Hands and Faces: A Preliminary Inventory for Written ASL

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HANDS AND FACES: A PRELIMINARY INVENTORY FOR WRITTEN ASL

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ABSTRACT

American Sign Language (ASL) can be characterized as a face-to-face language; much like other face-to-face languages in Africa and the Americas, ASL has not had a written form. We discuss some characteristics of writing systems, the advantages of writing for a community, and the differences between linguistic transcription and writing for daily use. The remainder of the paper focuses on two aspects of ASL--handshapes and nonmanual behaviors--that need to be accounted for in any writing system. We discuss the process of selection and classification of items to be represented in a writing system for ASL.

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This paper is a report of ongoing work in the development of a computerized writing system for ASL, called SignFont. The goal of the project is to produce a practical and usable means of writing for ASL, with the ultimate goal of encouraging ASL literacy for Deaf people. The hope is that Deaf people will be able to read and write newsletters, books, letters, lists, papers, plays, or poems in ASL, without having to depend on or refer to their second language, English.

Several notational schemes have been devised, but they have been cumbersome and difficult for "ordinary" people to learn (Liddell & Johnson 1986; Baker & Cokely 1980; Stokoe, Casterline & Croneberg 1965; Anderson 1981). Currently, most written works seeking to represent signs laboriously illustrate a person producing each sign; other systems try to represent such movements as stick figures. However, it is possible to create semi-abstract graphic symbols that represent the linguistically significant characteristics of signs.

The project began with a pilot study, proving the feasibility of using a personal computer to encode written ASL. Now, we are completing the linguistic analysis and devising symbols and a typography for SignFont. This paper focuses on two particular areas of the analysis: inventories for handshapes and for nonmanual markers. We begin by discussing some of the rationale behind writing systems in general, turn to some differences between linguists' goals and the needs of writing systems, review previous inventories of handshapes and nonmanual behaviors, and finally present the inventories we are proposing for this system.

The paper focuses on handshapes and nonmanual behaviors because they exemplify two of the extremes in the sorts of challenges this project presents. First, they both have received a fair amount of linguistic attention in the past, so that we have a solid foundation on which to base our inventories. Handshapes tend to submit themselves to the sort of phonological principles which linguists bring from the analysis of spoken languages; that is, they evidently behave in linguistically comprehensible ways, always in conjunction with other parts of manual signing. Nonmanual behaviors, by contrast, are in some ways unique to signed languages.

While facial expressions and posture shifts--usually representing affective states--are present in human communications in general, in signed languages they have the potential for assuming morphological and syntactic importance.

Second is the issue of sequential presentation of signs. Although signers are often said to think of signs as wholes, it is quite possible for manual signs to be analyzed in a linear or sequential model (see Liddell & Johnson 1986 for a good example of this approach). Linguistically significant nonmanual behaviors, by contrast, are layered onto manual signs. Their scope in this regard represents, in large part, the extent of their meaning. Since writing is a two-dimensional (sequential) affair, regardless of how compressed it may become in form, this layering of information is a challenge to the writer/reader. Finally, the function of both handshapes and nonmanual behaviors can be morphologically meaningful. These similarities and differences make for an interesting set of challenges in designing a written system for a visual language.

Why write? In the history of humankind, language plays an ancient and crucial role; writing, in contrast, is a comparatively new phenomenon. It is a cultural invention, while language itself represents a species-specific event. In recent linguistic thought, writing has been viewed as a secondary system, while language is of primary import. Indeed, taking the long view, most language users in the history of the world have not used writing. For one thing, not all cultures have invented writing systems. For another, literacy was reserved as a privilege of the few until only recently in human history.

If human beings and cultures can survive, then, without the use of writing, why do we write at all? What is the good of it? First, writing is a means of preserving culture and cultural artifacts created by the members of a society. Through the use of writing, people have a straightforward and relatively dependable means of recording history. In this fashion, a culture can achieve a certain continuity. Second, writing means that messages can be transmitted more freely across time and space. Two people can communicate without seeing or hearing each other,

indeed without even being alive at the same time. (We note in passing that cultures have survived and continue to survive, keeping historical records and maintaining cultural standards without writing; for example, precontact African, Melanesian, and Amerind peoples all had rich and complex cultures. Yet, on contact with Western culture, these people invariably saw the advantages of being able to preserve cultural records through writing. See, for example, the story of Sequoyah and the Cherokee writing system (Fromkin & Rodman 1974).)

The skeptic might agree with us so far, but raise the objection that Deaf people are already literate in English, and that they have no need to write in ASL. Others might object by saying that it is impossible to write ASL; as a visual/gestural language, it simply cannot be recorded properly on paper. Our response to the first is that there is no reason why Deaf people should be limited in their reading and writing activities to their second language. Moreover, the lowered reading and writing levels achieved by deaf children in school (Allen & Osborn 1984; Conrad 1979; Gregory, Shanahan & Walberg 1984; Jensema 1975; Wolk & Allen 1984) bear evidence as to the relative success of programs designed to produce English language literacy in deaf and hearing-impaired youngsters. In fact, it is reasonable to assume that abilities in reading and writing English will be enhanced if Deaf children are first both fluent and literate in American Sign Language. Textbooks and support materials in a variety of educational areas would assist Deaf children to learn English more readily; they could, for example, read classic children's literature in translation.

Moreover, creative Deaf people--poets and playwrights, for example--would be able to express themselves directly in their own language. Often, a Deaf poet creates an image or a "figure of sign" that is impossible to translate into English. The only means of preserving such use of ASL is to depend on memory or film. Not many people have access to film or video equipment. How much more convenient for the poet (and for us readers) to be able to write it and read it in ASL.

The second objection to writing ASL--that it is impossible--is not new. Linguists and anthropologists who have worked in exotic language communities around the world are familiar with this phenomenon. Speakers of unwritten languages all believe that their language is impossible to capture onto paper. Even the Cherokee in the time of Sequoyah initially rejected his efforts, believing that no writing system could adequately represent their language. Yet, there is no intrinsic reason why ASL cannot be represented with symbols in two dimensions. It is a language, structured and organized much like all other languages. The development of an adequate system will be difficult, but there is nothing about it which is impossible.

Representing the selected images in a computer, as we have attempted from the outset, will prove that sign typesetting is possible, paving the way for printed mass media, including textbooks, written in ASL. In this day of electronic communication, it is essential to design a writing system that is immediately ready for electronic transmission and storage. Ultimately, the system should be able to provide a sign language alternative to TDD's.

Computer storage of signs also has implications for the conduct of research on sign. For example, it makes possible the collection of large data bases for analysis of phonological and morphological structure and of syntax and dialect. (Such an analysis of English might lead us, for example, to "discover" mass nouns and verb valence or the syntactic differences between British English and American English.) Furthermore, computer-aided statistical analysis of observed combinations of parametric values, for example in the pairing of handshapes with contacting regions or movements, should make the linguistic description of ASL structure, especially in the formulation of structural constraints, available years sooner than if it were done entirely by hand. The same is true of the compilation and analysis of inflectional and derivational paradigms, the grammatical use of space, and the elegant but elusive classifier system.

Degree of iconicity in the typography. One issue of primary concern is the degree of iconicity or the extent to which the character set directly represents signs.

In other words, how much should written symbols look like actual signs? For example, a system could include specific and explicit (i.e., picture-like) information about the exact shape of each hand and where they are in relationship to each other. It is difficult, however, to represent a three-dimensional sign on a two-dimensional piece of paper.

A symbolic (or written) code for any language should be able to stand alone, divorced from context. But using symbols that look like hands that need to be placed on the right or left side of a sheet of paper would require that people make mental reversals of right and left that are often very difficult. People become confused about which side of the flat surface represents which part of "real" space. Any sign language teacher has enough experience with learners' problems with left and right to be able to verify this concern. Such an approach raises more problems for learning than it would be worth. Additionally, of course, with respect to a writing system, the more iconic the system, the more phonetic the representation. This increases the number of symbols required and lowers the efficiency of the system.

Moreover, we have no empirical evidence that signs are processed or remembered through this sort of direct representation. Indeed, short term memory experiments suggest that signers uniformly code ASL signs on the basis of the component elements of signs, rather than on the basis of semantic or iconic properties (Bellugi, Klima, & Siple 1975; Klima & Bellugi 1979; Poizner, Bellugi & Tweney 1981).

In general, then, signing space does not so much reflect the real world, but rather an internal spatial world. In short, the loci (points in space) are abstract and so are the articulators (hands); they exist at an underlying level, and the notion of left and right--as we know from watching all kinds of signers--is a trivial matter. This is true so long as one is not describing present referents, giving directions, describing the layout of items in a room, or the like (spatial mapping). The relationship between the hands does have significance in various parts of the language, and we do not ignore that fact. For example, the use of abstract loci (and

the second hand of most two-handed classifier constructions) is often based on the assumption of a dominant and a nondominant hand. In most of the grammar, however, a more abstract system, detached from physical reality, more closely represents or taps into the signer's grammar.

Some arguments from data on the acquisition of ASL relate to this issue and provide support for our approach. First, work on acquisition of spatial mapping strongly suggests that children acquire this aspect of the grammar relatively late; this means that "reality" is in fact no help to the child in processing or acquiring the language (Lillo-Martin, Bellugi, Struxness & O'Grady 1985). Second, Petitto (1983) suggests that real-world pronouns, or deixis, can be a tricky thing for the young deaf child to acquire. Finally, work on the acquisition of facial grammar (Reilly, McIntire & Bellugi in press-a) suggests, at least peripherally, that iconicity itself presents no assistance to the child learning ASL; rather, it poses something of an "extra," though nonserious, hurdle which the child must overcome in getting at the abstract picture of linguistic representation. Indeed, everywhere one looks in the child language data, one finds similar indications (Supalla 1982, Newport & Meier 1986). What this all boils down to is a fairly strong argument for making the system as abstract as is possible.

Typographic design. Like linguistic analysis, typographic design poses some unusual problems. Should one choose a character set that looks like Roman, Arabic, Chinese, Sanskrit, or what? How can one design a typography that is simultaneously legible on a printed page (even in boldface or small print) and on a computer screen?

We want a typography that is both easy to learn and easy to write by hand and to type on a keyboard. We also want to ensure that a reasonable amount of information will appear on a standard printed page. "Reasonable" in this case means that, on the average, the same density of information will appear on a written page of ASL as appears on a standard written page of English.

As with any design problem, whether computational or artistic, there are an infinite number of solutions. Many symbol sets can be designed for a given sign language, but whatever symbol set is selected, it should follow a few general principles. In addition to the principles of comparable information density and minimum number of total symbols, we have defined the following general principles for typeface design:

The typeface should accentuate linguistically important elements and minimize the ink and space given to nondistinctive elements;

. Symbol elements should be kept simple to permit size reduction while maintaining legibility;

Symbols representing easily confused items (e.g., two similar handshapes) should be somewhat similar yet typographically distinct;

Those things that are always there (e.g., the palm of the hand) or that fall into the most common category (e.g., neutral signing space) need not be notated; i.e., there is a "default" value for many elements; and

White space should be recognized as an important and valuable element of the system.

Inventories--linguists' goals. In beginning the analysis of a new language, linguists' interests are focused on making the most complete inventory possible of the sounds used in that language. In the case of ASL, linguists beginning with Stokoe (1960) have suggested various inventories of the formational characteristics of the language. While analyses have varied, all seem to agree that handshapes, for instance, are one of the basic parameters of signs, and that any phonological or phonetic analysis of the language must account for handshapes. An absolutely complete inventory (phonetic) of the handshapes in ASL would be a very large one indeed. Yet such an inventory is in the interests of providing a complete description of any language and we provide below such a description of ASL handshapes..

For a writing system, however, we needed to provide a phonemic rather than a phonetic inventory, namely, those handshapes which are significant in signalling

meaningful changes in language forms, and those which speakers readily recognize as both different and important. Phonemes are those formational parts of language which can be written into rules that will predict the phonetic output of a speaker. Such rules are, of course, part of the grammar which exists in the mind of any competent user of any language. Such an inventory has, therefore, psychological reality for users, even though they may never become consciously aware of it. The impact of such language analysis on the community of users is typically minimal. That is, linguists can analyze any language without changing or influencing language use in the community. In positing an inventory to be used for a writing system, however, linguists present long-lasting implications for the community.

The social and political implications of literacy for any given language community are virtually immeasurable. For example, teachers of ASL and of sign language interpreters across the U.S. have been working for many years to gain academic recognition for ASL so that students could gain credit towards graduation and towards satisfaction of a foreign language requirement. These efforts have been stymied by certain factions within academia who are unable to expand their view of language. One of the arguments commonly used in opposition to ASL's status as a "foreign" language has been that "it has no literature." (Interestingly, this has been less effective on campuses where American Indian languages have taken their rightful places as separate languages.) Of course, the lack of a written form has not deterred Deaf people from creating a rich literature, but it has been restricted to videotape and before that to the "oral" tradition, in which stories, poetry, and linguistic games are maintained through live transmission from one person to another, much as in the African, Amerind, and Melanesian cultures mentioned above. A written form of ASL could provide the means of recording ASL literature in a more traditional fashion, easily recognizable as such by academics in literature and foreign language programs. Perhaps more importantly, a written form of ASL has the potential for revolutionizing educational programs for deaf youngsters.

For many years, a "bilingual" approach to education has been promoted as one with much potential for improving the academic success rate of deaf and hearing-impaired youngsters. Often, however, the term "bilingual" has simply meant that teachers and students were allowed to sign. Worse, the argument has been raised that these children, after all, must eventually become literate in English, so why "waste time" with ASL? With the introduction of written ASL, deaf children could become literate in their first language and enhance their potential abilities in written English at the same time. Textbooks in science, math, driver's education manuals, and sex education materials would be that much more effective if they were presented in ASL. Educators who truly believe in bilingual education for deaf children would have a tool of immense power. (See Woodward 1979 for a thorough discussion of these issues.)

It is for this reason that we have approached our task with more than normal caution, consulting with Deaf and hearing signers at every step. Too, for a writing system, we face much more serious constraints on the size of the inventory than we would in simply describing, for example, the handshapes, either phonetically or phonemically. For a writing system, economy is vital. The set of symbols must be small enough in number for use on a daily basis. Similarly, we should limit the inventory to those characteristic aspects which Deaf signers themselves recognize intuitively to be significant for the language. Variations which are strictly phonetically produced will run counter to users' intuitions and will over-burden the learner. Yet, we must include everything which Deaf signers feel is necessary to an adequate representation of the language. It is again for this reason that we have constantly consulted both Deaf and hearing signers as to the size and composition of our suggested inventories.

Previous handshape inventories. In the past, several analyses of handshape have been presented. Let us look at a few of these, and examine some of their differences and similarities. In 1960 and 1965, Stokoe presented the first attempt at a phonemic inventory of ASL. He includes nineteen handshapes: /A/, /B/, /5/, /C/, /E/, /F/, /G/, /H/, /I/, /K/, /L/, /3/, /O/, /R/, /V/, /W/, /X/, /Y/, and /8*/ (open 8). For

most of these cheremes (structurally equivalent to the phonemes of spoken language), Stokoe includes one or more allochers (conditioned variants). So, for example, under /A/, he includes [A], [S], [10], and [T]. In all, Stokoe's phonetic (allocheric) inventory includes forty-one handshapes.

Several years later, Klima and Bellugi (1979) presented another view of the phonetic/phonemic inventory of ASL. In their analysis, they present the same nineteen phonemes (as hand configuration primes) and forty "subprime" handshapes. Their subprime, or phonetic, handshapes are not identical to Stokoe's, nor are they distributed along the same lines. Still, the inventories are approximately the same.

Newkirk (1975) describes a possible orthography for ASL. His phonetically organized handshape inventory is symbolized by "handshape groups" consisting of phonemic bases plus optional diacritics for common features such as "angle," "curled," "extra finger," etc., and includes 54 shapes which in other inventories may be subsumed under other handshapes. Wilbur (1979) discusses Woodward's (1973) inventory, as well as Kegl and Wilbur's (1976) inventory. Both of these inventories are based on articulatory characteristics as well as tentative feature analyses. Woodward's inventory has 40 handshapes; Kegl and Wilbur's has 22. Friedman (1976) presents an inventory of 29 phonemic handshapes, but rejects the possibility of a feature analysis for ASL. Her phonetic (the same as Klima and Bellugi's subprime) inventory contains 50 handshapes.

Finally, in a recent proposal for a linguistic transcription system for ASL, Liddell and Johnson (1986) state that they include more than 150 handshapes in ASL. This is a strictly phonetic count, and they have a system of 13 binary features that will generate all of these. Their view of the phonology of ASL is strongly influenced by current theories of phonology, including auto-segmental attachment. While some of these inventories (Wilbur, Woodward, Klima & Bellugi, Friedman, and Stokoe) are strictly linguistic analyses, others (Newkirk, and Liddell & Johnson) have more pragmatic goals. As stated above, Newkirk was proposing an orthography for ASL.

Liddell and Johnson are proposing a transcription system, a means for linguists to write down, in a detailed fashion, what individual signs look like. Still, while elegance (for linguists, the notion of completeness with economy) has been a goal for each of these analyses, economy for a writing system can and sometimes will override the need for completeness.

A writing inventory. In our approach to assembling a handshape inventory for writing, we have been bound by a need to include the smallest possible number of tokens that is still adequate to represent signs. For example, it has been necessary for us to include enough handshapes to account for all numbers and for all handshapes that may be used for name signs. Similarly, we wanted people to be able to write fingerspelling handshapes. In an initial phonetic approach (still holding economy as a primary goal), we established a base of 84 handshapes (see Table 1). (Appendix A contains a complete description of these handshapes.) We use the following conventions in the symbols for these handshapes:

adding a wedge (x~) or an angle (x^) is usually "bent" or "angle," bent only at the knuckle ridge;
adding a colon (x:) is usually "curled," both first and second joints bent some;
adding a hyphen (x-) is "flat," first and second joints as straight as the context allows;
adding a period (x.) is "extra finger," usually thumb.

Beginning with the complete phonetic inventory of handshapes, we developed a smaller phonemic-level inventory of 40 items with which we believe it is possible to write all lexical signs, fingerspelling, name signs, numbers, and classifiers. Figure 1 presents this phonemic-level inventory for handshape and the actual SignFont symbols used to notate each handshape. We used several counterbalancing criteria to select items for the inventory. The first was that each item should be phonemic in ASL. The second criterion, however, was one of economy--each item

must carry a certain minimal functional load. Another criterion for inclusion was the impact the exclusion of marginal shapes might have on the utility of the system. For instance, the omission of /7/, although it figures only in numbers and rarely in lexical signs, would be difficult to justify. Similarly, /E/ is of marginal productivity in lexical signs, but its exclusion would damage the system's ability to encode name signs.

Finally, in some cases, such as /0-/, we included shapes which though possibly not phonemic are required because of historic or cultural importance in the signing community.

Figure 2 presents the forty phonemic-level handshapes together with the phonetic-level representatives within each phonemic group. The forty phonemic groups in Figure 2 do not represent a straightforward reshuffling of the phonetic-level shapes in Table 1. In ASL it is sometimes the case that one surface-level shape will arise from more than one phonemic source, for instance [3] from /3/ and /2/, [X#-] from /A/ and /X/, [B:] from /B/ and /C/, etc. The groupings in Figure 2 show the phonetic-level groups that function together phonemically.

The diacritics for "curled," "angle," "thumb extended," and "flat" used in Table 1 and Figure 2 indicate the frequent sharing among different handshapes of some common features. Often the phonetic shapes subsumed under a phonemic handshape are in free variation; at other times the appearance of one or another of the possible shapes is determined by the context in which the handshape is used.

In writing signs orthographically, such features should be notated when phonemically distinctive, either by the use of a diacritic or by using unique characters for phonemically distinct feature bundles. We have chosen in our preliminary design of a character set to use diacritics for four recurring features, in

TABLE 1: INITIAL PHONETIC INVENTORY (84 INDIVIDUAL HANDSHAPES)

/A/	[A], [10], [X#-]
/D/	[D], [bD]
/B/	[B], [B real], [B~], [B.], [B.~]
/5/	[5], [5~]
/0/	[O], [O-], [3#]
/C/	[C], [C.], [B:]
/C-/	[C-]
/4/	[4]
/5:/	[5:], [4:], [E:]
/E/	[E], [E-]
/S/	[S], [S@]
/1/	[1], [1~], [5 index]
/L/	[L], [L~]
/X/	[X], [1:], [L:]
/T/	[T], [T@]
/G real/	[G real]
/bC/	[bC]
/bO/	[bO], [bO-], [X#-]
/8/	[8], [8@]
/R/	[R], [R.], [R~]
/K/	[K], [Km]
/H/	[H], [H~], [H.], [H.~]
/H/	[H:], [H:.]
/N/	[N]
/V/	[V], [V~], [3], [5]
/V:/	[V:], [3:]
/3/	[3], [3#], [3#-]
/3:/	[3:]
/7/	[7], [7-.]
/W/	[W], [W:], [W~]
/M/	[M], [M~], [Mb]
/I/	[I], [I2]
/6/	[6]
/Y/	[Y], [Y~]
/]-/	[ ]-], [ ]-~]
/]-./	[ ]-.] [ ]-:.], [ ]-.~]
/F/	[F], [F@], [F#-]
/MF/	[MF]

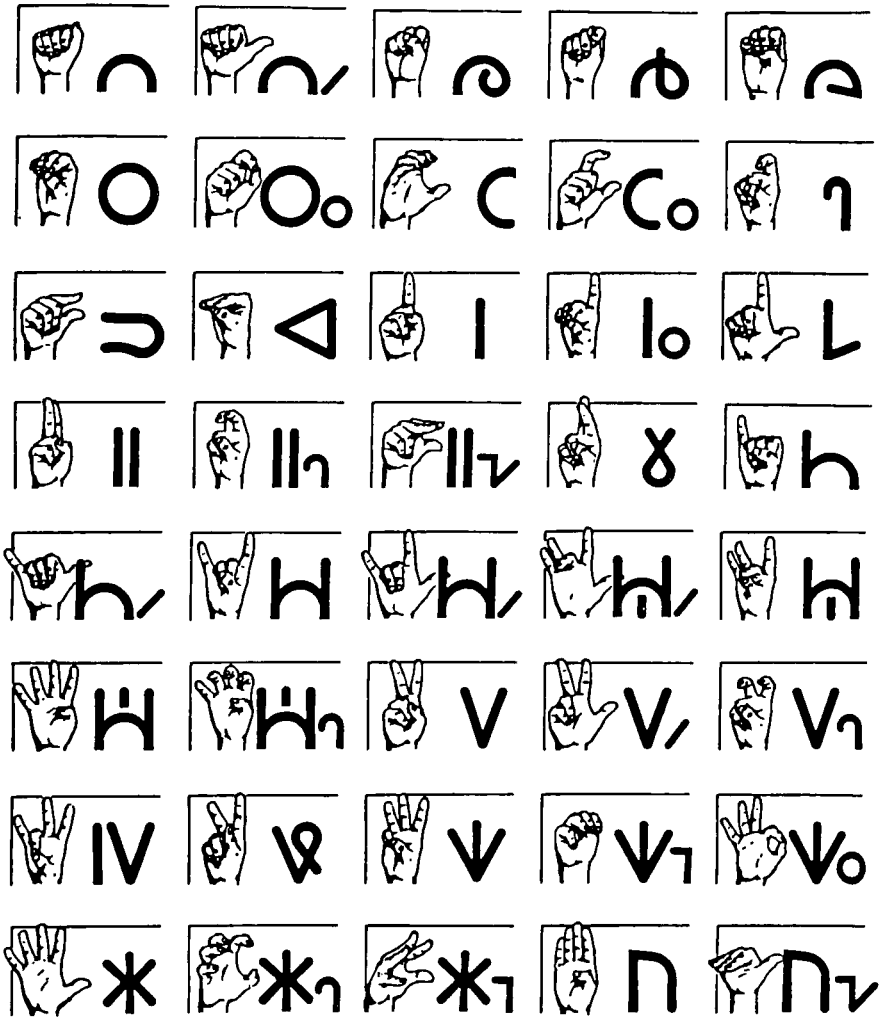


Figure 1 Proposed inventory of handshapes. The SignFont symbols for each handshape are presented together with illustrations of the handshapes.

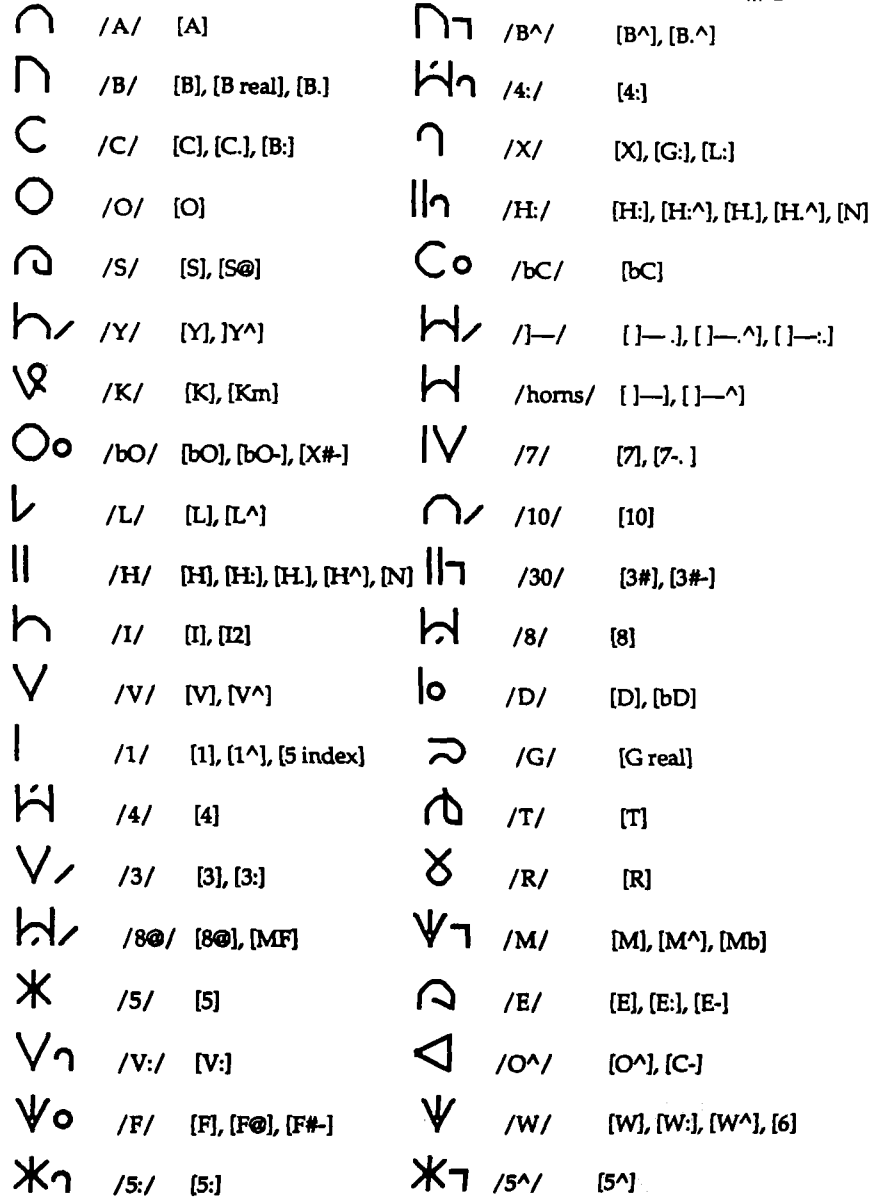


Figure 2 The proposed phonemic-level handshapes and the phonetic-level representations within each phonemic group. The SignFont symbols are presented to the left of each group.

QUESTION: yes/no, WH-word, and rhetorical.

NEGATION: includes all nonmanual negation markers.

EXCLAMATION: includes "assertion" and commands.

FOCUS: includes topics, conditionals, and relative clauses.

Adverbial Nonmanual Markers

CS: near in time or space. Scope varies from one sign to whole clause.

TH: carelessly, etc. Scope varies from one sign to whole clauses.

MM: normally, etc. Scope vaires from one sign to whole clauses.

"VERY": includes "puff cheeks", "EE', "intense", "pursed lips", "brr", "up", and both tongue flaps. Scope varies from one sign to whole clauses.

Discourse Nonmanual Markers

TURN TO DOMINANT SIDE: includes shoulders, face, or just eyes. Scope varies from one sign to whole sentences.

TURN TO NONDOMINANT SIDE: includes shoulders, face, or just eyes. Scope varies from one sign to whole sentences.

TURN UP: includes face or eyes. Scope varies from one sign to whole sentences.

TURN DOWN: includes face or eyes. Scope varies from one sign to whole sentences.

BODY BACK: body moves back, usually to the dominant side. Indicates a "special" time or place different from the place or time of the narrative. Scope varies from one sign to whole sentences.

Figure 3 Inventory of nonmanual markers. The SignFont symbols are presented to the left of each group.

order to minimize the number of unique characters required. We notate "curled," "angle," "thumb extended," and (somewhat broadly) "baby." The last-named diacritic distinguishes /b0/ from /0/ and /bC/ from /C/ rather neatly.

Faces: A Special Case

Facial expression in ASL functions in two distinct ways: to convey emotion, as it does in spoken language, and to mark certain specific grammatical structures. This dual functioning in ASL of similar facial behaviors presents some interesting challenges for a writing system. Let us look first at recent research on nonmanual behaviors.

Work by Baker and Padden (1978), Liddell (1978/1980, 1986), Coulter (1979) and Baker-Shenk (1983) has suggested that nonmanual behaviors are critical in marking certain grammatical structures in ASL. These findings indicate that facial signals in ASL function in basically two grammaticized ways. First, they mark specific syntactic structures, for example, topics, as in 1):

1) _____t
LIBRARY, ME GO-TO NOT-YET
"I haven't gone to the library yet"

A similar facial expression, but with a different scope and head tilt, constitutes the marker for conditionals, as in 2):

2) ____cond.
EAT BUG, SICK WILL YOU
"If you eat bugs, you'll get sick"

In 2), if the nonmanual marker were absent, the sentence would not be a conditional sentence. It is the presence and the exact scope of the facial marker that make this example a complex sentence with a subordinate clause. For example, the same

string of signs without the "cond." marker would read as a compound sentence, as in 2'):

2') EAT BUG, SICK WILL YOU
"You ate bugs and you're gonna get sick"

Other syntactic structures requiring facial markers are questions, e.g.:

3) _____ wh-q
WHO STEAL MY BOOK WHO
"Who stole my book?"

Secondly, certain facial behaviors represent adverbs which appear with a variety of predicates and carry with them specific meanings, as in 4) and 5). In 4), the facial configuration called "mm" means "effortlessly," "easily," "regularly":

4) _____mm
YESTERDAY ME SLEEP~SUNRISE
"Yesterday, I slept in"

In 5), the facial configuration called "th" means "awkwardly" or "carelessly," so that the same string of manual signs takes on a different meaning as a result of the different facial adverb:

5) _____th
YESTERDAY ME SLEEP~SUNRISE
"Yesterday, I overslept"

A third function of nonmanual gestures in ASL is facial signals which accompany particular lexical items, e.g., THROW-UP (which is normally accompanied by a protruding tongue) and SLEEP (which is accompanied by closed eyes). This category includes those lexical items representing affective states and

behaviors, e.g., CRY, LAUGH, and HAPPY. Many of these facial expressions which are linguistically required in ASL appear to be isomorphic with certain aspects of affective facial expressions.

Another set of nonmanual behaviors in ASL involves shifting the angle of head, shoulders, or simply eyes. Such shifting is used to indicate direct quotation, a change in characters in a narrative, or sometimes pronominal reference (Baker & Padden 1978). Often such a shift is the only indication of a shift in speaker identity (Baker & Cokely 1980).

Concerns in writing nonmanual behaviors. At first glance, it seems that the group of facial signals accompanying specific lexical items need not be shown in a written symbolic system. This would exclude affective facial signals and those items such as THROW-UP which need no "additional" written symbols. Yet, it might also eliminate at least one minimal pair, LATE/NOT-YET, in which the nonmanual signal accompanying the latter sign is the single distinguishing mark:

6) A: _____q B: ___neg+th
URSIE ARRIVE LATE vs. NOT-YET
"(Did) Ursie get here?" "(She's) late" vs. "Not yet"

It is not immediately apparent how crucial such a pair is. Yet if we write such lexeme-specific behaviors, there is no obvious cut-off for other items in this third category.

Does the NOT-YET/LATE pair differ from signs like THROW-UP? If so, how? First, the markers for NOT-YET ("neg" and "th") are both independently existing morphemes; the protruding tongue with THROW-UP or closed eyes with SLEEP, by contrast, are nonmorphemic. Rather, they are semi-iconic traces left over from a time when signs were more iconic in nature (Frishberg 1975). They often, as suggested above, are isomorphic with certain universal affective facial expressions.

Secondly, such facial behaviors are integral to the signs which they accompany, and do not co-occur with others, carrying some specific and consistent meaning with them. Other signs' co-occurring facial behaviors are usually affective in nature. They do carry meaning but it is paralinguistic, rather than linguistic in nature. Thus, signs for affective states often are said to "require" matching faces, so that signs for HAPPY, SURPRISE, and ANGRY, e.g., would co-occur with "happy," "surprised" and "angry" facial expressions. Yet these facial expressions do not carry linguistic meaning. They can be overridden by other affective facial expressions (anger at being surprised) or by grammatical facial behaviors (not surprised). Signs for affective states are thus not necessarily accompanied by the "matching" affective universal facial behavior. These facial behaviors can be properly understood as paralinguistic in nature and roughly equivalent to affective intonation in spoken English. (In this case, we can safely eliminate the necessity for including them in the written signal.)

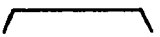
In some cases, grammatical (adverbial) facial behaviors become lexically attached to manual signs either directly or indirectly related in meaning. Thus, the sign RECENT has lexicalized the co-occurring "cs" morpheme which means "near in time or space." Going back to the original example, if we view the minimal pair LATE/NOT-YET in this category, we can take the facial markers attached to NOT-YET as morphological rather than lexeme-specific. ("Neg" and "th" will both certainly be in our inventory for nonmanual morphemes.) This means that we still need not concern ourselves with writing facial expressions in the latter group (which includes RECENT, LATE, and NOT-YET). This would eliminate having to write the nonmanual behaviors accompanying items such as SLEEP, HAPPY, TIRED, SEARCH, etc.

There are a few reasons why we want to do this. One is that it reduces the potential size of the inventory considerably (see below). Another is that the functions, as we have discussed, are not necessarily comparable between morphemic and syntactic facial markers and those which can be understood as more strictly affective and intonational in nature. Finally, the physical realization of

these different types of facial behaviors leads to a natural and obvious distinction between groups.

It has been suggested that grammatical facial behaviors in ASL share some characteristics with intonation in spoken languages. Similar to facial expression, intonation plays a variety of grammatical and paralinguistic roles, but although there are some overlapping functions, they are clearly not identical. For example, in hearing children some sentence intonation contours are acquired before the one-word stage (Weir, 1968). Nonmanual markers for topics and wh-questions, however, appear at about age three in Deaf children learning ASL as a first language (Reilly, McIntire & Bellugi in press-a). Full mastery of timing and scope take even longer. Further, conditional nonmanual marking still poses problems at age seven, three-and-one-half years after the first conditionals appear (Reilly, McIntire & Bellugi in press-b).

We should note here that despite their similarity, affective and linguistic facial behaviors differ significantly in their scope, contour and timing (Charlotte Baker-Shenk first made this observation). That is, grammatical facial behaviors have a very clear and specific onset and offset pattern and their coordination with manual signs is crucial in indicating the scope and function of such linguistic behaviors. Thus, linguistic nonmanual behaviors typically have "mesa-like" contours and sharp onset and offset, as in 7) below.



7) LAST-YEAR MY C-P-A TAX FIGURE-OUT

Affective facial actions, by contrast, are inconsistent and inconstant in their onset/offset patterns and in their apex shapes. Example 8) is one possible pattern for affective nonmanual behaviors out of a virtually infinite set:

8) TRUE++ ME EXCITE SEE-you

Linguistic facial behaviors are strictly rule-governed and their scope and shape are controlled by linguistic factors, not paralinguistic factors.

This leads to some interesting challenges for a writing system. In writing English, for example, one need not necessarily attend to intonation or stress. The occasional use of italics ("Not your gold bangle!") and the more common use of narrative techniques such as adverbial phrases ("...she said in a horrified tone...") are ways that the writer of English has of handling such problems of co-occurring features not naturally accounted for by the writing system. For ASL, however, no such tradition exists (although with a writing system, the possibility will be raised). Nonmanual adverbs may co-occur with a single sign or with an entire predicate phrase; such scope differences may critically affect the meaning. Somehow this writing system must be able to account for such variations in scope in a comfortable and readily teachable and learnable fashion.

Let us briefly review existing inventories for nonmanual facial signals, then present one for a writing system.

Preliminary nonmanual (facial) inventories: Baker and Cokely (1980) present an inventory of syntactic and morphological behaviors previously presented by other linguists, such as Liddell (1978/80), Baker and Padden (1978), and Coulter (1979).

SYNTACTIC

q "yes/no question"
{brows raised, eyes widened, head forward (plus head tilt or turn)}

wh-q "wh-word question"
{brows furrowed (plus head forward plus head tilt or turn)}

rhet-q "rhetorical question" {wh's only}
{brows raised, head turned (plus chin up)}

neg "negation"
{brows furrowed, head shake (plus frown or raised labio-nasal muscles and tightened or pursed lips)}

nod+tight lips "assertion"
{brows furrowed, tightened, pressed lips, head tilt}

t "topic"
{brows raised (plus head tilt or turned)}

cond. "conditional"
{brows raised, head turned, head forward (widened eyes)}

rel. cl. "relative clause"
{brows raised, raised labio-nasal muscles, mouth opened, chin up}

MORPHOLOGICAL

cs "very close to the present time"/"very close to a particular place"
{unilateral raised labio-nasal, mouth slightly open, head slightly tilted (ipsilaterally)}

th "without paying attention"/"carelessly"
{protruding tongue, mouth slightly open (plus head turned)}

mm "normally; regularly"/"things going along fine, as expected"
{lips funneled (plus wrinkled chin)}

puff cheeks "a lot; huge number of"/"large; huge"/"of great magnitude"
{brows raised, chin wrinkled, cheeks puffed, head turned}

intense "awfully large; surprisingly huge"/"of awfully great magnitude"/"to an unusually great degree"
{brows furrowed, raised labio-nasal muscles, lips tightened, mouth slightly open, head forward}

pursed lips "very small, thin, narrow"/"smooth"/"quickly; easily"
{lips tightened, mouth slightly open, lids drooping, voiceless ingressive}

sta "over and over again"/"too much; hard"
{brows furrowed, mouth slightly open to wider, head turned, voiceless alveolar stop-release}

pah, pow, cha meanings not yet clear

Anderson (1981) includes most of the above and adds two adverbs:
brr "distributive plural" {voiceless bi-labial fricative}
ap "shutting, closing"

and one grammatical (different analysis):

nonfinal "repetition"/"relative clause"/"rhetorical question"/"conditional"/"purpose clause."

Anderson does not specify what this "nonfinal" marker looks like, but (see above) it may be read as "raised eyebrows" plus some sort of head turn and/or tilt. This could be read as some sort of subordination marker, especially given Coulter's analysis (see below).

Davies (1985) adds two adverbs:

Qtf (quick tongue flap) "smooth"/"effortless"/"fluent"

Tf (tongue flap) "all-inclusive"/"all"/"everything"/"all the way"/"from beginning to end"/"from start to finish"

Qtf (quick tongue flap) occurs in conjunction with "instant actions" or predicates modified for rapidity. Tf (tongue flap--either lateral or horizontal) co-occurs with predicates of time, distance, or quantity. It appears to co-vary with "wiggle" (wiggle is only applied to signs formed with a "five" hand).

Coulter (1979) has a different analysis of certain recurring nonmanual signals:

raised brows "topic"	
lips spread "specific"	
wrinkled nose	"emphasis"
upper lip raised	"dislike"/"definite"
head nod and forward lean, eye contact	"question"/"command"

Coulter has collapsed the structures including relative clauses, goal clauses, partitives, hierarchical relations, conditionals, "when" adverbial clauses, and topics under the single rubric "topic." They are all background information, nonpresupposed, and sentence-initial. His analysis is tempting, possibly even correct, although Anderson's term, "nonfinal" may be more satisfying. Whether this means that it is the best analysis to surface in a writing system is still at issue.

We present below a very reduced set of nonmanual markers, which we feel is sufficient to capture in a writing system the necessary information signalled by nonmanual markers in ASL.

Our nonmanual inventory has 13 items. Figure 3 presents this inventory together with the SignFont symbols for each nonmanual marker. Four of the items are syntactic markers, four are adverbials, and five are head and posture shifts. The syntactic group includes the following: question, negation, exclamation, and focus.

"Question" functions like the question mark in written English, and represents a graphemic marker for all kinds of questions--"yes/no," "wh-" and "rhetorical;" "negation" marks negatives; "exclamation" is the graphemic marker used for commands, as in

9) FINISH! "Stop doing that!"

and assertions, as in

10) ME FINISH TOMORROW WILL!
"I'm going to finish up tomorrow (or else)!"

Finally, "focus" collapses topics, relative clauses, and conditionals.

The first three adverbial graphemes are fairly simple: cs, th, and mm (see above). The adverbial grapheme "very" encompasses "puff cheeks," "ee," "ap," and both tongue flaps.

The last group of nonmanual behaviors we call "body markers." These behaviors include postural or eye gaze shifts. Such shifts are used to mark a shift in character, time, or place, and are used to indicate direct quotation in narratives. The shoulders may shift to the right or left; the orientation of the face or the eyes may shift left, right, up, or down (or some combination); the upper body may shift back (usually to the dominant side).

---Figure 3 here---

SUMMARY

Our work on this project has involved treading a fine line between that which is linguistically complete and that which is functionally most efficient. The inventories presented for handshape and nonmanual markers comprise two out of a total of five

inventories that we have developed for writing down signs. We are currently refining inventories for location, contacting region, and movement. Although the notation of these aspects of signs form the basis of a separate report, we very briefly mention some directions taken.

In a number of ways, it seems clear the contacting region specified for the signing hand is more salient than the spatial orientation of the hand. For instance, there are restrictions on combinations of handshapes and contacting regions, but none specifically related to handshapes and orientations. Also, handshape assimilation processes in compound formation and sentential signing tend to preserve contacting regions more than any other features of handshapes. Furthermore, given the handshape of a sign and the contacting region involved, the spatial orientation of the hand in making the sign can be predicted.

For sign movement our analysis has brought us to a smaller inventory than those most often defined. Rules for the realization of movements in sequential and simultaneous application make the linear notation of movement possible. These same rules come into play in the notation of the myriad forms created by the elaborate inflectional system of ASL as well. We feel that this complete set of inventories should provide an adequate basis for an ASL orthography.

We have presented here two possible inventories for writing down signs, one inventory for handshape, the other for nonmanual markers. We have been guided by trying to formulate a phonemic analysis of these two formational aspects of the language. The better the match between the orthography and the linguistic structure, the more efficient and effective the writing system will be. Given that we cannot write every physical detail of every sign unfolding over time, decisions must be made about what to include and what to leave out. The more those decisions are based on the linguistic structure of sign, the better the system will capture relevant information, and thus the greater the likelihood of producing a learnable, usable writing system for sign. Analyzing sign for the purpose of creating a writing system, however, implies a different set of goals from those usually assumed for a

linguistic analysis. To make the system "writable" and "learnable," we needed to limit the number of distinct symbols used. This raises the possibility that some distinctive attributes of sign may not be represented. On the other hand, some forms that are phonetically predictable in a linguistic sense may seem intuitively very distinct to signers. Such forms may need separate representation (and hence an increased number of symbols) simply because learning the linguistic predictability is too confusing for most people.

American Sign Language does not now have a commonly accepted written form. The development of an orthography for a visual-gestural language will resolve some long-standing issues in sign notation, will open up new investigations into processes of reading, and will allow deaf signers to be able to read and write in their native language. Furthermore, it would lend credibility to sign language to people outside of the linguistic and Deaf communities.

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APPENDIX A: Phonetic Handshapes in ASL

/**A**/ represents a group of fist handshapes exemplified by the fingerspelling letter A. Surface forms include the following:

[10] as in GASOLINE. This is chosen when contact is tips, or when the number 10 is intended;

[X#-] as in APPLE. This is written with X because the index finger is extended and curled. The thumb fits inside the crooked index finger. This shape is chosen when there is knuckle contact with /**S**/;

[A] as in WASH. This is the basic fingerspelling shape with the thumb alongside the index finger. It is used whenever one of the other variants is not chosen.

/**D**/ stands for the fingerspelling letter D and subsumes two physical forms:

[D] as in DOCTOR. This has the ring and little fingers extended parallel to and forming the contacting region along with the middle finger;

[bD] is a dialectic variant of **[D]** in all positions, and is selected in dialects with **[D]** predominant when in the context of handshapes such as /**N**/ in fingerspelling, etc.

/**B**/ represents the general set of flat open handshapes with the fingers compact (not spread). It is realized in the following variants:

[B] as in PRAISE. The thumb may be kept parallel and touching the index-finger edge of the palm;

[B real] is the fingerspelling B with the thumb tucked into the palm. It appears in signs where there is extensive contact along the radial edge, as in DOOR or FLOOR, where the thumb might get into the way if extended;

[B~] is the angled B of LIAR, where the thumb is tucked into the palm. Note that this is the shape used in many /**M**/ signs, and arises from **[Mb]** when the little finger remains extended with the three significant fingers in /**M**/;

[B.] is B with the anchoring thumb extension, as in the beginning shape of STUBBORN. It occurs also in signs with radial contact, as in SHARE (alternating with **[B real]**), and in BOTHER;

[B.~] is angle-B with the thumb out, as in HAVE. The angle shape arises from the tip contact directed inward to the chest, and the thumb extension merely gets it out of the way.

/**5**/ is the class of flat open hands with the fingers spread apart:

[5~] is angle-5, which occurs in signs such as MAKE-A-VIDEOTAPE and VACUUM, and arises from the combination of 5 = = >0 handshape closing, which has been reduced by reduplication in a derivational process. It also appears optionally in FIVE-THOUSAND, where the **[B~]** (from **[Mb]** from /**M**/) of THOUSAND assimilates the (spread) feature value from /**5**/;

[5] is the number 5, the basic shape which occurs most everywhere else, as in VAGUE, TREE, or MOTHER.

/**O**/ is the fingerspelling letter O. It occurs in three alternatives:

[O-] is the flattened version found in MONEY and DEVELOP-FILM, and in some renderings of TEACH. Although contact with the back of the hand, as in MONEY, requires this shape to be chosen, it may vary with **[O]** in most contexts;

[O] is the basic rounded form found elsewhere, as in MORE or NONE;

[3#] is the closed handshape in THIRTY. It occurs as an alternate of /**O**/ (zero) in the context of two-finger shapes such as /**N**/ in fingerspelling and /**3**/ in counting. "D-O-N" is [bD]-[3#]-[N]. THIRTY is [3]-[3#].

/**C**/ is the fingerspelling letter C. Its variants are based on the position of the thumb:

[B:] is a rounded B, identical to **[C]** except that the thumb is brought into the palm alongside the index finger. It appears in ENGLISH, for instance, where the grasping function of /**C**/ is performed without the involvement of the thumb;

[C.] is like /**C**/, except that the thumb is parallel to the palmar plane. It occurs when there is thumb contact with a /**C**/, as in the first part of WIFE;

[C] is the basic fingerspelling shape, is in LIMOUSINE, POLICEMAN, or CUP, and occurs whenever one of the others is not selected.

/**C-**/ is a flat classifier shape, as in SMILE, which can be described as a **[B~]**, the angle-B, with the thumb extended perpendicular to the palm (therefore parallel with the other four fingers). Note that some signers use this shape in contexts where others use **[C]**, as in CHURCH.

/**4**/ is the number FOUR, as in IGNORE.

/**5:**/ is the clawed handshape group:

[5:] is the basic claw, as in ELABORATE;

[4:] is the claw with the thumb tucked into the palm, as in SIT-IN-A- CIRCLE;

[E:] is a very tight claw, which may be a distorted /**E**/. It occurs in such signs as SCREAM (in some signers' usage), and as fingerspelled E in the northeastern U.S.

/**E**/ is the fingerspelling letter E:

[E] is the basic shape, as in ELEVATOR;

[E-] is distorted by untucking the four fingers slightly, opening a gap between their tips and the edge of the thumb. It occurs as the beginning handshape in signs such as BE-TIGHT-WITH-MONEY.

/**S**/ is the fingerspelling letter S:

[S@] is open-S, a phonetic variant found in signs where the /S/ opens to /**5**/, as in MANY;

[S] is the basic S shape, as in SHOES.

/1/ is the number ONE and other handshapes with the index finger prominent:

[1] is the basic number 1, found in many classifier signs. It also is both the active and base shape in SPECIFIC;

[1~] is angle-1, where the index finger bends straight from the knuckle ridge, as in ME or WE, where the tip contact is directed to the chest (and in other such contexts);

[5 index] is the shape **[5]** acting as a **[1]**, in that index-finger contact alone is used. Index contact is normally disallowed with the shape /**5**/, but allowed when the shape arises through assimilation processes. In the example MEAN/CRUEL, a complicated history has left **[5 index]** as the starting shape.

FIVE-CENTS is a clear example of handshape hybridization leading to the otherwise disallowed index tip contact in **[5]**.

/**L**/ is the fingerspelling letter L:

[L] is the basic shape, as in LAW or HAIR-DRYER, with the index finger straight and extended parallel to palm, and the thumb likewise straight and parallel to the palm;

[L~] is angle-L, where the index finger is bent straight from the knuckle ridge, and is perpendicular to the palm. It occurs in signs such as TAKE-TURNS, or all forms of LATER, where change of orientation can be visually augmented by the bending of the index finger. In these signs, the index finger can start out bent.

/**X**/ is the fingerspelling letter X:

[X] is the basic shape, as in MUST. When there is tip contact, it occurs in the second segment of the index finger, as in TAXES;

[1:] is curled-1, as in TIME. Note that tip contact here is actually at the tip. This usage occurs whenever there is actual tip contact with what looks like /**X**/; the shape appears to derive historically, however, from /1/

[L:] is like fingerspelling L, but with the index finger curled as in **[X]**. The thumb is extended parallel to the palm, and is often used in anchoring, as in WHO. Also has thumb contact in NOT-HAVE-TO, etc. Occurs as a form of visual stress augmentation of /**L**/ in LARGE.

/**T**/ is the fingerspelling letter T:

[T] is the basic shape, as in TUESDAY;

[T@] is a relaxed form of [T], with the index finger contacting the thumb at the nail, appearing in some signers' renditions of signs such as QUICK, where the thumb is flicked out from under the index finger.

/**G real**/ is like the fingerspelling letter G, and is a classifier shape usually, as in WORD. It alternates with **[1]** in initialized signs such as GUILTY.

/**bC**/ is a classifier shape, as in SHERIFF or MOON, and is like /**C**/ except that it uses only the index finger and thumb. The index finger is curled as in /**X**/, while the thumb is extended parallel to the index finger. This shape differs from /**G real**/ in the shape of the index finger.

/**bO**/ is like the fingerspelling letter O, except that it uses only the index finger and thumb:

[bO] is the basic rounded shape, as in PERIOD. It may occur in all contexts where the phonemic shape is called for;

[bO-] occurs in sequences with /**G real**/, such as BIRD, where the index finger is straight to begin with. It is a flattened version of /bO/;

[X#-], described under /**A**/ above, is a very tight version of /**bO**/, and may occur when there is tip contact, as in WRITE.

/**8**/ is the number 8:

[8] is the basic shape, as in HATE or AGE-EIGHT. It is used in number signs, and in sequences opening to **[5]** or **[8@]**, though here the thumb may overlap the middle fingernail slightly, rather than contact tip-to-tip;

[8@] is open-8, the "feeling" handshape, found in FEEL, NUDE, or TELEGRAPH.

/**R**/ is the fingerspelling letter R:

[R] is the basic shape, with the thumb folded in over the ring finger;

[R.] has the thumb extended, and occurs in signs with anchoring thumb contact, as in RETIRED;

[R~] is angle-R, and occurs in signs such as ROPE, where the fingertips make contact (cf. **[H~]** in BACON, etc.).

/**K**/ is the fingerspelling letters K and P;

[K] is the basic shape, as in KEEP or PEOPLE;

[Km] is a dialectic variant where the ring and little fingers are extended along with the middle finger, and become part of the contacting region (the alternation of **[Km]** with **[K]** is similar to that of **[D]** with **[bD]** and **[O]** with **[bO]**).

/**H**/ is the fingerspelling letter H and a related group of two-finger shapes:

[H] is the basic shape, as in HONEST or TRAIN;

[H~] is angle-H, as in BACON, where the two fingers are bent straight from the knuckle ridge;

[H.] is the basic shape with the thumb extended, as in PAINT-A-PICTURE. It occurs in signs with anchoring thumb contact, as in the start of HORSE. It varies with **[H]** in many contexts, as in INNOCENT;

[H.~] is angle-H with the thumb extended. It occurs as the ending shape in HORSE, and freely in #HA-HA.

/**H:**/ is curled-H, which is a two-finger shape group like /**H**/, but with the fingers curled at first and second joints:

[H:] is the basic shape as in FLYING-SAUCER. Note that the thumb is extended with the fingers;

[H:.] is the basic shape but with the thumb extended parallel to the palm. It is a free variant of **[H:]**. FLYING-SAUCER is often signed with this shape.

/**N**/ is the fingerspelling letter N, as in NOBLE. Signs in /**N**/ are usually formed with **[H~]**.

/**V**/ is the fingerspelling letter V:

[V] is the basic shape, as in VISIT.

[V~] is angle-V. It usually arises from tip contacting region use, as in LOOK-AT, FORK, and GOOD-SPORT;

[3] is the same as **[V]**, but with the thumb extended, as in SMOKE-CIGARETTE. It is in free variation with **[V]** in all signs where the thumb will not get into the way. It does not occur where radial contact is called for;

[5] varies with **[V]** in base hands calling for between-adjacent-fingers contact, as in START.

/**V:**/ is bent-V:

[V:] is the basic shape, with the thumb in, as in STRICT, HARD, and IMPASSE;

[3:] is a free variant of **[V:]**, as in PROBLEM, wherever the thumb will not get into the way.

/**3**/ is the number 3, and the vehicle classifier:

[3] is the basic shape, as in SHIP, GARAGE, or THREE-WEEKS.

[3#] is the ending shape in THIRTY. It is listed here because it is a predicted outcome of clustering /**3**/ with handshape-closing movement;

[3#-] is the ending handshape in DUCK, a flattened form of **[3#]**. It is a predicted outcome of clustering /**3**/ with handshape closing movement. Notice that this flattened form is the more usual in signs where numbers are not involved.

/**3:**/ is bent-3, as in INSECT or DEVIL.

/**7**/ is the number SEVEN:

[7] is the basic shape, and occurs in number-incorporating signs such as SEVEN-YEARS-OLD;

[7-.] is open-7, and is phonetically to /**7**/ what **[8@]** is to /**8**/, except that the index and middle fingers are touching. It is probably derived from /**H**/, and occurs in the signs such as HOLIER-THAN-THOU ("goody-goody"), and in pinkie-affected signs such as INNOCENT, where the relation to /**H**/ is clearer.

/**W**/ is the fingerspelling letter W and the number 6. Notice that the conservative distinction in form between the two usages (thumb overlapping little fingernail in W, thumb tip touching little fingertip in 6) may be totally lost in sentential signing:

[W] is the basic shape, as in WORLD;

[W:] is bent-W, as in WEIRD;

[W~] is angle-W. This arises from W in signs such as WAR, where the tips face each other.

/**M**/ is the fingerspelling letter M:

[M] is the basic shape, and occurs most often in carefully signed name signs. It often occurs in MONDAY;

[M~] is angle-M, where the index, middle, and ring fingers are straight rather than curled, and bent from the knuckle ridge. This shape gives support to tip contact. This is the usual form of the handshape in all contexts;

[Mb] is a distorted form of angle-M, where the index, middle, and ring fingers are extended straight in the plane of the palm. The thumb is tucked into the plane, and the little finger is retracted, and may even be held down by the thumb. This is a very tense handshape, and occurs in some initialized signs such as MEDICINE (from FSL MEDICIN "doctor") where the hint of M is desired. The shape has been replaced by forms of /**B**/ in most instances.

/**I**/ is the fingerspelling letter I:

[I] is the basic shape, where the thumb is wrapped around the index, middle, and ring fingers, as in I, EGOTISTICAL, and DRAW;

[I2] is the same as **[I]** except that the thumb is relaxed and laid along the radial edge of the hand, as in **[A]**. This occurs freely varying with **[I]** for many signers, and surprisingly in the sign INCH (from MEASURE, with initialization from /**Y**/) with radial contact.

/**6**/ is the number 6, as in SIX-MONTH, SIX-WEEK, discussed under /**W**/ as differing from the latter by having the thumb tip contacting the pinkie tip, in contrast to forms of **[W]** where the thumb pad overlaps the pinkie fingernail.

/**Y**/ is the fingerspelling letter Y:

[Y] is the basic shape, as in THAT or YELLOW;

[Y~] is angle-Y, where the thumb and pinkie are extended perpendicular to, rather than parallel to the palm. It occurs where there is tip contact on both the thumb and pinkie, as in BIG-WORD or HIPPO.

/]- / is the "horns" handshape:

[ ]- is the basic shape, as in CIGARETTE or MOCK;

[ ]-~] is angle-horns, as in the end of TENT, where the movement is augmented visually by having the fingers bend.

/]-. / is the ILY handshape:

[ ]-. is the basic shape, as in AIRPLANE-LAND;

[ ]-.~] is angle-ILY, as in AIRPLANE, where the use of the index finger as significant digit in the movement is called for;

[ ]-:.] is bent ILY, as in ETC., where the curled index finger is called for by the wiggling movement (cf. **[W:]** in WEIRD).

/**F**/ is the fingerspelling letter F and the number 9:

[F] is the basic shape, as in PREACH, FREE, and CHAIN;

[F@] is open-F, the beginning shape in PICK, the ending shape in DISCONNECT. Notice that it occurs only in signs where there is a sequence including the complementary closed **[F]** shape as well, though this may be interrupted in at least one inflection);

[F#-] is flat F, which occurs phonetically in signs such as MEAT where the object grasped is flat.

/**MF**/ is the middle finger used as a separate handshape. It differs from /**G**/ only minimally, and occurs only in signs of socially restricted status.

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