An alternative representation of ASL phonology

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Abstract

There are several models which show phonological structures in sign language. Of these, the MH model (Movement Hold model) and MH model (Movement Position model) are typical. The biggest difference between the two is that the former has the same structure as the syllable model in spoken language phonology, which uses syllables to represent phonological phenomena, but the latter does not. Although the main advantage of using syllables is that it is possible to compare sign language phonology with that of spoken language, some problems with the MP model remain. A few proposed revisions have been presented, but with little success. In this paper, I suggest new ways of representing the structure of sign language phonology using syllables. Furthermore, by considering sign and spoken languages in the same way, we will be able to draw comparisons which will lead towards a better explanation of sign language. Nowadays, the role of sign language is becoming increasingly important in the field of nursing. Approaching sign and spoken languages from the same viewpoint, rather than separately, will lead to an increased understanding of them within the field.

Keywords: MH model, MP model, mora, extrametricality, hold

1. Introduction

There are some prosodic models of ASL (American Sign Language), for example, the Movement Hold model (MH model) (Liddell, 1984, Liddell & Johnson, 1989, Liddell, 1990)[11,12,13], the Movement Location model (Hand Tier model; ML model) (Sandler, 1986, 1987, 1989)[18,19,20] and the Movement Position model (Moraic Theory of Syllable Structure; MP model) (Perlmutter, 1992, 1993)[15,16]. Liddell (1993)[14], who proposes the MH model, demonstrates that there are a number of phenomena which we cannot explain using the MP model. Hayes (1993)[5] shows his proposed revision of the MP model. In this article I reconsider the inadequacy of the MP model, show that there is a problem also in the proposed revision by Hayes, and suggest an alternative theory.

2. The MH model

The MH model is proposed in Liddell (1984)[11], Liddell & Johnson (1989)[12] and Liddell (1990)[13], and is still being developed. Liddell proposes two sequential units, an H (hold) segment and an M (movement) segment, corresponding to stationary or moving states of the articulators. The MH model has a skeletal and a melody tier, which also exist in the

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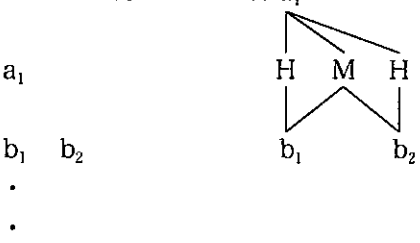
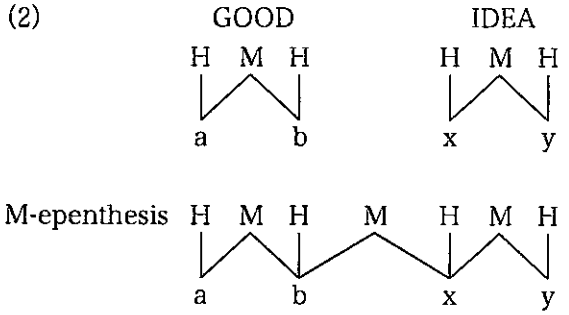
phonological structure given by Hayes (1989)[4] and Hyman (1985)[7] in the phonology of spoken languages. A skeletal tier contains Ms and Hs, and a melody tier a number of articulatory features specifying hand configuration, orientation and the relevant locations involved in the production of the sign. In (1a) melody features (abbreviated as a_1, b_1, b_2) spread to every segment of the sign. Thus, the set of features represented by a_1 will attach to the initial H, the M, and the final H, as illustrated in (1b).

(1) a. H M H b. a_1

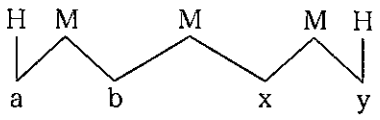


This can be considered to be the same as initial syllabification in an earlier stage where syllables are formed. After that, it is treated as a segmental difference depending on the situation, which can be easily explained by two rules, which are M-epenthesis and H-deletion.[1] In (2), GOOD and IDEA, for example, are each syllabified as initial syllabification with the syllable structures of oral languages but they are not really syllables, combined with each other, and M-insertion applies to the structures before H-deletion. This is the resyllabification in spoken languages, and GOOD IDEA as an output begins with an initial H before consecutive Ms and ends with a final H.

(2)



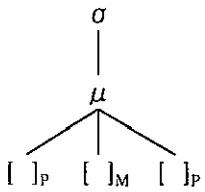
H-deletion



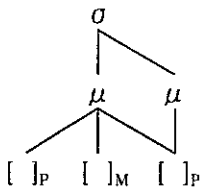
3. The MP model

MP is a theory in which Purlmutter (1992)[15] explains ASL phonology with syllabification, and it is considered alongside the moraic theory of phonology being developed by Hyman (1985)[7], McCarthy & Prince (1986)[17], Hayes (1989)[4], and others. In MP a mora is considered as a unit of phonological weight and a timing unit or a unit of phonological length, and a syllable consists of one mora or two. There are two features, a movement (M) and a position (P), on a tier of the syllable structure in the segment like (3).

(3) a. GOOD (not phrase-final)



b. GOOD (phrase-final)



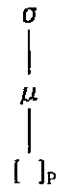
When GOOD and IDEA, which have had initial syllabification applied, are resyllabified as GOOD IDEA in (2), mora insertion is triggered in GOOD in (3a), and it becomes (3b).

4. Problems raised by Liddell

Liddell (1993)[14] raises the following concerning MP:

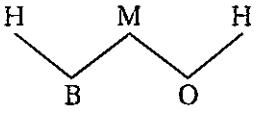
① In MP, DEFLATED can be illustrated only as in (4).

(4) DEFLATED



The MP model is not useful in accounting for the long initial hold, the movement, and the final hold. In the MH model it can be illustrated as (5).

(5) DEFLATED



If a hold is considered as syllable weight, namely a mora, DEFLATED needs four moras. This is because in the emphatic form a long hold (two moras) is inserted in the initial position, and one mora in the handshape change and one mora in the final hold.

In spoken language, it is not considered that there are two moras in onset, so it is difficult to explain it using syllables. Perlmutter basically never considers syllables to have any holds in initial position. He believes that movemental syllables end in a hold only in final position; otherwise they have no hold, and mora insertion correctly predicts the distribution of holds in phrase-final position. Liddell, however, says that some signs never end in a hold, even in phrase-final position (HAPPY). Some signs begin with a hold (GOOD, RICH, POWER).

If Liddell's observation is true, in the MP model, P is considered as a consonant of spoken phonology. Perlmutter explains it by taking up sonority hierarchy in (6) and (7).

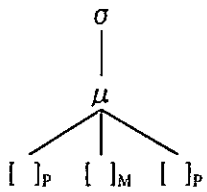
(6) a. Classes of segments (or the features that characterize them) are ranked in a SONORITY HIERARCHY.
b. Each relative sonority peak in a phonological string is the nucleus of a syllable.
c. Vowels are more sonorous than consonants.

(7) In sign languages, Ms are more sonorous than Ps.

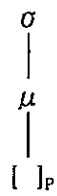
In other words, a consonant in spoken phonology is identified with P in MP model in sign language phonology, and a vowel with M. M means neither handshape nor second movement but path movement. In (4), if DEFLATED has four moras, there is no M but only one P, which means that P has four moras. This is a very unnatural situation: A syllable without any vowels is rare, and a consonant with plural moras rarely exists.

② The other problem is that in which P has the feature of handshape change. In the MP model, as mentioned above, an M means only path movement and not handshape change. Then, according to Liddell (1993)[14], the initial P in (8a) places the hand at the correct location but does not contain features which account for handshape change. But lone P in (8b) must show the placement of the hand and account for the initial and final handshapes. The three Ps - two Ps of (8a) and one P of (8b) - are all different.

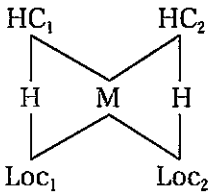
(8) a. UNDERSTAND$_{path}$



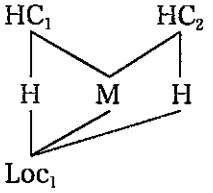
b. UNDERSTAND$_{nonpath}$



(9) a. UNDERSTAND$_{path}$



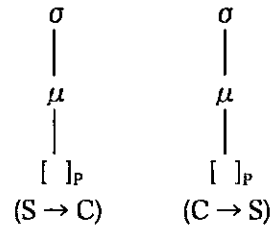
b. UNDERSTAND$_{nonpath}$



In the MH model, however, the structure of MHM is the same both in path and non-path movements in (9), and there is no difference between Ms and Hs in (9a) and (9b).

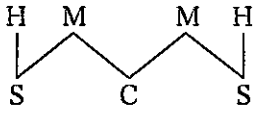
③ SHOCKED is illustrated as follows.

(10) SHOCKED



In (10) each mora indicates handshape change but does not show initial hold nor final hold.

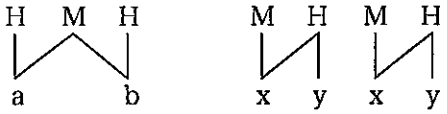
(11) SHOCKED



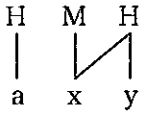
In the MH model the two Hs are thought to be an initial hold and a final hold, and the two Ms between them two handshape changes: S → C and C → S. Though impossible to explain by the MP model, this can be easily explained by MH.

④ GOOD NIGHT as a phrase is different from GOOD^NIGHT as a compound word in its length. Whether a mora is a unit of length or weight is problematic, but I will not consider that in detail here. This problem will be taken up in the next section, but here I consider it to be a unit of length.

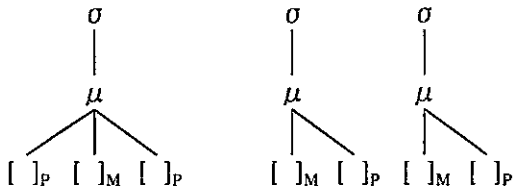
(12) GOOD NIGHT



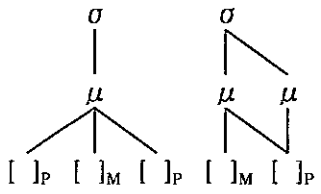
GOOD^NIGHT



(13) GOOD NIGHT



GOOD^NIGHT

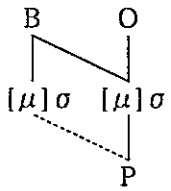


Purlmutter (1993)[19] does not mention any of the structural changes described above.

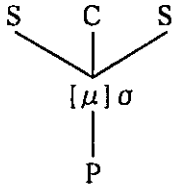
5. Revision proposed by Hayes and this thesis

Hayes (1993)[5] proposes the following revision of the MP model:

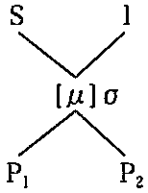
(14) DEFLATED



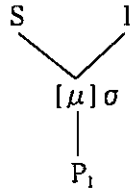
(15) SHOCKED



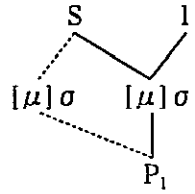
(16) a. UNDERSTAND$_{path}$



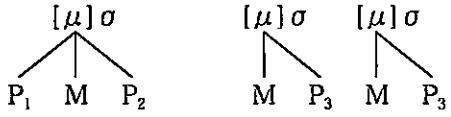
b. UNDERSTAND$_{nonpath}$



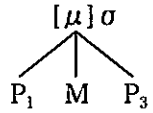
c. UNDERSTAND$_{nonpath,\ empahatic}$



(17) a. GOOD NIGHT



GOODNIGHT



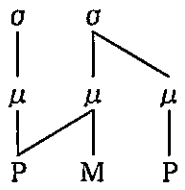
Before considering Hayes's revision, I would like to ask whether syllable structures of moraic phonology are necessary in ASL. What are the advantages of moraic phonology in ASL? Indeed, what exactly is a mora? Each phonologist gives a different definition of mora, which is usually taken to mean either length or weight of a syllable, and this is discussed in Brentari & Bosch (1990)[1]. One definition is that a mora is usually taken as syllable weight in quantity sensitive language, and it triggers stress. However, it is unclear whether stress plays a great role in ASL phonology. On the other hand, Liddell speaks about the mora in terms of duration, so he seems to think of it as syllable length. But each mora has a different length both in colloquial and sign language phonology. Also, it is difficult to take the mora as a unit of length considering Brentari & Bosch's discussion.

In addition, I wonder if syllable structure is essential. Liddell explains ASL without using a syllable structure, although Perlmutter and Hayes use it because they can compare the syllable structure of sign languages with that of spoken languages and can find the differences between them. It is, furthermore, because they can explain various phenomena in sign language phonology by analogy with spoken language phonology. I, however, doubt that the syllables of the former play the same role as those of the latter. In considering whether they are necessary or not, I present the syllable structures of Perlmutter, their revision by Hayes, and my own thoughts on them. Perlmutter only illustrates the syllable structure (4), and Hayes proposes (14).

The emphatic forms of signs like DEFLATED pose a serious problem, because the MP model would treat them as single P segments since there is no path movement. And the MP model is not capable of accounting for the sequence of the long initial hold, the movement, then the final hold, because the sign is treated as consisting of only a single segment. Non-path movements are not Ms in the MP model but path movement are, and (4) has to show the sequence of the initial hold, the non-path movement (handshape change), and the final hold, which is impossible. Hayes increases the number of moras and shows the handshape change. In the MP model by Perlmutter, M and P express a vowel and a consonant in spoken language phonology. If so, a

syllable with two moras, consisting of only consonants, is very unusual in spoken language phonology. As mentioned above, this is because Perlmutter does not consider non-path movements, handshape changes and second movements to be Ms, and M is considered as a vowel of spoken language phonology. I propose the following revision:

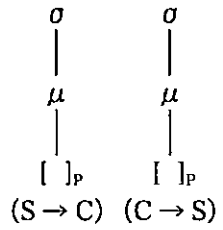
(18) DEFLATED



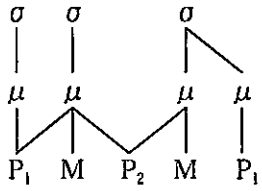
In the MP model, as short hold has one mora, it is difficult to express this structure by one syllable, and I propose that it should be divided into two syllables. In this case, a mora is given to the initial hold. According to Perlmutter, the fact that a P can be a syllable nucleus only if not adjacent to an M is then explained in exactly the same way as the fact that in oral languages a consonant can be a syllable nucleus only if not adjacent to a vowel. As it is impossible for onset to have a mora in the syllable structure of spoken phonology, the P which is given a mora should be thought to form a syllable by itself. This is less than ideal situation, but there is no other way to explain initial short or long hold at present. Even if a P is adjacent to an M, it should be a syllable nucleus. I propose, too, that the range of M should spread to secondary movement and handshape change. The small number next to P means the location of hands. (18) shows that handshape change takes place in the same location.

Next, I consider the example of SHOCKED. In Liddel(1993)[14], he says that MP model would apparently represent it as a sequence of two Ps in (19), and the representation faces the difficulty in representing the initial and final holds. In (14), Hayes insists on using only one mora to explain three phonetic facts: initial hold, final hold and handshape change. However, I divide it into three syllables in (20), as in (18), and give a full mora to only P in initial syllable.

(19) SHOCKED



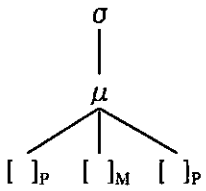
(20) SHOCKED



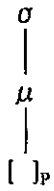
When Perlmutter shows the phonological structure of SHOCKED, he must add parentheses under P. To compensate for this weakness, Hayes proposes the structure of one syllable in (14). But in (18), considering that he gives a mora to handshape change, it follows that the syllable should have two moras in it. Furthermore, when one mora is given to initial and final hold, the syllable of (14) needs four moras. The proposed revision of this paper is given in (20), and it has the four-syllable structure with three moras. Also, M (handshape) of the second syllable, which shows a nucleus in colloquial phonology, and P (final hold) which indicates a coda in spoken phonology, are given moras.

Hayes explains that the difference between UNDERSTAND with path movement and UNDERSTAND without path movement is the existence of only one P as in (16a) and (16b), and does not give each mora to both path movement and handshape change. Unlike MP model in (21), he gives one mora to handshape change in nonpath and emphatic form in (16c).

(21) a. UNDERSTAND$_{path}$



b. UNDERSTAN$_{Dnonpath}$

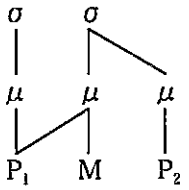


This is the same as the explanation of MP model by Perlmutter in path or nonpath and nonemphatic form. In MP model, path movement can constitute a syllable on its own, but handshape change and secondary movement are features included in both P and M. Does handshape change or secondary movement with path movement have the same length as one without path movement? At this stage, it is difficult to tell. According to Perlmutter's explanation, an M does not include handshape change or secondary movement but path movement. An M is more sonorous than a P, so it looks like a vowel in spoken phonology. Though path movement of an M is given a mora as a nucleus, handshape change and secondary movement are not always given a mora, which is contradictory.

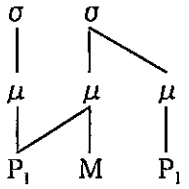
In spoken English, phonologists have not made a phonological issue of whether a mora is length, because whether a mora means length or not, it is not an important problem. In fact, the length of every mora in English is different. But even if we don't think of a mora as length but rather as weight, it is not clear whether weight in ASL phonology is effective or not for the reasons mentioned above.

It should, therefore, be supposed that an M includes not only path movement but also handshape change and secondary movement, and has a mora. And it also should be supposed that the combination of path movement, handshape change and secondary movement does not increase the number of moras. In (22), I propose that the syllable of (21) and (16) is divided into two.

(22) UNDERSTAND$_{path}$



UNDERSTAND$_{nonpath}$

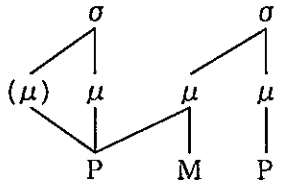


How, then, should the emphatic form of UNDERSTAND be explained? It cannot be explained through MP by Perlmutter. Both forms of UNDERSTAND in (16a) and (16b) above can have emphatic forms. Hayes presents (16c), the emphatic form of (22b), as a proposed revision.

There are some problems with this model. One is that onset has a mora, and as I have already shown it, onset doesn't have a mora in spoken phonology. The second problem I have described, is that if there is only one mora in long hold, it is impossible to understand the difference between long and short hold. In (16c), whether there is a final long hold or a final short hold, the same syllable structure is the same. The third and biggest problem is where the initial mora appears from. In MP, the phonological rule of mora insertion is applied only to the phrase final position, but in (22) it is applied to the phrase initial position. In this paper, I propose extrametricality. Extrametricality rules as a notion of metrical theory were put forth by Liberman and Prince (1977)[10], and the idea of general rules of extrametricality were proposed in Hayes (1982)[3].[2] They designate a

particular prosodic constituent as invisible for the purposes of rule application, and if extrametricality rules are applied to constituents, they are sheltered from any phonological rules and protected from input to output.

(23) UNDERSTAND$_{\text{nonpath, emphatic}}$

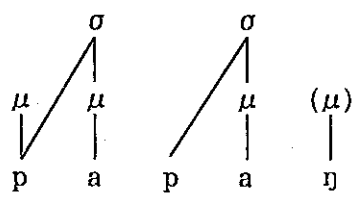


In (23), the initial mora of the first syllable is evacuated by extrametricality. When this syllable begins with short hold, the evacuated mora remains extrametrical, and when it begins with long hold, the extrametricality is deleted at the stage of its output. One problem of extrametricality being removed in output arises, but if syllabification can be divided into two (initial syllabification and resyllabification), this phenomenon is well explained. It is because when the syllable begins with short hold, only initial syllabification is applied to the syllable, and the initial mora can be considered to remain extrametrical up to resyllabification, and when it begins with long hold, both initial syllabification and resyllabification are applied to it.

Hayes (1981)[2] says that the unmarked edge for extrametricality is the right edge, and the left edge is the marked edge. The theory of extrametricality, then, is not universal.

Next I consider the syllable structure of Korean, as shown by Jun (1994)[9]. He shows "partial reduplication" applicable only to onomatopoeic words of Korean as follows:

(24) p'apaŋ



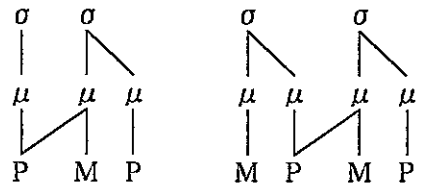
The initial mora of the first syllable is floating because an onset does not have any moras, so a phonological rule of "Stray Erasure" (Ito 1986)[8], (Steriade 1982)[21] ought to be applied to it. The parenthesis of the final mora means extrametricality. Stray erasure is a rule that any melodic material not associated to a skeletal point at the end of a derivation is erased at that stage. If there was a rule of mora deletion, it would delete the mora as a subrule of stray erasure. But when compensatory lengthening is respected, we encounter another problem, which will be discussed later.

⑤ Last of all, I give consideration to the example of the phrase GOOD NIGHT and the compound GOOD^NIGHT.

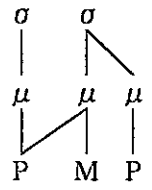
When the MH model in (12) is compared with the MP model in (13), it is obviously odd that GOOD NIGHT has the same number of moras as GOOD^NIGHT. Liddell (1993) says, "In compound GOOD^NIGHT, the only remnant of GOOD (the first member of the compound) is a contact at the chin. The movement away from the chin and the final contact are deleted. ..... the duration of the first member of a compound should be only a fraction of the duration of a simple (monosyllabic) sign." Hayes offers a proposed revision in (17).

My proposed revision is shown in (25).

(25) a. GOOD NIGHT



b. GOOD^NIGHT



A serious problem appears here which is also

seen in Hayes's proposed revision, and that is the number of moras. In (17), the structure of the compound word GOOD^NIGHT is derived from the phrase GOOD NIGHT, and two moras are deleted in the derivation by the "Mora Deletion" rule which states that a mora is deleted in compounding. It is hard to believe that Hayes (1989)[4], who proposes Compensatory Lengthening (CL), explains the phonological phenomenon by using Mora Deletion. CL can stand up without Mora Deletion; in fact, CL is incompatible with mora deletion. In (25), the number of moras in input is different from that in output; still, Mora Deletion should be allowed to apply, if CL is respected. I will leave discussion of that for another occasion.

6. Conclusion

I have talked about the revision of using the mora and tried to use it for the explanation of phonological phenomena in ASL phonology. But I wonder if in fact the mora is effective or necessary in it. What is the reason for using the mora? I think there are three possible reasons. In spoken phonology, a mora plays the role of drawing stress, and in ASL phonology, too, a mora can also be thought to play the same role to trigger drawing something phonological. But now it is not clear what the mora of sign language phonology triggers and/or affects. The second reason is that it triggers CL in spoken phonology, which Hayes, a former advocator, denies by using mora deletion. If mora deletion is applied, a mora does not play any role in triggering CL. The length of it is the third reason, but the mora as length is regarded as questionable because it is different in its position in spoken language. As a result, the mora cannot be considered to play an effective role in sign language phonology, and compared with spoken phonology, it cannot be said to be useful.

It is also difficult to imagine that the syllable structure with the mora is useful to explain sign language phonology.

Notes

1. M-epenthesis inserts an M between each of H segments, and H-deletion deletes medial Ms.
2. a. Constituency Only constituents (segment, syllable, foot, phonological word, affix) may be marked as extrametrical.
   b. Peripherality A constituent may be extrametrical only if it is at a designated edge (left or right) of its domain.
   c. Edge Markedness The unmarked edge for extrametricality is the right edge.
   d. Nonexhaustivity An extrametricality rule is blocked if it would render the entire domain of the stress rules extrametrical. (Hayes, 1995)[6]

Bibliography

1) Brentari, D. and A. Bosch. 1990. The mora: autosegment or syllable constituent. *CLS 26.* 1-15.
2) Hayes, Bruce. 1981. A metrical theory of stress rules. Cambridge, Mass.: MIT Ph.D. dissertation. Revised version distributed by Indiana University Linguistics Club. Published by Garland Press, New York, 1985.
3) Hayes, Bruce. 1982. Extrametricarity and English stress. *Linguistic Inquiry 13.* 227-276.
4) Hayes, Bruce. 1989. Compensatory lengthening in moraic theory. *Linguistic Inquiry 13.* 227-276.
5) Hayes, Bruce. 1993. Against movement: comments on Liddell's article. In Phonetics and phonology (G. R. Coulter, eds.), Vol.3, pp.213-226. Academic Press, San Diego.

6) Hayes, Bruce. 1995. Metrical stress theory. University of Chicago Press, Chicago.
7) Hyman, Larry. 1985. A theory of *phonological weight*. Dordrecht: Foris.
8) Ito, Junko. 1986. *Syllabic theory in prosodic phonology*. PhD dissertation, University of Massachussetts. Published 1988, New York: Garland.
9) Jun, Jongho. 1994. Metrical weight consistency in Korean partial reduplication. Phonology 11. 69-88.
10) Liberman, M. and A. Prince. 1977. On stress and linguistic rhythm. *Linguistic Inquiry 8*. 249-336.
11) Liddell, Scott K. 1984. THINKS and BELIEVE: Sequentially in American Sign Language signs. Language 60. 2, 372-399.
12) Liddell, Scott K., and Johnson, Robert E. 1989. American Sign Language: The phonological base. Sign Language Studies 64, 195-277.
13) Liddell, Scott K. 1990. Structures for representing handshape and local movement at the phonemic level. In Theoretical Issues in Sign Language Research (S. Fischer and P. Siple, eds.), Vol.1, pp.37-65. University of Chicago Press, Chicago.
14) Liddell, Scott K. 1993. Holds and positions: comparing two models of segmentation in ASL. In Phonetics and phonology (G. R. Coulter, eds.), Vol.3, pp.189-211. Academic Press, San Diego.
15) Perlmutter, David M. 1992. Sonority and syllable structure in American Sign Language. *LI* 23. 407-442.
16) Perlmutter, David M. 1993. Sonority and syllable structure in American Sign Language. In Phonetics and phonology (G. R. Coulter, eds.), Vol.3, pp.227-261. Academic Press, San Diego.
17) McCarthy, J. & A. Prince 1986. *Prosodic morphology*. Ms, University of Masschusetts, Amherst & Brandeis University.
18) Sandler, Wendy. 1986. The spreading hand autosegmental of American Sign Language. Sign Language Studies 50, 1-28.
19) Sandler, Wendy. 1987. Sequentiality and Simultaneity in American Sign Language Phonology. Doctoral dissertation. University of Texas at Austin.
20) Sandler, Wendy. 1989. Phonological Representation of the Sign: Linearity and Nonlinearity in American Sign Language. Foris, Dordrecht.
21) Steriade, Donca. 1982. Greek prosodies and the nature of syllabification. PhD dissertation, MIT.

和文抄録

An alternative representation of ASL phonology

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手話の音韻構造の表し方にはいくつかのモデルが存在する。その中でも特にMHモデル（Movement Hold model）とMPモデル（Movement Position model）は代表的なもので，その大きな違いはMPモデルが口語音韻論の音節構造と同じ構造，つまり音節で表すのに対してMHモデルは音節構造を使用しない。音節構造を使用する最大の利点は口語音韻論との比較が可能である点であるが，MPモデルには問題も存在する。その問題に対する修正案が音韻論学者によって提案されているが，まだ問題は解消されていない。本稿ではまだ残されている問題に対して更なる修正案を提示するものである。更に手話音韻論と口語音韻論を同じ形態で説明することができれば，それらを比較することによりもっと上手く手話を説明できると思われる。現在，看護の分野では手話の役割が更に重要になってきている。その看護の分野においても手話と口語を別々の観点から論じるのではなく，同じ視点からみることが可能になればより理解が容易になることと思われる。

キーワード：MHモデル，MPモデル，モーラ，韻律外性，静止