient to linguists.) Getting a pair of "No" answers is a sign of high complexity; such cases should be rare.

Additional evidence can come from related signs of other types. A minimally different Type 1 sign (both hands moving) which is regarded as an alternate pronunciation is strong evidence that the sign in question is an underlying Type 2, with tab specified as equal to the dez (examples in Table 3-3; NEVER-MIND in Fig. 3-4).

As pointed out by Anderson (1978b:171-180), who has independently noted this pattern of alternation, such Type 2's often arise by reduction of the movement in Type 1's. Conversely, the existence of a related Type 3 with the same tab focus (especially one that signers perceive as just a variant pronunciation) suggests that the Type 2's homotab is underlyingly specified in terms of its focus, and its handshape has assimilated to that of the dez. This occurs most often with B and G tabs. (See Table 3-4.) But often the handshape assimilation is accompanied by a change in focus to the symmetrical/identical Type 2 pattern (INSTITUTION); these cases must be considered to have been restructured to Type 2 form, with tab underlyingly specified as equal to the dez.

III.B.1.b.iii Variety of focus in neutral-handshape Type 2 signs

The neutral handshapes show wider variety of focus as homotab than as heterotab. About half of all homotab /A/'s in DASL focus on the folded mid-phalanges (with the heel of the hand often completing the surface); accordingly, these are [A] rather than the more common [S] (Wilbur, 1979). BEHIND and some others contact at the heel of the hand, EACH on the back of the thumb, ALGEBRA at the wrist. Edge contacts (radial or ulnar), as in COFFEE, are few. B has the same broad range of foci as in heterotab position and in similar proportions, with the notable difference that dorsal contacts (about twenty) equal all the other non-palmar contacts combined. Homotab 5 (including 4) has edge, palmar, and dorsal contacts, with only one finger-angle focus (INFILTRATE $5_{\top}.5^{\odot}$). G, like B, has mostly the same regions of contact in homotab position as in heterotab. The notable additions are a couple of radial-side contacts with the "fist" part (side of thumb, thumbweb, and index inner knuckle) rather than the finger. In $\bar{G}.G^{\dot{x}}$ 'right, correct', $\bar{G}.G^{\dot{x}\cdot\cdot}$ 'regular', and $\parallel\bar{G}.G^{x}$ '(sibling)'[10] the dez G taps the tab G from above. Since both are in the muscularly neutral semiprone orientation the dez ulnar edge contacts the tab radial edge. Most of the homotab O's, like the heterotabs, focus on the inside. PLAY-CARDS (whose tab alternates with B_a and whose dez alternates with bO and a kind of open A) focuses on the opposed tips.

III.B.1.b.iv Covert Type 3 signs

In about six separate A.A Type 2's the tab focus is on the folded midphalanges, the "palm" of the [A]. $A_{\perp\varphi}.A_{\top}^{\dot{x}}$ 'stupid jerk' (Fig. 3-1) is an example. In all of these the dez focus is also palmar, and the orientations are identical or mutually symmetrical. But no heterotab /A/ uses this focus. These signs, then, are underlying Type 2's, specifying the tab in terms of the dez.

In SUPPORT $\underset{\frown}{A}.A_{\top}{}^{x}$, however, the homotab /A/ ([S]) is in a neutral orientation, semiprone with straight wrist, and is touched from below on the ulnar edge, while the dez /A/ is supine with palm facing the signer and metacarpals upward, and touches the tab with the inner phalanges (the striking surface of the fist: "knuckle" focus). (This sign's pronunciation varies greatly. The form illustrated, $\checkmark\underline{A}_{\nu}.A_{\wedge}{}^{x}$, is different from the form given in DASL and described here.) This homotab /A/ is evidently specified as a neutral handshape, not as equal to the dez. Although the analysis is complete as given, it is supported by the existence of the phonologically and semantically similar Type 3 sign HELP $\underset{\frown}{A}.B_{a}{}^{x}$ (see Fig. 3-5).

COFFEE $\bar{A}.A_{x}^{@}$ fits both criteria. The hands are in identical orientations with symmetrical foci, the orientation is neutral, the focus is edge, the predominant focus for heterotab /A/. Either form of description would be cheap.

- BEHIND $A'.A_{\top}^{>x}$ illustrates the third pair of symmetrical foci mentioned earlier. It starts with palmside focus on both hands, side-by-side, and moves the dez behind the tab so that its knuckles (distal side) touch the heel, or palmside of the wrist, of the tab. What point on the fist is symmetrical to the knuckles? The root of the hand, the point where it is attached to the wrist. BEHIND makes the closest physically possible approximation to the third pair of symmetrical focal surfaces. (However, the morphology of this sign and others such as

CHASE and PASS suggests that the underlying specification refers to the spatial relationship of the hands rather than their foci.)

B has a variety of foci to deal with. The cases with none of the symmetry typical of a Type 2 are easiest to dispose of. We can confidently treat such signs as those in Table 3-5 as specified for neutral tab rather than homotab. And a sign like GLOVES $\bar{B}_{D}.B_{DX}^{\top\cdot}$, with a dorsal tab focus, symmetrical dez focus, identical orientations, and a Type 1 synonym $\bar{B}_{D}B_{DX}^{\top()}$, is a pretty evident underlying Type 2. But palmar focus is so heavily predominant in heterotab B and (on B) in all heterotabs taken together that the numerous symmetrical or identical palm-focus B.B's (such as SCHOOL $B_{a}.B_{D}^{x\cdot}$) are, in general, undecideable.

In about fifteen of the twenty or so B.B's with dorsal tab focus, the tab hand is oriented palm-down: e.g., WARN $\bar{B}_{D}.B^{\dot{x}}$. If, as proposed above, dorsal tab focus with palm-down orientation normally yields the lax D handshape, then these cases can be described as assimilation of the tab to the dez handshape. Only one feature need assimilate; the extension of the fingers, which is unitary both perceptually and articulatorily (action of the extensor digitorum communis muscle). This assimilation is normal for the tab dorsal focus with a B dez: DASL gives only five separate D.B signs, two of which are on the back of the wrist rather than the back of the hand.

In BOTHER $B_{D\varphi}.B_{\wedge}^{x\cdot}$ and PREVENT $B_{D\varphi}.B_{\wedge}^{\dot{x}}$ the dez ulnar edge strikes the tab thumbweb (sharply in PREVENT, repeatedly in BOTHER). BOTHER also has a variant with tab focus in the angle between the fingers, $5_{\top\varphi}.B_{\wedge}^{x\cdot}$, and PREVENT has a variant with impact on the inside of a C-tab, $C\varphi.B_{\wedge}^{\dot{x}}$. Tab angle focus normally uses the finger-angles of 5 (see below), but the midhand of the dez is too thick to fit into many people's finger-angle, and the thumbweb and palm are sturdier and more able to withstand impact than the fingerweb is. Therefore the thumbweb and C variants are articulatorily motivated. Fronting the thumb and bending the innerjoints (making C) relaxes the thumbweb so it can absorb impact without discomfort or injury. So these signs (and the heterotab MEAT $\bar{B}.F^{\mathfrak{I}}$, with thumbweb tab focus) are specified for tab angle focus, and modity their tab handshape and/or focus because of a physical constraint like the one that relates heterotab O and C to inside focus.

The special relationship between B and 5 -- the finger-spreading of 5 is generally not distinctive -- complicates the analysis, but resolution is not hard. Every B.5 in DASL either has a hand-internal movement that requires finger motion, or is a variant of a sign with such a movement: # (<u>close</u>), ℓ (<u>wiggle</u>), or ŋ (<u>bend</u> <u>fingers</u>). Most of them, including the two variants, have asymmetrical orientations and foci, and all have palmar tab focus except for one dorsal (BLOOD). For example: ALL-GONE $\tilde{B}_{a}.5^{\#[A]}_{>}$ with ulnar edge focus in the dez, STUDY $B_{a}.5_{v}{}^{\ell}$ with dez tip focus, and WEAK $B_{a}.5_{v}{}^{ŋ'}_{\times}$ also with tip focus. (All three have tab palm focus.) DASL's usage is to write 5 rather than B when spread fingers are essential to correct pronunciation. The authors evidently thought spreading essential only on the dezes of these signs, and this analysis bears out their judgment: DASL's B.5 signs are underlyingly Type 3, and their basehands are specified with neutral handshape.

5-tabs present a similar situation. The 5.B's all contact in the tab angle(s) and can be considered Type 3's, just as they are written: e.g., INTERMISSION $5.B^{\varrho}_{<}$. The 5.5's[11] all have symmetrical or identical orientation and focus: palmar.dorsal (i.e. palmar tab focus and dorsal dez focus), palmar.palmar, one ulnar.radial, and one angle.angle; so they are specified with homotab rather than neutral tab and are true

Type 2's. Examples: MESH $5_a . 5_{a} {}^{\top}_{\times}{}'$, VAGUE $5_\top . 5_\perp{}^{\curvearrowright}$, INFILTRATE $5_\top . 5^{\odot}$.

DASL lists only four C.C signs; all of them focus on the edge or on the tips of the thumb and fingers and use symmetrical or identical orientation, and are true Type 2's, e.g. LUXURIOUS-AUTOMOBILE $\surd C_\varphi . C^{\top}$. But three of the four homotab O's (all related) use inside focus and superficially vary between O-tab Type 2's and C-tab Type 3's, e.g. IN $O.O_v{}^{\odot}$. They are clearly specified for neutral tab and inside focus. ADD $O.O_{a}{}^{)(}_{\mho}{}^{\times}$, with symmetrical orientation and identical focus not typical for heterotab O, is a true Type 2.

Most homotab G's use one of the two foci that are most frequent in heterotab G, tip and "trunk." Those that do not are easily analyzed as underlying Type 2's: e.g., RIGHT/CORRECT $\bar{G}.G^{\dot{\times}}$ has identical orientation and symmetrical radial.ulnar "fist" contact, and $G_\wedge . G_\wedge{}^{)(\times}$ 'meet (transitive: one person meets one person)' has mutually symmetrical orientation and identical palmar "fist" contact. But most of the other G.G's use identical or symmetrical focus on "trunk" or tip with asymmetrical, nonidentical orientation, and they are harder to assign. In a sign like GOAL/PURPOSE $\surd G_\wedge . G^{)(}$ the answer to the first criterial question ("Are the foci and orientations either identical or symmetrical?") is, "Yes for foci, no for orientations," and the answer to the second question ("Is the tab focus typical for this handshape in heterotab position?") is "Yes." But all but two of DASL's thirty or so nonneutral Type 2's are symmetrical-or-identical in both focus and orientation. Unless the difference in orientations can be predicted from articulatory considerations -- and in most of these cases it does not appear to be -- the additional specifications for orientation that would have to be added as exceptions to the specification "tab handshape = dez handshape" would make Type 2 treatment too costly for these signs. So I will treat the tab of GOAL/PURPOSE and similar signs as specified for tab focus and orientation, i.e. as Type 3.

III.B.1.b.v Nonsymmetrical Type 2 signs

The exceptions to the Homotab Symmetry Constraint, (2), are morphologically complex. DIVE $H_{D}.H_{v}{}^{\stackrel{a}{v}}$ can be modified to describe the dive in some detail: DASL gives the example $H_{D}.H_{v}{}^{\wedge\vee}$ 'dive feet first', and describes the sign as "imitative: tab of board, dez fingers of legs." The tab here is a common classifier H - 'long flat object', a subclass of 'saliently two-dimensional' referring to objects whose three dimensions are <u>all</u> saliently unequal: longer than they are wide, and wider than they are thick. Other signs with this classifier include NECKTIE $\Pi H^{\times\vee}$, BOWTIE $\Pi H_{>}H_{<}{}^{\div}$, SCREWDRIVER $B_{a}.H_{v}{}^{\stackrel{\omega}{\times}}$, "SCOTCH"-TAPE $H_{D}{}^{+}.H_{D}{}^{\stackrel{\top\cdot}{\times}}$ (S & N, 1978), and FELLATIO $G.H^{\stackrel{\vee}{\times}}$. The dez is the V-'legs' classifier, assimilated to the tab in spreading. The other exception in DASL, DANGLING-STRING $I_{>}.I_{\wedge}{}^{\vee}$, is similarly constructed with the classifier I-'diminutive (small or very thin) saliently one-dimensional object', frequently referring to 'line' or 'string': THREAD $I_{>}{}'.I_{<}{}^{>} \sim I_{>}I_{<}{}^{\div}$, DRAW-A-STRAIGHT-LINE $\checkmark I_{v}{}^{\perp}$, SPAGHETTI $I_{>}I_{<}{}^{\dot{\hat{x}}}$, TALL-AND-THIN $\tilde{I}_{\wedge}.I_{v}{}^{\wedge}$.

III.B.1.c Exceptional heterotabs

The DC is not absolute: other handshapes than [A, S, B, 5, C, O, G] are occasionally found in heterotab position.[12] At least the following additional handshapes can be heterotabs: thumbÅ, F, H, I, L, V, Y.

Table 3-6 lists the examples from DASL and in Woodward, 1979 (SSB), plus one pertinent example from McIntire (1977).

G, I, and thumbȦ are the three linear handshapes of ASL: each shows one straight digit projecting from a closed fist. I and thumbȦ in heterotab position usually alternate with heterotab G and always use the same foci it does: tip and "trunk." I alternating with G often carries a diminutive nuance which should be considered morphological. (Compare such non-basehand signs as "UNDERSTAND-A-LITTLE" [K, B, and Lentz, 1979:324-325], and "HATE-A-LITTLE: $6_{\perp}I_{\perp}^{\dot{\square}}$.) These heterotab I's focus on the tip. In EGO, whose I is from the Sign-English pronoun I, the whole finger is focus. Heterotab Y in STRAWBERRY/CHERRY (the meaning varies dialectically) is deriveable from I by the "Rule of Thumb" (Battison, Markowicz, & Woodward, 1973). ThumbȦ, like I, alternates with G in some non-basehand signs as well: FOLLOW $\dot{A}_{\wedge\varphi}\dot{A}_{\wedge}^{\perp} \sim \dot{A}_{\wedge\varphi}G_{\wedge}^{\perp} \sim G_{\wedge\varphi}G_{\wedge}^{\perp}$ (Wilbur, 1979:58, citing J. Woodward, pers. comm.). $\dot{A}.Y_{D}^{\times}\ddot{\|}$ in STAY-THERE is assimilated from $\dot{A}.\dot{A}^{\times}$ 'stay' + $Y_{D}^{\triangle}$ '(deictic: object at location)'.

ANGLE, with heterotab L (also CHECK-OFF), uses the tab iconically in the same way as $C.G\overset{\circlearrowleft}{\times}$ 'circle', tracing its outline with the dez fingertip. THEN/OR may actually be a merger of two signs, both derived from numeral morphology. It is identical to a fast pronunciation of "FIRST-OF-TWO, SECOND-OF-TWO." The sense 'then' may come directly from 'first ... second'. And at least two other sign languages have independently developed similar signs for 'or', rotating the forearm to point back and forth between the two extended digits of the other hand (Australian SL with Y and Swedish-Finnish SL with V) (Anderson, 1979).

Heterotab V in CHOICE is clearly derived from a reference to choosing from two (or more-than-one), although it is by now lexically independent. BEGIN with V-tab is a variant of $5^{\odot}.G^{a}$, whose base handshape is neutral. An intermediate form is often seen in which all tab fingers are extended but only the two enclosing the dez finger -- usually the index and middle -- are spread. The form with V is evidently older, being the only pronunciation given by Long and Higgins (see Fig. 3-6). The moderm French SL <u>COMMENCER</u> $G^{\prime}.V^{\odot}$ has metathesized dominance from the Old-FSL sign (Oléron quoting Sicard, 1808), but the handshape appears to confirm the seniority of V. I hedge for two reasons: Sicard refers only to imagery and does not describe the handshape, and dez V could have been derived from 5 by the shift from grosser to finer articulation described by Frishberg (1976) for ASL (in such signs as STEAL, $\checkmark.\dddot{V}\,{}^{\dot{\alpha}}_{\mathrm{T}}$ from older $\checkmark.C^{\dot{\#}}_{\mathrm{T}}$). If phonotactics is any guide, BEGIN is now a victim of rule inversion: the innovated form is now phonologically unmarked (basehand 5 predictable from specification of Angle focus), and the older pronunciation is a phonologically marked variant.

DASL lists four signs plus two variant pronunciations with heterotab H. In four of them the dez differs from H by only one feature, in one by two features, and in one by three features. The features involved are spread fingers, bent fingers, abducted (fronted) thumb, and use of all four fingers instead of the index and ring. V and H often alternate, especially in the bent form (DASL:260), and spreading is not highly distinctive in general, as with B and 5. The fronted thumb is necessary for the grasping movement in MOOCH and the surround movement in DRESS (dual$\ddot{C}$). We can consider the basehand underlyingly specified for the extension of the same pair of fingers as the dez, but not for the bending or thumb-fronting: the spreading of the dez is phonologically insignificant. DRESS(C), identical to DRESS(dualC̈) in all but number of dez fingers, is underlyingly costlier because of that difference.

Heterotab F here manifests Allan's "annular" shape subcategory. (Active F is sometimes annular as well, as in HOLE $\checkmark . F^{x}$.)

III.B.1.d Summary: Determination of base handshapes

Many handshapes can interact with the other hand or the body at several foci. Allowable foci in heterotabs are partly predictable from the tab handshape and vice versa, but treating heterotab focus as distinctive allows principled prediction of variations in handshape and orientation, while treating tab handshape as distinctive does not allow such prediction of variation in orientation and handshape. In an analysis based on focus, Battison's Type 2 and Type 3 are replaced by one class of sign whose basehand is describeable in terms of the active hand (<u>homotab signs</u>) and another class whose basehand is predictable from its focus (<u>focal-tab signs</u>). Each of these classes represents a type of redundancy, analogous to the redundancies described by Battison (1978:30-32). Many signs can be described equally well in either way (focal homotab signs); presumably such double redundancy is more helpful to the language learner and user than either type alone, and generative phonology's inability to incorporate both redundancies in the description of a single sign is a failing of the theory. Battison's Type 2 includes all of the (pure) homotab signs, as well as the focal homotab signs and many focal-tab signs whose only similarity to the homotab signs is identity of active and base handshape; his Type 3 contains those focal-tab signs whose base handshapes happen to differ from their active handshapes. There are also more complex signs which require further specifications in addition to one or the other of these types of underlying description.

Table 3-7 displays the basehand foci postulated as available in underlying specifications of lexical signs. The column headings are handshapes, or sets of handshapes that are nondistinctive as heterotabs with certain foci. Each cell in the table gives the conditions under which that row's underlying focus produces that column's handshape in the basehand. Blank cells correspond to combinations that do not exist or are not phonologically predictable. A condition for a handshape feature ("HC") forces the base handshape to be the one shown at the top of the column, overriding any other conditions that may be met. Handshape features may be morphologically specified, as in FINGER $5^{I}.L^{\supset}$; this differs from the costly complete specification of an arbitrary base handshape only in that specifying <u>any</u> handshape features on a base hand, even the one or two required for a neutral handshape (whose remaining features are unmarked), is costly compared with homotab or focal-tab specification. The orientation and spatial-relation specifications are equivalent, given the focus (sect. I.B.1.f).

The list of foci in Table 3-7 is a subset of the one in section II.B.6. Thumb and Thumbtip, which occur as heterotab foci only infrequently and then in morphologically-influenced environments, appear only as derivatives of "digit" by the costly additional specification of thumb involvement. Heterotab-Knuckle focus occurs in DASL only in SLICE. ("'Trunk' of finger" is equivalent to "Finger Focus" of Chapter II)

Table 3-8 explicitly converts the conditions of Table 3-7 into predictions of the base handshape from its focus and possible additional specifications. Table 3-8 also includes the nonneutral heterotabs thumbȦ, F, and I (discussed in sect. III.B.1.c) insofar as they can be derived from specification of foci that they share with neutral heterotabs from which they alternate. I do not include derivations for heterotabs H, L, and Y, which occur in Table 3-6, because I do not consider the tab handshapes in those signs to be deriveable from their foci.[13]

Note in Table 3-8 that palmar and dorsal foci have no provision for specifying non-uniform fingers. In fact, any heterotab that has non-uniform fingers must use the non-closed finger(s) in contact or other focus. Heterotabs are known to be restricted to (usually) the six least-marked handshapes; their foci are restricted too. Apparently the heterotab would be too complex if it required attention in two parts simultaneously: the fingers by a marked (nonuniform) arrangement and the palm or back of the midhand by contact. (Active hands and (underlying) homotabs do use such combinations, though rarely, e.g. $\bar{B}_a . G_\wedge^{?}$ 'magnetic compass' and $[\,]\,G^{x\cdot}$ 'I alone', heel of dez G; $G_\wedge . G_\wedge^{xx}$ 'one person meets one person', "fist" palms of dez and homotab; $^{(\emptyset)}\dot{Y}_\wedge{}'\dot{Y}_\wedge{}^{\omega\sim}_{x}$ '"kissy-face," smooch demonstratively', double-dez "fist" palms. Dez dorsal focus is rare with all handshapes and parts of the hand, but does occur, as in $\frown Y_\perp^{\dot{x}}$ 'country bumpkin' and $\mathcal{D}A_a^{x\cdot}$ 'stone'.) In the terms of Chapter II, only <u>selected</u> fingers may be in focus.

With edge focus, however, B and G often vary (radial edge only: ulnar edge is always B). The plane of the palm or back of the midhand stops at the innerjoints when any fingers are bent or closed, so G is saliently different from B on these sides, and the ulnar edge of G is the end of the "fist," not at all like the straight ulnar edge of B. But both handshapes have the index finger fully extended, so the radial edge is the same for both.

III.B.2 Focus in active hands

We can reasonably expect many of the conditions in Table 3-8 to apply to active handshapes as well. There are more handshape possibilities for the active hand, but most of these neutral handshapes should be the unmarked choice: most frequent. In terms of the amount of information necessary to determine an active handshape and its focus, palmar focus (for example) with no other handshape information should be expected to imply B (the most frequent palmar-contact handshape); with palmar focus, an additional specification "fingers spread" would yield a 5 handshape. Focus on the tip or "trunk," by itself, should be expected to predict G. I also has one finger extended, but it is much less common than G, and generally more marked or less neutral in three of the senses listed by Battison (1978:37): absolute and contextual frequency, cross-sign language universality, and early native acquisition. Few dezes have palmar focus, but many focus on the "trunk" or tip, often alternating with G. In the active hand, as in the base hand, this relationship can be formalized by specifying the alternating signs alike, but marking the I-alternant additionally for pinky involvement.

III.B.2.a Fingertip(s)

The most common fingertip-focus dez, by far, is G (70 entries in DASL). B is next (50, including 5 cases with bent$\dddot{\mathrm{B}}$ (section III.C.2.b)), followed by ४ (24), 5 (15), I (10), and C (4). (These figures, like most in this chapter, are approximate, and generally exclude signs with grasping movement or relationship. I also exclude C and bent$\dddot{5}$ when the thumbtip is in focus as well.) It seems that G is the unmarked handshape with fingertip focus in dez position as well as in heterotab.

III.B.2.a.i (The effect of "facial displacement")

Frishberg (1976:65-70) describes <u>facial displacement</u>, a historical change affecting signs made in contact with the face: "two-handed signs tend to become one-handed ... [and] tend to displace historically from the center ... to the perimeter when made with asymmetrical contact." As she points out (80), this centrifugal shift clears the addressee's view of the signer's face for para-linguistic and grammatical information. (See Baker & Padden, 1978a; Liddell, 1977, 1978; and Coulter, 1979.) The same process affects the focus of active hands in the facial region, especially the lower face. About 15 of the B examples in the total given are made with the palmar surface of the tips on the head or face, where there are almost no contacts with the center of the hand (GO-TO-BED $\}B^{\times}$, on the cheek, is one). If the palm itself touched the chin in GOOD $\smile\!/B_{T}{}^{\perp}$(Fig. 3-6), the fingers would cover the nose, and the whole lower and central face would be blocked. At least six of the palmar-tip-focal B's on the face can be assigned to underlying palmar contact: SMELL $\hookleftarrow B_{T}{}^{\wedge\cdot}$, SWEET $\smile B_{T}{}^{\check{x}\cdot}$, NAPKIN $\smile B_{T}{}^{\frown}$, THANK-YOU $\smile\!/B_{T}{}^{\perp}$, GOOD $\smile\!/B_{T}{}^{\perp}$, and BETTER $\smile B_{<\wedge}^{\#[A]}$(the last two or three of these related). Remaining tip-focal B's can be seen as marked for uniform action of the fingers; uniform action is in general articulatorily simpler than nonuniform action, but one tip may be perceptually more salient than a row of four.

In 8 the tip of the bent middle finger is the only allowable focus. F is similar in shape and focal restrictions, but it has the thumb opposed to the bent finger. (Outside of numeral morphology, opposed [8] occurs only with opening or closing from a spread handshape that DASL writes with ɣ . This often alternates freely with F, as in STORY and TO-LIKE, but many F's do not change during the sign, and most of these do not alternate.

The similarity between F and ɣ in focus possibilities is part of a wider pattern, the "Most-Bent-Finger Constraint" (MBFC) (Mandel, 1978, here revised):

(4) Finger(tip) focus is restricted to the finger(s) bent furthest toward the palm without being closed, whether opposed or not. (Of course, if there are no bent fingers, finger(tip) focus can only be on the extended fingers.)

This is an extension of Friedman's observation (1976:75) that opposed handshapes never contact with the non-opposed extended fingers. Besides and F, this constraint applies to D, bD, K, thumb7̇, thumbḞ (the last two in variation with ɣ), thumbẆ (the last three, along with some ɣ's, derived from palmar-focus 5 by morphologically-required focus on one finger), and 6. In the analysis of Chapter II it is a direct consequence of the Finger Position Constraint. Since only selected fingers can be phonologically bent, any bent finger in a handshape must be a selected one; since all selected fingers must be in the same position, any more-extended finger on that hand must be an "other" finger; since only selected fingers can be in focus, only the bent fingers of that hand can be in focus.

In Chinese, Japanese, and Taiwan SLs (the last two are recently related) F can contact with the extended fingertips. The FPC can be saved as a universal sign language constraint if we say that such tip-focal F's underlyingly have the index finger closed rather than opposed. In the terms of Chapter II, they are [3Fg, +Pinky]. No regular handshape of ASL except I requires an underlying finger-selection specification. But these East Asian sign languages seem to use the extended pinky more freely than ASL. It occurs in the morpheme I 'female', corresponding to thumbȦ 'male' and capable of occurring in heterotab position. Taiwan SL also uses it in a classifier that is phonetically dualF but morpho-phonologically dualῙ̈.[15] We may be able to say, then, that [+Pinky] costs less in these sign languages than in ASL.

III.B.2.b Finger(s)

In the dez, as in the tab, the whole finger, instead of just the tip, can be the focus. Usually the HC is G, sometimes I; H and B also occur. The whole edge of the finger may make contact, as in BLACK $\frown G_{<}{}^{>}_{\times}$ or SAME $G_{D}{}' G_{D}{}^{\times}$, or only a single point in the middle, as in TEMPERATURE $G_{\wedge T}.G_{<}{}^{\sim}_{\times}$. When the finger is inserted in the Inside or Angle of the other hand (VAGINAL-INTERCOURSE $O.G^{\odot\cdot}$, BEGIN $5^{\circ}.G^{a}$, RIDE-IN-VEHICLE $O^{\odot}\dddot{V}_{D}{}^{\perp}$) or in the mouth (JEALOUS $\smile I^{\odot}$) I have chosen, perhaps arbitrarily, to call the focus Finger rather than Tip. PURSE $[]B_{T}{}^{\odot}$ is unusual: the bizarre spelling, literally "insert B-hand into trunk," is explained as "hand clasped under other arm against side" (DASL:185). Without insertion, Finger focus can occur on the Edge (NAME $H.H^{\times}_{+}{}^{\cdot}$) or the Flat (CHAIR $H_{D}.\dddot{H}_{D}{}^{\times\cdot}$, NEVER-MIND $B_{>}B_{<}{}^{I\sim}_{\times}$, SHY $\mathcal{J}\,\dddot{B}^{a}_{\times}$. Finger-edge for B is not distinguished from edge of the whole hand, because there is no abrupt change of width to make a visual boundary between fingers and midhand.

5's, and sometimes V's, can interlace by fitting the fingers of each hand into the angles of the other: FOOTBALL 5^5^ᴵ˙ , MACHINE 5ᴛᴵ5ᴛ? , PLUG-IN V.V° . The approach is usually from the Palmar side, but in MACHINE and related signs it is from the Dorsal side, and the fingers are slightly flexed. These signs are treated as having double focus, Finger + Angle.

III.B.2.c Palmar

Only A and B dez have palmar focus in any significant number of signs. The B's outnumber the A's on the order of 60 to 30 (including the lower- and middle-face palmar-tip foci of B mentioned above). This is what we expect, based on the basehand figures:. the unmarked palmar-focus handshape is B in dez as well as tab.

Treating the mid-phalanges plus heel of [A] as palmar focus deserves some discussion. (In tab position it was not so important, because it occurs there only as identical to the dez focus. But midphalanx focus in dez A is not conditioned by anything else, and the question cannot be postponed.) Tactually this (phonetic) focus shares with the palm only the heel of the hand, which is often not involved. But geometrically and articulatorily the regions correspond: each is a surface (not a point or line) the width of the whole hand, and they occupy the same place in their respective handshapes. If a sign such as PLEASE []B< , in which a B hand makes contact with the palm, is modified just by closing the fingers to an [A] with no other articulatory change, the phonetic region of contact becomes the midphalanx-heel surface of the [A]: SORRY []A .[16] These are the considerations that led Friedman (1976, 1977b) to call this surface PALM in her region-of-contact features for A and E.

Handshapes with opposed thumb (O, F, bO, K, D, bD, 6) do not contact on the palm or closed mid-phalanges (bO, K, bD): they neutralize fingertip with palmar focus. Thumbtip and fingertip are also neutralized, since the two are joined (see section below on bunch focus). Handshapes with non-opposed bent fingers rarely make palmar contact without fingertip contact as well.[17]

III.B.2.d Edge

A count of radial and ulnar contact in active hands show that both superficially and underlyingly, here as in heterotab position B has the edge: about 50 signs, to about 25 for A and 20 for C. This supports the earlier decision to treat edge focus as derived in heterotab A and underlying in heterotab B. Specified edge focus, then, produces the handshape B in the unmarked case.

III.B.2.e Bunch

O, F, and bO (usually written X in DASL) can open to 5, 5, and G or L, respectively, as well as being the result of these handshapes' closing (e.g. WHITE $[]5_{<}{}^{\#[O]}_{\perp}$, FIND $\underline{B}_{\vartheta}\cdot F^{\#}_{\wedge}$, and UNDERSTAND $\wedge\chi_{\tau}{}^{\square[G]}$.) They can also grasp with the opposed tips, either throughout the sign or forming and releasing the grasp as part of the movement. Counting all such occurrences, dez O and F each have around 30 signs in DASL with bunch focus; bO has around 20. (D, found only in initialized signs and treated in DASL as an allophone of G, has 5. 8, rarely, contacts on the back of the opposed thumb, as in (ELECTRIC-)LIGHT $\smile 8_{\tau}{}^{\dot{\square}\cdot}$, which is not in DASL.)

The environments are not noticeably different: hand and face tabs, end and sliding contact.[18]

The equal prominence of F to neutral O is interesting. F has gained historically: Long (1918) gives four signs as made with bO that today use F[19], and the process probably began long before his time. If bunch focus is significant to signers, misperception of bunch-focused O or bO as some different handshape which has no bunch would deprive the viewer of important information. In both LBB's and Stungis's analyses, O is perceptually close to A, differing in only the features Concave and Touch, while bO is even closer, differing in Touch and in Index (LBB) or Bent (Stungis) (which are lower-order features than Concave, carrying less information). But F differs from all of them in the highest-order perceptual features: Compact (which makes the major division of the handshapes), Broad, and Spread.[20] Use of F for bunch focus instead of O or bO shows the focus clearly, since the other fingers are away from the contact, and avoids ambiguity of handshape. F is visually similar to 8, but since 8 is much less frequent than A there is less chance of misinterpretation. In fact, F and 8 are frequently in free variation, so that seeing one as the other would not cause any confusion at all.

The sign counts alone give no support to choosing F or O as least-marked bunch-focus dez. But O is certainly more articulatorily uniform than F; and even with bunch focus, O is a frequent enough heterotab to suggest that it should be the unmarked bunch-focus dez too. In eventually developing a feature system, though, we should bear in mind the interchange between bO and F, and F's equal strength to O as a bunch-focus dez.

III.B.2.e.i Grasping bunch

Stokoe uses grasp for some movements and relations whose focus is not the whole inside of a curve but is either the angle between the fingers or the tips alone of the thumb and one or more opposed fingers. Grasp with angle is represented in this analysis as [Dominant Focus: Angle; Proximity: End-contact]. In the latter case, grasping with the tips, the grasped part is usually small in relation to the size of the hand, e.g. a fingertip (CHERRY $G^{x}.O^{\omega}$, the thickness of the thumbweb (MEAT $B^{x}.F^{x}$) or midhand (GRAVY $B^{x}.Y_{X}^{Y}$), or a pinch of skin (SKIN $^{(\jmath)}\nu F^{x}$, CURIOUS ΠF_{N}^{x}). But it can be as large as the width of the entire mid-hand (EARTH/GEOGRAPHY $\nu^{x}Y_{X}^{\omega}$). Although the dez focus is evidently Bunch, these cases must somehow be kept distinct from those in which the Bunch taps the tab, e.g. PICK-ON $G_{X\varphi}.X^{x\cdot}$. Within the analysis of Chapter II this can be done by specifying Closing movement (Internal End-contact or Final Near Proximity) when the grasp is a movement. Grasp relation, i.e. steady-state grasp, seems to be automatic: Bunch in steady-state contact automatically grasps the other surface, a relationship that need not be underlyingly specified but can be phonetically described with Palmar side of the tips in the Bunch.

III.B.2.f Inside

Inside focus is more frequent in the tab than in the dez. Dez inside focus is often mutual: the two hands, both active, grasp each other, e.g. MARRIAGE CC^{x} , FRIEND $XX^{x(\jmath}$.

C is the most common inside-focus dez: MARRIAGE CC^{x} , BITE $B_{D}.C^{x}$. In a few signs one or two digits curve around one digit of the other hand, or rarely around a body part. The examples I know are in Table 3-9.

Inside focus in dez or tab corresponds to Stokoe's <u>grasp</u> (I) and <u>enter</u> ($\odot$) as movement or initial relation between the hands. The great differences in the sets and frequencies of tab and dez handshapes whose foci can be called "inside" points to a real asymmetry here between base and active hands, perhaps rooted in the physical difference between being or going inside something (tab <u>inside</u>) and statically or dynamically surrounding something (dez <u>inside</u>).

III.B.2.g Angle

A few signs, all of them with V or bent$\ddot{V}$, focus on dez angle pure and simple: e.g., APPLY $G_{\wedge}.V^{\mathrm{I}}$, TICKET $B_{\alpha}{}^{!}.\ddot{V}^{\mathrm{I}\cdot}$, CHEAT $B^{\mathrm{I}}.V_{\varsigma}^{\omega}$. In a few more the hands (usually 5's or bent5's) interlace, the fingers of each fitting into the angles of the other. As noted above, these have double focus, on fingers and angles: e.g., INFILTRATE $5_{T}.5^{\odot}$, FOOTBALL-GAME $5_{\wedge}5_{\wedge}{}^{\mathrm{I}\cdot}$, MERGE $\ddot{5}_{T}\ddot{5}_{T}{}^{\dot{\mathrm{I}}}$, PLUG-IN $V.V^{\odot}$.

III.B.2.h Knuckle

On the order of thirty different signs in DASL focus on the back of either the innerphalanx, the midjoint, or the midphalanx of the dez. For example: ELECTRICITY $X_{>}X_{<}{}^{x\cdot\cdot}$, COST $B^{\prime}.X_{x}^{\dot{v}}$, CONTACT-SOMEONE $G_{\wedge\varphi}.\ddot{V}_{p}{}^{\dot{x}}$, HIT $G_{\wedge\varphi}.A^{\dot{x}}$, HOW $\ddot{B}_{T}{}^{\prime}\ddot{B}_{T}{}^{a}$. I refer here only to handshapes in which one or another joint is flexed, making the named surface distinct from the back of the hand in general: in X and bent$\ddot{V}$ the midphalanx or midjoint, in A the midphalanx or innerjoint, and in bent$\ddot{B}$ the back of the bent fingers without significant finer distinction.[21] Three of the six examples with bent$\ddot{B}$ are symmetrical Type 1's and the other three are on the cheek: they can all be derived from dorsal focus, since straight [B] in those positions would require either raising the elbows to shoulder level or higher, or else effortful or painful angles at the shoulder or wrist. (Cf. the discussion of bentB̈ and bentV̈ with tip focus, above.) In X, bentV̈ and A the focus is on the distal surface of the hand, where the fingertips would be if any fingers were fully extended. X is the dez handshape in about twelve of the cases, A in about eight, and bentV̈ in about seven. Note that just as for fingertip focus, the one-finger handshape is better represented than the uniform-fingers handshape: X and A for knuckle, G and B (or 5) for fingertip.

Friedman (1976, 1977b) has a special handshape symbol to represent the tightly flexed form of X that is used with knuckle contact: "[the] allophone [...] X_2 (the 'squished' variant) occurs when the sign entails contact on the body [or basehand] with the (extended) knuckle of the middle joint, as in ONION, APPLE, AND KEY" (1977b:21). Later, discussing fingertip focus (1977b:47), she defines midjoint contact (described as occurring only in X_2) as a variant of fingertip contact conditioned by the handshape, "[s]ince the middle joint really is the end point of the extension of the bent index finger of X_2." But these definitions are circular. And since knuckle contact also occurs with bentV̈ and A, maintaining an underlying handshape "variant" to determine it would require a bentV̈ as well, needed, like X_2, only with knuckle focus. (Since A has no literal fingertip focus, no variant handshape A_2 would be necessary.) Alternatively, we could derive surface phonetic fingertip contact in X (and bentV̈) from underlying palmar contact, since the two are never in contrast, and the bent fingertips are on the palmar face of the hand. Then we could derive surface knuckle contact from underlying fingertip, as Friedman does.

This solution, while at first distributionally appealing, is morphologically and phonologically unsound. The /V/ classifiers 'legs' and 'vision' use (surface-form) fingertip focus the same way in straight and bent forms. And a broad generalization can be drawn that restricts finger movement to fingers that are in focus (Chapter II), which is possible only if the fingertip contact in signs like SUSPECT $^\frown G_T \overset{\cdot}{\times}{}''$ and STINGY $B_\alpha . C_\upsilon {}^{T''}_{\times}$ is treated as fingertip rather than palmar focus -- which in turn suggests that, for consistency, fingertip contact without finger movement should be treated the same way.

III.B.2.i Dorsal

The back of the dez hand is focal in around forty signs in DASL. In about half of these, written with B, bent$\dddot{B}$, 5, C, or bent$\dddot{C}$, the fingers are all extended or bent.[22] There are three B's whose movement involves change of orientation, with contact at each orientation -- or, equally well expressed, change of focus, from palmar to dorsal or the reverse (e.g., COOK $B_\alpha . B_\alpha{}^{\times\upsilon\times} \sim B_\alpha . B_\upsilon{}^{\times\alpha\times}$); and several more (of Types 1 and 2) in which the hands are both B's and are parallel, and the matter of which one's palm faces the other's back is either freely variable (NEAR $B_{>\rho} . B_{<}{}^{)(}$) or morphologically determined by spatial relationship ($\bar{B}_\upsilon . B_\upsilon{}^{\wedge}$ 'above (some level)', dez palm; $\underline{B}_\upsilon . B_\upsilon{}^{\vee}$ 'below', $\underline{B}_\upsilon . B_\upsilon{}^{)(\times}$ 'up to', dez back (DASL:37).[23] In all of these the dorsal focus can be derived from the co-occurring palmar focus or from the morphologically significant orientation and spatial relationship.

There are also a couple of dorsal-focus dezes with A handshape, four with O that are all closely related, and one or two other handshapes. Surprisingly, V has six and bent$\dddot{V}$ two; but most of them turn out to involve the /V/-'legs' classifier. As with the palm, most dorsal-focus dezes have /B/ handshape; and when we take out those cases whose handshape is morphologically specified or whose focus is deriveable, /B/ is definitely left as the phonologically unmarked dorsal-focus dez handshape.

III.B.2.j Thumb and thumbtip

I have already described Wilbur's derivation of [A] from an underlying handshape which she equates with [S] in the environment of palmar (midphalanx) or thumbface contact (she cites as examples from DASL SECRET $\smile A^{\times\cdot}$ and PATIENT $\smile A^{\vee}_{\times}$); she also suggests vertical and forearm-rotation movement as possible phonological environments (see Fig. 3-7). It should be further noted that in a number of signs thumbȦ varies with a phonetically intermediate form with half-extended thumb, e.g. FOLLOW $^{(\emptyset)}A_{\varphi}\dot{A}^{\perp} \sim {}^{(\emptyset)}\dot{A}_{\varphi}A^{\perp}$ (which Wilbur (1979:58) reasonably considers to involve the underlying classifier thumbȦ "general object, usually taller than wide"). (Compare, in Fig. 3-8, the handshapes of FOLLOW, the closely related PASS, and MOST.) I find only two or three additional examples in DASL of A with thumbface contact (SUFFER $\smile A^{\omega}_{\times}$, EACH $\dot{A}_{\varphi}\dot{A}^{\vee\cdot}$, and possibly AMBITIOUS $[]AA^{\wedge}_{\times}{}^{\sim}$); with thumbȦ, STAY $\dot{A}.\dot{A}^{\times}$,, STILL, $\dot{A}^{+}\dot{A}^{\perp}$, TURTLE $\underset{\sim}{C}^{\perp}.\dot{A}^{\dot{\imath}}$).[24]

This variation between [A] and [thumbȦ] suggests a refinement of Wilbur's analysis. She states the rule as follows (translating "second joint" to "midphalanx," and adding braces where they are obviously called for):

$$/S/ \longrightarrow [A] \quad / \left[\left\{ \begin{array}{l} \overline{\text{midphalanx contact}} \\ \text{thumbface contact} \end{array} \right\} \right]$$

$$/S/ \longrightarrow [\text{thumb}\dot{A}] \quad / \left[\overline{\text{thumbtip contact}} \right]$$

Deriving A from S in the environment of midphalanx contact is phonetically plausible, as Wilbur points out: after all, the thumb gets in the way unless you move it to the side. But why should contact with the back of the folded-down thumb induce it to shift from one surface of the fist to another? The difference in comfort or accessibility is minimal. Wilbur does not justify this portion of her first rule. But if, instead, we derive these A's from thumbȦ, we have a clear articulatory motivation.

Consider the relationship of the fist to whatever it contacts in the thumbface-contact signs. In SECRET, PATIENT, and SUFFER it is at the mouth or infront of the chin, in AMBITIOUS it is on the front of the torso, in TURTLE it is covered by the nondominant hand, and in EACH it is in front of the dez and has handshape and orientation nearly identical to it. The musculature of the thumb, as of the fingers and the hand itself (at the wrist), is better equipped to apply or resist pressure at the pad, or palmar surface, than with the back. The thumb tends to yield readily to dorsal pressure, folding down and changing the handshape from [thumbȦ] to [A]. So we can state thumbface (dorsal thumb) contact as a conditioning environment for the change of thumbȦ to A. In STILL, TURTLE, and EACH thumbface contact results straightforwardly from the relationship between the hands: symmetrical foci in STILL and EACH, with palmar dez aspect and dorsal tab aspect; tab covering dez thumb in TURTLE. But where does it come from in a one-handed sign like PATIENT?

ThumbȦ is so shaped that we can press the thumbpad on a large flat surface only near the edge of that surface: otherwise the fist gets in the way. For illustration, try pressing your thumbpad against your chest or upper cheek, ignoring for the moment any awkwardness of the necessary fist orientation. (Frishberg, 1976:112 implicates a similar constraint in the historical retention of forearm orientation in LAST/FINAL $\bar{I}.I_{\check{x}}$.) Thumb contact in such a location is normally made with either the tip, as in PROUD []$\dot{A}_{\mathfrak{v}}\hat{x}$ and YESTERDAY $\}\dot{A}^{\times\mathrm{T}\times}$, or the radial edge of the thumb (on the <u>palmar</u> side of the hand), as in DRAMA []$\dot{A}\dot{A}\hat{x}^{\sim}$ and GIRL $\}\dot{A}^{\perp}_{x}$.

The mouth and the underside of the chin are at the edge of their surfaces, and the palmar surface of B is small enough for each thumbpad contact (the middle is not far from the edge). NOT $\smile\dot{A}^{\perp}$, LETTER $\smile\dot{A}_{\mathrm{T}}{}^{\times}\|B_{\alpha}.\dot{A}_{\mathfrak{v}}{}^{\times}$, and STRAWBERRY $\smile\dot{A}_{\mathrm{T}}{}^{\times}\|\smile G_{\mathrm{T}\check{x}}$ all use the thumbpad. If LETTER and STRAWBERRY retain [thumbȦ] with thumbpad contact at the mouth, why should PATIENT and the rest have [A] with thumbface contact? Orientation and fluidity are the answer. Thumbpad-mouth contact, while not difficult, requires a somewhat awkward orientation. The normal course is to relax the extreme flexion and supination of the wrist that it requires, thus shifting the contact to first the radial and then the dorsal surface of the thumb and bringing about the dorsal-pressure environment for the change of thumbȦ to A. That has happened in PATIENT, SECRET, and SUFFER.[25] But LETTER and STRAWBERRY have two contacts and strive to maximize fluidity (Frishberg, 1975, 1976) by minimizing the change between them. LETTER maintains thumbȦ handshape and thumbpad contact in both its parts, first at the mouth and then at the palm; while STRAWBERRY maintains palm-in orientation (with supinated forearm) and palmar-surface contact, first with the thumb and then with the index finger.

None of these articulatory forces apply to [S]. The folded mid-phalanges support the thumb against pressure as well as the edge of [A]'s closed index finger does, and the palmar aspect of the hand has no trouble touching the mouth or a large surface such as the chest (e.g., WRONG $\smile A_{\mathrm{T}}{}^{\times}$, BATHE [ ]$AA^{\sim}_{x}$). And the proposed underlying forms do not complicate the overall phonological analysis of the language, since Wilbur has already demonstrated that underlying /thumbȦ/ is needed for the classifier system (Chapter IV). In fact, this revision makes the analysis more regular by using /thumbȦ/ in the phonology of the general lexicon. The rule can now be rewritten more plausibly as:

$$/\mathrm{S}/ \rightarrow [\mathrm{A}] \quad / \quad [\overline{\text{midphalanx contact}}]$$

$$/\mathrm{thumb}\dot{\mathrm{A}}/ \rightarrow [\mathrm{A}] \quad / \quad [\overline{\text{dorsal thumb contact}}]$$

Thumbface contact is in general not underlyingly specified but arises from the relationship of the hand to the body or other hand, together with articulatory constraints on orientation, such as avoiding extremes of flexion, extension, or forearm rotation.

The third part of Wilbur's rule, /S/ ⟶ [thumbȦ], is not necessary in this analysis. The redundancy it represents is captured by the focus mechanism. PROUD, for instance, is underlyingly specified for trunk tab, thumbtip focus, and upward movement with continuous contact. Thumbtip focus requires [+Thumb-out] in the handshape, and with no other specifications the default values of the other features follow and result in [thumbȦ]. PATIENT is specified for lower-face tab, thumb focus, and repeated end-contact: the articulatory awkwardness of thumb-palmar focus at that location turns the hand, resulting in thumb-dorsal focus, which causes the thumb to close and produce the observed [A]. This is a case where the surface form is indeed different from the "underlying" form and its generative analysis is called for.

There are two or three thumbface examples with 6, about five with C, two with L and one with O. I also know of two with 8, not appearing in DASL. The O and 8 examples may be in variation with or derived from thumbtip contact. Only A and C, however, have simple end-contact on the thumbface. All the others have changing handshape, combined with thumbface-focused held or unidirectional sliding contact: e.g. $\breve{\bar{B}}_{a}.5_{\perp}^{\#[o]}$ 'deflate', $\bar{B}_{a}.L^{\#\cdot}$ 'newspaper', $^{(\emptyset)}\smile 8_{T}^{\square\cdot}$ '(electric) light', $\mathcal{D}O^{\times}\overset{\square}{\perp}$ 'influence'. This kind of complexity, with two parts of the hand involved in different ways, requires special phonological treatment, like coarticulation in oral phonology: Chapter II's analysis describes it with separate Focus and Movement (or Proximity) on the Internal and External scales. Most of the C examples derive thumbface contact from morphology or initialization.

The back of the thumb sometimes makes contact in other handshapes, in which the thumb is fronted and touching or parallel to the index finger, such as G_g and one allophone of B. This contact occurs as part of radial-edge contact, as in FORBID $B_{\perp}\varphi.G_{\wedge}^{\dot{x}}$ and DOOR $B_{\perp}{}'B_{\perp}^{\times}$. In fact, this allophone of B, close or equal to the alphabetic B_b, arises as a result of this kind of contact, in which a side-positioned thumb as in ordinary B would get in the way of visible and tangible contact by the full radial edge and have to take the full impact of end-contact. In the G_g cases the handshape may be specified as having the thumb fronted and parallel to the index finger, since at least some of them are derived from initialized signs: FORBID (with [L_j] closing to [G_g]) from another form $B'.L^{\dot{x}}$, which is itself from <u>LAW</u> $B'.L^{\times\vee\times}$, the latter two with palmar rather than dorsal contact; <u>GUILTY</u> $[\,]G_{<}^{\times\cdot}$ initialized with G_g.

III.B.2.k Summary: Prediction of dez handshapes

Just as nonsymmetrical basehand handshapes (heterotabs) are largely predictable from their focus, the handshapes of active hands (dezes) have regular frequency patterns when focus is specified. Most foci have the same most-frequent handshape in dez as in heterotab: Fingertip and Finger (G), Palm and Edge (B), and Inside (C). Dorsal dez focus is commonest with B, or more generally [+Uniform, -Closed], as is the case in heterotab (where the actual handshape is most often the lax Ɓ). But Angle and Knuckle, which in heterotab predict four-finger handshapes, are most often found in dez with the minimum number of fingers possible for that focus: two for Angle (V) and one for Knuckle (X). This is reminiscent of the historical pattern described by Frishberg (1976), in which gross articulation becomes finer, including reduction of the number of fingers involved (selected), especially in the active hand (1976:124). Dez Bunch focus is balanced between these two groups: four-finger O and one-finger F (which is not found in heterotab) are numerically equal, and the tentative choice of O as least-marked must rest on general articulatory principles.

III.C Focus and orientation as partial predictors of handshape features

If handshapes are not unanalyzable wholes but have features, then the sort of prediction I have been talking about so far is only one extreme of a range: it is the limiting case, in which one characteristic of the hand (focus) determines an unmarked value for each feature of the handshape. But single features of handshape can also be predicted. "Bunch focus implies thumb opposed to finger(s)" is a trivial example, with no exceptions, true by definition; other examples are less absolute but more interesting and substantive. Other characteristics of the sign, such as manner of contact, can predict handshape features as well.

Of course prediction is not one-way. The Most-Bent-Finger-Constraint limits focus on the basis of handshape; in 8 , handshape constrains focus to a single value. But I am concentrating here on prediction of a parameter that has traditionally been taken as primary.

III.C.1 Contact and finger alignment

The muscles that abduct the fingers -- spread them in the plane of the palm -- are not strong. When the fingers are abducted, impact or pressure on their edge tends to force them together, whether the hand is moving or stationary (striking or struck). Consequently there are no 5's, 4's, or V's with end-contact (impact) on this focus, though there are a number of B's and some H's: e.g., WINDOW $\bar{B}_{>}.B_{<}^{\times\cdot}$, SATISFIED $[\,]\bar{B}_{D}B_{D}^{\times}$, NAME $H.H^{\times\cdot}_{\ddagger}$. TWIN $^{(\emptyset)}\smile H^{\times>\times}_{\wedge}$ may originally have had a V handshape ('2') which became H under the impact of edge end-contact. (In KEEP $\bar{K}.K^{\times\cdot}$ the impact is on the radial.ulnar edges of the midhands, not the fingers, so the effect does not appear.) In fact, only four signs with V in DASL have any kind of contact on the finger "trunk" at all (in the analysis of Chapter II, Finger Focus): VIRGIN, VINEGAR, SAVE $V_{T\varphi}.V_{T}^{x}$, and SALT $V_{\mathfrak{v}}.V_{\mathfrak{v}}^{x\cdot\cdot}$. The first two are initialized and therefore underlyingly specified for finger spreading, and the last has undergone spreading historically, to avoid homonymy with CHAIR (Frishberg, 1976:205-206, S & N, 1978). In contrast, DASL lists over twenty noninitialized signs with H and finger contact, and at least seven of these are clearly on the "trunk": e.g., NAME $H.H_{\ddagger}^{x\cdot}$, RAILROAD $H_{\mathfrak{v}}^{\mp}.H_{\mathfrak{v}}^{\mp\cdot}$. (Many cases of palmar-side contact are ambiguous between underlying tip and "trunk" because, as with thumb contact in thumbÅ, the bulk of the "fist" prevents palmar-side contact along the full length of the fingers.) Five of the latter contact on the edge: three with sliding contact and two with end contact. However, there are several 4's with sliding or initial contact on the edge, e.g. INVENT $\frown 4_{\wedge}^{x}$ and QUEUE $4_{\wedge\varphi}.4_{\wedge}^{T}$. Perhaps the crucial difference is that the closed ring and pinky fingers of V/H inhibit full innerjoint extension of the index and middle fingers, which in turn limits their freedom to spread (Steindler, 1955:525).

At least two signs have end-contact on the edge of the midjoint or midphalanx of bentV: STERN $\omega\dot{V}^{x}$ and HARD $\mho\dot{V}_{<}^{x}$. In this handshape the index and middle fingers are bent to a hook shape by the flexor muscles. Impact at the midjoint applies less adductive force on the innerjoint (where the resistance must be exerted) than impact farther out, because the lever arm is shorter. But more important, bentV seens to be spread with more strength than straight V. I am not sure why this is so, but it would account for the occurrence of bentV, which has spread index and middle, with a type of contact that forces the fingers to align when they are straight.[26]

The open fingers of F are not spread only by abduction, in the plane of the palm, but also by stepwise incremental flexion at angles to that plane. The ligamentous bonds between the fingers pull the middle and ring fingers down toward the flexed index on one side and up toward the extended pinky on the other. Furthermore, edge contact in F is almost invariably on the joined thumb and index, and/or the midhand, where it does not contact the extended fingers. So the signs with F edge-contact (IMPORTANT $FF^{v\,x}_{\wedge}$, BUTTON $[\,]F_{v}{}^{x}$, HOLE-IN-CLOTHING $\checkmark.F^{x}$, and FLUNK $B'.F^{\dot{x}}$) are not in the domain of this constraint.

I know of two exceptions to this constraint, both initialized: WATER $\smile W^{x'}$ and FAIR/SO-SO $\smile F^{x'}$, contacting on the radial edge of the index and middle finger respectively. W, like F, has some incremental flexion, which may figure in keeping the fingers apart. The derivation of these exceptional foci from midhand-edge by facial displacement (sect. III.B.2.a.i) may also be relevant. Such a derivation is especially attractive for FAIR/SO-SO, which is otherwise the only ASL sign in which F focuses on any part of any finger except the index.

III.C.2 Fingertip contact and "bent" handshapes

Many bent$\dddot{B}$'s focus on the fingertips, which touch the tab more or less at a right angle: e.g., TIRED $[\,]\dddot{B}_{v}\dddot{B}_{v}{}^{a}_{x}$, AGAIN $B'.\dddot{B}_{\alpha}{}^{vx}$. (Wilbur (1979:74-75) has noted this.) There are two functional reasons to bend the hand in such an environment. First, there is the angle of contact. To touch at an angle any body surface in the signing space, the fingers must point in toward it. The whole arm must be flexed to bring them this close (in terms of the arm's physical range) to their ultimate point of attachment, the shoulder. Now, you <u>can</u> touch your chest at a visible angle with the tips of a completely straight B-hand, but it requires a sharp bend at the wrist and/or raising the elbow to a height that is unusual in signing. If you allow yourself to bend the innerjoints as well you can accomplish the contact with much less strain. If the contact object is a surface of the opposite hand, that surface cannot face in toward your body without blocking the addressee's view of the contact, and the angles that allow a view induce bent dez knuckles in the same way as body tabs (though not necessarily to the same degree, since the tab hand is farther from the shoulder than the chest is and can turn, as the chest cannot, to facilitate contact): for instance, AGAIN, AGAINST $B.\dddot{B}_{<}{}^{\dot{x}}$. Second, since the fingers are different lengths, touching the tip of a straight B to a surface at right angles brings only one or two fingertips into contact. Bending the innerjoints does a lot to equalize their effective lengths; allowing the midjoints to bend as well lets all of them touch, at the cost of destroying the hand's planarity.

G and V are also often angled, for similar reasons. The handshapes in ME $[]G_{T}{}^{T} \sim []G_{T}^{x}$ and LIPREAD $\smile V_{T}{}^{\alpha\cdot}$ are phonetically [angled$\hat{G}$] and [angled$\hat{V}$], never straight [G] or [V]. In some cases the midjoints may be flexed instead or as well: GLASS $\smile G^{x\cdot}$ with a [curved$\hat{G}$], facilitating insertion between the lips to touch the teeth; LIPREAD with [hooked$\ddot{V}$].

III.C.2.a (V and K)

V and K differ in the innerjoint angles of the extended fingers (and often in thumb position as well). The index can be fully extended by the extensor proprius indicis muscle (Fig. 3-9) while the other fingers are closed, but middle finger extension requires action by the common extensor muscle of the fingers, which tries to extend the ring and pinky as well. Consequently there is a tendency in V for the middle finger to be only partially extended. If the index finger stays level with it, the mechanics of the extensory apparatus inhibit abduction (lateral spreading), reducing the fingers' visible separation (Steindler, 1955:525). This pushes V toward H, with which it sometimes merges: SALT $V_{D}.V_{D}^{x''} \sim H_{D}.H_{D}^{x''}$, SMOKING $\smile V_{T}^{\perp''} \sim \smile H_{T}^{\perp''}$. If the index extends further than the middle finger, separation is retained or increased and the handshape becomes a K.

V and K frequently vary freely (DASL:78). Their alternation is particularly evident in signs requiring contact by one fingertip, such as SKIP $B_{a}.K_{v}^{x\perp x}$ (with the /V/-'legs' classifier) and often SEE $\triangle V_{T}^{\perp}$ (/V/-'vision'). In the pronoun WE-2 $K_{a\phi}^{)'}$ (with /V/'2'; DASL spelling V_{T}^{I}) each finger points to one person, and the back-and-forth orientation-changing movement, pointing to both in turn, is most easily made by nodding (flexing and extending) the wrist, so that the palmar/dorsal spread of K's fingers is deictically more effective than V's abductive ulnar/radial spread.

For perceptual and articulatory reasons the distribution of midjoint and innerjoint flexion is different in /B/, /G/, and /V/. [B] is planar from wrist to fingertips while [G] and [V] are lines emerging from the "fist." The angle at the innerjoint origin of these lines is not salient, but innerjoint flexion breaks the plane of [B] into two planes joined at an angle. Articulatorily, G and V have some finger(s) extended and others closed. The extensor indicis proprius makes it easy to produce a [G] with extension fully or nearly equal to that of [B], but V sometimes angles and adducts toward H, or "stairsteps" toward K.

Stungis's results (1978) suggest that the most important features distinguishing the finger arrangement of V from those of its near perceptual neighbors are extension of just the middle and index and their separation from each other, while G is distinguished by prominent extension of the index alone.[27] When focus is on both tips, and the hand is bent to touch or approach a tab, [angled$\hat{V}$] may be too unspread (or spreading it may require too much effort). In [hooked$\underset{\text{ʒ}}{V}$] the innerjoints are extended, possibly even more than in straight [V],[28] and wider separation is possible than in [angled$\hat{V}$]. [hooked$\underset{\text{ʒ}}{V}$] is also "lighter" than [angled$\hat{V}$]: the bend is further down the forearm (more distal), and the demands of the tendon effect between the fingers and wrist (the "knuckle-wrist connection," Mandel (1979)) are satisfied.

III.C.2.b "Bent" V vs. "bent" B: Phonological and morphological conditioning

Stokoe conflates innerjoint angle (for which I use Anderson's symbol ^) with midjoint hook (ʒ) under the name and symbol bent (‴). They function somewhat similarly in fingertip focus but they are perceptually different. Wilbur (1979:74-75) appears to consider [angled$\hat{B}$] (Stokoe's bent$\dddot{B}$) and [hooked$\underset{\text{ʒ}}{V}$] (Stokoe's bent$\dddot{V}$) to be derived by a single phonological process in all tip-focus environments:

> There are, of course, signs that are made with already bent handshapes, e.g., X), but of concern here is a process of bending that arises from one hand coming into proximity or contact with the other hand or some part of the body. For example, when the fingertips of the B hand come into contact with the body at the chest or with the other hand, the result is [bent] $\dddot{B}$. Similarly, the V hand of LOOK/SEE bends as it comes close to the palm of the other hand in SCRUTINIZE. Even the suggestion of contact with a surface causes bending, as in WINDOWSHOPPING, where the closer a person gets to the window to look, the more bent the fingers become, although the fingers may never actually touch the palm (SCRUTINIZE and WINDOWSHOPPING may actually be surface

> variants of a sign meaning "to look carefully at"). Interestingly, the V hand when used as a classifier "by legs" does not bend in contact with the palm, as in STAND, except morphologically for meanings that imply bent knees (KNEEL, CLIMB) or animal legs. However, if one were to talk about the ceiling falling in, or someone crawling into a tight spot, or some other situation where the space is reduced but the knees are not actually bent from standing position, the V hand would bend in contact with the palm. Other aspects of this process remain to be delineated. (Wilbur, 1979:74-75)

/V/ becomes [angled$\hat{V}$] here by the same process that turns /B/ to [angled$\hat{B}$] and /G/ to [angled$\hat{G}$]: GET-UP $B_a . V_a^{\perp x}$, AGAIN $B_a{}^{!} . \ddot{B}_a^{\perp x}$, and OWE $B_a . G_v^{x\cdot}$.[29] But in /V/ and /G/, for the perceptual reasons already described, innerjoint flexion is not salient, not phonologically distinctive, and not marked in DASL notation.

But midjoint flexion is salient, and the difference between [V] and [hooked$\text{V}$] is used in ASL morphology. In fact, all of Wilbur's [hooked$\text{V}$] examples are determined morphologically as well as phonlogically. 'Bent knees' and 'animal legs' belong to the distinctive morphophonology of /V/-'legs' (S & N: Supalla, 1978; Frishberg & Gough, 1973). Wilbur's other examples share a very general 'diminutive' process morpheme, which I call <u>Compression</u>: it is realized in various parts of the sign as reduction of distance. Her descriptions make it plain that the /V/-'vision' [hooked$\text{V}$] of WINDOWSHOPPING and SCRUTINIZE is dependent on a reference to physical proximity, a reduction of the normal distance between an observer and the object of observation, and that the [hooked$\text{V}$] variant of /V/-'legs' is similarly dependent on reduced space for the 'standing' that straight [V] for 'legs' normally implies. The same morpheme appears in CHERRY in the form $I^{\perp} . E^{\omega}$ (Woodward, 1979), compared with $^{(D)}G^{\perp} . O^{\omega}$. DASL gives two other forms of this sign, in which G and I alternate as heterotabs: $_{\cup}G_{T}\check{x} \| G_{\wedge}^{\perp} . X_{\wedge}^{\square} \sim {}_{\cup}G_{T}\check{x} \| I_{\wedge}^{\perp} . X_{\wedge}^{\square}$ (the first component is RED). Both heterotab I's are probably diminutives from the G's: I have already described the alternation index vs. 'diminutive' pinky. The E dez is quite unusual -- DASL has only one or two uninitialized examples, JEWISH and (?ELECTRIC)-STREETCAR -- and is well explained here as derived from the O of the second form by the same midjoint flexion that compresses [V] to [hookedV̧], bringing the tips of the fingers closer to their bases and reducing their extendedness. (The I.E form of CHERRY thus is a double diminutive, marked on both hands.) This morpheme is probably also frozen into [hookedV̧]-'animal legs': S & N (Supalla, 1978) describe this classifier more precisely as representing "the category of small, nonhuman animals like frog, bug, and bird."

Coulter (1979:34-36) describes a facial morpheme spread lips (or "ee"), whose various uses are united by "the notion of nearness, or of identity" [which is the limiting case of nearness]. He adds (44, n.14): "I believe that the signer tends to hunch his body closer to whatever sign this facial expression accompanies," and associates "ee" with Liddell's nonmanual signal "cs" (1978:62-63; 1977:73-77). I see this hunching toward the (manual part of the) sign as another instance of Compression. It also appears in the "crossedF"-'infinitesimal object' classifier (S & N: Supalla, 1978; below, sect. IV.B.1), contrasting with round$\widehat{F}$-'small object'; in a number of socially restricted signs using inside Focus with S as a classifier usually referring to the anus in contrast to the vagina, i.e. a small, compressed hollow space; and in the movement of DIMINISH $CC\omega^{)(} \sim B_{\alpha} \cdot B_{v}\omega^{)(} \sim G_{a} \cdot G_{v}\omega^{)(}$.

Frishberg & Gough (1973:18-19) put LIPREAD in the morphological group of bentV 'difficulty, distortion, offensiveness', along with BLIND (which has also changed from straight V to hooked V̧), STEAL, and other signs; but this articulatory simplification is also a factor in the development of LIPREAD's bentV̈. VAIN []$V_T V_T$ ~ ... and MISUNDERSTAND ^V$^{\times a \times}$ have V's and qualify semantically but do not occur with bentV̈. VAIN has no contact or near-contact, and the movement of MISUNDERSTAND makes bentV̈ less efficient for tip contact than straight V. In contrast, TOAST B.V̈$^{\times a \times}_{\perp}$ is semantically unrelated to F & G's 'difficulty etc.' group, but tip contact with the palm and back of the tab in succession is much easier with bentV̈ than with the iconic, and presumably etymological, straight V 'fork'. (Long describes TOAST with V, but HARD and DIFFICULT with "crooked H.")

III.C.3 Orientation of the fingerplane

Several signs with double-dez B̈B̈ refer to relative levels and maintain a constant orientation, not of the palm, but of the fingerplane: the surface formed by the four angled fingers, held straight at the midjoint. LIMIT $\ddot{B}_T\ddot{B}_T$, NOBLE $\ddot{B}_{v>}B_{v<}$^ (and its antonym DEGRADE $\ddot{B}_{v>}\ddot{B}_{v<}$v), PROCEED-IN-ORDER $\ddot{B}_{v>}\ddot{B}_{v<}$, and EQUAL $\ddot{B}_{v>}\ddot{B}_{v<}$ all keep the fingerplanes horizontal, allowing the innerjoint to bend as much or as little as is comfortable in bringing the hand to the right height. One-handed ADULT (Ø)$\ddot{B}_v$ does the same. PROGRESS $\ddot{B}_{>T}B_{<}$ and GO-AHEAD $\ddot{B}_{>}\ddot{B}_{<}$ turn the arrangement 90°, with frontal planes and forward movement. (For PROGRESS, this direction is morphologically associated with the future.) In the terms of Chapter II, the orientation of these signs has to be specified as [Fingerplane Horizontal] (LIMIT, etc.) or [Fingerplane Vertical, Tips Contra] (PROGRESS, GO-AHEAD).

III.D Circular movement

The Symmetry Constraint leaves a good deal of latitude in combining bilateral symmetry in some parameters of a sign with physical identity in others. At least one group of symmetrical signs is more tightly constrained than the Symmetry Condition implies to be necessary.[30] In uninflected signs in which both hands move independently (Battison's Type 1) and circularly, the hands' <u>senses</u> (<u>directions</u>) <u>of</u> <u>circling</u> must be bilaterally symmetrical, except that if the hands cross each other laterally the senses must be identical. For example (Fig. 3-10), VIDEOTAPE-RECORDER $^{(\emptyset)}G_v G_v^{@}$ and SUNDAY $B_\perp B_\perp^{@}$ have non-crossing orbits and symmetrical senses; MIX $\bar{C}_a C_v^{@\sim}$ and CRANKSHAFT $^{(\emptyset)}A_{v?}A_v^{@\sim}$ have crossing orbits and identical senses. When orbits are in a sagittal plane (vertical and front-back motion, e.g. GO/COME $G_> G_<\, ^{@\sim}_{\Delta}$ and BICYCLE $A_v A_v\, ^{@\sim}_{\perp}$) symmetrical senses are also identical; for frontal (e.g. SUNDAY) and horizontal (e.g. VIDEOTAPE-RECORDER) orbits symmetrical senses are opposite.

When the orbits are horizontal as in VIDEOTAPE-RECORDER or frontal as in SUNDAY, and non-crossing -- and are therefore bilaterally symmetrical in sense (by the constraint just stated) -- the hands circle in the same (symmetrical) <u>phase</u>, moving out toward the ipsilateral sides at the same time and in toward the center at the same time. In such signs the hands act symmetrically in all respects: orientation, movement, and phonetic location at every moment. But when the orbits cross and the senses are therefore identical and nonsymmetrical, the hands always move in opposite phase, 180° apart (MIX, CRANKSHAFT, GO/COME, BICYCLE). The hands can also maintain relative <u>held</u> <u>contact</u> and move as a unit (AMERICA, KEEP). I know of no uninflected held-contact signs that circle in a frontal plane, and only three that circle sagitally: $\breve{K}K\, ^{@}_{\sim}$ 'keep', which may be derived from $\bar{K}.K^{x}$ 'keep'; $B^{x}V^{@}_{\perp}$ 'ride; cheat', which is (at least phonologically) related to $\bar{B}.V_a^{vx}$ 'mount' in a very similar way; and $^{(Dr)}O'O^{@}_{\overset{x}{@}}$ 'be occupied with, struggling with [a problem]'.

Another analysis of circling held contact is possible. In AMERICA and COOPERATE the hands are side-by-side, and in RIDE and KEEP one is on top of the other: these four all circle in the plane that contains both hands. Assuming that frontal circling is prohibited, the only allowable plane that contains a lateral line (such as the imaginary line between the hands in AMERICA) is a horizontal plane, and the only one that contains a vertical line (as in RIDE) is a sagittal one. SUPERVISE and BE-OCCUPIED-WITH are then the only exceptions. The movement of SUPERVISE may be a lexicalized inflection, in the form that K, B, Newkirk, Pedersen, & Fischer (1979) call <u>apportionative</u> <u>external</u>. This inflection distributes the action of the verb across members of a closed group. In this case, the verb would be KEEP, which also has noncircling forms $\bar{K}.K^{x}$ and $\bar{K}.K^{x'}$, and whose meaning includes 'take care of'; since the meaning of SUPERVISE includes the work of a dorm counselor, e.g. in a residential school for the deaf, the semantic derivation of 'take care of a defined group of individuals' makes sense. COOPERATE is similarly related to CONNECT ('be connected') (see discussion, DASL:59).

DASL also uses the symbol $^{\frown}$ to write some signs whose motion is curved but forms an arc of 180° or less rather than a circle, e.g., HEART $[\,]G_{T}G_{T}{}^{\frown}_{x}$. In such signs the hands may touch at the beginning or end of the movement, but they do not cross, and, true to the generalization, sense and phase are strictly symmetrical.[31] There may be arcing signs which incorporate the morphophonological <u>arc</u> <u>root</u> (S & N) and violate this constraint, but none of the examples in DASL do. TOGETHER $A'A^{\perp}_{\frown}$, forward with a lateral arc, seems to include the arc root, but it keeps the hands in held contact.

In most of the crossing-hands cases the hands' foci are identical -- palm to palm (VAGUE $5_{T}\varphi 5_{\perp}{}^{\omega\sim}$) or digit to digit (MINGLE $\bar{\dot{A}}\dot{A}_{v}{}^{\omega\sim}$) -- and their movement sequences are identical in terms of parts of the hand. In VAGUE both hands move (though in different phases) toward the metacarpals, then the pinky, then the wrist, then the thumb: metacarpals-ulnar-wrist-radial. In MIX the sequence is metacarpals-palm-wrist-back. (Or the reverse sequence may be used in each sign, but it will be the same sequence for each hand.) CRANKSHAFT is the only counterexample I know of, having symmetrical foci and opposite sequences of hand-part directions.

III.D.1 Exceptions

I know of two phase exceptions with non-sagittal circling and one with sagittal. SCIENCE $\dot{A}_{v}\dot{A}_{v}{}^{\omega\sim}_{v}$ circles frontally, without crossing, in alternating phase. It is probably a lexicalized derivative of POUR-IN (via its more specific meaning, 'chemistry' (DASL:14)) with durational circular reduplication and alternating addition of the second hand. (K, B, Newkirk, Pedersen, & Fischer (1979; in particular note 13, p.398) discuss doubling of hands as an inflectional process and the use of several phonological processes for derivation as well as for inflection; see also the discussion below of ENJOY and PLEASE.) WAGON $^{(\emptyset)}/G_{>}/G_{<}{}^{\omega\cdot}$ (hands low and at sides) circles sagittally in identical phase. The unusual location of the hands may be responsible: opposite-phase revolution so far out from the midline would (by Newton's Third Law) impose on the trunk a reactive force of twisting around the midline and swaying from side to side. (Avoidance of such forces may be one reason for identical phase in horizontal and frontal non-overlapping circling.)[32]

TRAVEL √Ḡ^√G_v ʘ̊, with horizontal circling in coaxial orbits, has two forms, one with identical phase and one with opposite. The latter is not exceptional, but the former is the only nonsagittal example with overlapping orbits (in fact one is directly above the other) and hands circling in identical phase without touching (held contact). Quite simply, it is difficult to keep two fingers touching, tip-to-tip and in a straight line in a bilaterally-asymmetrical arrangement, while simultaneously moving them in a circle and moving the whole circling complex in a straight line.

#DO(f) (Battison, 1978:134) violates the sense constraint, moving the hands in parallel circles in a horizontal plane. Its quickly-repeated Internal movement of opening and closing to opposition is similar to that of BE-BUSY, which is exceptional in its plane of circling (above). We expect Internal movement to cooccur with simple External movement or none at all, rather than one that violates a constraint. These circling movements may be distributive inflections, as in the cases of SUPERVISE and COOPERATE.

ENJOY (Ø) []B̄>B< ʘ̊ (Fig. 3-2.) appears at first to be an exception to the sense-of-rotation constraint on crossing hands: the hands circle frontally at the midline, crossing laterally though at different heights; but their senses of revolution are opposite, bilaterally symmetrical, and their phases are identical. This sign is clearly related to PLEASE []B< ʘ̊ . ENJOY can be derived from PLEASE by hand doubling to an unattested (and possibly never-existing) symmetrical *[]B>B< ʘ̊, followed by centralization to a vertical relationship on the midline (the current ENJOY). Frishberg (1975:704) describes such a centralization in CONTENTED []B̄_v B_v x̌ (glossed 'relief' in DASL), from Long's (1918) []B_v B_v x̌ . Unlike HAVE

$[\,]\dddot{B}\dddot{B}^{x}$ and TIRED $[\,]\dddot{B}_{v}\dddot{B}_{v}{}^{a}_{x}$, which also use /B/'s symmetrically on the ipsilateral chest but contact with the tips, ENJOY's palmar focus and CONTENTED's radial focus require the wrist to be brought back to the plane of the chest. When the hand is at the ipsilateral rather than the central chest, this position demands extreme flexion of the elbow, which would not be fully mitigated in the older symmetrical form of CONTENTED even by innerjoint flexion (to [angled$\hat{B}$], with the same fingerplane orientation as in the one-hand or vertically-related two-hand form, section III.C.3); nor in a symmetrical PLEASE/ENJOY by supinating the forearm to a palm-in fingertips-up position (since the circling motion would still bring the wrist very close to the shoulder). Doubling the hands vertically instead of laterally allows the dominant hand to keep its central position and avoids the sharply bent elbow for both hands. Deriving ENJOY from a symmetrical deeper form, the unattested $*[\,]B_{>}B_{<}{}^{@}_{x}$, maintains the generalization about sense of circling (to which this is the only surface exception I know of) while using only already-attested rules of sign change. The example also incidentally provides evidence for a phonological level in ASL at which generalizations hold that are surface-false.

III.E Opening and closing movements and handshape features

A fully open handshape (5) cannot be the initial handshape of an opening movement or the final handshape of a closing movement, and conversely for a fully closed handshape (A or S). Battison (1978:52) observed a strong tendency of <u>changing-dez signs</u> to differentiate their initial and final handshapes maximally along the open-closed dimension. Table 3-10 illustrates this tendency. The handshapes become more open moving upward and rightward, so the maximum contrast of open and closed appears in the lower-right corner of each section, and that is where most of the signs are found.

Ellenberger (1977) has shown the desirability of deriving the movement of many changing-dez signs from the initial and final handshape values rather than vice versa; this paragraph summarizes her argument. Battison (1978:52-53) found that the same fingers tend to be motorically involved in both handshapes, a requirement that leads to assimilation in loans from fingerspelling and in numbers: $L^{\dot{\#}}_{A}$ 'go' < G-O, TWENTY $L^{\#\cdot[bO]}$ < L-O (L='2'), THIRTY $3^{\#\cdot[\ddot{O}]}$ < 3-O. Friedman (1976) claimed that the more-open handshape can be predicted from the more-closed one. This treatment would require adding dualÖ to the inventory just to predict initial 3 in NO, DUCK, and THIRTY. But the dualÖ in THIRTY is assimilated from O. Calling this dualÖ and the bO in TWENTY underlying would obscure the assimilatory process as well as increasing the inventory. Therefore the prediction of one handshape from the other should not be constrained as in Friedman's rule; specifically, bO and dualÖ should be derived from the more-open handshape in all closing signs in which they occur, including those not derived from fingerspelling or numbers. <u>No</u> fingers involved -- A opening to thumbȦ or thumbȦ closing to A -- can be grouped with either four fingers or one and two. The initial [restrained-thumb$\dot{A}_{ə}$] of FAST (the only sign in DASL opening or closing just the thumb) appears in no other environment, but it is superficially close enough to [T], [bO], and [A] to be classed with any of them; DASL (12) uses two spellings, with A and bO (written as X, as it usually is in DASL), and describes two phonetically distinct but equivalent pronunciations. Distributionally the prediction can be based either on [T] as more-closed or [thumbȦ] as more-open, coupled with opening movement. But the situation is similar to that for [bO] and [dualÖ]: since uninitialized [T] is practically nonexistent, prediction from more-open thumbÅ is preferable, grouping zero fingers with one and two. (The "curl" is Anderson's (1978) diacritic for a "restrained" handshape, with the involved digit(s) held under another digit before opening.)

The arrows in the cells of Table 3-10 point to the handshape which on distributional grounds best serves as predictor of the other. Note that the signs with all four fingers extended follow Friedman's rule, with a significant number of exceptions requiring specification of both handshapes; but the signs extending two, one, or no fingers (A opening to thumbÅ) are generally predictable from the more-open handshape. Battison's "maximum differentiation" means that in most changing-dez signs at least one handshape will be very open or very closed. As a result, the ends of the open-closed spectrum will get crowded with signs sharing the same extreme handshape but having different mid-spectrum handshapes. Preference for the neutral handshapes has the same effect: Battison (1978:52) finds 88% of the 155 changing-dez signs in DASL using at least one neutral handshape, and 63% having both handshapes neutral. (These totals do not match Table 3-10 because here as elsewhere I have combined closely related signs and included subentries from DASL.) So in any changing-dez sign the handshape that is closer to the middle of the spectrum is likelier to predict the more extreme handshape than the other way around. But making this observation useful requires a workable measure of "distance from the middle of the spectrum," which I do not have; and the corresponding information about the sign can be predicted in other ways.

Friedman's rule and Ellenberger's demonstration prescribe opposite directions of handshape prediction, in terms of more-open and more-closed, for changing-dez signs involving respectively all four fingers and two, one, or none. But now the general uniformity of finger involvement, which Ellenberger wished to capture as assimilation, is split into two rules. If, however, we describe signs underlyingly in terms of features rather than parameters and their primes, or Stokoean aspects and their phonemes, we can have our cake and eat it too. Suppose the fingers involved in a sign are not specified for a handshape, but for the hand itself throughout a sign, while other handshape features (in a changing-dez sign) are specified for the initial or final state.[33] Whether the more-closed handshape has fingers opposed or closed (e.g., O or A) will be part of the specification for the appropriate state; whether the more-open handshape has curved or straight fingers (e.g., C or 5) will be specified for *its* state. To the extent that such information is phonologically predictable, it can be omitted from the underlying specification and filled in by markedness conventions or the equivalent. The constancy of the involved digits will be captured in the fact that they are specified only once, like the phonological location (tab), the orientation, or the handshape in a sign in which these do not change. In the terms of Chapter II, finger selection feature values are constant through the sign, while finger position features can be different in two states of the sign.

Since ± opposition and ± flexion seem to belong to the more-closed and more-open handshape respectively, why not specify the states as "more-closed" and "more-open," plus a specification of the direction of change as *opening* or *closing*? Because handshape is only one of the parameters that can change in the course of a sign: what we call the parameter of movement consists of (at least phonetic) change in one or more other parameters: handshape, location, orientation, and focus. The opposition "more-open" vs. "more-closed" is specific to handshape, but "initial" vs. "final" is a distinction applicable to changes in all parameters.

Table 3-11 describes the handshape changes in opening and closing signs in the way just outlined. For most cases only one of the "state" columns contains a specification. Constant features are not specified in either state -- only changing features are -- so for any feature F, [αF] in one state implies necessarily [$-\alpha$F] in the other. Furthermore, a finger that is opposed to the thumb in one state is hardly ever closed in the other: it usually changes to or from extended (straight or curved). So the $O^{\square}$ line in Table 3-11 would be filled-in somewhat as in (5):

(5) <u>digits</u> <u>initial</u> <u>movement</u> <u>final</u>

all +opposed

(must be opposite to value in other state)

-opposed

(markedness convention on change to/from opposition)

-closed

(elimination, by the definitions of opposed, closed, and extended)

+extended (all digits extended = B/5)

(direction of change from opposed to extended)

opening

Notes to Chapter Three

1. WRITE , GLOVES , PRACTICE , KICK , CITY , EASY , CHEESE , FISH , NOON ; MEAT , STUBBORN . This list is based on Battison (1978: 38).

2. The work in this section was partly inspired by Newkirk's finding (1978ms., according to K,B, Newkirk, & Battison 1979: 64n10) that much of the information about base handshapes can be determined from focus. I have been unable to gain access to his work.

3. Total about 200, including subentries; about 22 signs with other than palmar tab-focus.

4. Trunk is in quotes, here and elsewhere in this sense, to distinguish it from the trunk of the body used as a place of articulation.

5. I will often give only approximate figures for the number of signs in DASL that match a given description. Many signs entered separately in DASL are closely related, even as closely as an uninflected sign and an inflected form. Such cases should be counted as one piece of evidence in these calculations. I have also combined antonyms with reversed movement, such as IMPROVE and DETERIORATE , and other groups; but the resulting totals are always open to some discussion.

6. "Fist", in quotes, refers to the closed fingers, thumb, and body of the hand, when not all the fingers are closed and the handshape is therefore not a true fist.

7. This must be interpreted allowing orientation to be calculated in terms of any part of the hand that will allow a finding of "identical", or equivalently including bilateral symmetry of orientation. Battison refers to the palm and fingers or the metacarpals, but in LIMIT the palms are down and the ulnar edge out (= palms down and fingers contralateral), and in ENJOY the palms are in and the ulnar edge down (= palms in and fingers contralateral) (see Fig. 3-2). Cf. the phrase "(any part)" in the definition of (mutually) symmetrical orientation, below.

8. The Type 1 sign ASSEMBLY-LINE $4_{D}{}'4_{\alpha}\,\eta_{<}^{\cdot\cdot}$ has just this relation between the handshapes. However, the dezes' movements are synchronous, and identical both in spatial direction (toward the nondominant side) and in terms of the hand (ulnar edge leading). Of course, in a Type 2 sign the nondominant hand has no movement that could contribute to violation of this constraint.

9. These are schemata for 'sign with A tab and A dez', etc. Cf. the formula C(y)VC 'initial consonant, optional jod, vowel, final consonant'.

10. In BROTHER and SISTER, $\bar{G}.G^{\dot{x}}$ < older and formal $G_{D}{}'.G_{D}{}^{x}$.

11. Including a [5.4] , LONG-LIST, written $\underline{5}_{>}.B_{<}{}^{v}$.

12. Numeral morphology creates complex ordinals meaning 'n-th' or 'n-th of p', with any of the numeral handshapes thumbÅ '1', L '2', V '2', 3, 4, 5, 6, 7, 8, F '9' in heterotab position, and with focus on any digit-tip for n = 1 through 5 or on the joined thumb- and finger-tip for '6' through '9'. I exclude these ordinals from the present discussion. See Chinchor (1978a). Classifier morphology can also create violations of the DC. See S & N and Chapter IV.

13. The H tabs in Table 3-6 are derived from the dez handshape (DRESS with C dez is a lexical exception), as is the thumbÅ tab of STAY-THERE (with subsequent assimilation of the dez to the dez of the following deictic component). The Y tab of STRAWBERRY is derived like its I alternant, plus application of the Rule of Thumb (Battison, Markowicz, & Woodward 1975). The L tabs appear to be specified underlyingly for handshape, with the iconic and numerical morphology mentioned above. So are the V in CHOICE and the finger-spelling-influenced I in EGO.

14. However, G is highly confuseable in visual perception, data are lacking on children's substitution errors for I, and I has the same foci as G -- more, if we include inside (in the sign GAY-MALE-INTERCOURSE, Woodward 1979).

15. The Taiwan SL /dualÏ/ - [dualF̈] classifier is used in a name-sign ⌣F̈⊥ˣ for a teacher with a hairy mole on his chin (pers. comm., Peng Tsui-Chin & Tao Chung-Shan.) It would fit right into ASL morphophonology (Chap. IV) as a morpheme for 'two (or several?) very thin straight shapes'. Since that morphophonological system is based on the visual geometry of HCs and a scheme of shape classification for objects that is found in oral languages all over the world, it would not be surprising to find similar morphophonological patterns in other sign languages.

16. The subscripts are different in these DASL spellings because of variations in DASL's writing of orientation.

17. There is at least one exception: G̅∧.3̈ᴅˣ 'champion', related to the synonymous ⌒3̈ᴅ^ˣ by substitution of the G∧-'person' classifier for the signer's own body. This substitution removes the sign from the marginal top-of-head Location.

18. These figures include signs in which the dez grasps the tab or other dez. Signs in which the handshape changes without grasp were counted only if the bunch of the closed handshape touches or approaches the tab or other dez, as in BANANA ✓.5#·[o] and TAKE-PILLS ⌣F̈⊤ .

19. With their modern forms as written in DASL (where there are several, I give the one most like Long's form): SENTENCE F'F÷ , CAT ⌓FF÷ , INDIAN ⌓Fˣᵀˣ , UNFAIR F'.F˅ . Long describes UNFAIR as using O, but the photograph appears to have bO or dualÖ.

20. Stungis's analysis, skipping his third feature, Dual, which is meaningful only within the [-Compact] group.

21. Including ANALYZE, written $C_{D>}'C_{D<}$÷·· .

22. Almost all of the uniform-fingers cases can be reduced to B. The five bent$\ddot{\text{B}}$'s have been discussed above, under knuckle focus: all occur in positions where straight [B] would be difficult or impossible. The same applies to ANALYZE $C_{v>}{}'C_{v<}{}^{\div\cdot\cdot}$, though the classifier C- 'several or many objects viewed collectively', as in $C'C^{a}$ 'group, class', $C_v{}^{\Delta}$ 'go in a group', and $C_vC_v{}^{\perp}$ 'hordes (of ...)' may be present. The tensely hooked "claw" of UNKEMPT $\underline{\smile}\ddot{C}_v{}^{\hat{}}_{x}$ appears also in ROUGH $B_{\alpha}\cdot\ddot{C}_v{}^{\perp}$, of which it seems to be a lexicalized derivative with body-part incorporation: 'roughness on jaw' = 'chin-stubble', which has been metonymically extended to 'ill-cared-for, slovenly' in the same way as the English word <u>unkempt</u>, originally a strong past participle derivative = <u>uncombed</u>. DIRTY $\underline{\smile}5_v{}^{\alpha}$, possibly related to PIG $\underline{\smile}B_v{}^{7\cdot}$ (and felt to be so by signers), requires separated fingers for the wiggling movement.

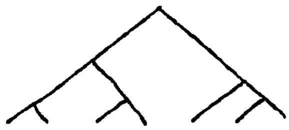
23. 'Up to' is written $\underline{B}_v\cdot B_v{}^{)(}_{\times}$, but that appears to be a typographical error.

24. STAY also occurs as a component of REMEMBER, which Wilbur cites as an example of thumbȦ with thumbtip contact; the contact is on the thumbnail, i.e. the back of the thumbtip. STAY is related to STILL.

25. Frishberg (1976: 204) discusses the shift of PATIENT from G to A under the influence of homonym avoidance, and variations between G and A in the phonologically similar SUFFER, as reported by Long. G and A - or in Wilbur's analysis /G/ and /S/ - are an unlikely pair of handshapes for alternation or variation, with no known cases other than these two; but G and thumbȦ, both of which are linear, with one digit extended, alternate often. This historical evidence, then, supports the shape-and-focus analysis of handshape given in Chapter II, as well as specifically supporting underlying thumbȦ for PATIENT and SUFFER.

26. The dorsal interosseous muscles, which accomplish abduction of the fingers, attach distally on the fingers to the extensor muscles as well as the the base of the innerphalanx (Wells & Luttgens 1976: 299). When the midjoints are flexed the extensors are passively stretched, and presumably the dorsales are too. <u>Add</u>uction (alignment) then would further stretch them, and they would resist. Perhaps in bent $\ddot{\text{V}}$ they oppose adduction in this passive way as well as by exerting tension. (The "knuckle-wrist connection" [Mandel 1979] also depends on passive stretching of the extensors during flexion.)

27. Stungis's [-compact, -broad] class is as shown. (The tree was generated by hierarchical clustering based on subjects' misperceptions of one handshape as another).



3 V R H K L G. The experimental stimuli, pseudo-signs presented through noise on videotape, did not use deixis or contact; if they had, K might have come out closer to V and 3 than to G and L.

28. By the tendon effect between the mid- and innerjoints. When the extensors on the back of the index and middle are pulled tight by midjoint flexion they pull in across the innerjoint, extending it. Cf Mandel (1979).

29. DASL's use of the spatial relation diacritic ¯ "above (the nondominant hand)" is inconsistent, especially with nondominant supine B, which is almost always in this relationship.

30. I am grateful to Lloyd Anderson and Ruth Loew for their helpful comments on an earlier version of the material in this section (Mandel 1980).

31. Type 1 cases: SHAPE ȦȦ , IMPORTANT FF$^{\times}$, PLATE $G_v G_v$ $^{\times}$ (also B̈B̈ $^{\times}$), HEART []$G_T G_T$ (also []$Y_T Y_T$). The analysis in Mandel (1980) excluded these signs from the general constraint.

32. In Mandel (1980) I said that FAMOUS also has sagittal identical-phase circling. Lloyd Anderson (pers. comm.) has pointed out that the movement of FAMOUS is more accurately described as an arc repeated with forward motion, like that of WASHINGTON, than as circling.

33. The following proposal and its elaboration owe much in inspiration to Ellenberger (1977).

CHAPTER IV

MORPHOPHONOLOGY

IV.A Iconicity, Morphophonology, and Phonotactics

IV.A.1 Morphophonology as iconic morphology

Iconic analysis of signs, though long popular, has been difficult to support with any evidence of linguistic reality. Iconic analyses of individual signs by both signers and nonsigners, including many sign linguists, often vary; what seems obvious to one person seems fanciful to another; and most iconic analyses are open to the criticism that the sign does not function iconically in the contemporary language. Frishberg (1975, 1976) showed that originally-iconic signs tend to become more conventional with time, participating in the phonological structure of ASL and being bound by phonological constraints at the cost of iconic representation. Hoemann (1975) and K & B (1979b) found that nonsigners can only rarely guess the meaning of a sign from its form. But people keep seeing iconicity in signs. In small studies, Mandel (1978) and Brown (1978) verified the conventional wisdom that iconicity has considerable mnemonic value for nonsigners learning signs. Do signers, then, completely ignore all the iconicity that outsiders find in their language?

Supalla & Newport have found a functioning middle ground between iconicity and arbitrariness: a rule-governed system of iconically-derived morphology that allows signers to generate novel verbs of motion and location with complex meanings. Much of this chapter consists of restatements of their findings in terms of my phonological analysis. (Although I have made some of the same findings independently, S & N's systematic explorations and clear exposition have been of great help to me. Their factor analysis of the morphophonology of shape classifiers (sect. IV.B.1) has been especially helpful to my formulation of HC in terms of selection and position of fingers. The term "morphophonology" in this sense, as well as the discovery of this system within ASL, is due directly to them (S & N: Supalla, 1978).)

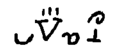
This system uses nominal morphemes called classifiers, which classify their referents according to either shape or abstract semantic categories. With a related system of size-and-shape specifiers, or SASSes (Newport & Bellugi, 1979), signers describe shapes. S & N use the word tracing (Mandel, 1977) for the shape-describing movement that many SASSes employ. They find that both verbs of motion and location and SASSes range along a continuum, from wholly novel uses of productive morphology to signs that were originally constructed morphologically but are now lexically "frozen" (S & N's term) and whose meanings are somewhat different from what their morphology would imply. (The remainder of section IV.A presents my view of the principles of the systems uncovered by S & N. Much of the data is theirs, but the analysis, except when specifically attributed, should not be taken as representing their views.)

The forms constructed with classifiers can be called classifier models, adapting the term used in Mandel (1977). S & N refer to "verbs of movement and location." In (1977) I included many nouns in "models." It appears from S & N's findings that noun models are probably always derived from verbs, and therefore the morphophonological system can be described as a system for constructing verbs. The word "model" is thus reduced to an abbreviation for "(morphophonological) verbs of movement and location, signs derived from them, and connected discourse in which the morphemes of such verbs and signs refer consistently to the same objects and directions of the event being described." Fig. 4-1, reproduced from S & N (Supalla, 1978) is an example of such a connected discourse.

In this middle ground, iconicity conventionalized into morphology, the productivity of pure iconicity has been limited to allow signers to chunk and process material as phonology, at the high speeds of linguistic interaction which require choosing between discrete alternatives, with the room for imprecision that that implies. As S & N analyze the system, it is iconic morpheme by morphene. Despite the overall iconic appearance of a model taken as a whole, they find that the signer analyzes the referent morphologically, dissecting out individual elements and coming up with their individual morphophonological representations, and finally reassembles these morphemes into a single sign or sequence of signs. For instance (S & N: Newport, 1981), a deaf child, age 4 years 5 months, acquiring ASL natively from parents who were also native signers, was shown a film of a hen jumping from the ground to the roof of a barn. The child analyzed the arc shape and diagonal upward direction correctly (i.e., as an adult would), but articulated them in sequence, contrary to both iconicity and correct adult morphophonology (Fig. 4-2).

But the iconic coding of distance and direction gives ASL morphophonology a type of redundancy lacking in the morphology of non-spatial languages. Suppose Abelard and Bertrand are talking face-to-face. Charlotte comes up behind Bertrand and taps him, and Bertrand turns around to look at her. In an ASL model, but not in English, the fact that Bertrand is no longer facing Abelard is automatically morphologically represented: if Bertrand is located in the model between Abelard and Charlotte, as must be the case to express the antecedent events correctly, the fingertips of the prone V-hand whose orientation expresses the direction of Bertrand's gaze cannot point at Abelard and Charlotte simultaneously. If Bertrand and Charlotte then go off together, the distance between them and Abelard increases and he is left alone. The morphology reflects certain semantic consequences automatically, without explicit coding.

S & N claim (Newport, pers. comm.) that similar redundancies would exist in any language that coded the same features morphologically -- distance, relative and absolute orientation, and relative and absolute direction of movement -- and that some oral languages do code some of these features morphologically. But it can hardly be mere chance that relatively few oral languages code any of these to the degree that ASL does, and that none seem to code them all. Because ASL uses space phonologically, it can code spatial relationships compactly by coding them iconically; because it is a language, it does so with morphological analysis rather than holistic direct analogy. The iconic appearance of models is directly due to ASL's visual-spatial modality.

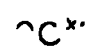
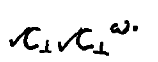
Similar redundancies can appear in number and shape within the HC parameter. For example, a deaf teacher asked his class, "You know a snake has two fangs. If one gets knocked off, how many are left?" He signed SNAKE  , then kept the V-hand (which has two extended fingers) in position near his mouth and pushed one finger down with the other hand. The answer was intentionally self-evident. It is not in English, or in ASL if asked non-morphophonologically. S & N (Newport, pers. comm.) point out that a language with singular and dual noun classifiers would make the same distinction in mentioning the remaining fang. Even English does so with noun number: remaining fang is singular. But in the ASL model the question need not even be asked. The arithmetic of this model is as transparent as counting on the fingers.[1]

DeMatteo (1977) and I (1977), looking at the apparent gestalt iconicity of entire models, called this direct connection between sign and referent "analog relationship," making "analog" imply "continuous" and opposing it to "discrete" or "digital." The relationship between most morphophonological morphemes and their reference is indeed analogous in some sense, with each phonological parameter representing its referential counterpart (distance, direction, shape, velocity), but it is not "analog" in this technical sense. S & N have found that indefinitely subtle distinctions of direction, distance, and speed are not available in classifier models (as DeMatteo and I thought they were); and the precision available is much less than our musculature and senses would allow in nonlinguistic processing. ASL sacrifices this precision for morphological and phonological discreteness. The loss of the distinction between a 90-degree left turn and one of 105 degrees is a result of digitizing direction to phonological quanta of more than 15 degrees. Distance and speed are similarly digitized, and shape is treated comparably (sect. IV.B.1). Location is also morphophonological, but the locations used are in neutral space, determined either by deixis or by the "base grid" with respect to a base hand (DR and Proximity: S & N, Supalla, 1978, and sect. IV.B.3 below). The morphemes of the morphophonological system are iconic but discrete.

To summarize: ASL morphophonology is a rule-governed system which represents many spatial relationships (distance, direction, velocity, duration, number; shape, part of object) by spatial relationships, digitizing quantity but maintaining quality (distance representing distance, direction representing direction, etc.). The parameters appear to hand together in the same way their real-world reference do: e.g., an implication that holds between relative location and relative orientation ir the real world holds between their morphophonological representatives as well (as in the case of Abelard and friends). The questions to be answered then are, what semantic features are coded, what are the quanta of digitization, and how are the semantic features translated into phonological form? S & N have done a great deal to answer the first two questions. This chapter is intended as a start on the third.

The rest of this section traces the general course of such tralslations or derivations. The middle sections of the chapter deal with two morphophonological subsystems, <u>classifiers</u> and <u>tracing</u>, which share a morphophonological use of HC and are distinguished by their use of movement. The chapter concludes with a summary and a number of example derivations of morphophonological morphemes and signs.

IV.A.2 From iconicity to phonology

The descent from iconicity to phonology starts with abstraction: some characteristic of the referent is selected that is visual and is transformable into a sign form. The process of selection can be seen in the coining of new signs, where two or three alternatives may compete: e.g., for 'computer',  (<u>c</u> and /MIND/^{2}) and  (reels of tape turning in vertical plane as on a tape drive). In contemporary ASL (as S & N have shown), neologizing usually draws on established morphology, but some <u>image</u> must still be selected: e.g., HELICOPTER $\bar{G}_{\wedge}.5_{\upsilon}^{\omega}$ uses the rotor and its axle, leaving out the body, tail, landing gear, and everything else associated with a helicopter (see Examples). This selected image is often metonymic, taking part of the referent for the whole (HELICOPTER; V /LEGS/, the legs for a person), or metaphorical, referring to it by another, somehow related concept ($\bar{A}.B_{\alpha}^{\dot{<}}$ 'fire from employment', slice the top off, decapitate; $5_{\upsilon}.G_{\wedge\wedge}^{\odot}$ APPEAR, pop up through, surface, emerge; Fig. 4-3); or the sign may be indexical, without an <u>image</u> strictly speaking, pointing out an example of the referent ($\}B_{\upsilon}^{\times\vee\times}$ HEAD, signer's own head; RED, signer's lips). I will give no further attention to the choice of an image for a given referent, as the principles of its selection are beyond the scope of this study. (See Mandel (1977), Cohen et al. (1977), Oléron, and DASL (pp. xxiii-xxv.).)

Physical point of view is often important to ASL morphophonology. Deixis-incorporation in general is a matter of point of view. More specific to visual coding, the side of things that is visible to the signer and viewer is more important to iconic representation than the invisible side. For most frozen morphophonological signs, which are located in mid-neutral space, the top is visible, the bottom either hidden or literally in the background, "behind" the top. Sometimes this concealment of what is beneath is used iconically, as in HIDE $\smile A^{\times} \,\vdots\, \underline{B}_{\upsilon}.A_{\times}^{\perp}$ (SECRET + moving the thumbȦ /OBJECT/ classifier under cover) and APPEAR $5_{\upsilon}.G_{\wedge\wedge}^{\odot}$ (an object -- originally G /PERSON/? -- pops into view from under a concealing plane). In other cases it simply backgrounds or conceals anatomical features of the sign that are morphophonologically irrelevant, such as the dez tips in PUT-ON-SHOES (see Examples).

Most of the derivations given in this chapter are morphophonological, and for them the image must be further abstracted into visual-geometric units that have morphophonological representations. In DIVE $\bar{H}_{\mathcal{V}} \cdot H_{v}{}^{a}_{v}$, a person on a diving board is abstracted to a downward-pointing pair of thin straight shapes (/LEGS/) on top of a long, flat horizontal shape, and the movement is abstracted to a pivoting about the person's middle followed by a downward movement.[3] This is the <u>abstract image</u> (AI) which the morphophonology represents. (Non-morphophonological multi-morphemic signs, some of which are also derived in the Examples (e.g. INDEX and THINK), have a less visual morphological analysis (MA) at this level.[4]) Here is where iconic representation becomes analyzed to parameters of orientation, location, etc., and digitized to discrete quanta of measurement: from here down we can speak of morphemes. In some cases no more specific image can be reconstructed from the observed form, and the abstract image is as far back as iconicity can be taken. Because of the redundancy of Direction, several superficially different abstractions of the same image may be possible: in CAR-APPROACHES-TREE ${}^{(\emptyset)}\!\surd 5_{\wedge} . 3_{<}{}^{)(}$, the car can be described as facing the tree and moving toward it or as facing the tree and moving "forward" (i.e. with its own front leading). See also the derivations of HELICOPTER and WINDMILL.

I must stress that these derivations are in many cases etymological, with varying degrees of relevance to current use of the sign. For most purposes the AI (or MA) is the top of the derivation, as new signs are generally formed from established morphemes. The purpose of the Image in the Examples is to relate each element of the AI to its etymological referent for the reader, not to imply its necessary relevance to the signer in ordinary discourse. Consider these English words: *overstrike* (in printing), *underlying* (e.g. in linguistics), *discover*, and *undertake*. The symbol Ø does have a slash struck over an O, but underlying forms are usually written at the top of a derivation, America and radium were never covered, and the morphology of *undertake* is semantically opaque. Nevertheless, historically and phonologically, the obvious analyses are the correct ones. Similarly, $\bar{B}_a \cdot V_v^{ax}$ FALL no longer refers strictly to human activity (as the /LEGS/ classifier would imply), or even to an animate subject; an apple can FALL (S & N: Supalla, 1978). It has been lexically frozen in this sign and lost its morphological meaning, but /LEGS/ is part of the historical analysis of the sign.

The MA or AI is stated in semantic terms, whether referring to geometric aspects of the referent (morphophonology) or less tangible ones (morphology in general); then the *morphophonological form* (MpF) transposes each morpheme into its phonological form. For ease in following the derivations, each unit or small group of units is keyed by a number through the image, MA, and MpF. Since morphemes are established parts of the language, already "frozen" to their meanings, they may include specifications not strictly required by iconicity. These are marked with "(+)" in place of a key number. Phonological redundancy (of direction) begins here as the iconic realization of geometric redundancy: the dez (active hand) in CAR-APPROACHES-TREE, with its fingertips toward the basehand, can be described as moving toward the basehand or as moving with its tips leading. Both are part of the AI, and both are represented morphologically; but the AI is stated in the same phonological terms as any non-morphophonological sign, and these directional descriptions are phonotactically redundant. A non-spatial language coding all these semantic features of the event could express them both or suppress one or the other; using both would increase the phonetic material without increasing information. In ASL they are both present, but there is no excess phonetic material.

The specifications of the MpF are sometimes sufficient to form a phonologically complete sign; often, as in CAR-APPROACHES-TREE, they are more than necessary. The observed form can often be described in other terms using phonotactically least-marked values. Such a <u>phonotactic</u> <u>minimal</u> <u>specification</u> (PtMS) is almost always simpler than the MpF, and often is not a subset of it, since the phonotactic rules incorporate anatomical considerations that are absent from visual geometry. The visual geometry of APPEAR $5_{D} \cdot G_{\wedge}{}^{\odot}_{\wedge}$ requires a horizontal planar basehand, but does not demand that the palm face specifically up or down. But the dez must approach it from beneath, and since phonotactically the Palmar side is the unmarked Flat, the basehand's unmarked Orientation in this environment is Dyadically "Palm toward Other Hand," and therefore Spatially "Palm Down." As in the MpF, the observed form may contain some arbitrary phonological elements that cannot be derived morphologically. These appear first in the PtMS and are marked with a "(+)."

The simplicity or complexity of the PtMS expresses the phonological simplicity or complexity of the frozen lexical item without respect to its morphological origins. Often phonotactic redundancies make several PtMS's possible, as in CAR-APPROACHES-TREE. Since I have not figured exact costs for the calculations of the simplicity metric, no precise comparisons can be made, but the difference in complexity between the PtMS given and the sign's MpF should generally be evident.

IV.A.3 Two uses of movement

In Mandel (1977) I distinguished two iconic means of representing shapes. In "substantive depiction"[5] "the signer's articulator takes on the shape of the [...] object" (Mandel, 1977:97), which is therefore continuously visible and can be moved to represent movement of the object. In "virtual depiction" "the signer's articulator, moving [...], leaves an imaginary trace of the [...] object" (Mandel, 1977:97); since movement is part of the shaping mechanism it cannot be simultaneously employed for representing referent movement. Classifiers are defined as such by their ability to be combined with morphemes of movement and location to form complex verbs (S & N) -- a morphological definition -- while SASSes are defined by their semantic function of specifying the size and shape of a referent object.[6] Classifiers cannot use movement to form their shape and simultaneously to represent movement of the referent object. SASSes, under this semantic definition, are not so constrained. Virtually-depictive SASSes are described in sect. IV.C.[7] The morphologically-defined set of classifiers and the semantically-defined set of SASSes intersect in a set of substantive size-and-shape specifiers, or size-and-shape-specifying classifiers: <u>SASSifiers</u> for short. They and some of their uses are described immediately below.

IV.B Substantive Depiction: Classifiers

(This paragraph is condensed from S & N, Supalla, 1978.) Many classifiers are SASSes, HCs referring to the shape of the referent. They are themselves analyzable into recurrent shape-referential elements, whose sum is equal to the meaning of the SASS. These, the

SASSifiers, can be distinguished from other SASSes which phonologically consist of a HC and a Movement (see sect. IV.C on Tracing, below). Other classifiers (sect. IV.B.2) refer to more abstract semantic classes. They

> seem to have originated as SASSes [but] are no longer analyzed as multi-morphemic, and they are no longer based on references to the visual-geometric parts of the object. Instead they refer to objects on the basis of the semantic categories the objects belong to. (S & N, Supalla, 1978:33.)

Specific shape reference has been "frozen out" of their meanings. (I see the division between abstract and SASS classifiers as actually not being so sharp: see section IV.B.2.)

The first part of this section describes the iconic representation of basic shapes by HCs. The next part discusses some morphemes whose shape-iconism has been partly or wholly lost. The third part presents some referential movement and location capabilities of classifiers, described by S & N, in the phonological terms of Chapter II; and the last part is a brief discussion of Internal movement in classifier hands.

IV.B.1 Abstract shapes and SASSifiers

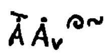
HCs represent shapes generally, not in detail. The shapes depicted include Allan's (1977) inventory of shapes defined by oral-language shape classifiers, and a number of others derived from those. His list follows, each member with the feature values and name of the HC(s) representing it morphophonologically. Parenthesized feature values are specified in the MpF but phonotactically implied by the non-parenthesized ones, and are therefore generally omitted in the PtMS.

"Saliently one-dimensional:" A long, thin object; an object saliently greater in one dimension than in the other two, roughly linear ("Line"). Single finger fully extended, with the others closed to clear the background: G, I; [1Fg, (-Th, +Cl)]. S & N's SASSifier /THIN-STRAIGHT-SHAPE/ is this G. It is found in PLUS $G_{<}.G_{\wedge}^{\times}$, HANG-OUT-LAUNDRY $\bar{G}_{>}.F_{>}^{I\,\because}$, /PERSON/ $G_{\wedge}$, HELICOPTER $\bar{G}_{\wedge}.5_{D}^{\omega}$, and many other signs. I, with Pinky-Diminution (addition of the specification [+Pinky], which overrides the default (+Index)) as a SASSifier represents an even thinner object and can be glossed /VERY-THIN-STRAIGHT-SHAPE/. ART/DRAW $B_{\wedge}^{'}.I_{\times}^{v\cdot}$ and SPAGHETTI $I_{>}I_{<}^{\div}$ are examples. This SASSifier may not be productive in verbal morphophonology (S & N: Newport, pers. comm.), although it may still be functional in lexical neologism.

R is a rather infrequent derivative, also perhaps non-productive. It occurs in CIGAR $\cup R_{\perp}^{\times}$, ROPE $R_{>}R_{<}^{\div}$, DOUGHNUT $\cdot R'R_{\times}^{a}$, BRAIDS $\supset RR^{v}$, and some other signs. It refers to a long, thick object, with a larger cross-section than G, as I refers to an object with a smaller one. Its referent often has a twisted or braided appearance: ROPE, BRAIDS, and perhaps CIGAR. Call it /THICK-STRAIGHT-SHAPE/; [(2Fg), +Crossed, (+Cl, -Thumb)].

"Saliently two-dimensional": A flat object; an object saliently smaller in one dimension than in the other two, roughly planar ("Plane"). More than one finger, fully extended and not spread; other fingers (if any) closed: B, H; [>1Fg, (+Cl), -Spr]. Number of Fingers represents relative width. B is S & N's /WIDE-STRAIGHT-SHAPE/, in opposition to their H /NARROW-STRAIGHT-SHAPE/: the distinction is that H ([2Fg, -Spr, (-Cl)]) represents an object with all dimensions saliently different (length > width > thickness). The latter is clearly the more highly detailed shape, perceptually as well as phonologically ([Uniform], = [4Fg]/[0Fg], is less marked than [2Fg]). When /WIDE-STRAIGHT-SHAPE/ is pierced through the palm-plane or entered from the edge (Tips), the fingers are spread to create at least one Angle. This B appears in BOOK $B'B^{a\cdot}_{x}$, DOOR $B_{\perp}'.B_{\perp}{}^{a\text{ɒ}}_{x}$, and MAGAZINE $\underline{B}^{\mathfrak{T}}.L_{\perp}$; H in "SCOTCH"-TAPE $H^{\#}_{\text{ɒ}}.H_{\text{ɒ}}{}^{\top\cdot}_{x}$ and NECKTIE ΠH^{xv}.

In many frozen signs, such as PARK-CAR $B_{a}.3^{x}$ and DANCE $B_{a}.V_{v}{}^{\wr}$, the palmar surface of the basehand (B/5 HC) seems to refer to a surface that something happens on, without reference to what lies beneath. S & N distinguish palm-up B from palm-down B as respectively moveable vs. immoveable flat object, but these signs use palm-up B for an (immoveable) flat surface. It could be treated as a morpheme /FLAT-SURFACE/, separate from /WIDE-STRAIGHT-SHAPE/, but such an analysis would be less certain if the same morpheme is not found in productive morphophonology. Since the signs are frozen -- e.g., PARK-CAR can be used for parking atop the Empire State Building, a location which productively would require G /THIN-STRAIGHT-SHAPE/ (S & N: Newport, pers. comm.) -- an alternative treatment may be preferable, namely attributing the basehand HC etymologically to /WIDE-STRAIGHT-SHAPE/ and the Palmar focus to phonotactics, since Palmar focus is generally much more frequent than Dorsal.

"Saliently three-dimensional": A bulky object, an object not saliently distinct in any dimension, roughly globular or solid ("Bulk"). All fingers closed, thumb extended: thumbȦ; [(Uniform), +Thumb, (+Cl)]. This classifier is not restricted to "bulky" objects, but it does include them, as the other abstract-shape classifiers do not. It is actually quite unspecific as to the shape of its referent. The purpose of the extended thumb, which does not derive from the shape as Allan describes it, may be to establish the "top" of the HC for representing the top of the object, in whatever the object's normal orientation happens to be. (In mid-neutral space with semiprone orientation, the neutral non-contact situation, the extended thumb points up.) S & N describe this classifier as referring to an object with a nonpermanent relation to its location. It is the least specific of all shape HCs, as H is the most specific of those presented so far. I will gloss this very shape-unspecific SASSifier as simply /OBJECT/. It occurs in CHASE , COMMUTE , and MINGLE .

Allan's remaining three major shape classes are nondimensional.

"Hollow": An enclosed space, a concavity. Fingers bent and thumb fronted to form a round enclosure, opposed or not depending on size: C, O, dualC̈, all with Inside Focus: [>1Fg, +Round]. DualC̈ is used only in productive morphophonology (not in the frozen lexicon), and not at all by many signers (S & N: Supalla, 1978). Here as in the straight shapes, Number of Fingers distinguishes extent along one dimension. S & N call these /DEEP-ROUND-SHAPE/ and /SHALLOW-ROUND-SHAPE/ as part of a six-shape paradigm, but as with /FLAT-SURFACE/ I will add /HOLLOW/ as a general use of C/O. It is found lexically in TEA O$^{\odot}$.F$^{\odot}$, EJACULATE-INSIDE-VAGINA C$^{\odot}$.A (Woodward, 1979), and GROW C$^{\odot}$.O$_{\wedge}$. See the next two abstract shapes.

"Prominent curved exterior": Bulging, convex. C/O (and perhaps also dualC̈) serve this function in depicting cylindrical shapes. It is found lexically in DIPLOMA O$_{\text{D}}$O$_{\text{D}}$; in CUP B$_{\alpha}$.C$^{\times}$ the difference between "inside of a curve" ("hollow") and "outside of a curve" ("prominent curved exterior") is indistinguishable. In SUNRISE B$_{\text{D}}$.C$^{\wedge}$ C represents a disk with no visible depth at all; the situation here, with a putative /ROUND/, is like that for /FLAT-SURFACE/ B and /HOLLOW/ C. For convexity that is curved in two directions, C adds [+Spread] and becomes round5̂, S & N's /DOME-SHAPED/, [(Uniform, +Thumb), +Round, +Spr] (Fig. 4-4). The digits of these HCs form the shape, but for contact with such a convexity ASL uses other HCs with other Foci: A/S, the Bunch of O, the Back of the lax Ɒ (TOMATO G$^{\times}$ A$_{\text{D}}$.G$^{\times}$, BEHEAD $O_a.B_a^{<}$, MELON $\mho 8^{x}$). I attribute this asymmetry to the general avoidance of contact on the Dorsal surface of nonclosed digits, which in turn has anatomical motivation: the extensor musculature is not well equipped to resist pressure or impact. The derivation of [A] with Dorsal-Thumb ("thumbface") contact from thumbȦ refers to the same fact.

The synchronic use of C in tracing doubly-curved solids (bowl- or dome-shaped: see next section) suggest that we should recognize a SASSifier /CURVED-SURFACE/ with C, more general than /DEEP-ROUND-SHAPE/ as the putative /FLAT-SURFACE/ with B would be more general than /WIDE-STRAIGHT-SHAPE/.

"Annular": A hole or opening. One finger bent and thumb fronted as for Hollow: crossedF (see below), round$\hat{F}$, open$F_{\sqcap}$, bC, bent$\ddot{L}$, frontedL_{j}, open$8_{\sqcap}$; [1Fg, +Round]. These variants are largely determined by the size of the referent. ASL uses these for flat, round objects as well as openings and, occasionally, objects that are ring-shaped as the digits are (CHAIN $FF^{x\,\iota\,\eta}$). The different-shaped referents (hole, disk, ring) take different Foci as their shapes allow (no Inside for a disk, no "trunk" for a hole), but S & N's name /FLAT-ROUND-SHAPE/ will do for them all. Examples: round$\hat{F}$ in HOLE $\checkmark.F^{x}$ and ZERO $8'.F^{\dot{x}}$, bC in TAKE-OFF-EYEGLASSES$^{(\varnothing)}\, {}^{\triangle}\ddot{L}^{\downarrow}_{v}$, open$8_{\sqcap}$ in PLATE$^{(\varnothing)}\, 8'.8^{\dot{v}}$.

The HC I have called "crossedF" refers to a very tiny object, such as a speck of dust. S & N (Supalla, 1978; Newport, pers. comm.) describe it as "index finger and thumb completely closed": the index finger and thumb are crossed at the midjoints, palmar side of thumb to radial side of index, like French fingerspelled t (Fig. 4-5). Phonologically, in HC features, it is [1Fg, +Round, +Compressed, -Closed]. It can be described in Internal terms as [Int Focus: Palmar Thumb, Finger; Int Prox: Contact].

"Horn-shaped" (for Allan, one form of "prominent curved exterior") appears at least in part as a derivative of this or of /THIN-STRAIGHT-SHAPE/: X ([1Fg, +Bent, (+Cl)]) occasionally represents a hook shape (HOOK (Ø)◡X , EGYPT (Ø)⌒X ,), and bC a crescent shape (TURKISH (Ø)⌒L).

I will add one more "shape" to Allan's list for the purposes of ASL morphophonology:

"Saliently zero-dimensional": A small object of no discernable or salient shape, roughly a point ("Point"). The Tip: G or I (with Tip Focus), [1Fg, (+Cl)], or thumbȦ [(+Unif), +1h, +Cl]; or the one-finger Bunch: F, bO, [1Fg, +Opp, (+Index)]. Some variant names of fruits may involve size alternation: CHERRY $Ǝ^{I}_{.}O^{\omega}$ (also used as 'strawberry'), with a diminutive variant (Ø)I$^{I}_{.}$E$^{\omega}$ that exhibits Compression on the dez and Pinky-diminution on the basehand and a related sign PLUM (Ø)Ȧ$^{I}_{.}$O$^{\omega}$, in which the shift from the index to the thicker thumb may be augmentative. bO is often used with /BE-LOCATED/ on the vertical plane of signing space, especially with (etymological) reference to writing (cf. WRITE Ba.X with bO); PERIOD (punctuation) X, THEREFORE X . CLOWN (Ø) F uses F on the face in the reverse orientation, Bunch-Backward. (See sect. III.B.2.e on visibility of the bunch.)

S & N's analysis of the morphophonology of SASSes reveals a finer structure within this set. The sequence of straight shapes "wide-straigh- B; narrow-straight H; thin-straight G" corresponds to the curved sequence "deep-round C/O; shallow-round dualC̈; flat-round F etc." Figure 4-6 (from S & N: Newport, 1981) presents this series.

This shape-defined series is functional for productive morphophonology, but in the frozen lexicon it comes into competition with phonological demands. I have postulated [+Straight] as unmarked for selected fingers, and since [+Round] implies [-Straight] it is phonologically marked. All three of these straight HCs occur frequently in the frozen lexicon, but among the round ones dualC̈ does not (and is totally lacking for some signers). B, G, and C/O occur freely as heterotab HCs, each specifiable by Focus alone there: Palm, Edge, or Angle (B); Tip or Finger (G); Inside (C/O). Each of these HCs can be specified even in isolation by a single feature, with the others taking default values: B [-Closed], G [1Finger], C [+Bent]. But F, H, and certainly dualC̈ do not so occur and cannot be so specified. O appears to be in a weak position: it is practically a variant of C in the dimension of closure, alternating with it in heterotab, and in dez it shares greatest Bunch-focus frequency with F.

As the straight and round shapes vary in width, the one-finger shapes have multiples. G /THIN-STRAIGHT-SHAPE/ has a dual with V or bentL‴ and a plural with 4 or 5. G /POINT/ has a dual and plural, both with Thumbtip + Fingertip Focus; but since these are used mainly in contact with a plane location (physical or nonphysical), the HCs are usually bentL‴ and bent5‴ to bring all the tips into the same plane at an angle. (See section IV.B.4 on virtual depiction.) Number-incorporation in some signs (Chinchor, 1978) adds the HCs 3 'three' and 4 'four' (as opposed to 'many').

Notice that in the non-Uniform HCs ([1Finger] or [2Fingers]) only the selected fingers participate in representing the abstract shape. The other fingers are relegated to the background: closed in G, H, V, bC, dualC̈, and bentL⃛, extended in F, openF$_{\square}$, and openB$_{\square}$. This is the morphophonological importance of finger selection, comparable to its phonotactic constraints on Focus and Internal Movement. The phonological feature Number of (selected) Fingers, already needed for the phonotactics of the frozen lexicon, corresponds directly to the morphophonological feature of width: /WIDE/ (including "deep") is [4Fingers] (equivalent to [+Uniform, -Closed]), /NARROW/ (indluding "shallow") is [2Fg, +Closed], and /THIN/ is [1Fg]. /STRAIGHT/ is [+Straight]. Only Round is of questionable phonotactic usefulness, since the largest /ROUND/ SASSifiers (openB$_{\square}$, bentL⃛) can be fully extended at the innerjoint and slightly flexed (30 degrees or less) at the midjoint, while the smallest is an F or O in which the fingers and thumb are more-than-usually bent at the midjoint and touch on the Distal rather than the Palmar sides of their tips, forming a round curve rather than the oval, somewhat pointed one used for signs without /ROUND/. /ROUND/ is subject to reinterpretation: ZERO $B^{'}.O^{x}$ occurs with both the round morphophonological O and the flattish phonotactically-unmarked one.

Handpart and orientation are significant in classifiers (both SASS and abstract). A linear shape has a middle (Finger Focus) and an end (Tip), the curved shapes have ends or cross-sections (Edge) and interiors (Inside), and the planar shapes have ends (Tip), edges (Edge), and flat surfaces (Flat). Plane also can be penetrated or entered from the edge (Angle). Sides and parts of the classifier refer to sides and parts of the referent. Many classifiers represent implements or body parts (brush, scissors, leg); quite naturally, the Distal side of the HC normally represents the distal part of the referent (tip of brush, points of scissors, foot). If the top of the object in its normal orientation is represented by a Flat or Edge, the Dorsal Flat or Radial Edge will normally be used: V /GAZE/, H /TONGUE/, 3 /VEHICLE/, thumbȦ /OBJECT/. This follows from the Spatial Orientation produced by (Internal) muscularly-neutral semiprone Orientation in the signing space. With the forearm rotationally relaxed, the hand is Radial-up in the lower ranges of signing space, but tilts inward toward the horizontal (bringing Dorsal to the top) as the elbow is raised to bring the hand into the upper regions. Radial-up also keeps the thumb and its possible shape involvement visible: much less of interest happens on the Ulnar side.

These parts can be used in connecting morphological orientation of the referent to phonological Orientation of the hand: e.g., given that in 3 /VEHICLE/ Radial = 'top' and Fingertips = 'front', a 3-hand with [Ori: Fingertips down] can refer, in appropriate context, to a car plunging down a cliff. In the example derivations these equivalences are stated as separate elements of the MA and MpF with their own key-numbers. (See also section IV.B.3, "Movement of classifiers.")

IV.B.2 Abstract classifiers

Abstract classifiers, though originally SASSifiers, don't have to look much like their referents. The /VEHICLE/ classifier, sometimes glossed "car" for its commonest referent, looks very little like a car or other vehicle customary today. It is probably derived (like most 'vehicle' classifiers (Allan, 1977:300) from SHIP $\bar{B}_a 3 \tilde{\perp}$, in which DASL reconstructs the mast and spars of a sailing vessel (/THIN-STRAIGHT-SHAPE/s projecting horizontally from a vertical /THIN-STRAIGHT/SHAPE/): it has been frozen at the morphological level as a classifier, much as FALL $\breve{B}\alpha . V_v^{\alpha x}$ has been frozen at the lexical level as a sign (sect. IV.A.2). Its iconicity as a hand is now limited to handparts: the Radial side represents the vehicle's top for purposes of Orientation, the Tips its front. VEHICLE-FALL-OVER can be signed as 3^{a} and VEHICLE-TURN as $3^{\perp ?}_{<}{}^{<}$, but details like 'fender' and 'taillight' are not available in the classifier.

/LEGS/, phonologically V, is closer to its abstract image. It refers to actions of a person, but especially actions involving the legs: WALK-TO $V_v \overset{\circ}{\Delta}$, STAND-UP $B_a . V^{\upsilon x}$, BE-SITTING $\bar{H}_{\upsilon} . \ddot{V}_{\upsilon}{}^{x}$, JUMP $B_a . V_v{}^{x \wedge x}$.
Its abstractness consists mainly in its frequent association with the meaning 'person', and the fact that specific reference to the legs is often "frozen out" of a lexical sign derived from it. Least abstract of all are classifiers that recur frequently with a constant meaning more specific than an abstract shape, but whose HC is nevertheless morphophonologically completely appropriate to that meaning. /TONGUE/ is H, phonologically identical to /NARROW-STRAIGHT-SHAPE/, normally in Palmar-Down Orientation (see end of section IV.B.1); /PENIS/ is G or I, /(VERY)-THIN-STRAIGHT-SHAPE/.

/LEGS/ ('person') and /VEHICLE/ may have begun this way as 'legs' and 'ship', reaching their current meanings by a familiar process of semantic generalization. (Compare the English and Romance adverb-forming suffixes -ly and -ment(e), whose etyma mean respectively 'body' and 'mind'.) In fact, S & N's lexical continuum of morphophonological signs, from productivity to frozenness, is mirrored at the morphemic level in a continuum from classifiers that are fully productive in their iconic meaning, such as /WIDE-STRAIGHT-SHAPE/, through those whose meaning is modified by additional requirements, such as /LEGS/ (more specific than /TWO-THIN-STRAIGHT-SHAPES/, not just 'legs' but obligatorily human when used productively), to those whose meaning bears no synchronic relation to their shape, such as /VEHICLE/.

Other abstract classifiers will be introduced in the examples.

IV.B.3 Movement of classifiers

Verbs of motion and location frequently describe the movement of one object with respect to another. (See Mandel, 1977 and S & N: Supalla, 1978. This section is an attempt to describe some of S & N's findings in the phonological terms established in Chap. II.) Like other morphophonological referents, the path of movement is quantized to a system of a few discrete possibilities. Fig. 4-7 summarizes part of that system (adapted from S & N: Supalla, 1978). The arrow represents the line of movement of the dez; the eight squares of this base grid are possible basehand locations, each giving the model the meaning shown.[8]

Movements in which the dez touches the basehand are easily described in the phonological terms already established, with specifications for Dyadic Proximity. (Remember that Medium, Near, and Far are phonological distances, values of the Proximity parameter, and not morphophonological references to the distances between objects.)

(1) /MOVE-TO/ [Initial Medium, Final Contact]

(2) /MOVE-THROUGH/ [Grazing Contact]

(3) /MOVE-FROM/ [Initial Contact, Final Medium]

[Movement Shape: Linear] is the phonotactic default and will not have to be specified in the PtMS, even if it is morphophonologically required to be specified in the MpF. For the points behind and ahead of the line of movement we must add the convention that even without contact, the direction of linear movement specified by Proximity to a location is on a line that passes through that location rather than missing it. Then we have

(4) /MOVE-TO-NEAR/ [Initial Medium, Final Near]

(5) /MOVE-FROM-NEAR/ [Initial Near, Final Medium]

For the points beside the line of movement phonological description is a little more complicated. We can't use contact with the basehand, and even without the quite reasonable convention just stated, the obvious specifications (e.g., for Point 6, [Initial Medium, Final Near]) are the same as those for Point 4. The difference is direotion: 4 specifies movement toward the base to a point near it, while 6 specifies "off-center" movement to a point next to the object. I propose phonologically defining the movement determined by Points 6-8 in terms of these points' relationship to Points 1-3, just as S & N's glosses "MOVE-TO-BESIDE," etc., suggest. Let "Beside Other Hand" specify the base-grid location next to the basehand, i.e. <u>Near</u> it and at the same distance from the dez, and in the same tab plane (normally the horizontal).[9] Then we have

(6) /MOVE-TO-BESIDE/ [Loc: Beside OH; Prox: Init Med, Fin Cont]

(7) /MOVE-PAST/ (or /MOVE-THROUGH-BESIDE/) [Loc: Beside OH; Prox: Grazing Contact]

(8) /MOVE-FROM-BESIDE/ [Loc: Beside OH; Prox: Init Cont, Fin Med]

The orientation of the base hand with respect to the grid is often significant. For example, it distinguishes REAR-END-COLLISION (V) $3_{q}.3$)(ẋ (car A comes up behind car B and rams it in the rear) from BROADSIDE-COLLISION (V) $3.3_{<}$ ×ẋ (car A comes at car B from the side and rams it amidships). We could specify Focus, but the distinction exists even without contact, as in /STOP-SHORT-OF-REAR-END-COLLISION/ and /STOP-SHORT-OF-BROADSIDE-COLLISION/. This element of the model is best described by the nondominant hand's Dyadic Orientation: "Proximal toward OH" in the 'rear-end' signs, "Flat toward OH" in the 'broadside' signs.

The orientation of the dez with respect to its line of movement is also usually significant. It can be described phonologically as Internally-defined Direction of External Movement, e.g. Tipward, Flatward, or Baseward.

The whole grid can be significantly located and oriented. CARS-BACKED-UP $3\varphi . 3^{v}_{\top}{}^{\because}$ (which describes location rather than motion) refers generally to a line of stuck traffic; if the movement is forward from the basehand rather than backward from it, the meaning is more like 'line of traffic stretching out ahead'. These base grid examples are all on the nonphysical horizontal plane as Spatial Location. That plane can be raised, as for airplanes flying (S & N), or tilted (Fig. 4-1). These shifted nonphysical locations are infrequent or not used in the frozen lexicon. Direction of orientation and movement can also be distinguished more finely than 90 degrees, e.g. an oblique left turn versus a right-angle left turn. The tilt of the location plane is one such orientation change.

S & N mention without discussion the possibility of marking the whole movement path with the basehand, e.g. /MOVE-ALONG-ON/. Such movements can be described with Continuous Contact and the Dyadic directions already described for the frozen lexicon (sect. II.B.6): e.g., OH-Distal in HARVEST-CORN-BY-MACHINE $\bar{\beta}^{\mathrm{r}} . V_{v} {}^{\perp}_{\times}$ (Fig. 4-8, S & N: Supalla, 1978).

IV.B.4 Internal movement in classifiers

Classifiers can be combined with Internal Movement (change of HC) to refer to change of shape or arrangement in the referent. /LEGS/ is somewhat unusual in the amount of Internal Movement it is capable of. In WALKING the fingers wiggle alternately at the innerjoints, and in JUMP they bend simultaneously at the midjoints, in each case representing the motion of the legs in the referent action. The representation is not analogous one-to-one -- in WALK-UPSTAIRS $^{(B)}V_{v}$ the fingers do not wiggle as many times as there are steps -- but the principle is the same as in the other morphophonological dimensions: the abstracted shape and direction of the motion are preserved while their degree is digitized. The same analogy of midjoint to knee is used statically in HC, with bent $\ddot{V}$ for bent legs in SIT $H_{v}.\ddot{V}_{v}{}^{x}$, and more generally as a classifier for a seated person. See also the example derivations of /RAPID-UNCONCERTED-MOVEMENT/ and FIRE.

IV.C Virtual Depiction: Tracing

In Mandel (1977) I distinguished two types of virtual depiction, "sketching" and "stamping." Stamping refers to a shape at a location, and is the use of S & N's /BE-LOCATED/ with a SASSifier. Sketching is the same as what S & N (Supalla, 1978) call "tracing," so I will use their term for it.[10] Tracing, which recruits movement to the service of shape, allows more detailed description than SASSifiers, which are limited by the skeletal structure of the hand. Tracing extends an abstract shape by moving it through space, either adding a dimension to it or elongating it in a dimension it already possesses.

In tracing with the abstract shape Point (HCs G and I), the fingertip moves along a line or the boundary of an object: lexically, SQUARE $G_{\perp}{}'G_{\perp}{}^{\div v)(}$, CIRCULAR $G^{@}$. Plane (B) moving Edgeward traces a planar surface: TABLE $B_{\upsilon}{}'B_{\upsilon}{}^{\div}$, PRAIRIE $B_{\upsilon\varphi}.B_{\upsilon}{}^{\perp}$. Narrow Plane (H) moving Endward traces a long narrow flat object: RIBBON $^{(\emptyset)}H_{\upsilon>}H_{\upsilon<}{}^{\div}$. Prominent Curved Exterior (C, O) and Annular (F) moving Edgeward trace a cylindrical object: DIPLOMA $O_{\upsilon}{}'O_{\upsilon}{}^{\div}\sim F'F^{\div}$. Line moving Endward traces a long, thin object: LINE $I_{>}I_{<}{}^{\div}$ (with the derived I, /VERY-THIN-STRAIGHT-SHAPE/).

In addition, bentL moving Edgeward traces a pair of parallel surfaces demarcating a thick or thin flat object; here we are dealing with a derived abstract shape Two Parallel Lines, which is infrequent or not found as a SASSifier. One line is represented by the thumb, the other by the index finger or (depending on the thickness represented and thus the degree of index-innerjoint extension) its one or two outer phalanges. Two-points as bentL similarly traces parallel lines with thumb- and fingertios: COLLAR $\pi L'L^{\perp}_{x}$. (In both of these uses bentL alternates with C, just as F and O alternate in tracing a cylinder.) This use of bentL, varying in openness down to G_{g} or bO, associates the traced SASSes /PARALLEL-LINES/ and /2-PARALLEL-PLANES/ with the /MEASURE/ morpheme (see Examples). Number-incorporation (Chinchor, 1978) may bring other Tip-focused HCs into line-tracing: CORPORAL $\searrow V^{\sim}_{x}$, SERGEANT $\searrow 3^{\sim}_{x}$, SCOTLAND $\emptyset 4_{\omega} I^{\alpha}{}^{\sim}_{x}$ with V /TWO/, 3 /THREE/, and 4 /MANY/.

Tracing movement that involves a basehand starts there and moves away (DRINKING-GLASS $B_{\alpha}.C^{x\wedge}$); double-dez hands can start together and extend their trace in both directions (DIPLOMA $F'F^{\div}$), but cannot move in from the ends to meet in the middle (S & N: Supalla, 1980). The same is true of tracing at a body-tab, found especially in the frozen names of animals (S & N: Supalla, 1980): WOLF $\smile 5_{T}\perp^{\#[o]}$ (muzzle), ELEPHANT $\smile B_{D}\perp^{a}$ (trunk); also CLAW $^{(\emptyset)}5^{\#}_{\cdot}L^{\perp}_{\#}$, OLD $\smile A^{v}$, and JEWISH $\smile 5_{T}v^{\#[o]}$(beard for the latter two).

None of the traces mentioned so far (except CORPORAL and SERGEANT) uses complex movement to describe a complex shape. That capacity is fundamental to mimetic depiction (Newport & Bellugi, 1979). Tracing with Point is used mostly in this way and in lexicalized derivatives: SQUARE (often used as 'poster'), CIRCLE, RECTANGULAR $\ddot{L}'\ddot{L}^{\div x}$ (Two-points with bent$\ddot{L}$, double-dez), which simplifies phonologically to $\ddot{L}'\ddot{L}\overset{\div}{x}$ (Fig. 4-9). In BOWL $C_{\alpha}C_{\alpha}\overset{D}{\wedge}$ the C of /CURVED-SURFACE/, which curves only in one dimension, gets the other dimension of curvature added by movement. VALLEY $^{(\emptyset)}B_{D}B_{D}\overset{xx}{D}$ similarly manipulates the planar surface generated by Plane (B). A mimetic depiction of the spiral of a ram's horns uses Line (G).

The difference between tracing with Line and tracing with Point, both of which use G (or I), is determined by their orientation relative to the shape being traced. With Point the finger is held like a pencil and stays at an angle to the line being drawn, thus moving at an angle to itself. With Line the finger stays within the linear (not necessarily straight) object being traced, and therefore moves parallel to itself, or Endward. In tracing a spiral as a shape (e.g., a spiral drawn on paper) the fingertip would move in a widening or narrowing circle, pivoting at the wrist or elbow, changing orientation only slightly: if the spiral is traced on the vertical plane, the finger always points forward. But in tracing a spiral-shaped object, such as a ram's horn, the finger executes a continuous Mid-pivot movement and twists through 360 degrees, using all joints necessary and rotating the forearm to keep the finger behind the tip. (The other tracing shapes, aside from Point tracing a line/boundary, similarly use Mid-pivot movement to change orientation.)

Compare this with the difference between Tip and Finger focus in the frozen lexicon, e.g. between WHAT $B_{>}.G^{\vee}_{\times}$ and KILL $/B_{\perp}.G^{\dot{\vee}}_{\perp}$ (both on the Palmar side of the basehand), and between RED $\cup G^{\vee}_{\times}{}'$ or CRY $\ddot{\cup} X_{\top} X_{\top}{}^{\vee}_{\times}$ and LONELY $\cup G_{\wedge}{}^{\vee}_{\times}$ or BLACK $\cap G_{<}{}^{>}_{\times}$ on the face. WHAT, RED, and CRY touch the tab only with the finertip and move at an angle to themselves, while KILL, LONELY, and BLACK touch along the whole length of the finger (Radial side) and move parallel to themselves. The orientation difference in tracing is easily described as a difference between Tip and Finger Focus if tracing is considered to be Sliding Contact with the shape being described, and that shape is considered to be a nonphysical Location that the signer has in mind: the Focus stays within or in contact with the shape being traced. The viewer sees a G-hand -- or, more generally, a [1Fg, +Cl] hand -- moving non-Endward or Endward, and interprets it respectively as a Tip tracing a line/boundary or as a Finger tracing a saliently one-dimensional object in space.[11] This virtually-depicted shape is probably morphologically abstracted by the signer and the viewer to discrete units, in the same way as the spatial relations of objects (sect. IV.B.3) and the shapes that are substantively depicted with HCs (sect. IV.B.1).

IV.D Summary

S & N's published findings concerning the morphophonology of ASL reveal a system whose elements are iconically derived morphemes. These morphemes refer to the shape, size, and parts of objects (and to some degree to their number), and to their distance, velocity, direction of movement, and orientation. The latter group of referent characteristics are defined relative to other referent objects, to an observer or participant (represented by the signer), or to true horizontal and vertical. The morphemes are discrete, quantized in degree rather than varying continuously with the referent. They combine to produce constructions with an overall iconic appearance ("models"), though they evidently are not processed iconically by native signers. Both the models and (to a lesser degree) the morphemes range from those that are referentially productive to those that are "frozen" with a meaning more general than their morphological structure would imply, or otherwise different from it (e.g. FALL, /VEHICLE/, /TONGUE/).

I have shown that this system can be described in phonological terms that are generally compatible with those needed for the frozen lexicon plus deixis. There are some exceptions, however, such as the HC feature Round and the finer gradations of direction.

S & N have matched some of the shape-describing HCs of ASL morphophonology with part of the system of shapes that Allan (1977) describes as underlying the shape classifiers of a broad spectrum of oral languages. I have matched each of Allan's shapes (calling them "abstract shapes") to an ASL shape HC or set of shape HCs. S & N discuss the use of these HCs as size-and-shape-specifying classifiers (or "SASSifiers" -- my terms) which capture the abstract shape of an entire referent object and can be oriented and moved to describe its orientation and motion. In many of these depictive HCs only some of the fingers function iconically: these are the selected fingers in the phonological analysis of Chapter II. The same shape HCs are also used to "trace" the shape of a referent object. I have shown that the phonology of this tracing process can be adequately described in terms of nonphysical Locations, some of which are not used in the frozen lexicon and are more complex than the nonphysical Locations used with SASSifiers. The phonology of tracing also requires specification of Focus: a proper subset of the Foci used in the frozen lexicon is sufficient.

IV.E Example derivations

The morphophonological examples begin on the next page. Their format is described in section IV.A.2.

/FLUTTER/
ω

image: any apparent fast repeated motion of an object in place

MpF: Mvt: Joint: Forearm
Dir'y: Bidirectional
Manner: Restrained

This morpheme appears in MOVIE $5_{T}\cdot 5_{\perp}^{\wr}$, HELICOPTER $\bar{G}_{\wedge}.5_{\mathcal{D}}^{\omega}$, NERVOUS $B_{v}B_{v}^{\omega}$, SHINY $B_{\mathcal{D}}.\gamma^{\times\omega}$, and others. The movement also occurs without this morpheme in forms of TEN $\dot{A}^{\omega}$, and WHERE $G_{\wedge}^{z\cdot}$, among others.

HELICOPTER
$\bar{G}_{\wedge}.5_{\mathcal{D}}^{\omega}$ or $\bar{G}_{\wedge}\ 5_{\mathcal{D}}{}^{\omega}_{\wedge}$

image: (1) horizontal rotor (2) centered (3) at upper end of
(4) vertical axis (5) and spinning

MA: (1) /MANY-THIN-STRAIGHT-OBJECTS/ in horizontal orientation
(2) with Focus in center of shape
(3) Above and in steady-state Contact with Tip-focused
(4) /THIN-STRAIGHT-OBJECT/ in vertical orientation
(5) /FLUTTER/

MpF (1) Dom: HC 4Fs, +Spr, (-Bent, +Thumb)
Ori: palm-plane horizontal
(2) Foc: Midhand
(3) DR: Above
Dyadic Prox: Steady-state Contact
(4) Nond: Focus: Tip
HC: 1Fg, (-Bent, +Closed)
(5) Internal Mvt: Joint: Forearm
Dir'y: Bidirectional
Manner: Restrained

PtMS: Dom: Foc: Palm
HC: +Spr
Nond: Foc: Tip
DR: Above
Dy Prox: Steady-state Contact
Internal Mvt: Joint: Forearm
Dir'y: Bidirectional
Manner: Restrained

Tip Focus implies approximately perpendicular dyadic orientation. (The following series of implications are forcements rather than defaults, in the terminology of Chapter III. They look complicated, but they are built into the three-dimensional structure of sign phonology, just as the forcements " [+High] → [-Low], [+Low] → [-High]" are built into the structure of oral phonology.) If Dominant is above Nondominant and Nondominant Focus is Tip, with a Hc whose selected finger is extended (not bent), the Nondominant Orientation must be Finger-up; Dominant Palm Focus then forces Dominant Orientation to be Palm-down, which in mid-neutral space is prone.

The variant, in which both hands move upward while performing all the rest of this action, adds to the MpF the specifications "Spatial Mvt: (Shape: Linear), (Dir'y: Unidirectional), Dir: Up"; the redundant parenthesized specifications are implied by the Direction, which alone is added to the PtMS. The separate treatment of Spatial and Dyadic Movement obviates the decision as to whether the Nondominant is an anomalous moving location or an anomalous heterodez (coarticulator of different HC).

WINDMILL (B) G1.5ω

image: (1) vertical rotor (2) centered (3) at end of
(4) horizontal axis (5) and spinning

MA: (1) /MANY-THIN-STRAIGHT-OBJECTS/ in vertical orientation
(2) with Focus in center of shape
(3) in steady-state Contact with Tip-focused
(4) /THIN-STRAIGHT-OBJECT/ in horizontal orientation
(5) /FLUTTER/

MpF: (1) Dom: HC: 4Fg, +Spr, (-Bent, +Thumb)
Ori: palm-plane vertical
(2) Foc: Midhand
(3) DR: Horizontal
Dyadic Prox: Steady-state Contact
(4) Nond: HC: 1Fg, (-Bent, +Closed); Foc: Tip
(5) Internal Mvt: Joint: Forearm
Dir'y: Bidirectional
Manner: Restrained

PtMS: Dom: Foc: Palm
HC: +Spr
Nond: Foc: Tip
DR: Horizontal
Dy Prox: Steady-state Contact
Internal Mvt: Joint: Forearm
Dir'y: Bidirectional
Manner: Restrained

This is identical to HELICOPTER (first form) except in the Orientation of the entire dyad. The points of difference have been underlined. The use of Focus as an underlying parameter allows the difference to be specified in just one place in the PtMS. Compare the difference between the signs in Stokoe notation.

/BRUSHING/

image: The distal edge (with respect to the user) of a saliently two-dimensional implement brushes back and forth across a surface.

MA: (/WIDE-FLAT-OBJECT/ or /NARROW-FLAT-OBJECT/) moving on tab as described

MpF: (HC: 2Fg or 4 Fg)
Foc: Tip
Prox: Sliding Contact
Mvt: Dir: Palmar/ Dorsal
Dir'y: Bidirectional

This movement occurs in FELLATIO(G,H), FLATTER, PAINT (utilitarian), and PAINT (artistic). /FLAT-OBJECT/ dez is presupposed.

PAINT (utilitarian) $\left({}^{(D)}B_{T}.B_{DN}^{\eta}\right)$ $\quad {}^{(\emptyset)}B.B_{<}{}^{\wr}_{\eta}$

MA: (1) /WIDE-FLAT-OBJECT/ (2) /BRUSHING/ (3) surface of (4) /WIDE-FLAT-OBJECT/

MpF:
(1) Dom: HC: +Uniform, (-Closed)
(2) Foc: Tip
Mvt: Dir: Palmar-Dorsal
Dir'y: Bidirectional
Prox: Sliding Contact
(3) Nond: Foc: Flat
(4) HC: +Uniform, (-Closed)

PtMs: Dom: HC: +Uniform
Foc: Tip
Nond: Foc: Palm
Prox: Sliding Contact
Mvt: Dir: Palmar/Dorsal
Dir'y: Bidirectional

In neutral orientation the movement will be horizontal: (ʔ). (DASL notation forces the use of a Cartesian orientation here when the neutral orientation is actually at 45 degrees to the cardinal axes.) For the form given in DASL, one further specification must be added. [Mvt Dir: Vertical] will do: it will force the dez into a horizontal orientation, which defaults for dez to palm-down. If we take DASL's tab orientation literally the basehand will be vertical, palm toward signer, and the sign is specifically PAINT-VERTICAL-SURFACE (e.g. a wall). The specification [+Uniform] is the default for a HC in isolation, and therefore parenthesized in MpF(1), but with Tip Focus [1Fg] is default, so [+Uniform] must be specified in the PtMS.

/DIMINUTIVE (PINKY)/

image: pinky as smallest finger

MpF: HC: +Pinky

This morpheme usually appears as substitution of the pinky for the index finger, but there need by no sign with [+Index] corresponding to a sign with /DIMINUTIVE (pinky)/, because it is a part of a derived SASS, /VERY-THIN-STRAIGHT-OBJECT/. SPAGHETTI $I_{>}I_{<}\dot{\bar{x}}$, for instance, has no G-cognate.

/SMALL-THIN-STRAIGHT-OBJECT/

MA: (1) DIMINUTIVE (pinky)/ (2) /THIN-STRAIGHT-OBJECT/

MpF: (1) HC: +Pinky
(2) HC: 1Fg, (-Bent, +Closed)

The specifications for /THIN-STRAIGHT-OBJECT/ default to [+Index] , but the added specification [+Pinky] blocks the default by using up the specified quota of selected fingers. In section IV.B.1 this morpheme is glossed with <u>very thin</u> rather than <u>small thin</u>, but in fact the diminution does not have to be just in thickness (Woodward 1979).

/PENIS/
G or I

MA: /THIN-STRAIGHT-OBJECT/ or /SMALL-THIN-STRAIGHT-OBJECT/

/TONGUE/
H_{ν}

MA: /NARROW-FLAT-OBJECT/
(Tip = tip, Flat = flat surface)

MpF: HC: 2Fg, (-IntEx, +Cl) -Spr

FELLATIO (Ø) G. H_{ν} $\tilde{\eta}$

image: (1) tongue (2) licking (3) penis

MA: (1) /TONGUE/ (2) /BRUSHING/ (3) /PENIS/

MpF: (1) Dom: HC: 2Fg, (-Int Ex, +Cl), -Spr
(2) Foc: Tip
Mvt: Dir: Palmar/Dorsal
Dir'y: Bidirectional
Prox: Sliding Contact
(3) Nond: HC: 1Fg, (-Bent, +Cl)

PtMS: Dom: Foc: Tip
HC: 2Fg, -Spr
Nond: Foc : Finger
Prox: Sliding Contact
Mvt (Dyadic): Dir: Distal/Proximal
Dir'y: Bidirectional

/RECTANGULAR/ (traced SASS) $^{(\emptyset)}L_{\perp}{}'L_{\perp}{}^{\div\#}$

image: (1) /OUTLINE/ of (2) rectangle

MpF: (1) Foc: Tip
Prox: Sliding Contact
(2) Loc: virtual rectangle

PtMS: HA: Double dez
Foc: Thumbtip and Fingertip
Spatial: Prox: Sliding Contact
Loc: vertical plane
Dyadic: Prox: Initial Contact
Internal: Prox: Final Contact

Tracing this with four /POINT/s instead of one or two seems to be lexically specific to this SASS. Compare the SASS SQUARE $\surd G'\surd G^{\div v)(}$ (often meaning 'poster'), which uses two G's to trace a similar shape.

Morphophonologically the separation of the hands should precede the coming-together of each hand's tips. But phonologically the sequence is difficult to keep separate, perhaps because its parts are articulated from different sets of joints on different scales, and they become simultaneous (see text). Compare a form such as VEHICLE-TURNS, in which the forward and sideward movements are on the same scale, using the whole forearm, and are separated by a change in orientation.

/PERSON/ $G_{\wedge}$

image: (1) a person (2) standing upright

MA: (1) /THIN-STRAIGHT-OBJECT/ (2) oriented end-up

MpF: (1) HC: 1Fg, (+Index, +Closed)
(2) Ori: Tip up

This is the classifier I have elsewhere called $G_{\wedge}$ -'person'.

MEET (two people meet)

MA: (1) two /PERSON/s (2) make contact (3) face-to-face

MpF: (1) HA: Double dez
HC: 1Fg, (+Index, +Closed)
Ori: Spat: Tip up
Dyad: Palmar side to other hand
(2) Prox: Final Contact

PtMS: HA: Double dez
HC: 1Fg
Foc: Palmar side
Prox: Final Contact

The shift of the specification of the palm from Orientation to Focus occurs at the lexicalization of this sign. In productive use a moving /PERSON/ usually moves Palmward unless the referent person is going backward or sideways. There need be no contact or even approach. But in the lexicalized MEET the resulting Focus is also one of the two least marked (Edge being the other). Vertical Orientation is often lost too, the hands being in the same Orientation as for the beginning of REQUEST B'B ,
with tips pointing up and forward. In many deixis-incorporating signs the $G_{\wedge}$ - 'person' has only vertical Orientation, palm Orientation being determined by articulatory requirements.

MEET can deictically incorporate the loci of one or both /PERSON/s, as well as the number of /PERSON/s in each party up to four or five. For deixis incorporation the hand is specified for Initial Location (or steady-state Location if that person is being met: 'A meets B' rather than 'A and B meet'). For numeral incorporation the appropriate manual number is used. See Chinchor (1978a).

INDEX
(a) ΔG^{x} and (b) $G_{\Delta}{}^{\Delta}$

origin: The gesture of pointing with the index finger that our culture uses.

MpF: HC: 1Fg, +Index, +Straight
Foc: Tip
Loc: Deictic Object (at point Location)
Prox: Contact

PtMS: Foc: Tip
Loc: Deictic Object
(a) Prox: Contact
(b) Mvt: Dir: Toward Location

Since no sign may contact any physical object other than part of the signer's body, underlying contact with nonphysical objects -- visible and invisible referents and grammatical loci established in signing space to refer to the latter -- is manifested as Orientation and Direction of Movement. Unlike tracing and deixis-incorporating verbs, INDEX does not need to make "contact" with nonphysical Locations, in this case deictic loci -- perhaps because it is so common a sign that the longer movement and Final Hold Manner that mark such "contact" have historically been deleted in an unstressed position, much as English word-initial "th" became lexically voiced ð only in the deictics <u>the</u>, <u>this</u>, <u>thou</u>, etc., remaining θ in content words like <u>think</u>, <u>thigh</u>, and <u>thistle</u>. See the next entries.

Since Tip Focus defaults to [1Finger] , and the default position of selected fingers is extension, the other fingers must be closed. Since the least-marked finger for independent extension is the index, it is the default choice here. Though [+Straight] is default for [-Bent] HCs it must be specified here; see I/ME.

PLURAL-INDEX $G_{\Delta}^{\triangleright}$

MA: (1) INDEX to
(2) Deictic Object (at nonpoint Location)

MpF: (1) HC: 1Fg, +Index, +Straight
Foc: Tip
Mvt Dir: Across Location
(2) Loc: Deictic Object

PtMS: HC: +Straight
Foc: Tip
Mvt Dir: Across Location
Loc: Deictic Object

/MIND/ $\frown$

image: the brain

MpF: Loc: Upper-face

MIND $\frown G_{\top}^{\times}$

MA: (1) INDEX to (2) /MIND/

MpF: (1) HC: 1Fg, +Index, +Straight
Foc: Tip
Prox: Contact
(2) Loc: Upper-face

PtMS: Foc: Tip
Prox: Contact
Loc: Upper-face

The Palm-In Orientation that DASL specifies, requiring supine forearm, is phonotactically derived from the tendency of Tip contact to be made at an angle near the perpendicular. In touching the body this is most easily accomplished by bending at the wrist, innerjoint, or midjoint, or any combination. But the articulatorily neutral Orientation, semiprone, presents the Radial Edge toward the forehead, and Edgeward bending (radial and ulnar deviation) has the least range of all directions in these joints, while Palmward bending (flexion) has the greatest. By turning the Palmar side toward the surface to be touched, the signer makes

Tip contact, with a visible angle to differentiate it from Finger contact, easier.

I/ME
(a) $[\,]G_{\top}^{\times}$ or (b) $[\,]G_{\top}^{\top}$

MA: (1) INDEX to (2) self

MpF: (1) HC: 1Fg, +Index, +Straight
Foc: Tip
Prox: Contact
(2) Loc: Trunk

PtMS: Foc: Tip
Loc: Deictic Object
(a) Prox: Contact
(b) Mvt: Dir: Toward Location

The (a) and (b) forms alternate, as for INDEX in general. There are two possible reasons for such alternation with the same deictic object. As with deictic loci, the sign's syntactically unstressed position could be responsible. But there is also a sociolinguistic constraint among some signers against touching the body, and among women the chest in particular (Friedman 1976).

/GAZE/ $V_{D\Delta}$

image: (1) direction of sight from the two eyes
(2) toward the object

MA: (1) /TWO-THIN-STRAIGHT-SHAPES/ with base at Location of subject
(2) and Distal end toward object

MpF: (1) HC: 2Fg, (+Str, +Cl)
Ori: Base at subject
(2) Tip toward object
(+) Tip-to-tip direction horizontal

The normal orientation of gaze is toward an object roughly in the same horizontal plane, and with the head upright on the neck; it can tilt up or down, left or right, but it won't twist onto one side or the other: the line between the eyes will stay roughly horizontal. Correspondingly the normal orientation of /GAZE/ is with the line between the fingertips roughly horizontal. In the analog "normal Orientation" the fingers are horizontal, so phonologically the Palmar side is normally down (sect. IV.B.1).

READ
(a) $B_{a} \cdot V_{D} \overset{\wr}{\top}$ and (b) $B_{T} \cdot V_{v}\, \eta^{\cdot}$

```
image:   (1)  gaze
         (2)  scanning along the lines and down from line to line
         (3)  on a written page

MA:      (1)  /GAZE/
         (2)  at an object moving laterally, repeating downward
         (3)  on a /FLAT-SURFACE/

MpF:     (1)  Dom:  HC:  2Fg,  (+Str,  +Cl)
                    Ori:  Palmar Down
              Prox:  Non-contact
         (3)*             Tips toward OH
         (2)*       Mvt:  Shape:  End-pivot      ]
                          Dir:  Edgeward         ] Nested...
                          Dir'y:  Bidirectional  ]
                  ...within:  Shape:  End-pivot
                              Dir:  Downward
         (3)* Nond:  Foc:  Palm

PtMS:    Dom:  HC: 2Fg
               Foc:  Tips
               Ori:  Palmar Down
               Mvt:  Shape:  End-pivot       ]
                     Dir:  Edgeward          ] Nested...
                     Dir'y:  Bidirectional   ]
             ...within:  Shape:  End-pivot
                         Dir:  Palmward
         Nond:  Foc:  Palm
         Prox:  Non-contact
```

End-pivot movement in the MpF results from a fixed Proximal end and an orientable Distal end. The PtMS is essentially the same as the MpF, but is ripe for phonological simplification: the entire inner-nested movement is deleted (smoothed out), producing form b.

*(3) is distributed between the two hands.

PUT-ON-SHOE $^{(\emptyset)}B_{\vartheta}.C_{\vartheta}{}^{\text{I}}_{<}$

image: (1) shoe (2) slides onto (3) foot

MA: (1) /CURVED-SURFACE/
(2) approaches
(3) /WIDE-STRAIGHT-SHAPE/
from Distal end, and in final state encloses it

MpF: (1) Dom: HC: 4Fg, +Round
(+) Ori: Palm Down
(2) Foc: Inside
Prox: Init: Non-contact
Final: Contact
(3) Nond: Ori: Dy: Init: Distal toward OH
(+) Spat: Palm Down

PtMS: Dom: Foc: Inside
Nond: Foc: Dorsal
HC: +Straight
Ori: Init: Distal toward OH
Prox: Fin: Contact

Palm-down /WIDE-STRAIGHT-SHAPE/ is /FOOT/ in some other signs: WALK $B_{\vartheta}B_{\vartheta}{}^{\text{I}\sim}$, TOE $^{(\emptyset)}G_{v}\Vert 5_{\vartheta}.L^{\text{I}}$(index to foot, then grasp one fingertip). The palm-down Dominant Orientation and DR Above are phonotactically less marked than palm up and DR Below, but the observed form is also consistent with iconic "point of view" (sect. IV.A.2). Taking the referent event from its usual visual angle (well below eye level), the shoe's convex upper is what visibly covers the foot. If the dez slid onto the lower surface of the basehand, the sign would look less like the image because only the dez's outerjoints would show around the basehand's edges, and /CURVED-SURFACE/ would not be visible.

CUP $B_a . C^{x'}$

image: (1) cup (2) on (3) surface (such as table)

MA: (1) /DEEP-CYLINDRICAL-SHAPE/ oriented with axis vertical
(2) above and touching
(3) /FLAT-SURFACE/

MpF: (1) Dom: HC: +Round, Uniform
Ori: Edge Up
(2) DR: Above
Prox: Contact
(3) Nond: Foc: Palm

PtMS: Dom: HC: +Round
Nond: Foc: Palm
DR: Above
Prox: Contact
(+) Mvt: Freq: Repeated

The repetition of the movement may be arbitrary, to raise the sign's complexity to a medium level (Chinchor 1979), or it may be a nominalizing morpheme (S & N: Supalla & Newport 1978).

/LEGS/ 'human activity involving legs'

MA: /TWO-THIN-STRAIGHT-SHAPES/

MpF: HC: 2Fg, (+Cl)
(Parts: Tip = foot
Midjoint = knee
Flat = front)

"Tip = foot" follows from the Distal = distal pattern (sect. IV.B.1). "Midjoint = knee" is not used in all uses of the morpheme, any more than, say, "Distal = front" is used in all uses of 3 /VEHICLE/ (for instance in PARK-CAR $B_a . 3^{)(x}$, where only the vertical orientation is significant). Which Flat represents the front of the person depends on use of the midjoints and phonotactics: in KNEEL $B_a . \dddot{V}^{x}$, Dorsal must = front. But in SEXUAL-INTERCOURSE $^{(\emptyset)} V \, V^{x'}$ phonotactics requires Palmar focus, so that Palm = front.

WALKING V_v

MA: (1) /LEGS/, feet down
(2) the legs moving alternatively past each other in the flexion-extension direction
(3) and the hand moving (unidirectionally) along the same line, in deictic direction

MpF: (1) HC: 2Fg, (+Cl, +Str)
Ori: Tips Down
(2) Mvt: Intl: Dir: Palmar-Dorsal
Dir'y: Bidirectional
Phase: Alternating
(3) Extl: Dir: Deictic

PtMS: HC: 2Fg
Ori: Tips Down
Mvt: Intl: Dir: Palmar-Dorsal
Dir'y: Bidirectional
Phase: Alternating
Extl: Dir: Deictic

The PtMS is essentially the same as the MpF, except for some simplification of the HC specification: this sign is morphophonologically "saturated". The Internal movement is wiggling, but the same feature analysis happens to serve for morphophonological description and phonotactics.

/RAPID-UNCONCERTED-MOVEMENT/ $4^{\omega}, 5^{\omega}$

image: (1) many things
(2) moving irregularly with respect to each other

MpF: (1) HC: 4Fg
(2) Mvt: Intl: Dir: Palmar-Dorsal
Dir'y: Bidirectional
Phase: Alternating

All fingers wiggling.

FIRE $5_T\,5_T\,\overset{\wr}{\wedge}$

image: (1) flames flickering (2) upward

MA: (1) /RAPID-UNCONCERTED-MOVEMENT/ of
/MANY-THIN-STRAIGHT-SHAPES/
(2) oriented and moving Upward

MpF: (1) HC: 4Fg, (+Straight, +Spread)
Mvt: Intl: Dir: Palmar- Dorsal
Dir'y: Bidirectional
Phase: Alternating
(2) Extl: Dir: Up
Ori: Fingers up

PtMS: HC: 4Fg
Mvt: Intl: Dir: Palmar-Dorsal
Dir'y: Bidirectional
Phase: Alternating
Extl: Dir: Up
Ori: Finger Up
(+) Palmar In

This sign is also "saturated". The HC specification of /RAPID-UNCONCERTED-MOVEMENT/ partly coincides with that for the shape of the flames. Compare PREOCCUPIED $^\frown O_T\overset{\wr}{x}$, with $^\frown$/MIND/.

The Palmar-In Orientation probably is due to the combination of morphophonologically specified Tip-Upward with a perceptual Flat-Outward, which shows the classifier more clearly than semiprone Ulnar-Outward would. With Tips-Upward, Palmar-Outward would force the signer to raise his hands nearly to shoulder height or to hyperextend the wrist sharply, while Palmar-Inward lets him flex the innerjoints comfortably.

This sign can be single or double dez. The single-dez form figures in some other signs: BOIL $\underline{B}v.\,5_T\overset{\wr}{\wedge}$ and CANDLE $G'.\checkmark 5_T{}^{\wr}$. The upward External Movement is not always included, especially when other movements are used: CANDLE, WALL-OF-FLAME.

CANDLE $G^{1}.\sqrt{5}_{T}^{\ell}$

```
image:   (1)  flame  (2)  on top of  (3)  the candle

MA:      (1)  FIRE  (2)  above and touching
         (3)  a /THIN-STRAIGHT-OBJECT/

MpF:     (1)  Dom:  HC:  4Fg,  (+Straight,  +Spread)
                    Mvt:  Intl:  Dir:  Palmar-Dorsal
                          Dir'y:  Bidirectional
                          Phase:  Alternating
                    Ori:  Fingers up
         (2) DR:  Above
             Prox:  Holding Contact
         (3)  Nond:  HC:  1Fg,  (+Str,  +Cl)
                     Ori:  Finger Up

PtMS:    Dom:  HC:  4Fg
               Mvt:  Intl:  Dir:  Palmar-Dorsal
                            Dir'y:  Bidirectional
                            Phase:  Alternating
                     Extl:  Dir:  Up
               Ori:  Fingers Up
         (+)         Palmar in
         Nond:  Foc:  Tip
                Ori:  Tip Up
```

This PtMS simplifies by losing the Nondominant Orientation specification, so that the 'candle' is no longer vertical.

WALL-OF-FLAME $(\emptyset)\ 5_{T}5_{T}\overset{\circ}{\div}$

MA: (1) /FIRE/ (2) extending from one side to the other

MpF: (1) HC: 4Fg, (+Straight, +Spread)
Ori: Fingers Up
Mvt: Intl: Dir: Palmar-Dorsal
Dir'y: Bidirectional
Phase: Alternating
(2) HA: Double-dez
Dyadic Prox: Init Contact
Spat Loc: Vertical Plane
Spat Prox: Sliding Contact

PtMS: HA: Double-dez
HC: 4Fg
Ori: Fingers Up
Palmar In
Foc: Edge
Mvt: Intl: Dir: Palmar-Dorsal
Dir'y: Bidirectional
Phase: Alternating
Dyadic Prox: Init Contact

Palmar-In Orientation is not just added phonotactically here, but partially derived from contact with the vertical plane.

PARK-CAR $B_{a}.3^{)(\times}$ $({}^{(D)}B_{a}.3^{\times})$

MA: (1) /VEHICLE/ in normal orientation
(2) /MOVE-TO/ (3) on top of (4) /FLAT-SURFACE/

MpF: (1) Dom: HC: 2Fg, +Thumb
Ori: Radial Up
(2) Prox: Init Medium
Final Contact
(3) DR: Above
(4) Nond: Foc: Palm

PtMS: (1) Dom: HC: 2Fg, +Thumb
Ori: Radial Up
(2) Prox: Init Medium
Final Contact
(3) DR: Above
(4) Nond: Foc: Palm

The PtMS is identical with the MpF. But there is a distinction here not evident from DASL's spelling, which omits the initial approach ($)($) and corresponds to a simpler Proximity specification, simply Final Contact. That specification is the form of /BE-LOCATED/, which gives DASL's form the meaning CAR-BE-PARKED. The difference is that between "Where did you park the car?" ($B_{a}.3^{)(\times}$) and "Where is the car parked?" ($B_{a}.3^{\times}$). (My thanks to Hartmut Teuber for helping me clarify this difference.)

CARS-BACKED-UP
(a) $3_{\rho} . 3^{v \dot{\top} \dot{\top}}$ and (b) $^{(\varnothing)}3_{\rho} . 3^{\top}$

MA: /VEHICLE/ behind /VEHICLE/ behind /VEHICLE/ in the horizontal plane, all facing the same way (along the row)

MpF:
- Spat Loc: Horizontal Plane
- Spat Prox: Contact
- Dom: HC: 2Fg, +Th
  - Ori: Spat: Thumb Up
    - Dyad: Tips toward OH
  - Mvt: Freq: Repeated] Nested...
  - ...within : Shape: Linear
    - Dir: Away-from OH
- Nond: HC: 2Fg, +Th
  - Spat Ori: = Dom

PtMS:
- Spat Loc: Horizontal Plane
- Spat Prox: Contact
- Dom: HC: 2Fg, +Th
  - Ori: Dyad: Tips toward OH
  - Mvt: Freq: Repeated] Nested...
  - ...within : Shape: Linear
- Nond: HC: = Dom
  - Spat Ori: = Dom

The Thumb-Up Orientation is morphophonologically '/VEHICLE/'s top on top' and phonologically neutral, so it can be omitted in the PtMS. The Dominant hand has to have its Tips toward the Nondominant for the cars to be lined up, and whatever Spatial Orientation that produces, the Nondominant has to share for them to be facing the same way.

The direction of repetition, Away-from the basehand, seems to be a requirement of the construction of this type of array (a row of identical items; cf. the similar constraint found by S & N for tracings (sect. IV.C). The generalization over these constraints is not that the dez must move Away-from the other surface (basehand, body Location, or co-articulating other hand), for classifiers move toward, away, or past as the model requires. The environment that requires [Direction: Away-from] is movement representing static extendedness: either the length of a shape beyond the size of a SASS HC (DIPLOMA) or beyond its capacity to represent shape (ELEPHANT), or else the length of a row of individual objects each placed with /BE-LOCATED/. In the first case the morphophonological movement is smooth, in the second a series of End-contacts with the Location (here the horizontal plane). (Phonological smoothing may then apply to the latter, giving form (b) of this sign.)

Notes to Chapter Four

1. It would be interesting to study the ways in which deaf teachers and parents use these spatial redundancies in teaching deaf children.

2. In this chapter I will enclose glosses of morphemes, including classifiers, in slashes. /MIND/ has the form [Location: Upper-face] .

3. Some variations are possible - DASL mentions $H_{\vartheta} \cdot H_{v}{}^{\wedge\vee}$ 'dive feet first' - but they are limited by the morphologization of movement to an inventory of discrete shapes and degrees. Many morphophonological signs can be used either as frozen signs or productively, with their full morphophonological meaning (S & N). In this case, $H_{\vartheta} \cdot H_{v}{}^{\overset{a}{\vee}}$ could mean either 'dive' generally or specifically 'dive turning over in the air and entering head-first'.

4. An abstract image is a specific type of morphological analysis, given special attention because of the focus of this chapter on morphophonology.

5. The name 'substitutive depiction' was used there for consistency with other papers in the same volume.

6. Newport & Bellugi (1979) use a somewhat different definition.

7. A basehand classifier can be extended, with virtual depiction by the active hand, to represent a shape larger than that represented by the HC itself (S & N: Newport, pers. comm.).

8. The original figure includes only the locations here numbered 1-3 and 6-8; S & N allude in their text to other locations, including 4,5, and others. The labels for 4 and 5 are mine, the rest are theirs.

9. Euclid tells us there are two points satisfying these conditions, but articulation tells us to choose the Ipsilateral one in default of a contrary specification. If the line of movement is not on the Forward—Backward dimension the default remains subject to empirical investigation.

This Beside is actually a combination of Dyadically-defined DR and Proximity, much as Stokoe's diacritic ' is [DR: [Ipsi, Prox: Near/Contact]. If other such combinations are found necessary, the Dyadic direction used here can be isolated as Abreast-of, in terms of the dez's line of movement with respect to the basehand. Cf. Across-deictic-object, sect. II.B.6).

10. They attribute the term "tracing" to me (1977). That is not completely accurate, but the change in terminology is an improvement.

In addition to S & N, Coulter (1975) has studied this field in some detail. My aim in this section is to show the connection between tracing and SASSifiers and to connect it with lexical phonology.

11. On the basis of recent unpublished findings, S & N disagree with this analysis of tracing (Newport, pers. comm.).

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(The abbreviation SLS stands for Sign Language Studies, published quarterly by Linstok Press, Silver Spring, MD (previously by Mouton, and also previously semiannual). NSSLRT stands for National Symposium on Sign Language Research and Teaching. Three of these have been held so far, in 1977, 1978, and 1980. The proceedings of the first two appeared in 1980: Silver Spring, MD: National Association of the Deaf. Papers cited with reference to either of those were presented and have been printed in the Proceedings. Papers cited as at NSSLRT 1980 were presented and are to appear in its Proceedings.)

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KEY TO ILLUSTRATION CREDITS

Every illustration not drawn for this dissertation (whether in a Figure or a Table) is credited by an abbreviation. An asterisk following a credit abbreviation indicates that the illustration has been modified, usually to show the form of the sign referred to in the text. In the following Key, a name appearing after a colon identifies the artist.

B	Battison 1978: Elizabeth Baird
C	Carmel 1975
DASL	Stokoe, Casterline, & Croneberg 1965/1976
Ha	Hagerty 1976
Hi	Higgins 1923
HL	Hoemann & Lucafo 1980: Rosanne Miezio
HPO	Humphries, Padden, & O'Rourke 1980: Frank A. Paul
KBb	Klima & Bellugi 1979b: Frank A. Paul
KBNB	K, B, Newkirk, & Battison 1979: Frank A. Paul
KBNPF	K, B, Newkirk, Pedersen, & Fischer 1979: Frank A. Paul
KBSb	K, B, & Siple 1979b: Frank A. Paul
NB	Newport & Bellugi 1979: Frank A. Paul
O	O'Rourke 1973
R	Riekehof 1963
S	S&N: Supalla 1978: Frank A. Paul
We	Wells & Luttgens 1979
Wi	Wilbur 1979

Fig. 1-1: A non-ASL handshape, dualF̈

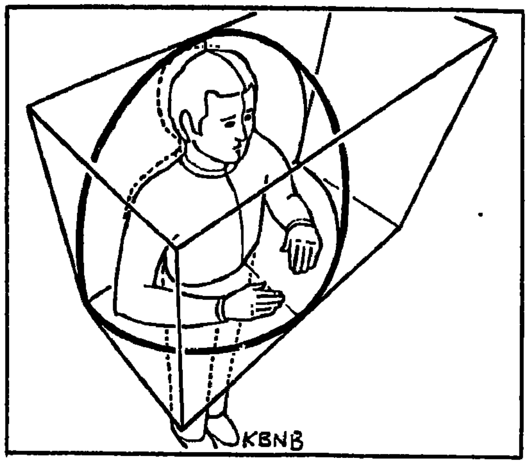


Fig. 1-2: Normal limits of signing space

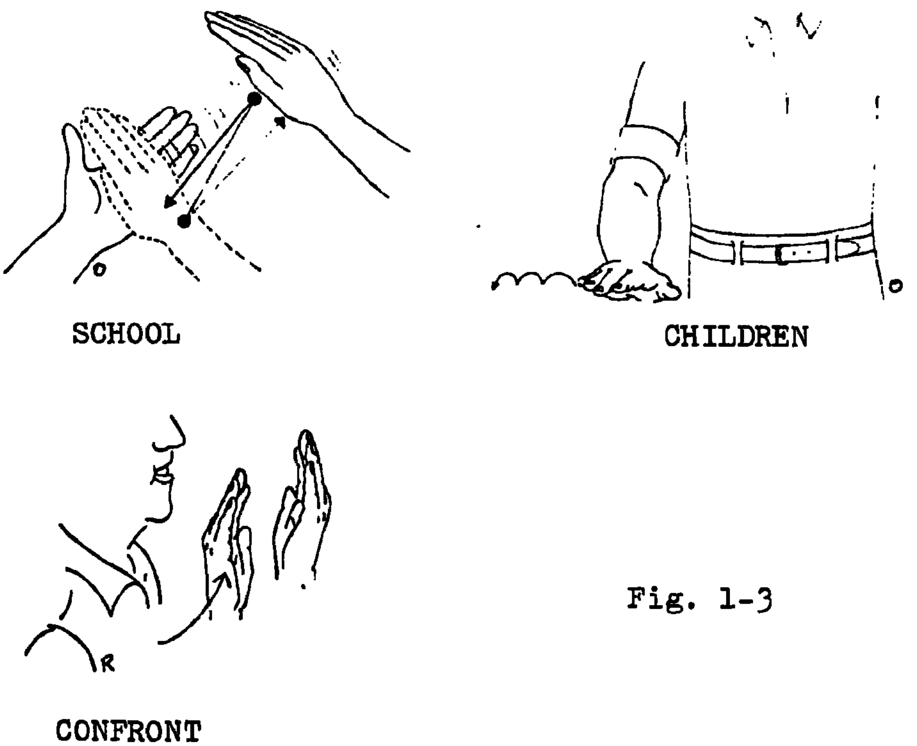


Fig. 1-3

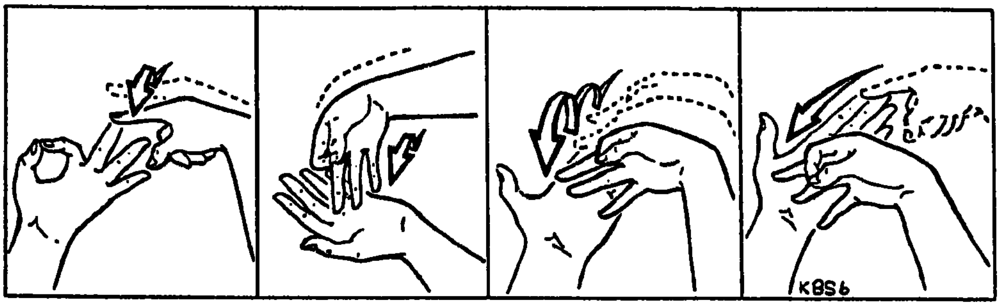


Fig. 1-4: Extended-finger focus in F of Chinese Sign Language

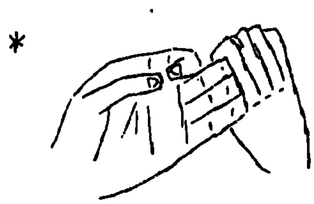


Fig. 1-5: Disallowed extended-finger grasp on F in ASL

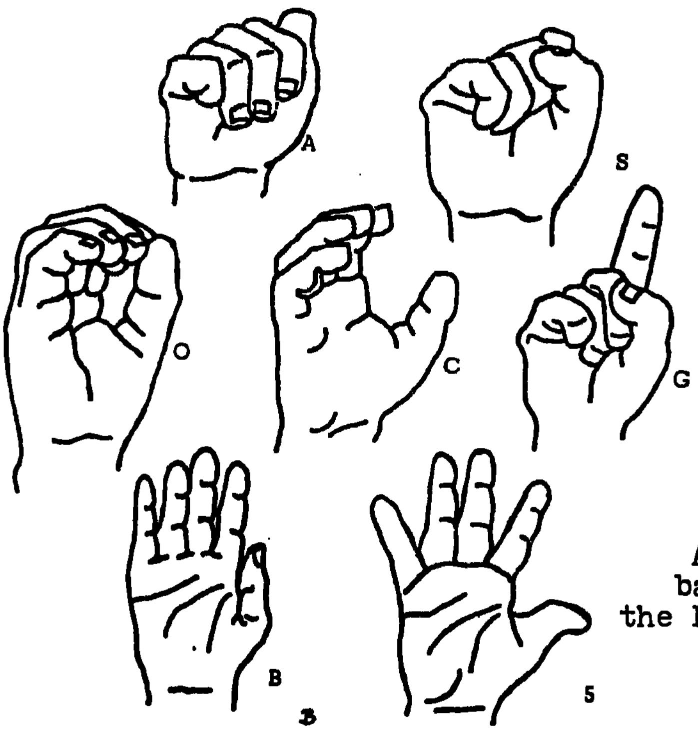


Fig. 1-6: Allowable "neutral" base handshapes under the Dominance Condition

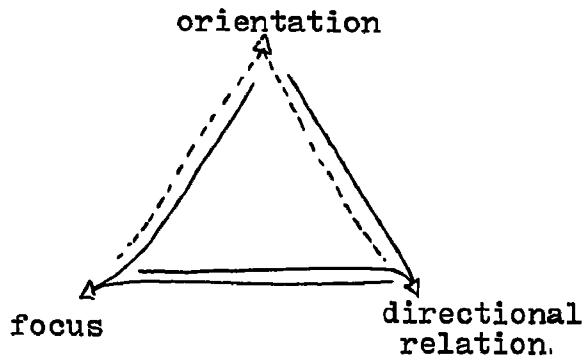
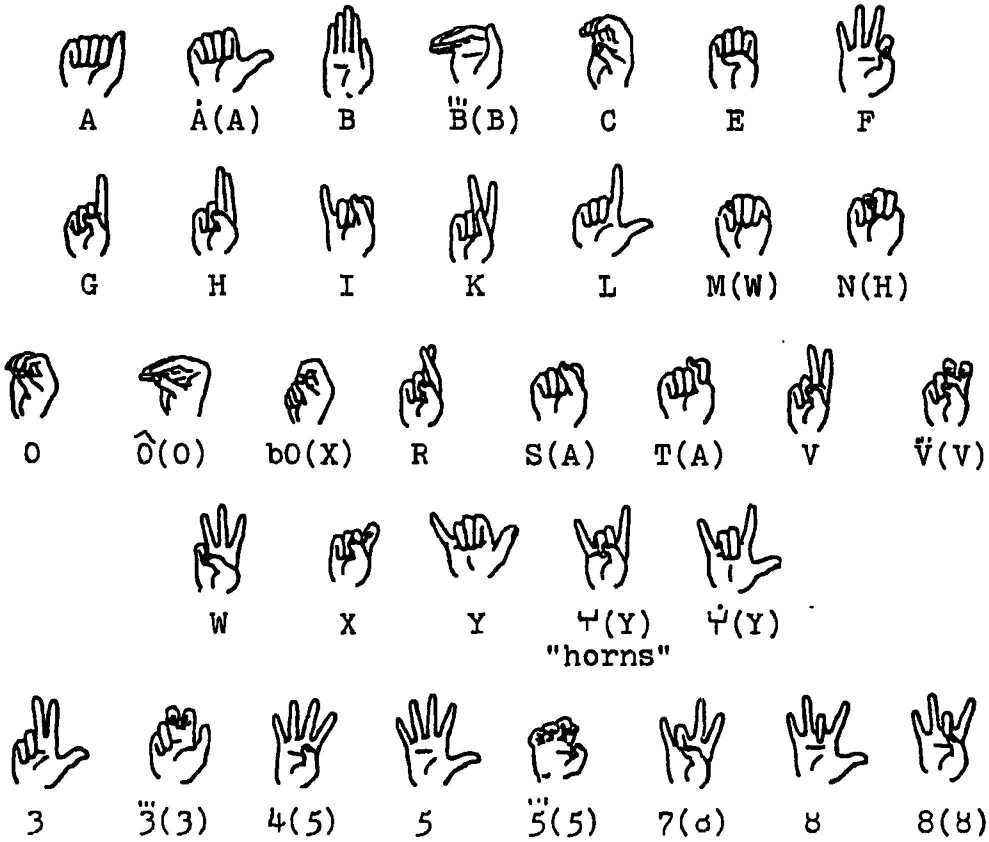


Fig. 1-7: The three-way redundancy between three minor parameters



Parenthesized symbols show DASL's classifications. DASL also considers 5 an allophone of B, but gives it a separate symbol for convenience.

Fig. 1-8: Handshapes of ASL

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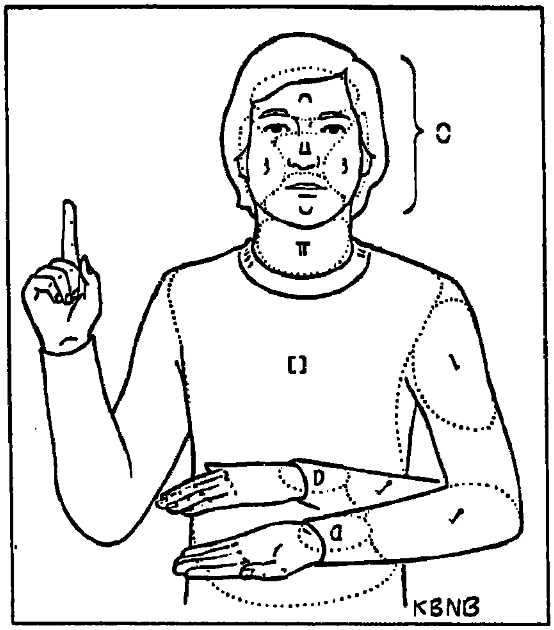


Fig. 1-9 : DASL location primes with their symbols

(Fig. 1-10 has been deleted)

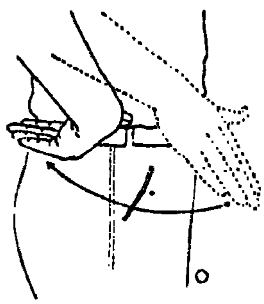


Fig. 1-11: LATE
[]√B_v $\underset{\top}{?}$·

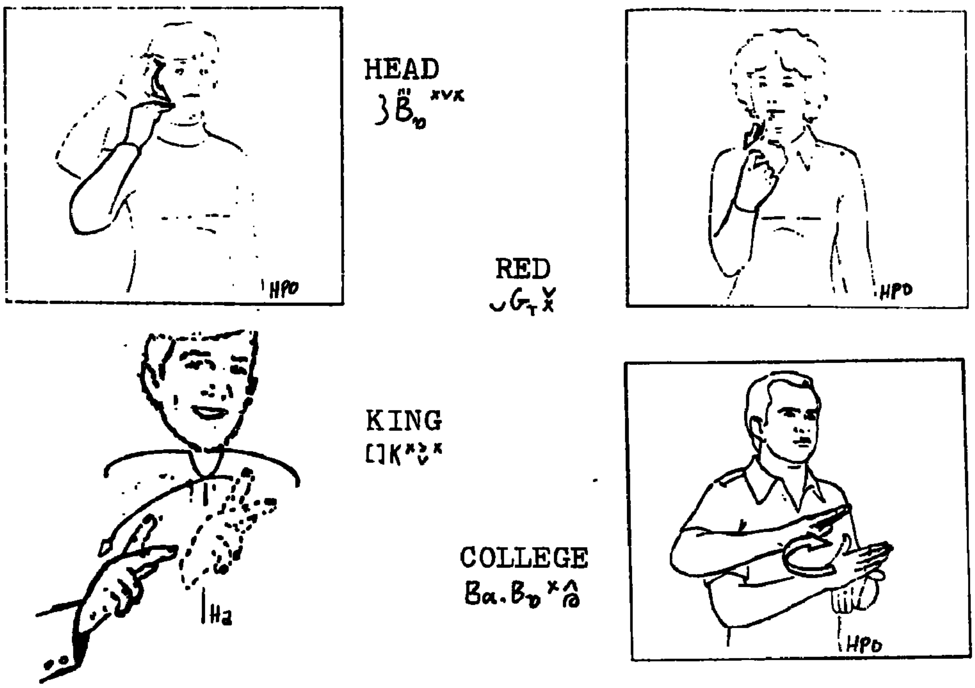


Fig. 1-12: Movement "clusters" of DASL notation

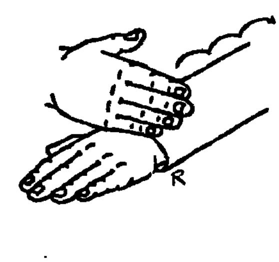


Fig. 1-13: IMPROVE

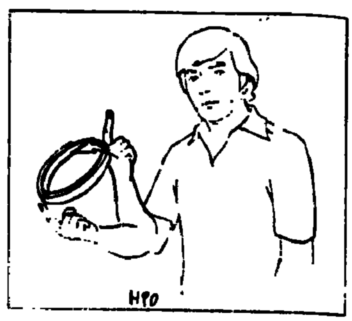
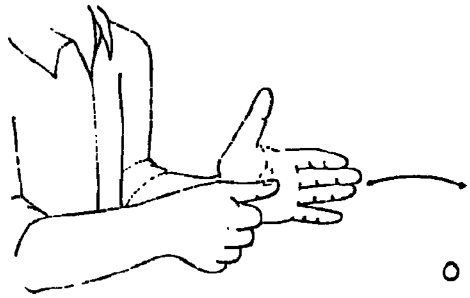


Fig. 1-14: ALWAYS

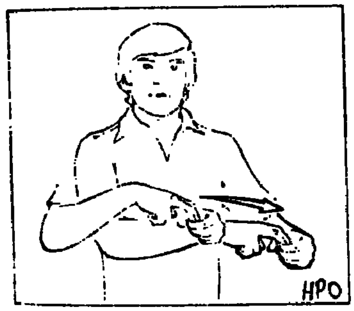
EMPHASIZE

Fig. 2-1



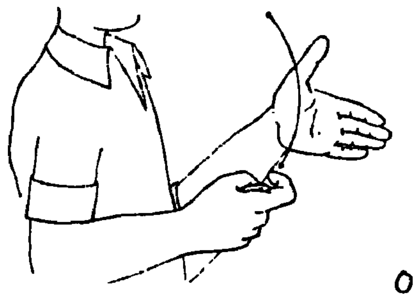
RIDE

Fig. 2-2



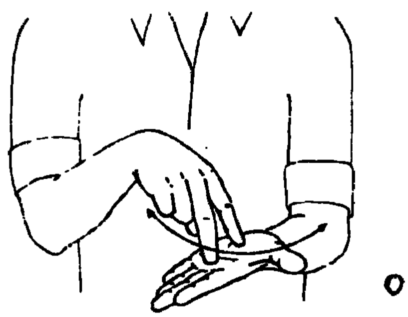
COST

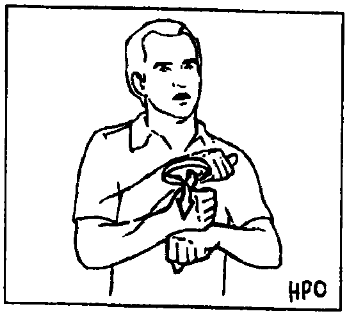
Fig. 2-3



DANCE

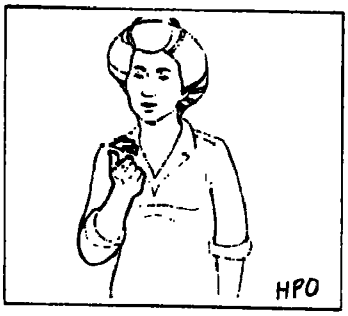
Fig. 2-4



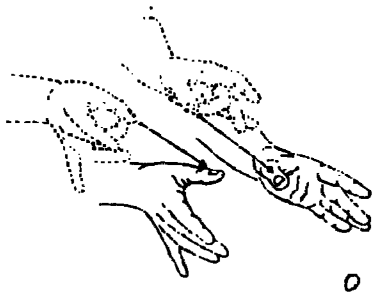


ESTABLISH　　INSTITUTE (older)　　INSTITUTE (newer)

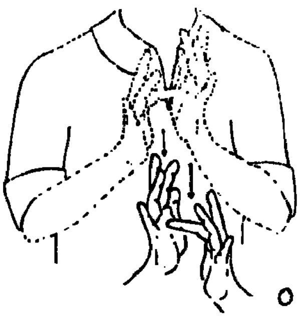
Fig. 2-5: Morphology and restructuring of INSTITUTE



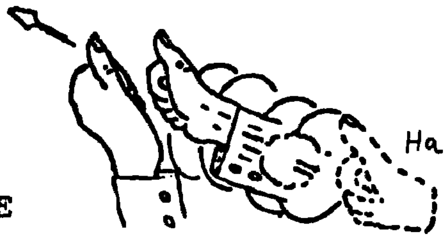
TINY



HATE



JESUS

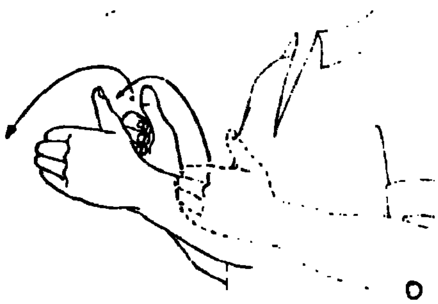


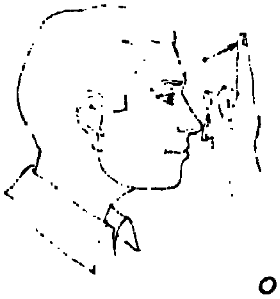
CHASE

Movement and Scale

Fig. 2-6

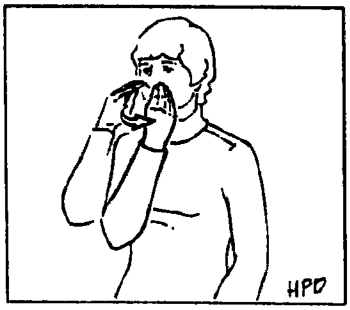
PROGRESS





UNDERSTAND

DEAD



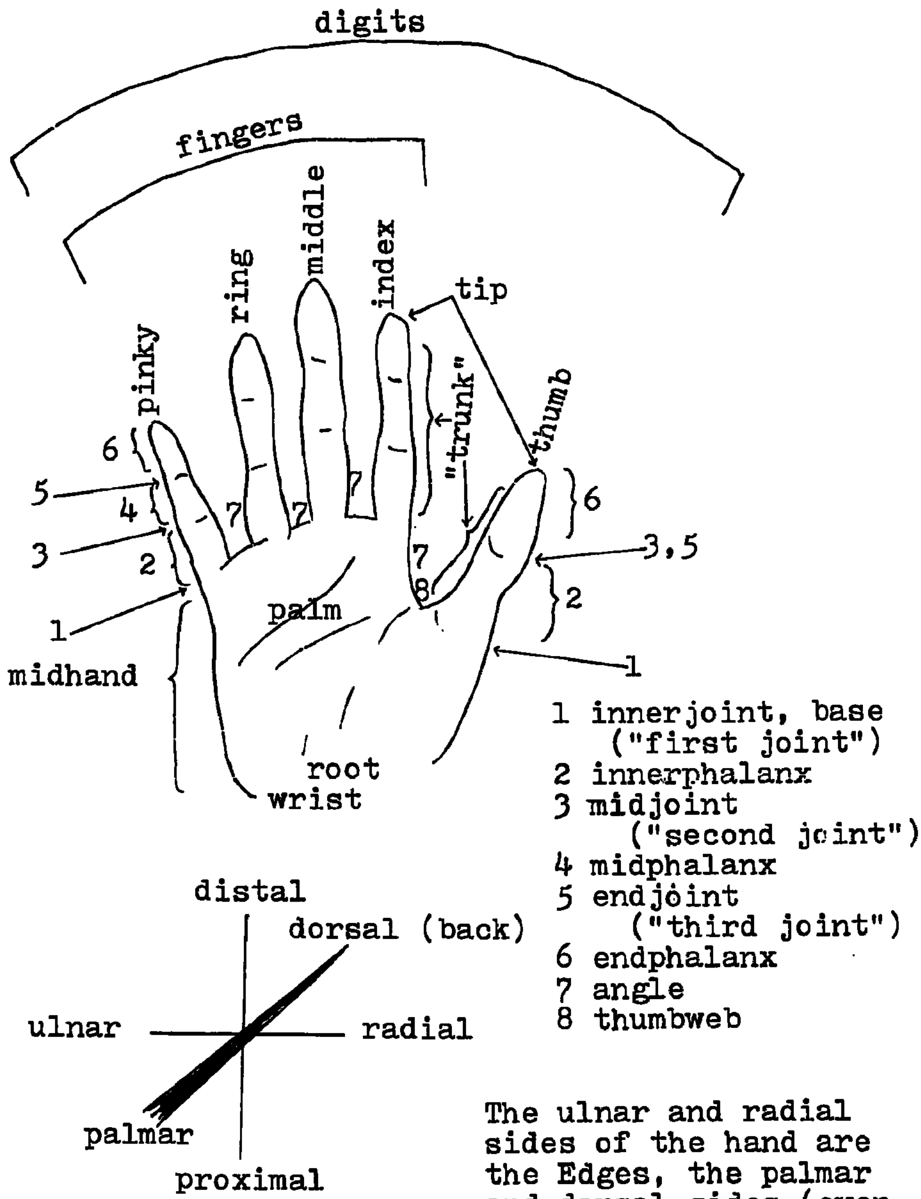
FLOWER

PARENTS

PIE

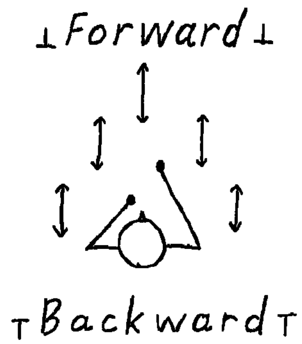
Two-state signs

Fig. 2-7

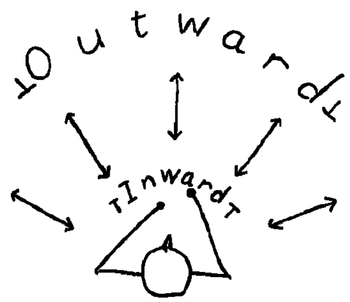


The ulnar and radial sides of the hand are the Edges, the palmar and dorsal sides (even of a finger) are the Flats, and the distal and proximal sides are the Ends.

Fig. 2-8: Parts and directions of the hand



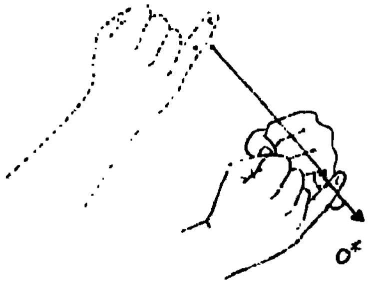
a: Cartesian



b: Polar

Cartesian and Polar Interpretations of Stokoe's ⊤ and ⊥

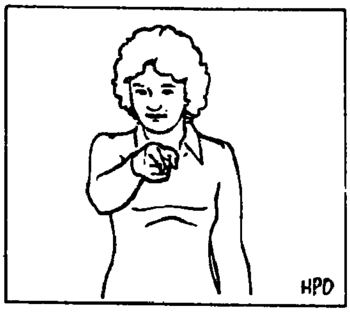
Fig. 2-9



LAST

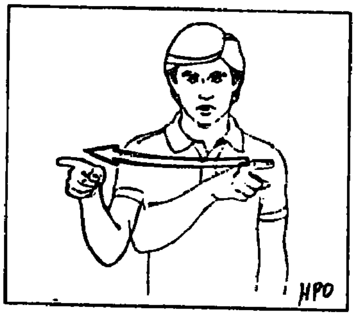
LIMIT

Fig. 2-10



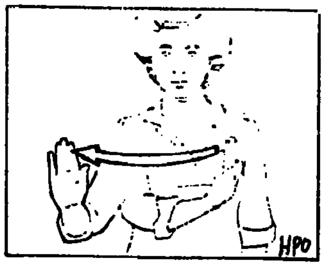
YOU

sing. plur.

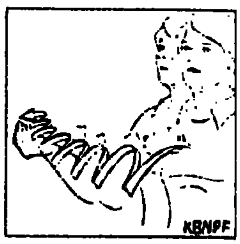


YOUR

sing. plur.

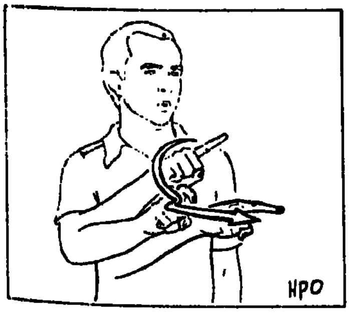


GIVE



uninflected 'to many' 'to each of many'

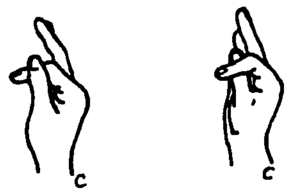
Fig. 2-11: The direction "Across Deictic Object"



QUESTION
Fig. 2-12

THIEF
Fig. 2-13

BOTHER
Fig. 2-14



f t
in the French
manual alphabet
Fig. 2-15

POSTPONE

SENTENCE

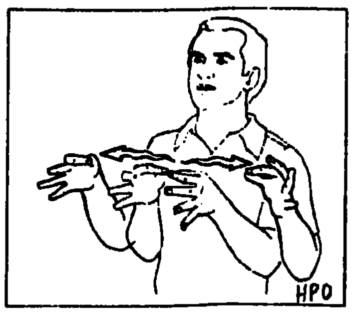
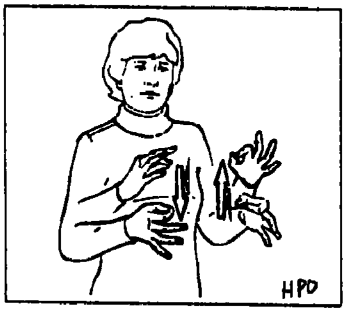


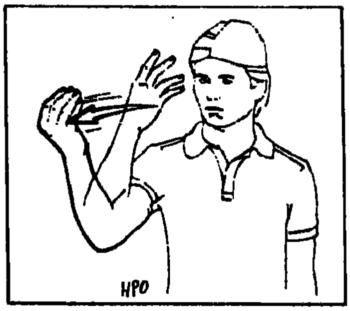
Fig. 2-16



JUDGE

PERSON

Fig. 2-17



GO-AWAY

WORD

BIG-WORD

Fig. 2-18: Expansion in lexical signs

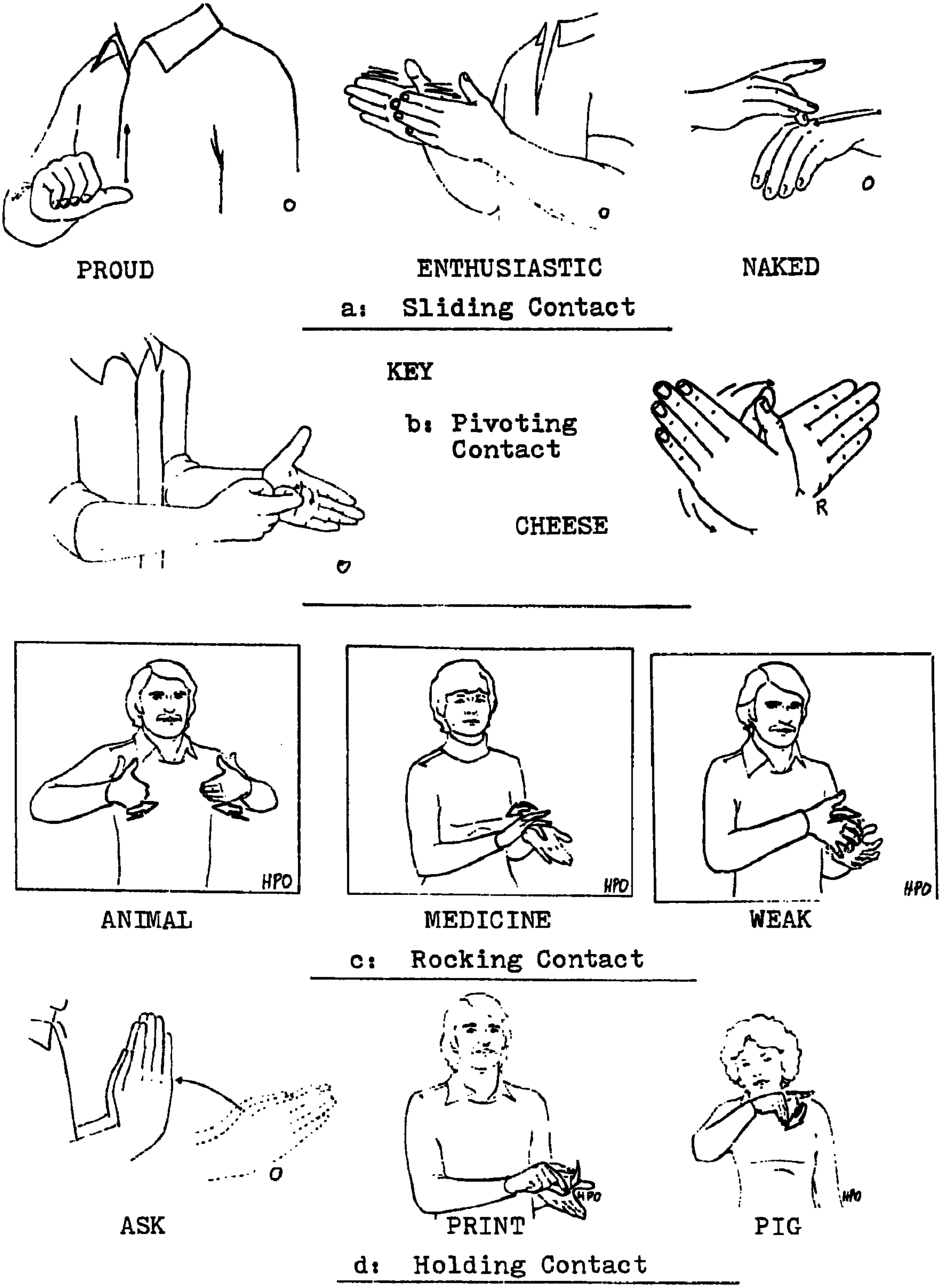
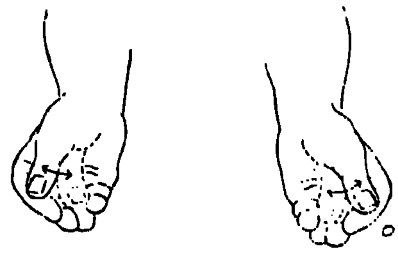


Fig. 2-19: Maintenance of contact and relative movement

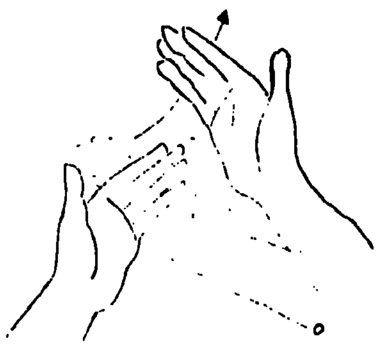
APPLE
Fig. 2-20



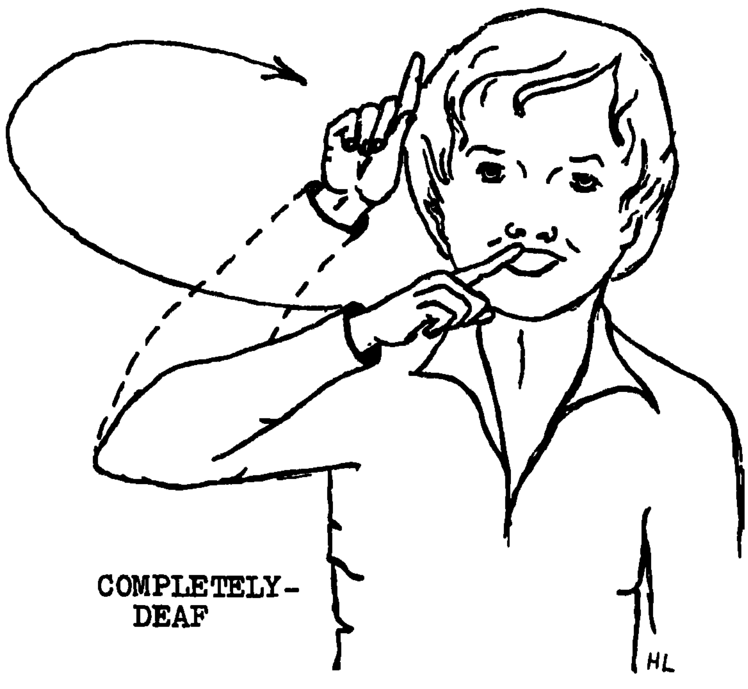
SOIL
Fig. 2-21

CAN'T

EASY
Grazing
Contact
Fig. 2-22



DEAF



COMPLETELY-
DEAF

Expansion for
emphasis or
augmentation

Fig. 2-23

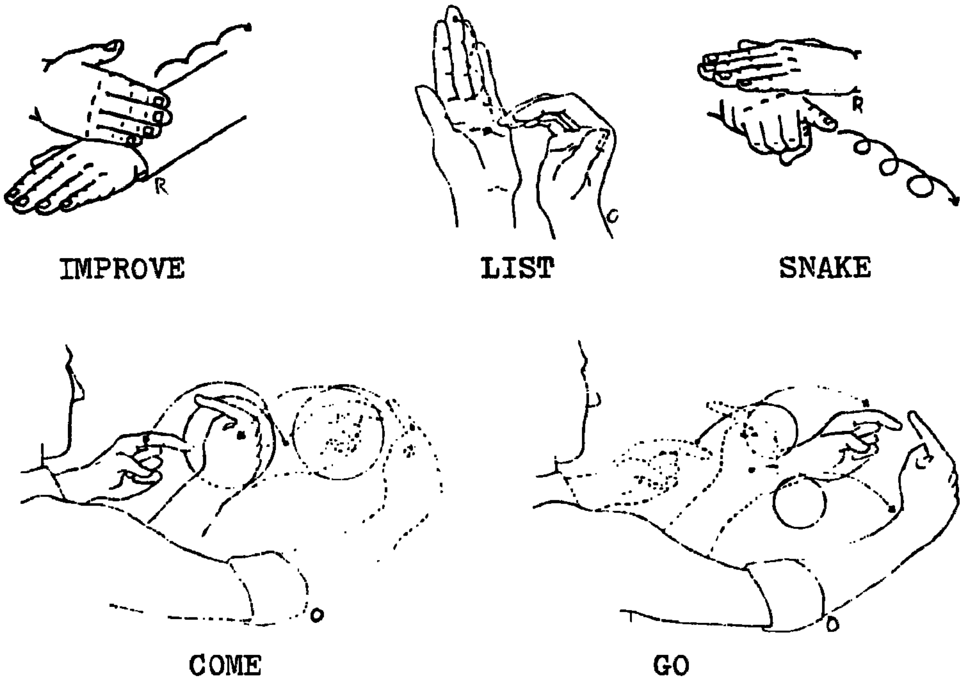


Fig. 2-24

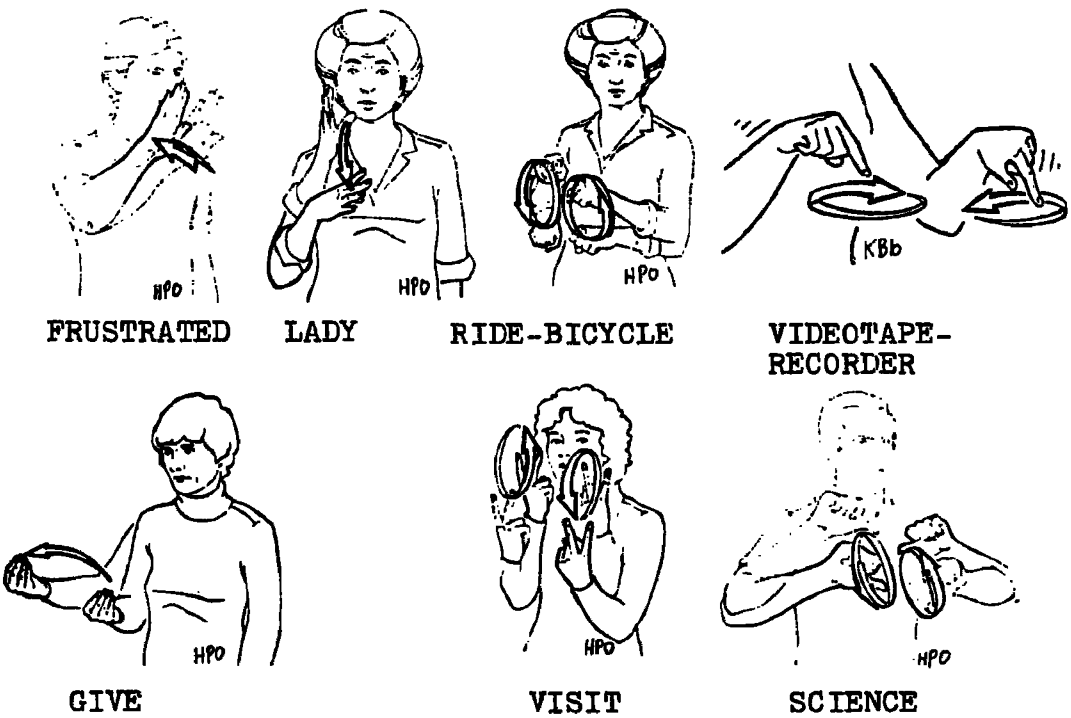


Fig. 2-25: Movement Direction

IMPROVE

CHILDREN

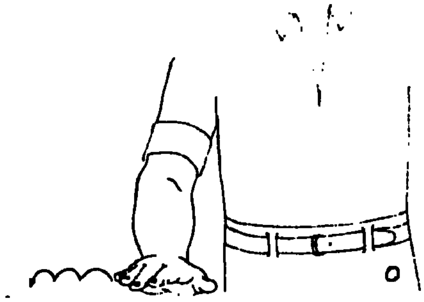


Fig. 2-26

SPAIN

UP-TILL-NOW

DEAD

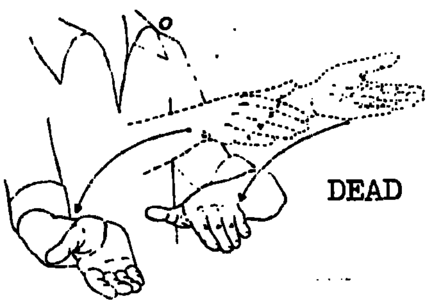
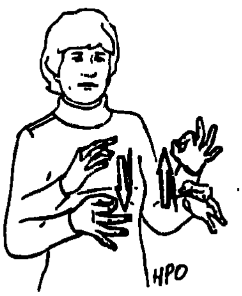


Fig. 2-27

JUDGE

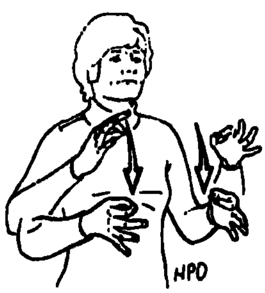


WALK

Phase: Alternating

Fig. 2-28

DECIDE



WALK-A-ROUTE

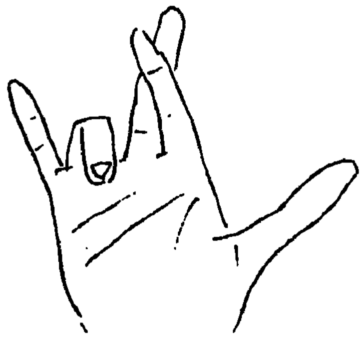


Fig. 2-29: The "I-really-love-you" HC

Fig. 2-30: Handshapes of Korean fingerspelling

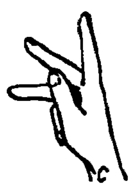
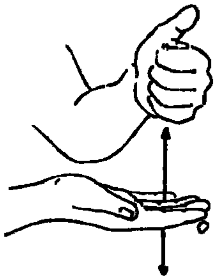
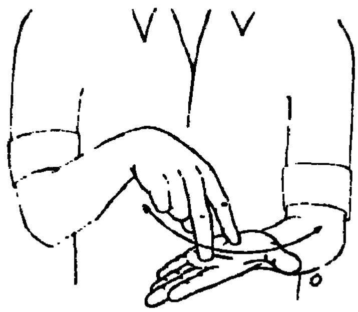


Fig. 2-31: French fingerspelled k

STUPID-JERK



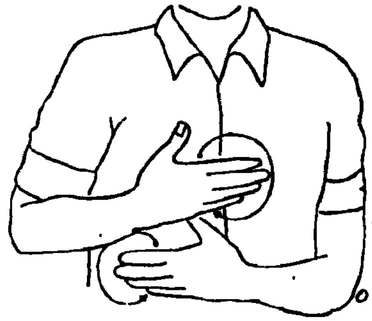
HELP



DANCE

Fig. 3-1

LIMIT



ENJOY

Fig. 3-2

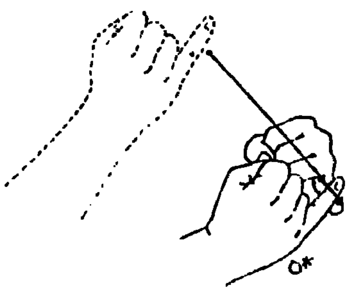


Fig. 3-3: LAST

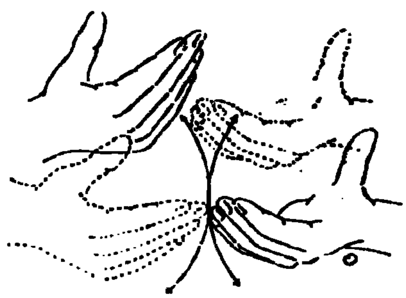
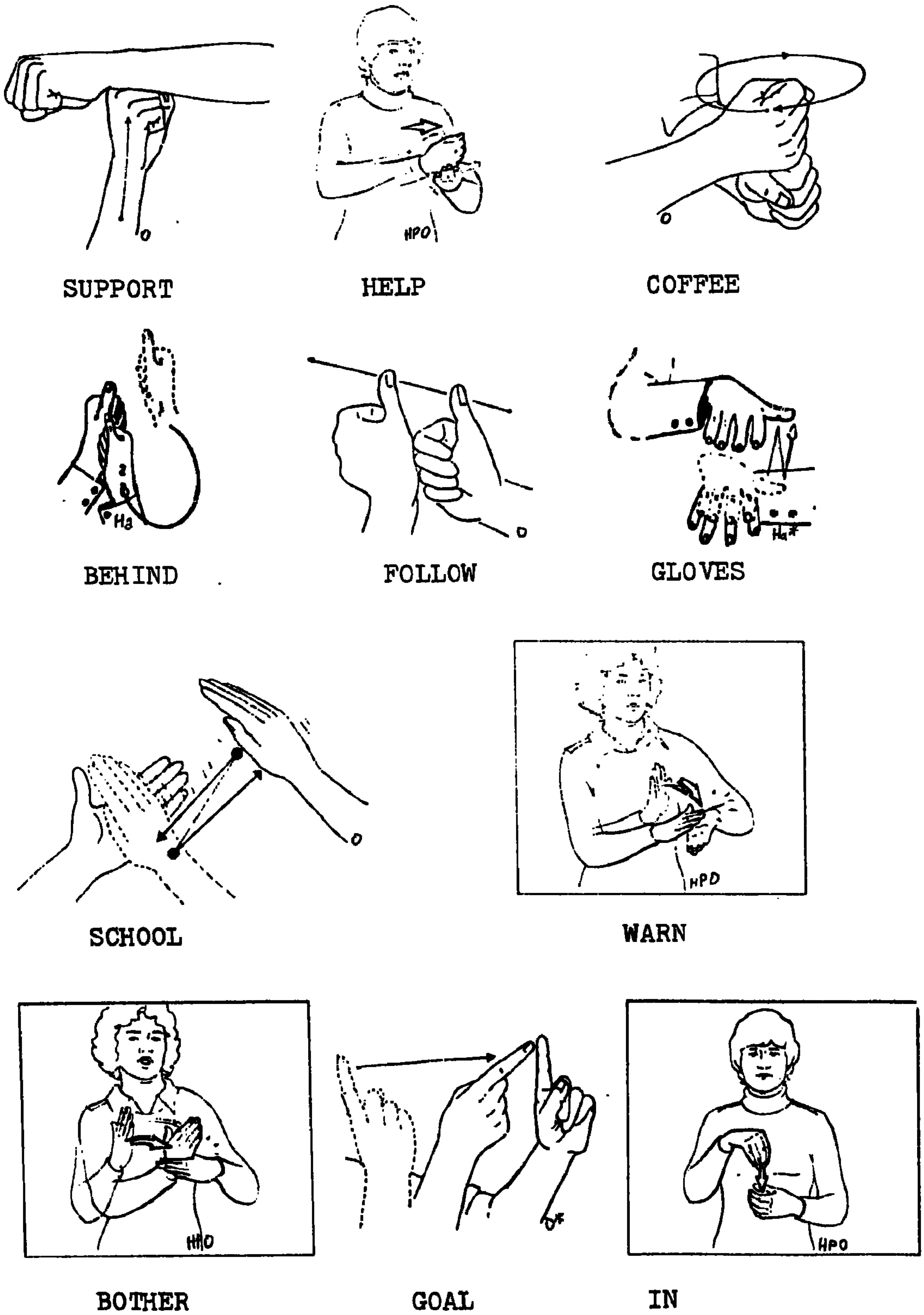


Fig. 3-4: NEVER-MIND



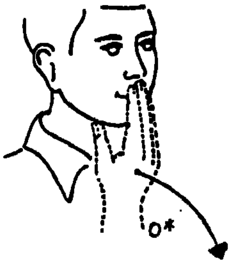
SUPPORT HELP COFFEE

BEHIND FOLLOW GLOVES

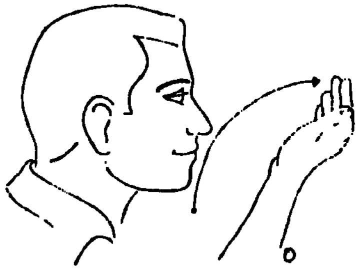
SCHOOL WARN

BOTHER GOAL IN

Fig. 3-5

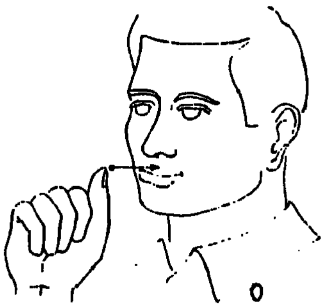


GOOD



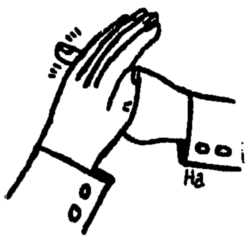
SMELL

Fig. 3-6



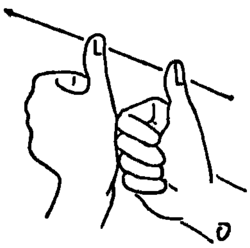
SECRET

PATIENT

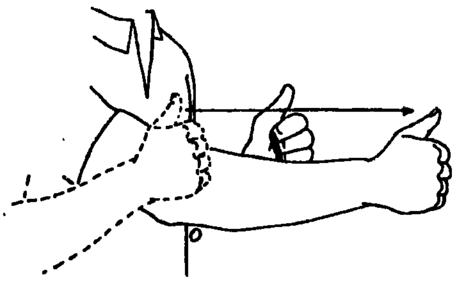


TURTLE

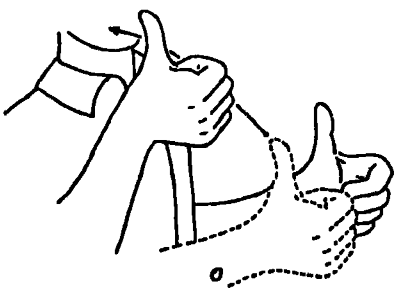
Fig. 3-7



FOLLOW



PASS



MOST

Fig. 3-8

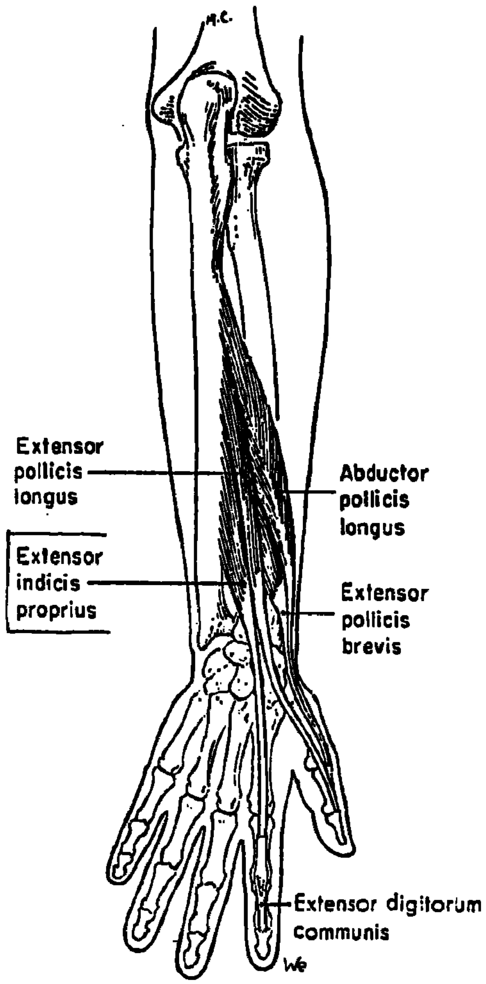
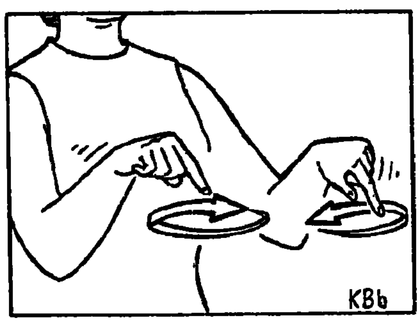
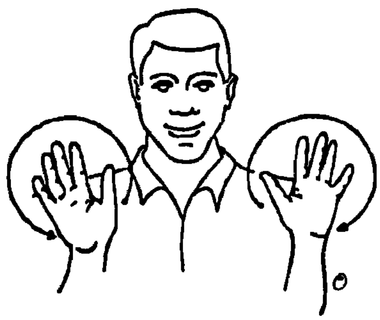


Fig. 3-9



VIDEOTAPE-RECORDER

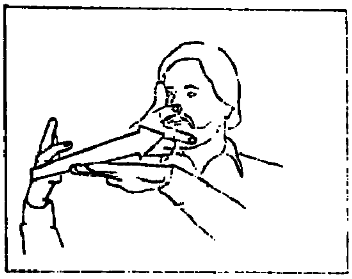


SUNDAY

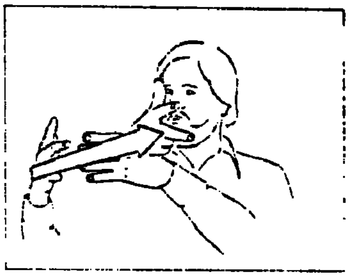
Fig. 3-10

1a. VEHICLE-WANDER-UPWARD-ACROSS-HORIZONTAL-WIDE-STAIGHT-SHAPE

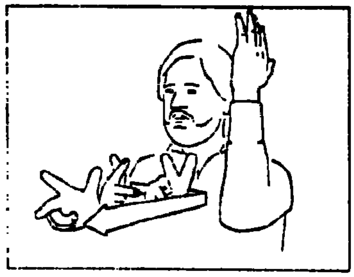
1b. VEHICLE-ROTATE-ON-HORIZONTAL-WIDE-STRAIGHT-SHAPE



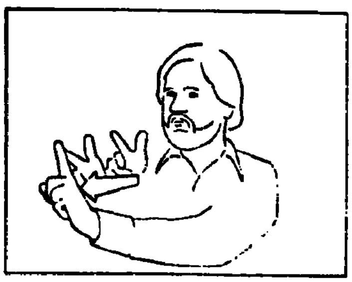
1c. VEHICLE-MOVE-ACROSS-HORIZONTAL-WIDE-STRAIGHT-SHAPE



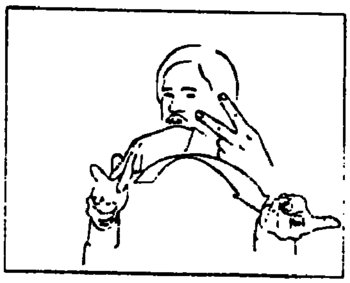
1d. VEHICLE-MOVE-THRU-FOUR-HORIZONTAL-THIN-STRAIGHT-SHAPES



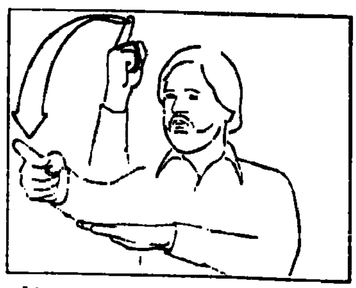
1e. VEHICLE-TURN-PAST-TREE



1f. VEHICLE-MOVE-TO VERTICAL-THIN-STRAIGHT-SHAPE



1g. PERSON-FALL-FROM-VEHICLE



1h. LONG-VERTICAL-THIN STRAIGHT-SHAPE-SWING-TO-HORIZONTAL

S

Fig. 4-1: An extended classifier construction

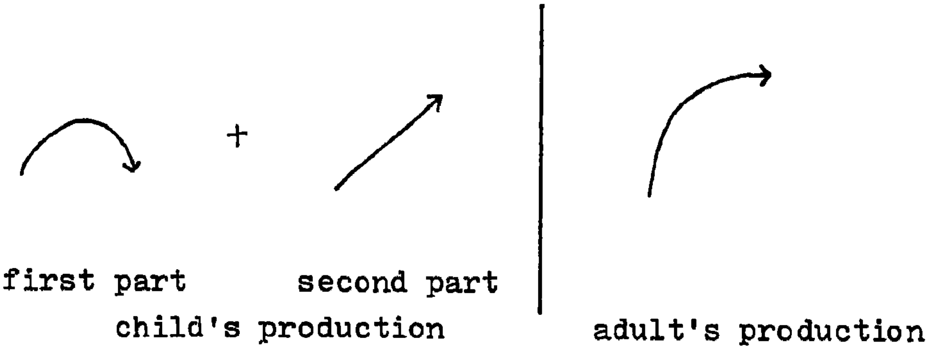


Fig. 4-2: Movement in verb describing an upward hop

Fig. 4-3: APPEAR

Fig. 4-4: Round$\overset{\frown}{5}$ in /DOME-SHAPED/

Fig. 4-5: CrossedF

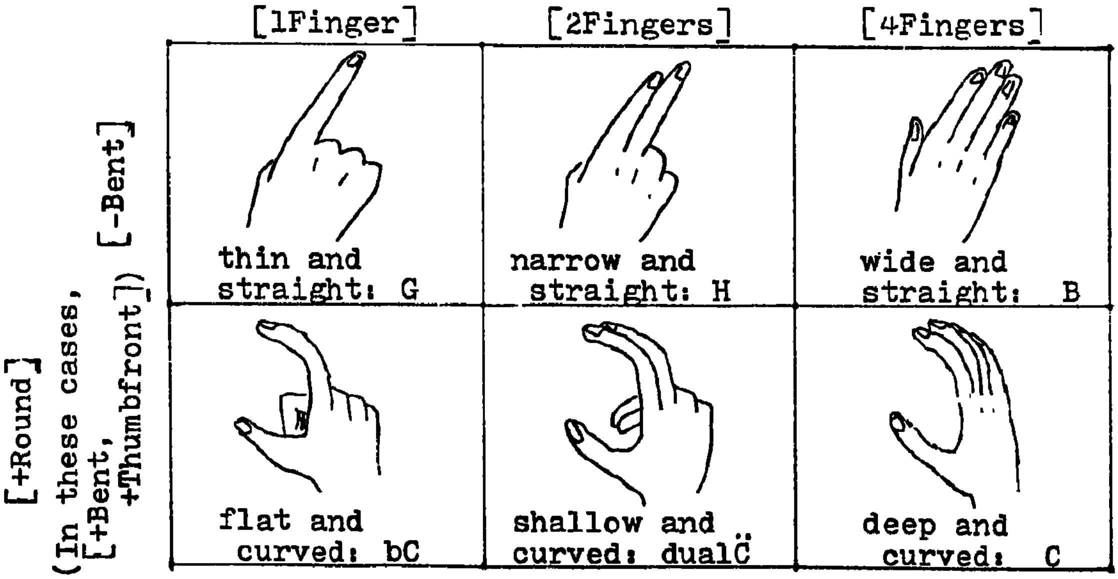


Fig. 4-6: A paradigm of morphophonological HCs (after S & N: Newport 1981)

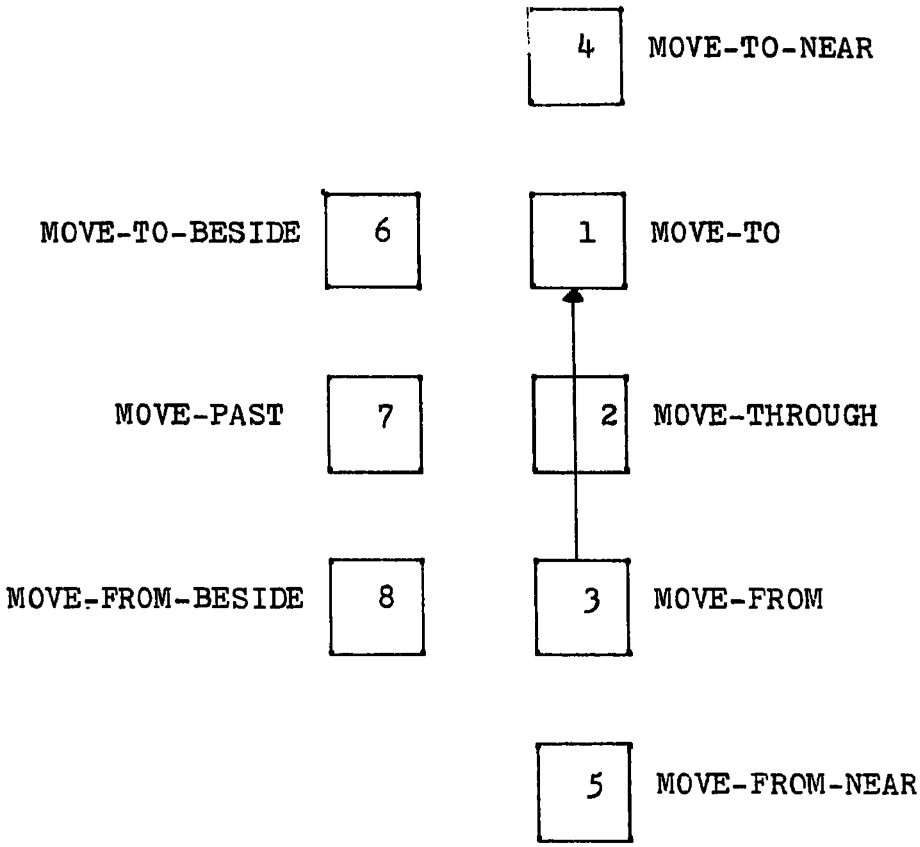


Fig. 4-7: A portion of the base grid for the linear movement morpheme
(Adapted from S & N: Supalla 1978)

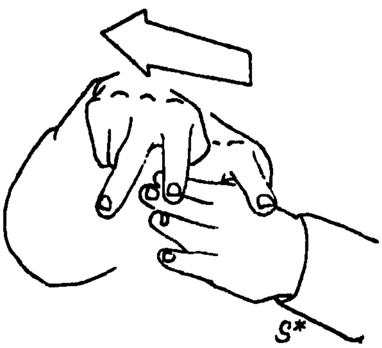
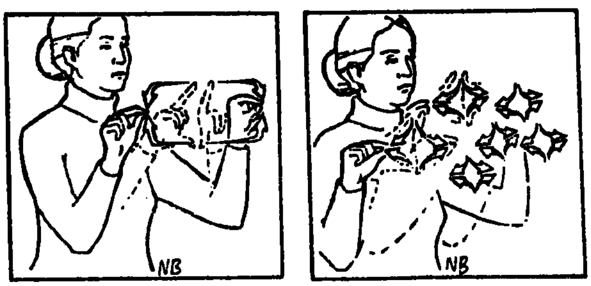
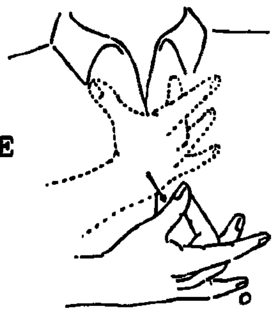
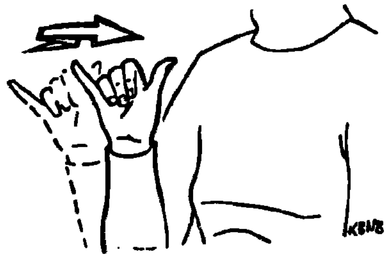
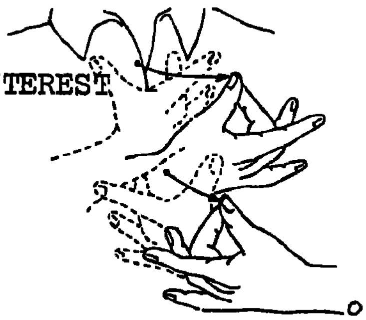
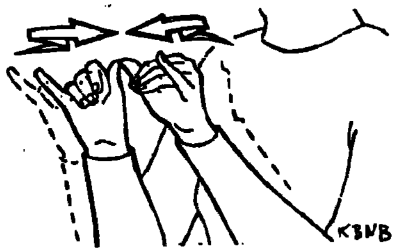
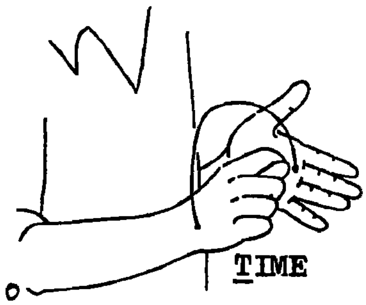


Fig. 4-8: HARVEST-CORN-BY-MACHINE



singular plural

Fig. 4-9: Phonological simplification of /RECTANGULAR/

	body	neutral space
one hand	TO-LIKE 	 SAME
two hands, both active	INTEREST 	 MEASURE
base hand and active hand	CAMERA 	 TIME

The combinations of hand arrangement and ± body location

Table 1-1

Table of symbols used for writing the signs of the American sign language

Tab symbols

1. Ø zero, the neutral place where the hands move, in contrast with all places below
2. ⌒ face or whole head
3. ⌒ forehead or brow, upper face
4. ⊔ mid-face, the eye and nose region
5. ∪ chin, lower face
6. } cheek, temple, ear, side-face
7. Π neck
8. [] trunk, body from shoulders to hips
9. \ upper arm
10. √ elbow, forearm
11. a wrist, arm in supinated position (on its back)
12. D wrist, arm in pronated position (face down)

Dez symbols, some also used as tab

13. A compact hand, fist; may be like 'a', 's', or 't' of manual alphabet
14. B flat hand
15. 5 spread hand; fingers and thumb spread like '5' of manual numeration
16. C curved hand; may be like 'c' or more open
17. E contracted hand; like 'e' or more clawlike
18. F "three-ring" hand; from spread hand, thumb and index finger touch or cross
19. G index hand; like 'g' or sometimes like 'd'; index finger points from fist
20. H index and second finger, side by side, extended
21. I "pinkie" hand; little finger extended from compact hand
22. K like G except that thumb touches middle phalanx of second finger; like 'k' and 'p' of manual alphabet
23. L angle hand; thumb, index finger in right angle, other fingers usually bent into palm
24. 3 "cock" hand; thumb and first two fingers spread, like '3' of manual numeration
25. O tapered hand; fingers curved and squeezed together over thumb; may be like 'o' of manual alphabet
26. R "warding off" hand; second finger crossed over index finger, like 'r' of manual alphabet

DASL

Table 1-2: The primary symbols of DASL notation
(first page of two)

27. V "victory" hand; index and second fingers extended and spread apart
28. W three-finger hand; thumb and little finger touch, others extended spread
29. X hook hand; index finger bent in hook from fist, thumb tip may touch fingertip
30. Y "horns" hand; thumb and little finger spread out extended from fist; or index finger and little finger extended, parallel
31. ȣ (allocheric variant of Y): second finger bent in from spread hand, thumb may touch fingertip

Sig symbols

32.	^	upward movement	
33.	˅	downward movement	vertical action
34.	ᴺ	up-and-down movement	
35.	>	rightward movement	
36.	<	leftward movement	sideways action
37.	ᶻ	side to side movement	
38.	ᵀ	movement toward signer	
39.	⊥	movement away from signer	horizontal action
40.	I	to-and-fro movement	
41.	a	supinating rotation (palm up)	
42.	D	pronating rotation (palm down)	rotary action
43.	ω	twisting movement	
44.	ŋ	nodding or bending action	
45.	□	opening action (final dez configuration shown in brackets)	
46.	#	closing action (final dez configuration shown in brackets)	
47.	♀	wiggling action of fingers	
48.	@	circular action	
49.	)(	convergent action, approach	
50.	×	contactual action, touch	
51.	⌶	linking action, grasp	interaction
52.	†	crossing action	
53.	⊙	entering action	
54.	÷	divergent action, separate	
55.	()	interchanging action	

DASL

Table 1-2: The primary symbols of DASL notation (continued)

Analysis of the non-interactive <u>movement</u> primes

		unidirectional	bidirectional
External	vertical	∧ up ∨ down	N up and down
	transverse	> dominant side < nondominant side	≷ side to side
	sagittal	⊤ toward back ⊥ toward front	I back and forth
Internal	forearm rotation	a supination ɒ pronation	ω twist, alternating sup. & pron.
	knuckles	□ open # close	ꝏ wiggle
	indeterminate joint	ɳ bend or straighten	

@ (circle) can be executed Externally, on a cardinal plane of signing space, or Internally, from a single pivot; sometimes both descriptions are true at the same time. There is phonological evidence for considering it bidirectional.

Unlike the other primes in the right-hand column, ꝏ (wiggle) is not an alternation of the two corresponding unidirectional movements, since the fingers are synchronized in □ and # but staggered in ꝏ .

Table 1-3

$\bar{D}$	dominant	hand	above	nondominant	hand	
$\underline{D}$	"	"	below	"	"	
D'	"	"	beside (close to or touching)	"	"	
D^{+}	"	"	crossed with	"	"	
D_{φ}	"	"	in front of or behind	"	"	(tandem)
D^{x}	"	"	grasping	"	"	
D^{Θ}	"	"	inserted in or grasped by	"	"	
$D_{\text{ꟼ}}$	"	"	behind (closer to signer than)	"	"	
$D_{\text{占}}$	"	"	in front of	"	"	
D_{γ}	"	"	on opposite side of nondominant hand from deictic object			
$D_{\triangle}$	"	"	between nondominant hand and deictic object			

D here is not a DASL symbol, but represents the handshape symbol of the nondominant hand, whether it is active (double-dez sign) or an inactive basehand.

Table 1-4: DASL and additional symbols for Directional Relation

$\mathcal{D}$	forearm prominent	
$\dddot{D}$	bent handshape (where D is not normally bent)	
$\dot{D}$	thumb extended (similarly)	
$\hat{D}$	angled handshape "	not in DASL
$\overset{\frown}{D}$	curved handshape "	not in DASL
$\underset{\jmath}{D}$	hooked handshape "	not in DASL
bD	"weakest" fingers closed (pinky, ring, middle)	not in DASL
$\dot{S}$	movement is sharp, tense, or checked	(S represents any movement symbol)
S·	movement is repeated	(S represents any movement symbol)
#[D]	hand closes to D	
□[D]	hand opens to D	
$S^{\sim}$	hands execute movement alternately	

Table 1-5: Handshape and movement diacritics

extended	closed	0	1	2	3	4
+	+	G	H,L,X,ɣ,W	V,thumbẏ,W	3	
+	-	B	bent B̈	5,8,F,C	bent 5̈,ɣ	(ɣ)
-	+	S	A	I,Y		
-	-	0				

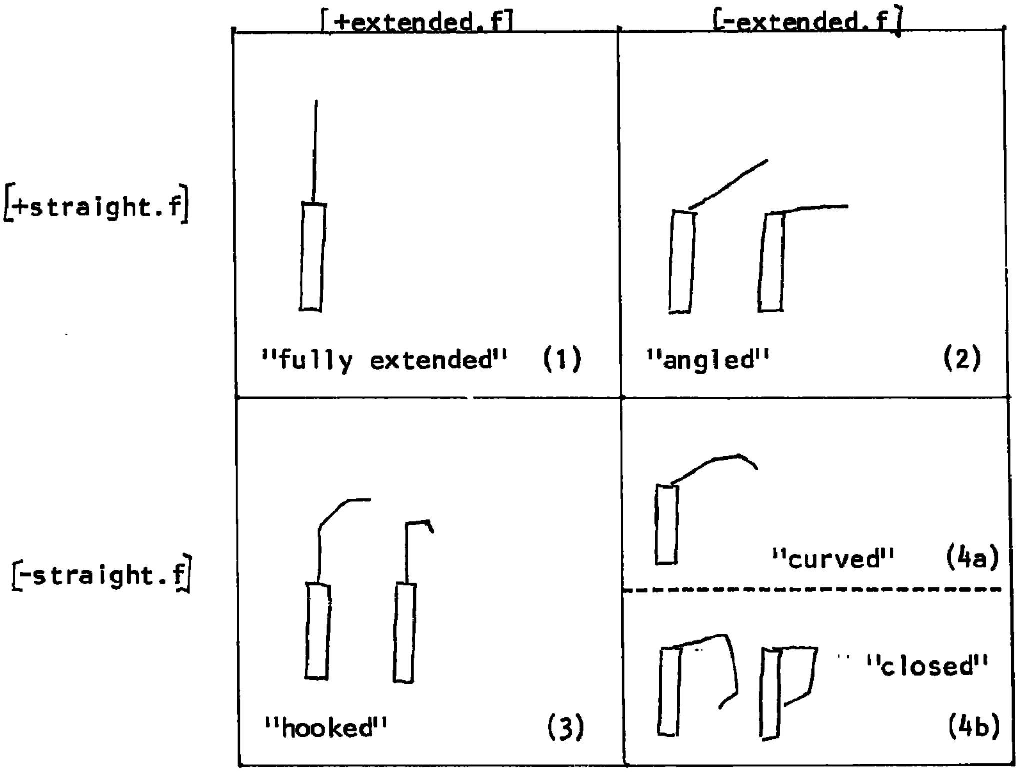
The entire inventory studied by K & W

0	0 5	0 5
1 B,5,8,F	1 bent 5̈,ɣ	1 B,ɣ
2 bent 5̈,bent B̈,ɣ,C	2 B,8,F,C,(ɣ)	2 bent 5̈,bent B̈,8,F,(ɣ)
3 (ɣ)	3 bent B̈	3 C
[+spread] unmarked	[+spread] and [+thumb] unmarked	[+spread] unmarked; [αthumb] unmarked in environment [αspread]

The parenthesized placements of ɣ apply if the published value [-bent] for ɣ is replaced by [+bent], which would be consistent with the definition of bent and the matrices of X and other bent handshapes.

K & W's [+extended, -closed] group with various markedness conventions

Table 2-1: Markedness values of handshapes in K & W's analysis



The stick figures represent the palm held upright and the finger being described, in edge-on view. If that finger is <u>selected</u>, then the general features for the HC are as follows:

(1) [-Bent]

(2) [+Bent, +Straight, -Extended]

(3) [+Bent, -Straight, +Extended]   } [±Opposed]

(4a) [+Bent, -Straight, -Extended]

(4b) Only in changing-HC signs, or in [+Uniform, +Closed].

(2), (3), and (4) are [+flexed.f]. Only (1) is [-flexed.f], and only (4b) is [+closed.f].

Table 2-2: Finger flexion features

	Fg	Ind	Mdl	Rg	Pky	Bt	Opp	Cr	Spr	IntEx	Cl	Th	Tside	Tfr	Tout	Tbt
ɣ	1	(-)	(+)	(-)	(-)	(+)	(-)	(-)	(x)	(+)	-	(-)	(+)	(-)	(+)	(-)
8	1	(-)	+	(-)	(-)	(+)	+	(-)	(x)	(+)	(-)	(+)	(-)	(+)	(+)	(-)
K	1	(-)	+	(-)	(-)	(-)	+	(-)	(x)	(-)	+	(+)	(-)	(+)	(+)	(-)

Parenthesized values are predictable and not underlying. "x" = "no value" (neither underlying nor assignable by the implications given in the text).

Table 2-3 : Underlying matrices for ɣ, 8, and K

SIGN	GLOSS	FOCUS
$A_{\varphi}.\dot{A}^{v\cdot}$	each	thumbface
$A^{\prime}.A_{\mathrm{T}}^{z\,x}$	behind	wrist/root
$A_{\varphi}.A_{\mathfrak{r}}^{\circ\,\prime}$	pursue	wrist/root
$\underline{A}^{\odot}.\dot{5}_{\upsilon}\dot{v}$	shit	inside
$A^{\odot}.5_{\upsilon}\dot{2}_{\perp}$	awkward	inside
$A.I^{\odot\cdot}$	anal intercourse*	inside
$A_{\upsilon}.G^{\odot}$	sexual penetration*	inside
$\underline{A}.G^{\odot}$	stick into vagina*	inside
$\underline{A}.\dot{A}^{\odot}$	stick into anus*	inside
$5_{\mathrm{T}}.G_{\vee}^{\perp}{}_{z}$	among	angles (sequentially)
$\underline{5}_{>}.4_{<}^{v}$	long list	ulnar
$5.G^{x\dot{v}\prime}$	various	tips (sequentially)
$5.G^{x}$	first of five+	thumbtip
$5.G_{\xi}^{\prime}$	fingers	fingers (sequentially)
$5^{\mathrm{I}}.L^{\mathfrak{I}}$	finger	one fingertip
$5.G^{x}$	n-th-year student+	one digit tip
$5.G_{x}^{\pm}$	graduate student	radial side of wrist
$5.X_{>}^{\square}$	eliminate	one fingertip
$\dot{5}.L_{a}^{x\,\mathrm{I}}$	contraceptive foam*	thumbtip
$C_{\upsilon\varphi}.B_{\wedge}^{\dot{x}}$	prevent	thumbweb
$C.G_{x}^{\odot}$	circle	inside (sliding around)
$B.F^{\mathrm{I}}$	meat**	thumbweb

* from Woodward (1979)

\+ numeral morphology

** There are about twenty other exceptional-focus B-heterotabs with radial, dorsal, and ulnar focus. These prove to be completely regular and predictable; see text.

Table 3-1: Signs with neutral base handshape and atypical focus

SIGN	GLOSS	FOCUS symmetrical identical	ORIENTATION ident.	mut. symm.
$\dot{A}^{\neq}, \dot{A}^{\times}$	stay	i	i	s
$F^{\prime}, F_{\upsilon}^{\zeta\prime}$	sentence	i	i	s
$F^{\prime}, F^{\perp}$	postpone	i	i	s
$F^{\prime}, F^{\hat{x}\cdot\cdot}$	sew	i	i	s
{ $\bar{F}_{\alpha}, F_{\upsilon}^{<\dot{>}}$	unfair	i		s
{ $F^{\prime}, F^{\dot{v}}$	unfair	i	i	s
H, H_{x}^{I}	short(time)	s	i	
$H_{\upsilon}^{\neq}, H_{\upsilon}{}_{x}^{I\cdot}$	railroad	s	i	
{ $H_{\upsilon}, H_{v}{}^{a}_{v}$	dive	*		
{ $H_{\upsilon}, H_{v}^{\wedge v}$	dive feet first	*		
{ $\bar{H}_{\upsilon}, H_{\upsilon}^{a}$	decrease	s	i	
{ $H_{\upsilon}, H_{\alpha}^{\upsilon x}$	increase	s	i	
$H^{\neq}, H^{\circlearrowright\cdot}$	weight	s	i	
$\bar{H}, \sqrt{H}^{\curvearrowright x}$	universe	s	i	
$H, H_{\neq}^{x\cdot}$	name	s	i	
$H_{\upsilon}, \dddot{H}_{\upsilon}^{x}$	sit (including related signs, and counting bent $\dddot{H}$ = H)	s	i	
$H_{\upsilon}, H_{\upsilon}^{k\cdot\cdot}$	salt	s	i	
$3_{\varphi}, 3^{\vee}{}_{\dot{T}\dot{T}}$	cars backed up	s	i	
{ $I_{>}^{\prime}, I_{<}^{>}$	thread, line	i	i	s
{ $I_{>}, I_{\wedge}^{\vee}$	dangling string	i		*
{ $\bar{I}_{\wedge}, I_{v}^{\wedge}$	tall, thin person	i	i	s
$I_{>}, I_{x}^{\vee}$	last, final	i	i	s
$\bar{I}, I^{x\cdot}$	institution	s	i	

Table 3-2: Type 2 signs with nonneutral handshape
(continued on next page)

SIGN	GLOSS	FOCUS symmetrical identical	ORIENTATION ident.	mut. symm.
$\bar{K}.K^{x}$	keep	s	i	
$K_{a\text{ϙ}}.K^{x}$ $K_{\alpha\text{ϙ}}.K^{\partial x}$	perfect	i		s
$\underline{\dddot{V}}_{\text{ɒ}}.\dddot{V}_{\alpha}{}^{\dot{v}}$	amazed	i		s
$V_{\top\text{ϙ}}.V_{\top}{}^{x}$	save	s	i	
$\ddot{V}_{>}.\dddot{V}_{<}{}^{\dot{x}}$	hard	s	i	
$V_{\top}.V_{\perp}{}^{xax}$	reverse* (two contacts)	i	2:i	1:s
$V_{\text{ɒ}}.V_{\text{ɒ}}{}^{x\cdot\cdot}$	salt	s	i	
$V.V^{\odot}$	plug in	i	i	s
$\bar{V}.V^{x}$	keep	s	i	
$\underline{V}_{\text{ɒ}}.V_{\text{ɒ}}{}^{\dot{x}}$	stupid jerk	s	i	
$\bar{W}.\checkmark W^{\partial x}$	world	s	i	
$\bar{X}.X^{\frac{\perp}{x}}$	ruin	s	i	
$\bar{X}.X^{\frac{\perp}{x}\cdot\cdot}$	tease	s	i	
$\chi_{\top\text{ϙ}}.\chi^{x}$ $\chi_{\top\text{ϙ}}.\chi^{\partial x}$	exact	i		s
$\chi_{\top\text{ϙ}}.\chi_{\perp}{}^{\dot{x}}$ $\underline{\chi}_{\text{ɒ}}.\chi_{a}{}^{\dot{x}}$	revenge	i		s
$\bar{\chi}_{a}.\chi_{\text{ɒ}}{}^{x\cdot}$	(part of name of card game "Old Maid")	i		s

* morphologically complex

Mutually symmetrical orientation is equivalent to identical focus.

Table 3-2: Type 2 signs with nonneutral handshape
(second of two pages)

GLOSS	TYPE 2 SIGN	TYPE 1 SIGN	MOVEMENT IN TYPE 1
postpone	$F^{\prime}.F^{\perp}$	$FF^{\perp}$	together forward
interpret	$F^{\prime}.F^{\omega\cdot}$	$F^{\prime}F^{\omega\sim\cdot}$	alternately twisting
never mind	$\dot{B}_{>}.B_{<}{}^{\frac{\top}{\times}}$	$B_{>}B_{<}{}^{\frac{\top}{\times}\sim}$	alternately back and forth
amazed	$\underline{\ddot{V}}_{D}.\ddot{V}_{a}{}^{\dot{v}}$	$\underline{\ddot{V}}_{D}\ddot{V}_{a}{}^{\div}$	separating vertically

Table 3-3: Some Type 2 - Type 1 alternations.

GLOSS	TYPE 2 SIGN	TYPE 3 SIGN	TAB FOCUS	DEZ FOCUS
frequent (a place)	$B_{\wedge}\varphi.B^{\times\cdot}$	$G_{\wedge}\varphi.B^{\times\cdot}$	index finger	tips
prevent	$B_{D}\varphi.B_{\wedge}{}^{\dot{\times}}$	$C_{D}\varphi.B_{\wedge}{}^{\dot{\times}}$	thumbweb	ulnar
institution, residential school for deaf	$\bar{I}.I^{\times\cdot}$	$DI^{\times\cdot}$	dorsal radial "fist"	ulnar "fist"

Table 3-4: Some Type 2 - Type 3 alternations

SIGN	GLOSS	TAB FOCUS	DEZ FOCUS
$B^{\prime}.B_{D}{}^{\frac{\dot{v}}{\times}}$	cheap	palmar	radial
$\bar{B}_{D}.B^{\frac{\perp}{\times}}$	across; after	dorsal	ulnar
$B_{\wedge}\varphi.B^{\times\cdot}$	frequent (a place)	radial	tips

Table 3-5: Some B.B signs specified for neutral tab

SIGN	GLOSS	ALTERNATE TAB HANDSHAPES
Å^ɪ.X^⌑	cherry, strawberry+	G,I,Y
Å.V̈	capture	G
Å.Y_v^x ¦¦ Y_v	stay there	
F.G^⊙·	anal intercourse**	O*,A*
H_∧.C ~ H_∧.C̈	dress (verb)	
H_v.3	mooch	
H_v.V̈^ω	restless	
H_v.V̈_v^x H_v.Ḧ_v^x	sit	
I^⊙.O^	ego	
I^ɪ.X^⌑	infinitesimal	G*
I^ɪ.X^⌑	cherry, strawberry+	thumbÅ,G,Y
I^x.A	ejaculation**	G*
L.G^x	angle	
L.G^x⊥x L^⊙.G^ω	then, or	
V_T.F^ɪ7^ɪ	choice	
V^⊙.G^a	begin	5
Y'.O^ω	strawberry+ (McIntire 1977)	Å,G,I

* alternation carries semantic distinction
\+ frequently the second component of a compound, preceded by RED ∪G_T

**Woodward 1979

Table 3-6: Type 3 signs with nonneutral base handshape

neutral handshapes → specified foci ↓	B/5 extended	5 extended spread	5/thumbB́/C (at least loosely extended, thumb out)	𝒟 laxly curved	C curved, thumb front	O opposed	G just index extended	A S closed
palmar	all							
dorsal	HC:fingers extended - - - - - - - - - else			tab palm down, = dez above tab				
edge	HC:fingers extended - - - - - - - - - else			tab palm down, = dez tandem to tab			HC: one finger extended	HC: fingers closed
digit(s) tip or "trunk"		multiple fingers					else	
angle(s)		else	dez focus thick - - - - - - - - - impact					
bunch						all		
inside					large dez, tab cannot oppose	small dez, tab can oppose		HC: fingers closed
wrist	HC:fingers extended			else				

Table 3-7: Underlying neutral heterotab handshapes and foci with conditioning environments and specifications

FOCUS	ADDITIONAL SPECIFICATIONS	RESULTANT HC FEATURES	HC
palmar	none	fingers extended, uniform	B/5
dorsal	none:	fingers uniform:	
	palm down or dez above tab	fingers lax	𝒟
	other orientation or DR	fingers extended	B/5
	fingers extended:		B/5
edge	none:	fingers uniform:	
	palm down or dez in front/back of tab	fingers lax	𝒟
	other orientation or DR	fingers extended	B/5
	fingers extended		B/5
	single finger	index extended	G
digit(s) (tip or "trunk")	none:	single digit extended:	
	none:	index	G
	pinky involved:	pinky	I
	thumb involved:	thumb	thumbȦ
	multiple fingers:	fingers spread:	
	none	fingers uniform	5
	not uniform	index and middle	V
bunch		fingers uniform, opposed to thumb	O
inside	none:	fingers bent, uniform, thumb fronted:	
	fingers and thumb can touch around dez	opposed	O
	... cannot touch ...	not opposed	C
	fingers closed		A[S]
	single finger	index opposed, others extended	F
angle(s)		digits spread (oblig.):	
	none	fingers uniform	5
	fingers not uniform	index and middle	V
	thick dez focus or impact in movement	focus on tab thumbweb	5/thumbḂ/C

Table 3-8: Derivation of heterotab handshapes from focus and possible additional specifications

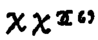
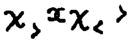
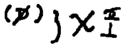
SIGN	GLOSS	FOCI
	run	index around thumb
	suspend, pause	index around back of index
	relax	index around back of index
	friend	indexes mutually
	tow, pull	indexes mutually
	behind-the-ear hearing aid	index around back of ear
	hook	index in corner of mouth
	capture	index and middle around index or thumb
	childhood friend	pinkies mutually (Pinky-Diminished from FRIEND)

Table 3-9 : Non-uniform dez with inside focus

fingers:	+Closed: none	+Closed: i		+Closed: im		-Closed: all	
initial↓ / final:→	thumbÅ	G	L_j	V		C	5 ← more-open
restrained8/ restrainedF							← 6
O, bO (dualÖ)			1↑				←23
restr-thumbA, S restrbO, restrdualÖ, ↑ more-closed	2↑	5↑ +4n		4↑ +3n		1↑	←22

O P E N I N G

final↓ / initial:→	thumbÅ		L_j		3	bentB̈/C	B/5 ← more-open
8/F							← 5
bO,dualÖ,O			13↑ +1n		2↑ +1n	4(↑)	←35
A,S ↑ more-closed	(1*)↑		2()			← 22	15(↑)

C L O S I N G

Numerical signs are excluded from the main count in each cell and presented separately with the letter n.
*Although DASL has no signs with thumbĀ closing to A, there is at least one: TOOTHPASTE $\tilde{G}_{>}\dot{A}_{D}\#$.

Table 3-10: Number of separate changing-dez signs in DASL by more-open and more-closed handshape

OBSERVED FORM			CHANGING FEATURES OF INVOLVED FINGERS		STEADY-STATE FEATURES	
INIT.	CHANGE	FINAL	INIT. ONLY	FINAL ONLY	DIGITS INVOLVED	OTHER
S	open	(5)	closed	(straight)	timrp	
S	open	C	closed		timrp	bent
5	close	S	straight	closed	timrp	
C	close	S		closed	timrp	bent
0 [a]	open	(5)	opposed		(t)imrp	
(5)	close	0	(straight, spread)	opposed	(t)imrp	
B	close	0	straight, aligned	opposed	(t)imrp	
C	close	0		opposed	(t)imrp	bent
(restrained-dualÖ)	open	V	closed		im	(+Closed)
3	close	restr-dualÖ		opposed	(t)im	(+Closed)
b0	open	L_j	opposed		(t)i	+Closed
L_j	close	A		opposed	(t)i	+Closed
L_j	close	A		closed	ti	(+Closed)
(A)	open	G	closed		i	+Closed
restr8/ restrF	open	(5)	opposed		(t)m/(t)i	-Closed
5	close	8/F		opposed	(t)m/(t)i	-Closed
(A)	open	thumbÅ		thumb out	t	+Closed
thumbÅ	close	(A)	thumb out		t	+Closed

Table 3-11: Changes of handshape formulated as handshape features with initial and final states

[a] see text