SINGLE FINGER EXTENSION:
For a Theory of Naturalness in Sign Language Phonology

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Introduction. Linguists investigating American Sign Language have expressed interest in a theory of marking for sign language phonology; i.e. a level of sublexical structure in sign language analogous to but not dependent on the phonological components of spoken languages. Battison (1974) and Siple (1978) are notable pioneers in research on physiological constraints on signs. Lane, Boyes-Braem, and Bellugi (1976) and Poizner and Lane (1978) have attempted to find perceptual bases for similarities in formational aspects and to develop a feature analysis of handshapes and location based on tests of perception of a visually degraded signal. Frishberg (1975) and others (Woodward & Erting 1975, Woodward & De Santis 1977) have shown that signs in American Sign Language (ASL) and French Sign Language undergo natural language change comparable to marking in spoken languages. Boyes (1973) proposed a four-stage model in her study

 ISSN 0302-1475 37:289 1.50

of handshape acquisition in ASL. McIntire (1974, 1977) retained the notion of four stages but found a somewhat different set of handshapes in the stages of the child she studied.

However, as De Santis (1980) has pointed out, much of this data is based on White middle class linguistic consultants' production. In addition, most studies have used the data from the performance of only one or two consultants. De Santis (op. cit.) and Woodward (1978a) have attempted to expand studies of marking by looking at certain locations and handshapes across nine different sign languages from five different sign language groups.

In this paper, I will examine handshapes with single finger extension in data from ten different sign languages. A summary of the sources of data and information on the relationships among the languages follows. Table 1 shows the ten languages, the sources, and the number of lexical signs included in each source. It should be noted that not all these sources of sign language data were collected by trained linguists. The most trustworthy data (with regard to form and not necessarily meaning of signs) is from Providence Island, India, Rennell Island, and the U.S. and French Deaf communities; these languages have been investigated by trained linguists. Regardless of the investigators' disciplinary perspectives, however, the data from all ten languages show the same patterns and similar frequencies of handshape formation.

The French group is the best researched. Old French Sign Language (FSL) was used until about 1880, at which time it was forced underground by mandatory oral educational practices and the prohibition of deaf instructors in French schools. Modern French Sign Language is a highly restructured version of Old FSL. American Sign Language is historically related to Old FSL, but there is evidence to support a heavy language mixture and the possible creolization of Old FSL with indigenous varieties of ASL in the U.S. ca. 1817, the date of Clerc's arrival (Woodward 1978b). Von der Lieth (1976) points out that Swedish and Finnish Sign Languages are related to Old FSL; however, modern FSL, ASL, Swedish, and Finnish Sign Languages are not mutually intelligible (See Jordan & Battison 1976 and Battison & Jordan 1976 for a discussion of inter sign language intelligibility).

Language	Source	No. Lexical Entries
1 American	Stokoe et al. (1)	1692
2 Australian	Jeanes et al.	919
3 British	Brit. Deaf Assn.	325
4 Finnish	Sign Lang. Comm.	2974
5 French	Oleron(2)	872
6 Japanese	Jap. Dict. Signs	1078
7 Providence Is.	Field Data '77	1035
8 Rennell Is.	Kuschel	217
9 Swedish	Bjurgate	2541
10 Indian	Vasishta et al.	896

Table 1. Languages and sources of data, with number of lexical entries.

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(1) Personal name signs excluded.
(2) See also linguistic studies by Woodward (1976) and Frishberg (1975).

Table 2 shows hypothesized relationships among the languages. The ten are shown in six groups:

French, British, Asian, Indigenous 1, Indigenous 2, and Unknown Affiliation.

French:	American, Finnish, French, Swedish
British:	Australian, British
Asian:	Japanese
Indig 1:	Providence Island
Indig 2:	Rennell Island
Unknown:	Indian (Delhi)

Table 2. Hypothesized relationships among the ten sign languages.

The British Sign Language group may have a tenuous connection with FSL, but is viewed primarily as a separate group of historically related sign languages distinct from the FSL group. Stokoe (in Stokoe et al. 1965) reports much more difficulty in establishing communication with British signers than with French signers, when he used only ASL. It is important to distinguish communication between signers from mutual intelligibility of sign languages; communication between signers of unrelated languages may occur beyond any mutual intelligibility because of a general flexibility on the part of deaf people to modify their own signing, to create spontaneous hybrids or pidgins, or to resort to pantomime (Battison & Jordan 1976).

Japanese Sign Language is not related historically to the French or British groups, although it appears to have some connection with Hong Kong and Taiwan signing.

Indigenous sign languages are those used by isolated groups who have had no direct contact with users of other sign languages. Providence Island, in the Caribbean, is very isolated and has three to four times the expected deaf population. (A rule of thumb posits one or two deaf persons per one thousand of population). There are at least seventeen deaf people in a total population of approximately three thousand on Providence (Washabaugh, Woodward, & De Santis 1978). In addition, it has a different sign language from mainland Colombia, to which it belongs. The other indigenous sign language, reported by Kuschel (1974), in contrast to that of Providence Island, is used by only one deaf man, and his hearing companions on Rennell Island in the Pacific.

Indian Sign Language (the sign language of deaf people in India), though slightly influenced by British and American Sign Languages, definitely belongs to a different group from any of the other languages discussed in this paper (Vasishta, Woodward, & De Santis 1980).

With this body of data from ten sign languages, I will examine the relative frequencies of occurrence of handshapes with single finger extension. While it is possible to extend the index finger or any of the other fingers singly, not all sign languages make use of these four different handshapes in forming their signs. In addition, there seems to be a developmental order in which handshapes using these finger extensions may be acquired. Boyes (1973) proposed a four-stage model of handshape acquisition in ASL. McIntire (1974,

1977) retained the notion of four stages but found somewhat different handshapes in each stage. Single finger extended (commonly referred to as a 'G' handshape) is learned very early, in both investigators' "stage one." Little finger only extended (commonly referred to as an 'I' handshape) is learned comparatively late, in "stage three."

These stages represent a hypothesis about marking, in that the earliest stages should have the least marked (i.e. least complex) handshapes, while the later stages should have more marked (more complex) handshapes. I hypothesize here that if these stages of language acquisition do represent levels of relative complexity, then comparative data across sign language should also reflect similar distribution; i.e. if a sign language has handshapes that are marked, it should also have unmarked handshapes; but the presence of unmarked handshapes does not imply the presence of marked handshapes (either in a language or in an infant's stage of handshape acquisition).

Data from ASL suggest that handshapes with mid finger or ring finger extension should be more marked than either the pinky ('I') hand or the index ('G') hand. In addition, we can suspect that pinky hand is more marked than index because pinky hand is acquired later than index hand. To test these hypotheses and find out whether mid is more or less marked than ring, we need to look at what occurs in the other nine sign languages we have data for.

Analysis. Tables 3a and 3b show the results of an analysis of single finger extension handshapes in the signs of ten sign languages. There is an implicational ordering for the occurrence of handshape; i.e. if the sign language has signs using ring finger extended handshape, then it will have handshapes with mid finger extension, and the presence of mid finger extension implies little finger extension, which in turn implies the presence of handshapes with index finger extended. Note that there is not only an implicational order, but also the actual frequency of use is implicational, so that index hand is more frequent than pinky hand, which is more frequent than mid finger hand, etc. There are no exceptions to this pattern; the data are 100 % scalable.

Handshapes in a leftward column of Tables 3a and 3b are less marked (more natural) than those in columns to the right. Percentages across sign languages are also fairly consistent. Ring finger hand is extremely marked (complex), because it occurs in only one of the languages. Mid finger hand is only slightly less marked. With the exception of Providence Island Sign Language, which probably does not have a phonological unit of pinky extension, little finger extension (the next less marked) is found in a small proportion of the signs of the ten languages; from 0.5 % to 2.0 % of their signs use the pinky hand. Index finger extension is obviously much less marked, as it occurs in from 12 to 23 percent of the signs.

The relative marking of these handshapes also holds in correlations with the number of locations in which these handshapes can occur. Table 4 shows this possible relationship of handshape and

Table 3a. Actual Frequencies of Handshapes (all signs included).

Sign Language	Number of Lexical Entries	Index	Pinky	Mid	Ring
Japanese	1,078	22.6%	.5%	.4%	.4%
British	325	18.5%	1.2%	.9%	0
Australian	919	14.7%	2.0%	.1%	0
French	872	12.7%	.8%	0	0
American	1,692	14.6%	1.5%	0	0
Finnish	2,974	18.2%	.5%	0	0
Indian	896	19.8%	.7%	0	0
Swedish	2,541	16.7%	.7%	0	0
Rennell Is.	217	16.6%	.5%	0	0
Providence Is.	1,035	21.6%	0*	0	0

*Only one sign, the less commonly used variant of BET in Providence Island Sign Language makes use of an "I" handshape. This sign is obviously borrowed from a hearing gesture made while betting. It may be possible to generate the phonetic "I" from an underlying "G" handshape. At any rate there is no formal contrast through minimal pairs between index and pinky in Providence Island Sign Language.

Table 3b. Actual Frequencies of Handshapes (Signs borrowed from oral language excluded).

Sign Language	Number of Lexical Entries	Index	Pinky	Mid	Ring
Japanese	1,078	22.6%	.5%	.4%	.4%
British	325	18.5%	1.2%	.9%	0
Australian	919	14.5%	1.7%	.1%	0
French	872	12.7%	.2%	0	0
American	1,692	14.3%	.5%	0	0
Finnish	2,974	18.2%	.4%	0	0
Indian	896	19.2%	.4%	0	0
Swedish	2,541	16.7%	.7%	0	0
Rennell Island	217	16.6%	.5%	0	0
Providence Is.	1,035	21.6%	0*	0	0

*See note in Table 3a.

location. There is a clear implicational pattern to be seen in Table 4: if a handshape can occur on the arm it can occur on the trunk; if it can occur on the trunk it can also occur on the face; and if it can occur on the face it can occur on the hands or in zero tab. In summary, if a handshape can occur in a more marked location, it tends also to occur in a less marked location (De Santis 1980).

Group	Hands or zero tab	Face	Trunk	Arm
0	-	-	-	-
1	+	-	-	-
2	+	+	-	-
3	+	+	+	-
4	+	+	+	+

Table 4. Possible locations for handshapes.

The data fit this implication. Table 5 shows the actual correlation of handshape (uninitialized) with location. There are no exceptions to this pattern; it is 100 % scalable. In addition to this regularity, it is also possible to set up another implication based on the group number. Table 6 shows this relationship.

Again there are no exceptions to this pattern, which is also 100 % scalable. This implicational pattern means that in each sign language, signs with single index finger extension can occur in more locations than can signs with little finger extension, which in turn can occur in more locations than signs with single mid finger extension, etc.

Group	Hand or zero	Face	Trunk	Arm	Handshape	Language
4	+	+	+	+	index	Japanese
4	+	+	+	–	index	British
4	+	+	+	+	index	Australian
4	+	+	+	+	index	French
4	+	+	+	+	index	American
4	+	+	+	+	index	Finnish
4	+	+	+	+	index	Indian
4	+	+	+	+	index	Swedish
4	+	+	+	+	index	Rennell Is.
4	+	+	+	+	index	Providence Is.
2	+	+	–	–	pinky	Japanese
2	+	+	–	–	pinky	British
2	+	+	–	–	pinky	Australian
1	+	–	–	–	pinky	French
2	+	+	–	–	pinky	American
2	+	+	–	–	pinky	Finnish
1	+	–	–	–	pinky	Indian
2	+	+	–	–	pinky	Swedish
1	+	–	–	–	pinky	Rennell Is.
1	+	–	–	–	pinky	Providence Is.
1	+	–	–	–	mid	Japanese
2	+	+	–	–	mid	British
1	+	–	–	–	mid	Australian
1	+	–	–	–	ring	Japanese

Table 5. Actual correlation of handshape with location.

Language	Index	Pinky	Mid	Ring
Japanese	4	2	1	1
British	3	2	2	0
Australian	4	2	1	0
French	4	1	0	0
American	4	2	0	0
Finnish	4	2	0	0
Indian	4	1	0	0
Swedish	4	1	0	0
Rennell Island	4	1	0	0
Providence Island	4	1	0	0

Table 6. Implicational grouping of location across handshape.

Explaining marking. I propose the following features for explaining the difference between the single finger extension handshapes (index, pinky, mid, and ring finger): +central and +ulnar. Table 7 shows these features as they apply to the handshapes. It is obvious that central is a more heavily weighted feature than ulnar, since both index and pinky, the least marked handshapes, are -central. Mid and ring finger hands have the marked characteristic of +central. A handshape that is -ulnar is less marked than the corresponding +ulnar handshape (index vs. pinky; mid vs. ring). Assigning an 'm' (marked) characteristic to +central and +ulnar, we obtain the information displayed in Table 8.

Index	Pinky	Mid	Ring
-central	-central	+central	+central
-ulnar	+ulnar	-ulnar	+ulnar

Table 7. Features on handshapes.

Index	Pinky	Mid	Ring
		m central	m central
	m ulnar		m ulnar

Table 8. Weighted features on handshapes.

These features can only be considered tentative until tested by further linguistic analysis and by anatomical-linguistic research.

Conclusion The analysis of these data shows that a theory of marking can be developed for sign languages along the same lines as those for spoken languages--only the particular physiology is different. Our data show the same trends as those found by Greenberg (1966); i.e. the occurrence of more marked (complex) units will imply the occurrence of less marked (more natural) units, and more complex units will be less frequent than less marked ones. We have seen for example that languages with the feature +central will also have the feature -central, and that there are a much larger number of -central handshapes than +central handshapes. In addition, +ulnar handshapes are more marked than are -ulnar handshapes. The earlier data from the limited studies of child language acquisition of American Sign Language also indicate that +ulnar handshapes are learned much later than their -ulnar counterparts. Moreover, there is no historical evidence to suggest that any unmarked handshape has become marked through natural language change--unless through assimilation, which overrides marking constraints. (Borrowing from spoken languages is excluded from natural language change.) Thus, as expected in marking theory, forms that are most complex will tend to be statistically less frequent, learned later by children, and more subject to historical change.

Much more research is obviously needed, especially comparative data from widely diverse sign languages, before a true theory of marking can be developed for sign language phonology. However, such pieces as we are able to fit together at this time suggest a strongly ordered hierarchy of marking for sign language handshapes, and point to a natural theory of phonology for all sign languages. I hope in future work to compare other individual features for complexity and naturalness and to interrelate these features in marking matrices.

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