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Author(s): Lynn A. Friedman

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PHONOLOGICAL PROCESSES IN THE AMERICAN SIGN LANGUAGE
 Lynn A. Friedman
 University of California, Berkeley

This paper presents a discussion of types of phonological processes--synchronic and historical--that occur in the American Sign Language (ASL) as compared with those of oral language. Presented below are types of processes that occur in both oral and visual language, those which cannot occur in visual language, and those which cannot occur in oral language, due to the nature of the physical signals.

The American Sign Language is a manual/visual language used by over a half a million deaf people (and numerous hearing people) in the United States today. It is one of many visual languages. There is no one universal Sign Language. Various visual languages such as ASL, Israeli Sign Language, Chinese Sign Language and Iranian Sign Language are totally unrelated historically. Others are related--such as the American and French Sign Languages--but their historical relationship does not in any way correspond to the relation of the oral languages spoken in the same areas. It is true of all sign languages that they are not derivative of any oral language. Their structures "phonological", syntactic and semantic are unique.

How can the term "phonology"--the study of sound and sound systems--possibly be applied to a language without sound? For some the term is anomalous. Others can intuitively grasp the correspondence of the study and analysis of the structural organization (or formational properties) of language using a manual/visual signal to the structure of oral/auditory language. The term "phonology" is used throughout this paper in this abstract sense--to cover the description and analysis of the formational structure of any language, be it in the oral/auditory or in the manual/visual modality.

There are four basic articulatory parameters in Sign Language: 1. hand configuration--the shape of the articulators; 2. place of articulation--the area or point on the signer's body, or in the articulation space defined by his body, at which or near which the articulation is made; 3. movement--the movement of the articulator(s) from one point to another within the articulation space; 4. orientation--the orientation of the hand(s) in relation to the signer's body.

A simple sign involves one hand configuration, made with one or both hands, combined with one place of articulation, a specification for orientation and a movement of the articulator(s).¹

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

Frishberg (1974) discusses what she has called "fluidity" as a historical phonological change in ASL. Primarily, the term fluidity refers to processes of assimilation. However the tendency toward fluidity is possibly broader in scope than assimilation. Frishberg states that fluidity

"or the smoothness tendency of signs says both that the movement involved in a sign should be smooth and that the transitions between the two parts of a compound sign should be minimized". (p.4)

In regard to the first principle given--that the movement of a sign should be smooth--she offers as an example of the change toward smoothness the sign ANY. This sign 60 years ago was articulated with an "ague-like shaking motion".² Today the sign is made with the fist, thumb extended palm toward signer with a quick movement in which the hand is turned so that the palm is away from the signer, while the hand moves rightward. The Old French sign FOR (Fr. 'pour') consisted in two parts--first touching the extended index finger to the forehead and then pointing outward to the object. Today FOR entails a single movement from the forehead outward. If we examined the possible cause for such changes, we might refer to this aspect of "fluidity" as a change for the purpose of ease of articulation. This type of change in ASL most closely corresponds to manner assimilation in oral language in which a segment is altered in its manner of articulation for the primary purpose of ease of articulation--e.g. the voicing of voiceless stops in intervocalic position. The change in movement described here represents a change from a more complex to a simple movement, caused presumably by the signer's desire for simplification of effort.

The second type of "fluidity" described by Frishberg very clearly amounts to assimilatory processes. The sign INFORM was originally composed of a compound of KNOW plus BRING. Today the sign is monomorphemic and

"monosyllabic". The sign is made by an opening motion of the two hands, one at the forehead and one in neutral space. That part of the sign in which the hand is at the forehead is derived from the original KNOW (bent palm toward signer, fingers touching forehead), but the ending hand configuration, orientation (palm away from signer in INFORM) and movement is derived by means of anticipatory assimilation to the sign BRING (two hands in neutral space, moving outward, palms upward). As another example consider the sign GOLD (or CALIFORNIA), earlier a compound of EARRING (index and thumb grasp ear lobe) and YELLOW (twisting or shaking movement of Y hand--pinkie and thumb extended--in neutral space). Currently the sign GOLD entails a twisting movement of the Y hand shape moving from the ear downward. Again, the change in GOLD represents an anticipatory assimilation of both hand configuration and movement. Another example of assimilation can be seen in the sign TOMATO, derived from the compound RED (index finger extended, palm inward, drawn downward along mouth) and a form of SLICE (side of dominant hand--open palm--drawn downward along side of non-dominant hand--in fist shape). The current sign TOMATO entails an anticipatory assimilation of the orientation of the hand in the first part from the orientation in SLICE and a perseveration of the hand configuration of RED (index finger extended) which remains constant throughout the sign.

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

There are countless examples of this type of unintended anticipatory assimilation of hand shape. This is not surprising in the light of the following evidence in regard to hand configuration and place of articulation in signs in which the non-dominant hand acts as the place of articulation. It would appear that, in general, the onset of appearance of hand configuration and place of articulation (where location = non-dominant hand) are not simultaneous as previously supposed. From evidence gathered from video taped portions of normal signing, we find that hand configuration of the articulator of a

given sign is formed first, and only then is the hand shape of the place of articulation hand shaped or even brought into the signing space. In addition, we find that in connected discourse, the hand shape of the articulator anticipates the following sign, while the shape of the place of articulation hand lags or perseverates the shape of the previous sign. In most cases, this does not cause assimilation--that is to say that the anticipation comes after the previous sign has already been formed correctly and the perseveration does not remain throughout the following sign. However this tendency for hand shape to anticipate the following sign's hand shape and for shape of place of articulation hand to perseverate shape of the previous sign would tend to cause unintentional assimilation in rapid signing and would thereby be a viable explanation for the type of assimilation discussed here. For example, consider the phrase SCHOOL SAVE 'school saves'. The sign SCHOOL is made with two B hand shapes (open flat palm). The dominant hand taps the palm of the non-dominant hand twice. SAVE is made by touching the palm-up side of the extended index and middle fingers (V) to the underside of the closed fist (A), thumb upward. In connected discourse, rather than signing each sign as in citation form, the signer first makes the sign for SCHOOL, then as he moves the dominant hand around to the underside of the non-dominant hand (for SAVE) he changes the B shape to the V shape of SAVE while maintaining the B shape of the non-dominant hand from SCHOOL. Only after the dominant hand has come into position for the articulation of SAVE does the shape of the non-dominant place of articulation hand change to the A shape required for SAVE. The fact that this type of anticipation-lag process occurs consistently in the language can be unambiguously supported by evidence from video tapes, when viewed frame by frame.

This type of process is hardly surprising. The anticipation of following and perseveration of preceding segments occurs constantly in oral language and is the basis for the explanation of assimilatory change in speech production. As an example consider the evidence of nasalization of vowels in English caused by early lowering of the velum in anticipation of the following nasal. Another example of the anticipation-lag syndrome of signal production is the introduction of an epenthetic stop between a liquid and a fricative as when the English word [pals] becomes [pɔlts]. The dental stop is introduced due to the fact that the speaker cannot make the transition in place of articulation from [l] to [s] quickly enough. In the articulation of [l] the tongue tip is on the alveolar ridge, sides of the

tongue not touching. Production of [s] entails the reverse articulation--sides of the tongue making contact with the ridge, tip not in contact. In making the transition from [l] to [s], the speaker makes complete closure producing the stop [t]. Thus the tongue tip contact of [l] perseverates and the side closure of [s] is anticipated.

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

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

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

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

What might also be called a tendency toward centralization can be seen in changes that occur in rapid signing (analog of rapid speech). In rapid or colloquial signing or when the signer is tired, the tendency is to

centralize location of signs. Again, locations tend to move downward, inward and upward to a more central location and outward to neutral space--that is, off the body. One functional result of the tendency for location to move off the body is loss of contact in contact signs. CONTACT is a distinctive feature of the movement parameter.³ By means of the centralization process (expanded in definition here), the loss of this distinction occurs at times. Moreover, loss of place of articulation distinction results in rapid signing, when for example the distinction between the locations forehead and neutral space are lost when both are articulated in neutral space. For example, the sign THINK--index finger on forehead--is often signed in neutral space, having moved downward and off the body in rapid signing. Thus we could state that the functional load of centralization is neutralization.

ASL has several morpheme structure conditions, one of which entails, in double contact signs (signs in which there are two places of articulation), that a. the choice of the location of the second contact is limited (and dependent on the location of the first contact) and b. that a neutralization of distinction occurs in the major location area of the second contact. That is, for example, that the choice of location of second contact may be at the central chest, but not at the shoulder. In this constraint, we also find a neutralization of distinction in the place of articulation parameter.⁴

One striking example of neutralization in ASL is the addition of the extended thumb to hand configurations which previously did not entail this extension. The change is ongoing. Not all signs have this change nor do all signers extend the thumb. Thus we find a neutralization in progress. Signs to which the extended thumb is added are those which previously merely extended the index finger (G) or the index and middle fingers, unspread (H) or spread (V). When the G hand shape adds the extended thumb, it has the same shape as the L shape, which is considered distinctive.⁵ The change which entails the addition of the extended thumb to the H shape makes it resemble the 3 hand shape (thumb, index and middle fingers extended and spread). The change in V allows it to merge with 3. Thus the change in the shapes G, H and V causes a neutralization of distinctive features of the hand configuration parameter. Examples of signs which exhibit this change include RED (G hand drawn down mouth), VOICE (V hand moves down neck) and NAME (H hand taps H hand).⁶

A third phonological process that occurs in both oral and visual language is deletion. In oral language, a segment may be deleted--with or without compensatory

change (e.g. loss of nasal following nasalization of preceding vowel as in French) or inserted (e.g. intrusive stop, epenthetic vowels, etc.). In visual language, however, the simultaneity (simultaneous articulation) of components and the necessity for one unit from each of the four parameters to be present in each sign prevent the deletion (actually make it impossible) of one component.⁷ Deletion occurs in ASL, but what is deleted is whole units or items.

Frishberg (1974) discusses the historical deletion of parts of compound signs and of facial expression and gross bodily movement when used for segmental purposes (as opposed to suprasegmental or prosodic use). The sign BIRD (a metaphorically iconic representation of a beak) originally was a compound of a sign for beak and one for wings. The 'wing' portion has been deleted. Another example is the sign DARK which is derived from the present day sign BLACK plus the present sign DARK.

Many signs originally required the use of facial expression and gross body movement for non-prosodic purposes. In the present phonological structure of ASL, only the hands may articulate segmental portions. The face and body are used extensively for the superimposition of prosodic features.⁸

As an example of this change, which we might term deletion (of facial expression and body movement component, with compensatory change), consider the sign (BE)PATIENT, originally entailing pressing the forefinger against the lips and bowing "the head as if in resignation".⁹ Today the sign is made with the first shape and the articulator (thumb toward signer) moves downward in the mouth area. The head does not move.

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

Another striking type of deletion occurs in the deletion of one hand of a double articulator (two handed) sign in rapid or colloquial signing. It is possible, in colloquial signing to articulate all signs which are two handed in citation form with only one hand. The deletion of one hand occurs either when the signer is tired or more commonly when one hand is otherwise occupied (e.g. holding a book, etc.). There are two types of signs which entail the use of both hands: a. double articulator signs, in which both hands have a movement component and b. those signs in which one hand is the articulator, the other the place of articulation. When this type of deletion occurs in a double articulator sign, it is always the non-dominant hand which is deleted. When one hand acts as the place of

articulation, that hand is the non-dominant one. In rapid or encumbered signing (i.e. when one hand is otherwise occupied) it is the non-dominant place of articulation hand which is deleted. It is with the second type of sign that compensation is made subsequent to deletion, in that another unmarked place of articulation must be added (to account for the loss of the hand as location). This new location may be any convenient surface--e.g. table top, chair, thigh, etc.--if the signer is seated or, for example the hip or the book (or whatever) in the non-dominant hand if the signer is standing. I have witnessed the sign YEAR (normally made with double fists--dominant hand circles, then makes contact with non-dominant hand) made only with the single fist of the dominant hand, in a circular action in neutral space and then making contact with the signer's hip. This type of deletion is clearly the most common form of synchronic phonological alternation.

In regard to addition (or insertion), I have given the example above of the addition of the extended thumb in signs with the G (index finger extended), H and V (index and middle fingers extended, unseparated and separated) hand configurations. Again, I remind the reader of the impossibility in visual language of word internal insertion.

There are various types of phonological processes that occur in oral language that do not and in fact cannot occur in visual language. These include such processes as metathesis, syncope (of component or segment) and such purely segmental phonological changes as for example loss of final vowels or devoicing of final consonants. The reason for the lack of these and other similar processes in visual language is clear. All entail an alteration, or alternation in the case of metathesis, or deletion of linear segments within the word or syllable. I have discussed at some length (Friedman 1974b) the idea that no change can occur on the segmental portion in a visual language because there are no linear segments per se. Each "monosyllabic" sign requires one and only one component of each of the four parameters. One could hardly for example metathesize a movement and hand shape that are in addition articulated simultaneously. For those signs which entail two places of articulation or two hand configurations, one of the following must occur: a. in a double location sign the hand shape remains constant, or b. one of two hand shapes assimilates to the other, or c. in a single place of articulation sign, the hand shape change entails an opening or closing action, always either starting from or resulting in a neutral shape (e.g. B closing to A, A opening to 5, 5 closing to F, but never

for example 8 changing to F). If the sign entails a closing action, it must start with a neutral hand shape (i.e. 5 closing to F); if the sign entails an opening action, it must end in a neutral shape (i.e. 8 opening to 5). Rather than describing these signs as for example B closing to A or A opening to 5 (as Stokoe has done and I have continued to do), it may be well to describe only the salient hand shape (it can be demonstrated that there is only one) with the notion of beginning from or ending in that hand shape to or from a neutral, unmarked and possibly unspecified hand shape.¹⁰ Any change which entails an alteration of a particular segment, conditioned by the surrounding segments (note that the concept surrounding in the linear sense is anomalous as well in ASL) cannot occur in visual language. It is conceivable however, for the components of a single parameter to metathesize across word boundaries (and only across word boundaries as there are no inflectional affixes in ASL), but this type of metathesis would not only be unintended but incidental as it would not result in permanent phonological change in a given item.

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

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

1. Simultaneous articulation of components. Clearly in an oral language, segments are produced in a linear order. In visual language, in every sign, at least four components are articulated simultaneously. Although this is not within the scope of this paper, I would

mention that the potential exists in visual language for articulating more than one item at the same time.¹¹ Of course, in oral language, it is quite common for intonational cues, e.g. question, to be superimposed on the segmental portion as for example in the echo question 'John?'. However, besides adding intonational cues by pitch variation, etc., it is clearly impossible to articulate more than one string of segments at one time--there is only one articulator. However, due to the fact that there are two articulators in languages in the manual/visual modality, it is possible and in fact common to momentarily articulate two items with or without the addition of suprasegmental features. For example consider the Sign sentence EAT HE? in which the three morphemes EAT, HE and sentential question may all be articulated simultaneously: EAT by the dominant hand, HE by an index with the non-dominant hand, and question by raising the eyebrows and holding the signs for an extra beat.¹² This type of construction, in terms of the physical realization, is of course impossible in oral language.

2. Scalar items. Because of the nature of the modality, language in the visual mode has the ability to convey nuance of meaning in a unique way. Because he is using a visual language, the signer has the ability to alter the shape of a sign in such a way as to convey degrees of meaning. Oral language has this ability only in limited ways (phonologically). In some languages, for example English, one can intensify the degree of an item (usually a surface adjective or durative verb) by stressing it, as for example in the sentence, 'The fish was BIG!'. In other languages, for example Hoysan, intensification or lessening of degree can be conveyed by various types of reduplication. The Hoysan word [huŋʃ] 'red' when reduplicated with a high rising tone followed by a low level tone [huŋʃ¹ huŋʃ] means 'very red'; when reduplicated and the tones are reversed [huŋʃ¹ huŋʃ] it means 'slightly red'. These phonological processes to show degree are limited in oral language.

In visual language what I would refer to as scalar items and the "phonological" processes by which these items are formed are plentiful. Visual language has the advantage of being able to use a much less discrete signal than can oral language. Any oral language is bound by its phonological structure: it must form its words from among available, acceptable (in the language) phones, in an acceptable combination. If a speaker wishes to convey various degrees of meaning (except in those cases cited above), he must carefully choose the lexical item representing that nuance, which rarely bears any phonetic resemblance to any other lexical item

having the same "core" concept.

In many classes of items in ASL, it is possible to indicate degree of value by altering the "phonological" shape of the morpheme. If the signer wishes to convey, instead of for example 'big', 'very big', he simply makes the sign BIG bigger. If he wishes to convey 'extremely happy', he articulates the sign HAPPY relatively larger than it would be for 'happy' and more rapidly and it may be reduplicated.

The scalar dimension can be seen in many nominal signs, as well. The nature of the phonological alteration of course depends on the semantic nature of the referent of the sign. For example, the signer can convey the meaning 'big table' simply by signing TABLE larger than he would in order to convey 'table'. The same can be done for other signs having referents in which spatial dimension can be iconically indicated. 'Small boy' may be articulated by signing BOY (fingers closed to tapered O shape at forehead) and drawing the hand outward and downward while maintaining the final hand shape of BOY.¹³

3. Symmetry. Frishberg (1974) discusses the historical tendency toward symmetry in ASL. Signs have changed in such a way as to create symmetrical action of the two articulators. The tendency toward symmetry takes two forms. One is to cause the hand configurations of the two hands in two handed signs--either those originally monomorphemic or compound signs--to become the same. For example, the sign LAST (FINAL) originally had the index finger of the moving hand contact the extended little finger of the location hand. Today both hands have the little finger extended. [n.b. This is also an example of anticipatory assimilation.]

The second result of the symmetry tendency is to cause originally one handed signs in low acuity areas (i.e. below the neck) to become two handed, presumably for the purpose of adding redundancy to low acuity areas.¹⁴ The signs DIE (DEAD) and HURRY, for example, which today are articulated in citation form with two hands, derive from one handed signs. [n.b. This might also constitute an example of phonological addition.] It is clear that the tendency toward symmetry in ASL has no analog in oral language--a language can only insist on symmetry if there is more than one articulator.

¹ For further description and discussion of formational structure and historical details of ASL see Friedman 1974b, 1975.

² Frishberg quotes from Long, 1918, reprinted 1949.

³ See Friedman, 1974a,b for complete discussion of movement.

- ⁴For further detail see Friedman 1974b, Friedman & Battison, 1973.
- ⁵Friedman 1975, Stokoe 1960, 1965.
- ⁶This variation and its ongoing change in ASL is discussed in detail in Battison et.al., 1974.
- ⁷I have discussed at length the idea that the components of a sign utterance are not comparable in certain respects to the segments of a spoken utterance in Friedman 1974b.
- ⁸For further discussion of prosodic features see Friedman 1974a,b, 1975.
- ⁹Frishberg quotes from Long, 1918.
- ¹⁰For further discussion see Friedman 1975.
- ¹¹See Friedman 1973 for details.
- ¹²See Friedman 1974a,b for further discussion of question intonation in ASL.
- ¹³See Friedman 1973 for discussion of scalar reference in space and time locutions and Friedman 1974b for discussion of other types of iconicity.
- ¹⁴See Friedman 1974b for discussion of changes due to visual perception. Also see Siple 1973 for visual perception data.

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