Underspecification in American Sign Language Phonology
Author(s): Diane Brentari
Proceedings of the Sixteenth Annual Meeting of the Berkeley Linguistics Society (1990), pp. 46-56

Underspecification in American Sign Language Phonology

Diane Brentari
University of Chicago

I. Intro to the theoretical points
   A. harmonic rule application
   B. underspecification
II. Evidence from ASL
   A. Compounding
   B. distribution of [+contact]
   C. Place Harmony/Metathesis
III. Conclusion

I. Introduction

This paper is concerned with developing a theory of underspecification in American Sign Language (ASL). The purpose of this analysis is to show that underlying representations in ASL are not necessarily 'whole signs'; instead, these underlying forms often consist of incomplete structures that require syllabification or other prosodic principles in order to make them articulable in the language. Until now, what is seen in the surface form of signs has been considered to be in the underlying form as well. I show that not only can a large portion of this phonetic material be eliminated from underlying representations, but it must be eliminated if we are to arrive at the correct and most economical analysis of the following phenomena. My evidence comes from:

1) Compounding: I show that he input to the compounding process is not the surface form of the two lexical items that form the compound, but rather that the compound is formed from two underspecified representations.

2) Distribution of the feature value [+contact]: Both [+contact] and [-contact] have been posited in the underlying representation of previous work on ASL (Liddell and Johnson 1989). If only [+contact] taken as a part of the underlying representation, we can see how its distribution can be predicted, and how [-contact] is assigned.

3) Signs that undergo what has been called metathesis (Liddell and Johnson 1989). One group of signs allows the two places of articulation (POA) to occur in either order--POA1, POA2 or POA2, POA1.

The theory I will be using is a 'harmonic' approach to phonology (Goldsmith 1990). In this theory, there are three levels of phonological representation which are present in the grammar in a parallel, rather than a derivational fashion. That is to say, the set of principles operating on a given structure at one of those three levels has access to all of the information from the other two levels of the phonology. A given structure will strive to achieve a "best fit" with all three levels. I will limit my description of these 3 levels to details needed for the analysis to follow. These levels, which are all cognitive levels of the phonological component of a grammar, are:

1. Underlying or M(orphophonemic)-Level: This level interfaces with the morphological component of the grammar. It contains the representations composed of underspecified distinctive features which need not be pronounceable according to the phonotactic constraints of a particular language. Many spoken languages do not allow consonants clusters (for example, Yawelmani doesn't allow three consonants (Kenstowicz and Kisseberth 1979, Archangeli 1984)); Yoruba doesn't even allow clusters of two consonants (Pulleyblank 1988). Such languages often insert a vowel in such cases to avoid this situation. This process of epenthesis does not occur at the underlying level, but rather in accord with principles of syllabification and word formation. An analogy can be made between this process mentioned above in spoken languages and ASL, where two distinct places of articulation are allowable at M-Level, even though they do not conform with the phonotactics at the phonetic level: an intervening movement must be inserted.

2. W(ord) Level: This intermediate level of the phonology contains principles of word, syllable, and metrical foot structure, as well as principles which may differentiate between monomorphemic and polymorphemic words in the way they are syllabified.

W-Level phonotactic statements can insert empty slots on the moraic or the skeletal tier in order to conform with the syllable template. In spoken languages like those alluded to above, the syllabic template inserts an epenthetic vowel that often surfaces as the completely unspecified vowel. In ASL, an unspecified movement value, which is phonetically realized most often as an arc movement, is inserted between two contrastive places of articulation. In contrast, movements present in underlying representation are called 'paths'.

3. P(honetic)-Level: This is the component of the phonology that interfaces with the phonetic component of the grammar. Redundant feature values of two types are filled in here: 1) those that arise as a result of trivial underspecification, and 2) those that arise as a result of non-trivial underspecification. (Steriade 1987) Non-trivial underspecification involves segments which lack underlying values for a feature. For example, the distinction between [+aspirated] vs. [-aspirated] stops in English as a result of their position in the syllable and an obstruent stop will acquire this distinction in this way at P-Level. In ASL, the distinction between 'top' and 'bottom', such as [cheek[+top]] vs. [cheek[-top]] in signs such as DEAF and HOME, or [trunk[+top]] and [trunk[-top]] in RELIEF, SATISFIED are acquired as the result of non-trivial underspecification in much the same way as [±aspiration] in English. [1] Trivially specified redundant values can arise as the result of privative underlying features. For example, in languages with a canonical 3-vowel system, vowels that are not [+low] (namely, /u/ and /i/) are filled in with [-low]. Another source of such redundant values is the mechanism responsible for filling in [+voice] for all [+sonorant] segments in English. In ASL, segments that are not marked underlyingly for the feature [contact] or [distal] acquire [-contact] as the result of trivial underspecification.

The underspecification theory assumed here is Restricted Underspecification; that is, a theory that allows all contrastive features of a language to be expressed underlyingly. This is different from Radical Underspecification, which allows only privative features in underlying representation, and only those features that are universally marked. Moreover, I am adopting a mechanism whereby features will be specified as to whether they are privative, equipollent or n-ary underlyingly and may have an unspecified value, as well. In this way, privative features have 2 possible values, equipollent values have 3 values possible, and n-ary features have (n+1)possible values.

An example of how a feature in ASL can be contrastive for some signs, yet not for others, is the [± contra] distinction (an equipollent feature), and it is analogous to [±voice] in English, which is contrastive in obstruents but no where else. In signs that the [± contra] distinction is not contrastive, it is not specified underlyingly. In this analysis, only underspecified, contrastive features will be present underlyingly. Below are examples of signs that are not contrastive for [±contra] distinction in (1a), and examples where it is contrastive in (1b).

1a. *unspecified for [±contra]*	1b.*specified for [±contra]*
FLOWER	DEAF
MEMBER	BEE
NAVY	PITTSBURGH
HONEYMOON	LEATHER
CONGRESS	CHARACTER
SATISFIED	MILITARY

I exploit such redundant contrasts as [± contra] and argue for an underspecified representation in ASL that is more economical than the underlying representations posited by Sandler (1987a) or Liddell and Johnson (1989).

II. Arguments

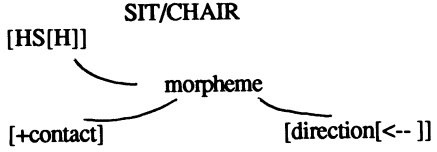
A. Compounding

In 1978, Supalla and Newport published their ground-breaking article concerning the difference in structure between nouns and verbs in ASL. Many such pairs exist. The verbs in this group form a group of single, punctual actions:

2a.		2b.	
	FLY		AIRPLANE
	SIT		CHAIR
	PUT-ON--HAT		HAT
	CALL		NAME

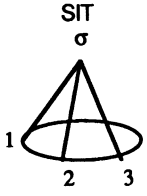
A significant, but often overlooked idea raised in this article is that neither verbs or nouns are derived from the other, but instead both are derived from a common underlying form. This analysis is driven by that idea. Here, both SIT and CHAIR have the same form underlyingly: (HS=handshape; the lines associating the features to the central morpheme node are not association lines; they refer to the unordered arrangement of the features of the morphological unit in question.)

3.



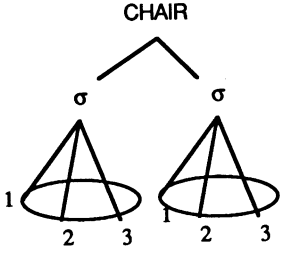
There is no specification for place of articulation because SIT (and CHAIR) are articulated in the unspecified place of articulation--the place called neutral space by Stokoe , et. al. (1965).[2] Because this information is sufficient for syllabification, this structure will syllabify as if there are no other morphophonological structures in play. This is the case in verbs. As Supalla and Newport state, nominalization calls for [repeated] [restrained] manner in articulating the path--here [repetition[x2]]. This results in a bisyllabic structure at W-Level.[3] The syllable structure of SIT and CHAIR are shown in (4).

4a.



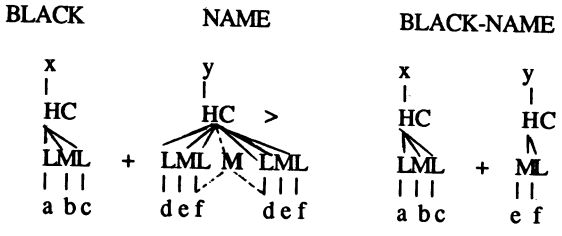
1. [+ contact]
2. [HS[H]]
3. [direction[<--]]

4b.



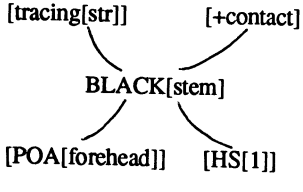
In many compounds, one of the two stems which make up the compound come from such pairs. One such case is the compound often glossed BLACK-NAME=BAD REPUTATION.[4] It is misleading to gloss this sign this way because NAME implies the nominal form, and both Sandler (1987a) and Liddell and Johnson (1989) have posited that the compounding process takes this reduplicated form above, rather than the underlying form, as the input to the compounding process. For Sandler, there is a rule of truncation for reduplicated signs in compounding that operates from the right. This formulation is represented below (Sandler 1987:278).[5]

5.

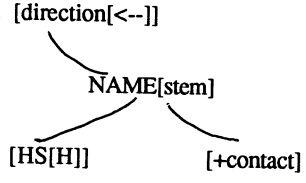


In my analysis, the underlying forms of BLACK and NAME are syllabified directly, yielding a bisyllabic structure, based on the fact that there are two distinctive path features in the respective stems. That is to say, instead of the compounding process [BLACK]$_{word}$ + [NAME]$_{word}$ > [BLACK-NAME]$_{compound}$, my analysis allows for [BLACK]$_{stem}$ + [NAME]$_{stem}$ > [BLACK-NAME]$_{compound}$. Both [tracing] and [direction] are path features. The underlying structures are as follows:

6a



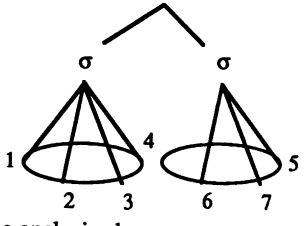
6b.



These structures are syllabified at W-Level as follows:

7.

[BLACK[stem]-NAME[stem]compound]]



1. [tracing[str]]
2. [+contact]
3. [[HS[1]]
4. [POA[forehead]]
5. [direction[<--]]
6. [+contact]
7. [HS[H]]

The analysis above suggests a test for predicting the monosyllabic or bisyllabic nature of compounds in ASL. If there are a total of two path features in both stems, the compound will be bisyllabic; if there is just one path feature in both stems the compound will be monosyllabic. Below, some bisyllabic compounds are listed in Group 1; monosyllabic compounds are listed in in Group 2. [6]This evidence suggests that, in the syllabification of compounds, underlying paths are differentiated from other types of movements.[7]

8.

Group 1
SLEEP-SUNRISE ('oversleep')
BLACK- NAME ('bad reputation')
SLEEP-SHOES ('slippers')
THRILL-INFORM ('entertainment')
NAME-SHINE ('good reputation')

Group 2
GOOD-NIGHT ('good night')
SPEAK-NAME ('mention')
TOMORROW-MORNING ('next day')
RED-SLICE ('tomato')
BLUE-SPOT ('bruise')
THINK-SELF ('decide yourself')

The contrasting examples in (8) are, on one hand, BLACK-NAME ('bad reputation') and NAME-SHINE ('good reputation'), which have two stems containing two path features, making these compounds bisyllabic, and, on the other hand, SPEAK-NAME ('mention') which contains only one path feature in the two stems and consequently is monosyllabic. It makes no difference whether CALL/NAME occurs as the first or the second element of the compound, it contains the [direction] feature in both cases.[8]

B. Distribution of the Feature Value [+contact]

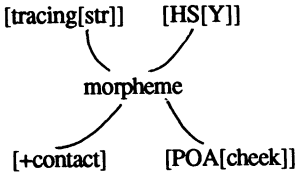
In this section (B) and in the next section (C) of this analysis, 4 groups of signs will figure prominently: (UR=Underlying representation)

9.

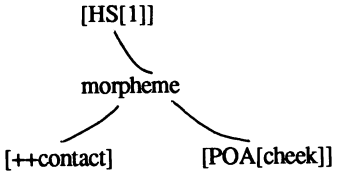
	Group 1	*Group 2*	*Group 3*	*Group 4*
	THINK	GOOD	SHAVE	DEAF
	MY	GOAT	WE_1	WE_2
	KNOW	KING	FORGET	NAVY
UR	HS	HS	HS	HS
	[POA]	[POA_1]<[POA_2]	[POA]	[POA]
	[+ contact]	[++contact]	[+ contact]	[++ contact]
			[tracing]	

We will be focusing on Groups 3 and 4 first. Group 3 contains signs that have an underlying path feature--[tracing], as well as [+contact], handshape features, and a POA, while signs in Group 4 have no underlying path, while Group 4 doesn't. Group 4 has [++ contact] while Group 3 signs have only [+contact]. These contrasts are seen below in SHAVE (Group 3) and DEAF (Group 4).

10a. SHAVE



10b. DEAF



In this analysis, [+contact] is a feature value of the underlying representation, which is defined as follows:[9]

11. [contact]--the feature that indicates that a sign contacts the body or non-dominant hand.[10] The values of this feature are:

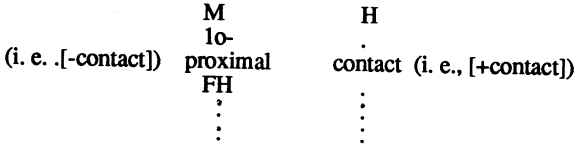
a. [+contact]--segments that contact the body once
b. [++contact]--segments that contact the body twice
c. [-contact]--the unspecified value inserted at P-Level.

Handling the feature [+contact] in this analysis hinges on the structural differences underlyingly between Groups 3 and 4. The [contact] value will be associated to the underlying structure. If there is an underlying path feature, [+contact] will associate to that path, otherwise a [+contact] value will associate to the POA. It is noteworthy that, in the signs in Group 3, contact is obligatory during the path, but this contact is not obligatory on the beginning and end points of the path. (The two variants of SHAVE are acceptable.)

Predictably, [+contact] is obligatory at the POA's for signs like DEAF. This explains the difference between Group 3 and Group 4 along this dimension.

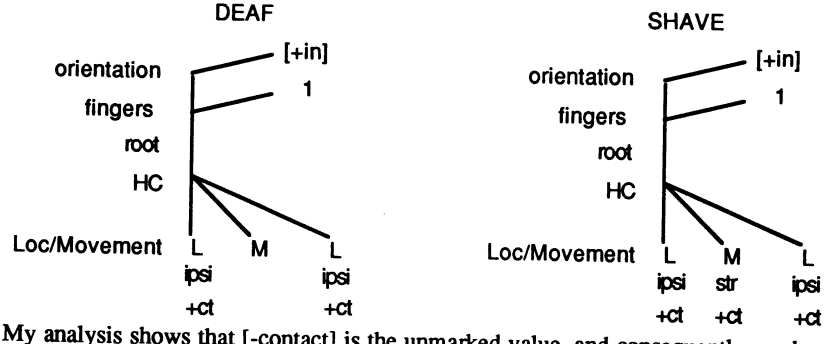
Previous work has analyzed [contact] differently. In Liddell and Johnson's system of phonological representation (1985, 1989), both '+' and '-' contact are present in the underlying representation of a single sign. Moreover, for signs such as KNOW, THINK, and MY, both the approaching movement and the contact are present:

12.



Sandler's (1987a) representation of Group 1 though 4 is identical, and consequently has a difficult time representing the distribution of the [+contact] feature in Groups 3 and 4. This representation on the skeletal tier (here the Location/Movement Tier) makes no distinction between underlying movements --here called paths-- and movements inserted either by the syllable template or the P-Level phonotactics. Even though Sandler recognizes that only [+contact] is present underlyingly, her skeletal template makes predicting its distribution problematic. [Contact] must be specified on some movements but not others. Her representations for DEAF and SHAVE are shown in (13):

13.



My analysis shows that [-contact] is the unmarked value, and consequently need not be specified in the underlying representations, and, further, predicts exactly which movements will have associated contact.

C. Place Harmony/Metathesis

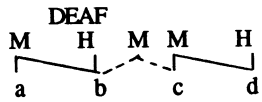
A more interesting question to ask of the data in (9), and the more difficult one to answer, is why the signs in Group 4, and only Group 4, allow the two points of articulation to be signed in either order. An example is presented below.

14a. FATHER [POA[forehead]] DEAF [POA[cheek [+top]] < POA [cheek[-top]]]

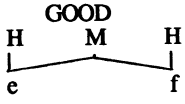
14 b. MOTHER] [POA[chin]] DEAF [POA[cheek [-top]] < [POA[cheek[+top]]

Johnson and Liddell (1989) describe this process as 'metathesis'. They recognize a difference in structure between Group 2 and Group 4, shown below (lower case letters=melody units) :

15a.

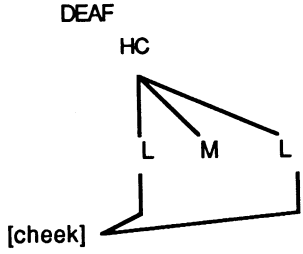


15b.



Sandler describes all the groups listed in (9) with the same underlying representation--and LML structure. She does recognize that most monomorphemic signs exhibit what she calls 'Place Harmony', meaning that the same major body area is present in both location segments of such signs (1987b, 1989:135). This is shown below in the sign DEAF. According to Sandler's analysis, Group 3 and Group 4 signs should behave identically, since they have identical underlying representations, yet they do not.

16

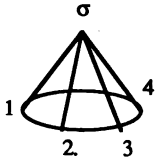


The differences in behavior between Groups 3 and 4 can be predicted if we utilize the evidence that has been built up in this paper so far, which distinguishes these 4 groups on the basis of underlying structure.

Group 1 are monosyllabic signs that contain only handshape, place or articulation (POA)and [+contact] specifications. The initial movement to contact is a result of syllabification at W-Level rather than the underlying [direction] feature in SIT, CALL and the other signs in (2). We know that this is notable difference because of the difference in their behavior in compounds. 'THINK' in THINK-SELF ('decide for yourself') and THINK-DROP ('shocked') has no underlying direction or tracing feature and consequently contributes no moraic unit to the compound, resulting in the monosyllabic compound structure. Recall that the underlying structure for 'CALL/NAME' contains a [direction] feature, resulting in a bisyllabic compound in BLACK-NAME. The result of syllabification in both types of signs is the same, but the underlying representations are different in an important way. THINK has inserted an unspecified movement inserted in order to satisfy syllabification requirements. The syllabified structures for both THINK and CALL are shown in (17).[11]

17a.

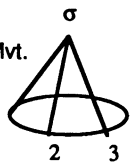
THINK



1. [HS[1]]
2. epenthetic syllable Mvt.
3. [+contact]
4. [POA[forehead]]

17b.

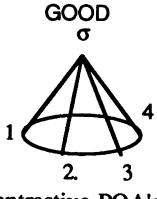
CALL[verb]



1. [HS[H]]
2. [direction [<--]]
3. [+contact]
4. unspecified POA

Group 2 contains monosyllabic signs that contain 2 contrastive places of articulation underlyingly. The linear order of these two POA values is achieved by virtue of their order on this feature's tier ($POA_1 < POA_2$), a formal construct discussed in McCarthy (1989). An unspecified movement will be inserted at P-Level that will make the transition between these two POA's. The syllable structure of GOOD is represented in 18.

18.



1. [HS[4]]
2. [++contact]
3. [POA[chin] < [ø]]]
4. [H2[4]]

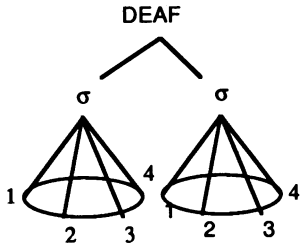
Since Group 2 contains 2 contrastive POA's that are linearly ordered at this level, no metathesis is expected.

Group 3 signs contain an underlying path feature, while Group 4 signs do not. This explains the difference in the distribution of [+contact] as we've seen. If the beginning and ending POA's in Group 3 signs are phonetic consequences of the path, then it is expected that these two points of articulation could not be inverted without changing the underlying path.

Group 4 sign have both 1) a different phonetic and phonological structure than Group 2 signs, and 2) phonetic POA's that are unordered. We must account for the phonetic difference between Group 2 and Group 4 described by Liddell and Johnson (1989). The situation can be accounted for in the following way.

Underlying Level: DEAF [HS[1], [POA[cheek]], [++ contact]
W-Level:

1) Because there is just one underlying POA in Group 4 signs, a syllabic movement is inserted, much in the same way as it is inserted for Group 1 signs like THINK and KNOW.
2) Because there is a [++contact] feature value, syllabification proceeds to copy the single contrastive POA underlyingly. The only way to achieve this double contact at this level is to form a bisyllabic structure of the form MPMP.
   The syllabified form is shown in (19).



1. epenthetic syllabic Mvt.	1. epenthetic syllabic Mvt.
2. [+contact]	2. [+contact]
3. [[HS[1]]	3. [HS[1]]
4. [POA[cheek]]	4. [POA[cheek]]

P-Level:

1) An additional movement is inserted between the 2 syllables. This accounts for the slight difference in the shape of the arc, noted by Liddell and Johnson between Group 2 signs and Group 4 signs.
2) The following P-Level phonotactic constraint applies:

20. **Phonetic Reduplication Constraint**

Underlying path features may reduplicate in ways that are phonetically identical; underlying POA features may not reduplicate in ways that are phonetically identical; consequently two redundant values are inserted.

(20) accounts for the fact that there are a large number of signs that have identical bisyllabic forms. All of the nominalized signs in (2b) contain two identical syllables.[12] This is because, as Supalla and Newport (1978) originally found and I support, the underlying path is reduplicated in these signs. In the signs that metathesize, however, the lack of an underlying path (in conjunction to the single POA) result in two redundant values.

In the sign DEAF, the redundant values [cheek[+top]] and [cheek[-top]] are now assigned. What emerges from this account is that it is precisely because the two POA's in DEAF are redundant values, rather than distinctive ones that such signs may metathesize. Further, it is the continuous access to the information at all 3 levels that predicts the nature of these redundant values. As saw earlier in this paper in (1), [±contra] is not specified for all signs. Signs in (1a) will exploit this [±contra] distinction in assigning redundant values. NAVY, CONGRESS, MEMBER, RESTAURANT and FLOWER will have redundant [±contra] features assigned. Signs in (1b) already have a [±contra] specification underlyingly; consequently a 'top/bottom/ [±top] will be assigned in just these cases. DEAF, HEAD, HOME, etc., contain a redundant [±top] value.

III. Conclusion

From the evidence presented above, we can see that ASL utilizes underspecified underlying representations in its morphophonological and phonological processes. The underlying representation argued for above is significantly reduced from earlier accounts of ASL underlying structure. To sum up, then, we have seen how positing such an underspecified representation:

1. economizes the compounding process
2. predicts the distribution of the feature [contact]
3. predicts the group of signs that will allow metathesis at P-Level.

Moreover, we have seen that such an underspecified representation is important is determining exactly which values can be pressed into service at P-Level as redundant values.

NOTES

[1] Approximate English glosses for ASL signs referred to in the text are typed in upper-case letters.

[2] The place of articulation in the sign SIT can assume a person agreement morpheme. This phenomenon is entirely compatible with this analysis and not the focus of this paper.

[3] [Restrained] is a phonetic phonotactic constraint that doesn't function at W-Level in this analysis.

[4] The verb in the pair is glossed as CALL (As in, "You can call me 'Al'".)

[5] I chose to reproduce Sandler's analysis here because she has explicitly stated that it is the phonology, rather than the phonetic component that she seeks to access. Liddell and Johnson have been working on a 'bottom up' analysis of ASL, and so such a claim is notably absent.

[6] Only Path shape and direction features have sufficient weight in this process to occupy a mora in the phonological syllable(s) of a compound. Syllabic weight has traditionally been equated with sonority (Hyman 1984, Hayes 1989; Perlmutter, ms., for a discussion particular to ASL). Whether or not ASL has a sonority hierarchy is not the subject of this paper; however, this evidence from compounds assists in establishing that there is a notion of syllable weight at work in ASL.

[7] Word-level stress may also play a factor in this process. Compounds containing the sign FACE are exceptions to this: In both FACE-STRONG ('resemble') and FACE- SAME ('look-like' or 'appear-like'), the circular movement in FACE is deleted

[8] My thanks to Carol Padden for pointing out the importance of the compound NAME-SHINE. ('good reputation').

[9] We know that [+contact] is the underlying value rather than [-contact] because :

1. There are a number of signs that are specified [+contact] underlyingly --with [+contact] evident in careful signing--which delete the [+contact] value in fast signing. Some examples are FORGET, THINK, SPACY, UNDERSTAND, SICK, KNOW, RESTAURANT, HEALTH, HEAD, HORSE, and SCOTLAND. This suggests that there may be a widespread phonetic rule that allows the sign to delete contact in such signs.
2. [±distal] signs, such as WANT, DARK, RAINBOW and FLY are redundantly [-contact].

[10] This is one of two types of contact in ASL: 1) contact between the dominant hand (H1) and the non-dominant hand (H2) or body, and 2) contact between selected fingers of H1 and the thumb of H1. For the analysis being presented here, only type 1 is relevant.

[11] At M-Level, the unspecified Path feature in THINK and the unspecified POA feature in CALL/NAME is not represented.

[12] There are also signs that are not nominalized that contain 2 identical syllables, such as COUGH, MILITARY, CANADA. My analysis accounts for these by positing an underlying [direction] feature in these signs, exactly as the nominalized forms.

REFERENCES

Archangeli, Diana. 1984 Underspecification in Yawelmani phonology and morphology. Doctoral dissertation, MIT. [Published 1988, NY: Garland Press]

Goldsmith, John. 1990. Autosegmental and Metrical Phonology. NY: Basil Blackwell, Ltd.

Hayes, Bruce. 1989. Compensatory Lengthening in Moraic Phonology. Linguistic Inquiry 20 (2): 253-306.

Hyman, Larry. 1984. A Theory of Phonological Weight. Providence, RI: Foris.

Kenstowicz, Michael & Charles Kisseberth. 1979. Generative Phonology. NY: Academic Press.

Liddell, Scott & Robert Johnson. 1989. American Sign Language Phonology: The Phonological Base. Sign Language Studies 64: 195-273.

McCarthy, John. 1989. Linear Order in Phonological Representation Linguistic Inquiry 20 (1): 71-99.

Perlmutter, David. ms. A Moraic Theory of American Sign Language Syllable Structure.

Pulleyblank, Douglas. 1988. Vocalic Underspecification in Yoruba. Linguistic Inquiry 19: 233-70.

Sandler, Wendy. 1987a. Sequentiality and Simultaneity in American Sign Language Phonology. Doctoral dissertation. University of Texas, Austin.

Sandler, Wendy. 1987b. Assimilation and Feature Hierarchy in American Sign Language. In Anna Bosch, Barbara Need & Eric Schiller (Eds.) CLS 23 (2): Parasession on Autosegmental and Metrical Phonology, 266-278. Chicago: CLS.

Sandler, Wendy. 1989. Phonological Representation of the Sign. Providence, RI: Foris.

Supalla, Ted & Elissa Newport. 1978. "How Many seats in a chair?" The derivation of nouns and verbs in American Sign Language. In Patricia Siple (Ed.) Understanding Language Through Sign Language Research, 91-133. NY: Academic Press.

Steriade, Donca. 1987. Redundant Values. In Anna Bosch, Barbara Need & Eric Schiller (Eds.) CLS 23 (2): Parasession on Autosegmental and Metrical Phonology, 339-363. Chicago: CLS.

Stokoe, William, Dorothy Casterline & Carl Croneberg. 1965. Dictionary of American Sign Language on Linguistic Principles. Silver Spring, MD: Linstok Press.