Robson, Barbara. 1972. Community vs. individual competence: English /h/ in Jamaican Creole. In: From soundstream to discourse. Edited by D. G. Hays and D. M. Lance. Topeka, University of Missouri Press.

_____. 1973. Pan-lectal grammars and adult language change. In: New ways of analyzing variation in English. Edited by R. W. Shuy and C.-J. N. Bailey. Washington, D. C., Georgetown University Press. 164-170.

# A GOOD RULE OF THUMB: VARIABLE PHONOLOGY IN AMERICAN SIGN LANGUAGE

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Introduction. Knowing that modern linguistics owes much to a centuries-old tradition of phonology, it may be difficult to understand why interest in sign languages of the deaf has focussed primarily on syntax, and has tended to ignore the form of the signs themselves. There are three principal reasons.

First, superficial examination of these very special languages has tended to perpetuate the myths that they are auxiliaries to spoken languages, are ideographic, lack duality of patterning, or are even universal. Hence, one would reason that it would be of interest only to study the order of signs in sentences and make some comparisons to speech, if the forms of the signs themselves are unconstrained, and to map isomorphically onto their referents.

Second, the status of sign languages in deaf education is vitally linked to the question of syntax, since a substantial number of North American educators advocate the use of some variety of Signed English, a pidgin language (Woodward 1973a) which imposes English word order and inflectional structure on the morphological system of American Sign Language (ASL). Needless to say, both the natural morphology and natural phonology of ASL are strained by this imposition. Much of the work on sign languages thus far has been geared to pointing up the need to appreciate them as the independent systems they are.

Third, linguists sometimes find it difficult to make the jump from oral languages to manual-visual languages, and bring their theoretical baggage with them at the same time. In encountering language in a different modality, differences appear more important than similarities. However, as more of what is common to all languages is understood, it is found that sign languages are linguistically structured in very familiar ways.

What we shall attempt to show here is (a) that ASL has a level of structure analogous to the phonology of an oral language, (b) that the form of this phonology is in part determined by the articulatory dynamics of the body, and (c) that variation theory offers significant insights into this phonology.

There are those who would balk at our use of the term 'phonology', since, taken literally, it must involve sounds, and sign languages clearly do not. There are others who intuitively grasp what the term means when it is applied to signs. Just what do we mean by phonology?

For sign languages, the phonology systematically separates the set of gestures which may represent meanings in a given sign language from the entire range of gestures which may be produced by the human body. This involves constraints on underlying forms (morpheme structure conditions) and constraints on surface variation, expressed by phonological rules.

In every case, the form of the constraints and P-rules is familiar to generative phonologists of whatever persuasion, while the content of the rules, and their motivations, refer to a different articulatory and perceptual basis. Thus sign phonology will eventually lead to a 'phonetics' of sign, based on the natural dynamics of manual articulation and visual perception. For example, we have one tongue, but two independent hands. This independence is constrained, however, by the need to simplify manual-visual signals in a rapid transmission context.

The importance of this type of motivation cannot be overemphasized, and we will introduce it when relevant to the analysis. While we are far from a theory of naturalness of signs, we have a good idea of some general tendencies based on the constraints and processes we have observed so far.

## Lexical description

In attempting to describe and classify both the static and dynamic aspects of signs, we have relied heavily on the seminal work done by Stokoe (1960) and Stokoe, Casterline, and Croneberg (1965). Their success in producing a first dictionary of ASL was due to their



insightful classification of signs and their development of a suitable transcription.

Stokoe (1960) first proposed three aspects relevant to the lexical description of signs: (1) the 'tab', or location in space or on the body where the sign is articulated; (2) the 'dez', or hand configuration (shape) of the articulating hands; (3) the 'sig', or movement. All of these are distinctive, since many minimal pairs exist for each of these aspects. In addition, they have been found to be of some explanatory value for the errors made in memory tasks (Bellugi 1972).

More recently, it has become apparent that more information is needed to fully specify signs in the lexicon. This is the 'orientation' aspect, which specifies how the hands spatially relate to each other or to other body parts. Signs such as those for SHORT versus TRAIN and NAME versus SIT are distinguished only by the orientation of the hands.

This establishes the existence of sub-lexical units, but in order to strengthen the claim that ASL displays duality of patterning we can go much further. The elements within each of the four broadly defined aspects compose finite sets, and their combinations into morphemes are severely limited. Depending on the lect and the eventual form of the complete phonological analysis, there are approximately 25 different locations, 45 hand shapes, 10 types of movements, and 10 types of orientation.[1] Not all of these are distinctive at a relatively abstract phonological level. Each of these elements may be further decomposed in a distinctive feature analysis, but the details of this will be introduced only where they are relevant to the rules in the section on variation.

While working with the units of analysis themselves poses some knotty problems, even in a preliminary form they offer insights into the sublexical structure of signs. Predictably, not all combinations of these units are utilized by the signs of ASL. This redundancy can be captured by morpheme structure conditions, both segmental (simultaneous) and sequential.

The 'Symmetry Condition' is an expected feature of an articulator with bilateral symmetry and independently moving arms: if both hands have a movement component for a given sign (as opposed to being static), then specifications for hand configuration, movement, and location must be identical, and therefore symmetrical.

A second segmental constraint on possible signs is the 'Dominance Condition', which reflects the physiological fact of hand preference: if the hand configurations of a given two-handed sign are non-identical, then one hand must remain stationary while the other hand, usually the dominant hand, executes the movement.

In addition, for the signs which meet the Dominance Condition, there are restrictions on which of the 45 different hand configurations

may serve as the stationary hand. Only six different hands are allowed in that position, and they are the most unmarked, maximally differentiated six hands, which is just what one would expect in dealing with a true phonological system. These are (1) A -- the closed fist, (2) B -- the flat palm, (3) 5 -- the palm with fingers spread, (4) G -- fist with extended index finger, (5) C -- hand arcs in a semi-circle, and (6) O -- fingertips meet thumb, forming a circle.

These dezes are considered unmarked because they are maximally distinct both in articulatory and perceptual terms, have a high frequency of occurrence, are found in all sign languages which we know of to date, and are among the first handshapes mastered by the child acquiring signs. In addition, both adults and children make errors of substitution which tend toward this small set of handshapes. Another criterion which defines this class is 'point of contact'; these unmarked dezes may contact other body parts in a greater variety of ways than marked dezes, which may be restricted to one or two contact points. There are also other, more detailed criteria.

There are other morpheme structure constraints involving more complex types of signs. The body is divided into four major areas with respect to where a given sign may be articulated. These are (1) the head and neck area, (2) the trunk, from the shoulders to the hips, (3) the arm, from the shoulder to the wrist inclusive, and (4) the hand (we shall exclude from this limited discussion signs made off the body, in space). Although there are no a priori reasons why these particular boundaries have formal significance in ASL, they can be shown to be operative in two types of constraints, the first of these being a set of absolute constraints holding across these major areas.

For signs whose articulation involves contacting the body twice rather than just once, most make both contacts within the same major area. But there are signs whose contact is made first in one area, and then another. Not all sequences of contact are utilized by the ASL lexicon. For example, there are signs which originate in the head area and then contact the trunk, but there are none known which first contact the trunk and then the head. These facts are summarized in Table 1. A+ indicates that there are signs which have the indicated contact sequence. Note that only half the possible sequences are used.

A second constraint related to this same large set of signs involves a neutralization of place distinctions within these major areas. So far we have found that the second contact is constrained to a fixed, neutralized position, so that internal distinctions within a major area are lost. For instance, there is a sign made with the fully open '5' hand which first contacts the chin with the thumb. This is one of the signs for 'woman'. However, there seems to be no possibility of an



TABLE 1. Inter area constraints

| | | Second contact: head | trunk | arm | hand |
|---|---|---|---|---|---|
| First contact | head | + | + | + | + |
| | trunk | - | + | - | + |
| | arm | - | - | + | - |
| | hand | + | - | - | + |

ASL sign which first contacts the chin and then some more extreme part of the trunk, say the shoulder or any corner of the trunk.

The two types of constraints outlined above show a conspiratorial similarity, in that a relative complexity (double contact as opposed to a simple single contact) is counteracted by an increase in redundancy due to the neutralizing effects of the sequential morpheme structure constraints.

There are two major points to be made on this discussion of sublexical systems. The first is that there is indeed a 'system' to the components of signs, and that every possible gesture is not necessarily a possible sign. General constraints rule on the possible forms of ASL signs. Second, the motivation for these constraints comes directly from a consideration of the articulatory dynamics of the body, thus providing the basis for a discussion of the naturalness of signs and the naturalness of form change. So, although the 'phonetic' basis of signing presents some radically different dynamics, constraints on form manifest themselves in rather familiar ways at the level of lexical description.

## Variation and change in ASL phonology

There are many ways in which the form of a given sign may vary, all of them statable in phonological terms. Deletion of one hand of a two-handed sign, deletion of contact, or modification of a movement may occur. Locations of a given class of signs may shift from one part of the body to another. Assimilation of orientation, movement, location, and handshape all occur frequently within compounds and across lexical boundaries.

These changes are motivated by the need to limit the complexity of signs in rapid transmission and to facilitate transitions between signs. We also believe that a theory of natural phonology is possible for signing, which should eventually take into account both articulatory and perceptual complexity.

One striking example of phonological variation we have observed is the addition of an extended thumb to dezes which already have

other fingers extended. The 'G' (index finger extended from fist) and 'H' (index and mid fingers extended from fist, contacting) dezes are two good examples.[2]

When G changes to [+thumb], it merges with the dez 'L', which Stokoe (1960) considered a contrastive unit. When H changes to [+thumb], the configuration resembles that of '3' (thumb, fore, and mid fingers extended, and separated), an independent dez. Thus 'G' and 'H' changing to [+thumb] is highly interesting, since it causes a neutralization between distinctive segments in one case and a near-neutralization in the other case.

We believe this variation indicates ongoing historical change in ASL, since some 60-year-old sign films we have seen do not display this variation, and current sign manuals still list citation forms without the thumb. However, in conversation and even occasionally in citation, informants sometimes produce the [+thumb] variants of 'G' and 'H'. Not all signs with 'G' or 'H' dezes allow this variation currently.

## Field procedures

We obtained the intuitive responses of 39 signers as to whether they use [+thumb] or [-thumb] variants of eleven 'g' and 'H' signs. The informants vary according to three extralinguistic variables: whether they had deaf parents or not, whether they learned signs before or after the age of six, and sex. The variables [±deaf parents] and [±before age six] have been shown to correlate significantly with grammatical variation in ASL (Woodward 1973b).

We also tested the reliability of the above elicitation by comparing the informants' intuitive responses with the data we obtained by videotaping five of our informants. Three different levels of style were taped for each informant as they signed ten sentences. The eleven signs used in the elicitation were incorporated in these sentences in such a way as to avoid the influence of assimilation from surrounding environments. Style was introduced as an independent variable by requesting our informants to sign first to a deaf friend, and secondly, to a hearing teacher. A third, less formal style was obtained by taping a session without our informants' knowledge.

The informants' signing in the experimental situation closely followed their intuitive responses. For four signers there was a difference of one lect between the intuitive responses and the conversational signing. For one informant there was a difference of two lects (see Woodward 1973b). We also found that the feature [+thumb] remained the same for each informant in the three styles. However, there were striking lexical and grammatical differences in the styles for each of the informants.



## Implicational patterns

The eleven signs were found to be implicationally ordered as follows:

ME ⊃ NOSE ⊃ BORING ⊃ RIGHT ⊃ BLACK ⊃
NEGRO ⊃ NAME ⊃ WEIGH ⊃ RED ⊃ CUTE ⊃ FUNNY

Table 2 shows the twelve lects resulting from this implication. With thirty-nine informants there were 429 responses. There were twenty-two expections to the implication, yielding a 5.1 percent rate of exception or a 94.9 percent rate of scalability, a strongly valid implication.

TABLE 2. [+THUMB] Implication

| | Lects | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| ME | + | - | - | - | - | - | - | - | - | - | - | - |
| NOSE | + | + | - | - | - | - | - | - | - | - | - | - |
| BORING | + | + | + | - | - | - | - | - | - | - | - | - |
| RIGHT | + | + | + | + | - | - | - | - | - | - | - | - |
| BLACK | + | + | + | + | + | - | - | - | - | - | - | - |
| NEGRO | + | + | + | + | + | + | - | - | - | - | - | - |
| NAME | + | + | + | + | + | + | + | - | - | - | - | - |
| WEIGH | + | + | + | + | + | + | + | + | - | - | - | - |
| RED | + | + | + | + | + | + | + | + | + | - | - | - |
| CUTE | + | + | + | + | + | + | + | + | + | + | - | - |
| FUNNY | + | + | + | + | + | + | + | + | + | + | + | - |

## Correlation of lects with social variables

Table 3 shows membership in each of the lects in relation to social variables.

At the present time no correlation between membership in the lects and social variables has been found. This may be due to the fact that the present sample is too small and irregular, especially for phonological variation, which is often not as sharply stratified as grammatical variation (Wolfram 1969).

## Features conditioning the variation

Six features (or constellations of features) distinguish the eleven signs:

TABLE 3. Membership in lects

| Groups | | | | | | | |
|---|---|---|---|---|---|---|---|
| Deaf Parents | + | + | – | – | – | – | |
| Before 6 | + | + | + | + | – | – | |
| Female | + | – | + | – | + | – | |
| **Lects** | | | | | | | **Total** |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 1 | 0 | 1 | 0 | 2 | 0 | 4 |
| 7 | 1 | 0 | 0 | 1 | 0 | 1 | 3 |
| 8 | 2 | 1 | 0 | 1 | 0 | 1 | 5 |
| 9 | 1 | 1 | 0 | 2 | 3 | 0 | 7 |
| 10 | 0 | 1 | 1 | 0 | 2 | 2 | 6 |
| 11 | 1 | 0 | 1 | 0 | 2 | 1 | 5 |
| 12 | 1 | 1 | 1 | 0 | 5 | 1 | 9 |
| Total | 7 | 5 | 4 | 4 | 14 | 6 | 39 |

± Indexic — whether or not the sign is contiguous to (index) its referent.

± Bending of fingers — bending movement of the extended fingers from an open to a relatively closed position.

± Mid finger — whether or not the mid finger is extended.

± Twist — whether or not the sign has a twisting movement.

± Face — whether or not the sign is on the face.

± Center — whether or not the sign is made in the center of one of the four major areas of the body.

These features are justified independently on descriptive grounds (Woodward 1973b).

From the features in Table 4 we can determine the most heavily weighted environments and write a rule incorporating the constraints.



Table 5 shows the weightings with A being the most heavily weighted environment and Z being the least heavily weighted environment. The tentative rule which incorporates the weighted environments is given in Figure 1.

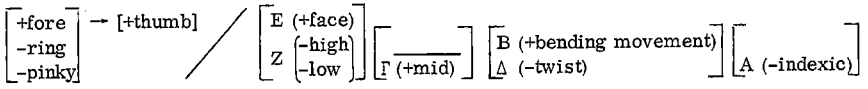
TABLE 4. Features of the eleven signs

| | Features | | | | | |
|---|---|---|---|---|---|---|
| | Indexic | Bending of fingers | Mid finger | Twist | Face | Center |
| ME | + | – | – | – | – | + |
| NOSE | + | – | – | – | + | + |
| BORING | – | – | – | + | + | + |
| RIGHT | – | – | – | – | – | – |
| BLACK | – | – | – | – | + | – |
| NEGRO | – | – | + | + | + | + |
| NAME[3] | – | – | + | – | – | – |
| WEIGH[3] | – | – | + | – | – | – |
| RED | – | + | – | – | + | – |
| CUTE | – | + | + | – | + | – |
| FUNNY | – | + | + | – | + | + |

TABLE 5. Weighted features of the eleven signs

| | Features | | | | | |
|---|---|---|---|---|---|---|
| | Indexic | Bending of fingers | Mid finger | Twist | Face | Center |
| ME | | | | Δ– | | Z+ |
| NOSE | | | | Δ– | E+ | Z+ |
| BORING | A– | | | | E+ | Z+ |
| RIGHT | A– | | | Δ– | | |
| BLACK | A– | | | Δ– | E+ | |
| NEGRO | A– | | Γ+ | | E+ | Z+ |
| NAME | A– | | Γ+ | Δ– | | |
| WEIGH | A– | | Γ+ | Δ– | | |
| RED | A– | B+ | | Δ– | E+ | |
| CUTE | A– | B+ | Γ+ | Δ– | E+ | |
| FUNNY | A– | B+ | Γ+ | Δ– | E+ | Z+ |

FIGURE 1. The rule of thumb




Environments are simultaneous, not sequential.

There are partial explanations for why these particular weighted features facilitate the operation of the rule, based on the articulatory dynamics of the body.

For the signs which involve a twisting movement, the extended thumb may interfere with a smooth movement by brushing against the body. Since unnecessary contact between body parts must be minimized, [-twist] facilitates the rule, while [+twist] inhibits it.

The presence of the middle finger, which distinguishes between the 'G' and 'h' dezes, facilitates the operation of the rule, since it seems that the more fingers that extend from the closed fist, the more tension is felt in the hand. This tension is subjectively reduced by extending the thumb, and is further reduced by bending the extended fingers.

We have no good explanation for the facilitation effect of [+face] and [+center]. In view of Siple's (1973) proposed perceptual constraints on signs, we should expect that signs made on or near the face should not promote neutralization of segments, as our Rule of Thumb does. Siple found that finer differentiation of movements, dezes, and sublocations are to be found in the facial zone, and that less differentiation is to be found in the areas further away from the face. This is simply because receivers focus their eyes on the signer's face, and visual acuity is thus highest in that area. Our proposed neutralization rule is thus not expected in an environment which supports differentiation of elements. Some other principle may be operating here, and it may explain the facilitation effect of both [+face] and [+center], since they are both relatively unmarked locational (tab) features. In any event, these two features are the least heavily weighted for our rule.

While the definition we have offered so far for [±Indexic] is most easily stated in semantic terms, this should not be regarded as a departure from phonological orthodoxy. Indexic signs can be characterized as a phonological class, though not in terms of existing features in our tentative framework. Indexical signs are those which are primarily defined by their place of contact (as in NOSE) or their



orientation (as in YOU). They are unspecified for movement, while the other signs in this study must be specified for movement.

An elegant feature solution for this particular problem remains to be found.[4]

The inhibitory influence of [+Indexic] is perhaps based on the fact that the saliency of the index finger in contacting or pointing must be maintained. The thumb not only adds a visibly ambiguous aspect to the hand, it offers another potential point of contact.

## Conclusion

American Sign Language has duality of patterning, that is, it has a level of structure analogous to the phonological component of oral languages. Sign phonological components are describable in terms of feature matrices, morpheme structure constraints, and other constructs in current phonological theory. Like their oral counterparts, sign phonologies are dynamic and require implicational and/or variable rule descriptions. The Rule of Thumb in this paper offers evidence of predictable on-going phonological change in American Sign Language. Observation of such changes is one of the many ways of approaching naturalness in sign phonology.

## NOTES

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1. For example, some movements can be described in terms of locations, assuming an unmarked direct movement between the two points.

2. 'G' and 'H' are simply names given to these particular dezes; they should not be confused with fingerspelled letters.

3. At the present time, we are not sure of the best way to distinguish name and weigh.

4. Even NAME and RIGHT, whose saliency seems to involve where they contact rather than how they move, must be specified for movement. This is evident when the stationary hand is deleted from these two-handed signs in certain very informal contexts. With no place to contact, the ordinarily redundant movement of these signs is emphasized.

## REFERENCES

Battison, Robbin. 1973a. Phonology in American Sign Language. Paper delivered at the Third Annual California Linguistics Association Meeting, Stanford University, May, 1973.

Battison, Robbin. 1973b. Toward a phonological theory of sign languages. Paper delivered at the Communication Center, NTID-RIT, Rochester, New York, September, 1973.

Bellugi, Ursula. 1972. Studies in sign language. In: Psycholinguistics and total communication: The state of the art. Edited by T. J. O'Rourke. Silver Spring, Maryland, American Annals of the Deaf. 68-84.

Friedman, Lyn and Robbin Battison. 1973. Phonological structures in American Sign Language. NEH Grant Report AY 8218 73 136.

Frishberg, Nancy and Bonnie Gough. 1973a. Morphology in American Sign Language. Working Paper, Salk Institute for Biological Studies.

_____. 1973b. Time on our hands. Paper delivered at the Third Annual California Linguistics Association Meeting, Stanford University, May, 1973.

Siple, Patricia. 1973. Constraints for sign language from visual perception data. Working Paper, Salk Institute for Biological Studies. (To appear in Semiotica.)

Stokoe, William C., Jr. 1960. Sign language structure: An outline of the visual communication system of the American deaf. Studies in Linguistics, Occasional Paper 8.

_____, Dorothy Casterline, and Carl Croneberg. 1965. A dictionary of American Sign Language. Washington, D. C., Gallaudet College Press.

Wolfram, Walter. 1969. A sociolinguistic description of Detroit Negro speech. Washington, D. C., Center for Applied Linguistics.

Woodward, James C., Jr. 1973a. Some characteristics of Pidgin Sign English. Sign Language Studies 3. 39-46.

_____. 1973b. Implicational lects on the deaf diglossic continuum. Unpublished Ph. D. dissertation, Georgetown University.

# VARIATION IN AMERICAN SIGN LANGUAGE SYNTAX: AGENT-BENEFICIARY DIRECTIONALITY

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1. Introduction. Recent studies of sign language in the United States (Stokoe 1970, 1972; Moores 1972, Woodward 1972, 1973a; Friedman 1973) posit a diglossic continuum between American Sign Language (ASL) and Standard English in the deaf community (as described by Meadow 1972, and Schlesinger and Meadow 1973). This is not the classic diglossic situation described by Ferguson (1959), since the H variety (Standard English) and the L variety (ASL) are two separate languages, but it is a situation that shares much of the attitudinal and social characteristics of typical diglossic situations.

Until this year, however, there had been no attempt to describe this diglossic continuum utilizing variation theory. This paper reports on three recent studies of variation in ASL syntax that utilize variation theory. These studies offer a crucial testing ground for the descriptive and explanatory power of variation theory, since these studies are on visual phenomena that linguists have not normally observed.

The first study, the D. C. study (Woodward 1973a), analyzed data on three ASL rules from 141 informants from the Washington, D. C., Frederick, Maryland, and New York City areas who varied according to four social variables. These variables identified the informants as deaf or hearing, as having deaf or hearing parents, as having learned signs before or after the age of six, and having attended some college or not. The second study, the Montana-Washington study (Woodward 1973b), tested the same three variables using thirty-six informants from Montana and Washington state who were