# AGAINST MOVEMENT: COMMENTS ON LIDDELL'S ARTICLE

**BRUCE HAYES**

*Department of Linguistics*
*University of California*
*Los Angeles, California 90024*

## 1. INTRODUCTION

In his article, Scott Liddell compares his own theory of ASL phonological structure with that of David Perlmutter. Liddell offers a number of arguments that his theory is the better one. As a commentator, I could in principle render a verdict about whose theory "wins." But I think that would miss the point: both theories have something important to say, for the most part in different areas. I also suspect that in the long run, neither theory will turn out to be fully correct, and that a quite different theory may replace both of them. In the second part of my comments, I suggest one direction in which substantially different theories might be explored.

## 2. LIDDELL'S ARGUMENTS AGAINST PERLMUTTER'S THEORY

By far the most important argument in Liddell's paper is this: in phrase-final position, HOLD contrasts phonologically with ABSENCE OF HOLD. For example, NAME ends in a hold phrase-finally, but HAPPY does not.

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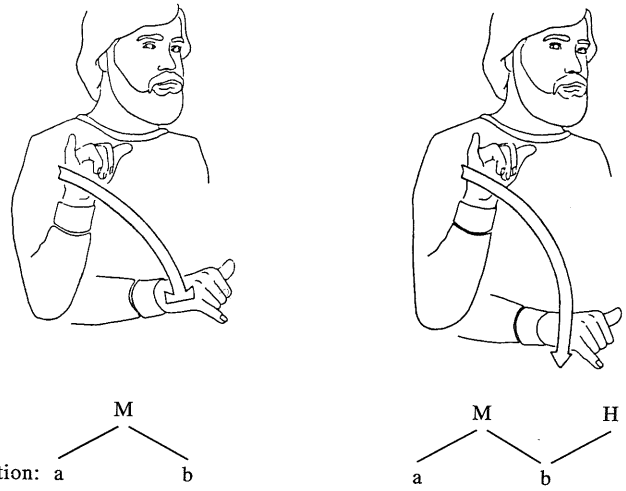
Before discussing this further, I want to strengthen Liddell's argument a bit. To justify the existence of a contrast, it is important to provide a minimal pair, to

minimize the possibility that the relevant phonetic distinction is derived. Such a pair in this case can be found in Supalla and Newport (1978): in final position, STAY ends in a hold, but THAT'S-THE-ONE does not. More precisely, STAY is produced with a full, obvious hold; whereas THAT'S-THE-ONE is produced with at most a short, nonobvious hold, or often with no hold at all. This is shown in (1), where I provide a transcription of these signs in Liddell's notation.[1]

(1) a. No final hold: THAT'S-THE-ONE b. Final hold: STAY




Such contrasts raise a problem for Perlmutter: in his analysis, an extra mora is always added in final position, by the rule of Mora Insertion. If this added mora lands on a P in a PMP syllable, then it is interpreted phonetically as a hold. But this would wrongly assign a hold to THAT'S-THE-ONE as well as to STAY, as (2) shows.

(2) THAT'S-THE-ONE (underlying form)


The criticism, then, is that by adopting a general rule of Mora Insertion, Perlmutter's analysis wipes out a lexical distinction that should in fact be maintained on the surface.

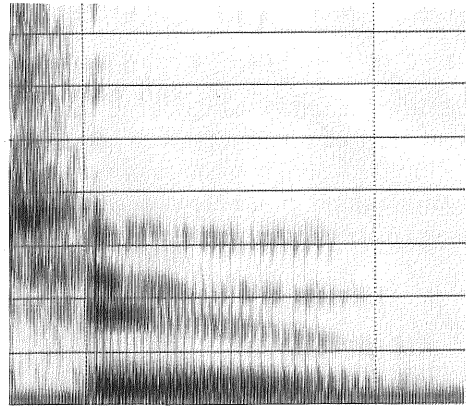
Is Perlmutter's proposal sunk by such counterexamples? I tend to think not, and I will sketch here a revision of Perlmutter's account that may solve the problem.

It is useful to consider the analogue of "holds" (that is, extra phonetic duration) in spoken language. Such "holds" typically have two sources: lexical representations, and phonetic rules. A lexical contrast of length would be seen, for example, in the Italian words ***nonno*** and ***nono:*** [nonnɔ 'grandfather' has a geminate "held" /n/, whereas [nonɔ] 'ninth' has a single "nonheld" /n/.



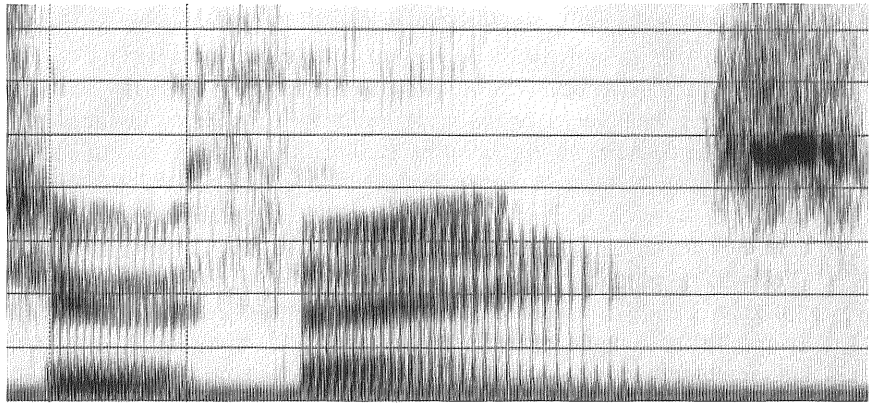
Length can also be derived by late phonetic rules. For example, in English and many other languages, segments in final position are phonetically lengthened. In the following spectrograms, the phrase-final /u/ in *two* is 2.12 times longer than the /u/ in *two things,* which is not phrase-final. I use a colon as an ad hoc notation for phonetic length.

(3) Phrase-final /u/: 239 msec



*two* [tu:]

Non–Phrase-final /u/: 113 msec



*two things* [tu θɪŋz:]

Phonetic final lengthening has been intensively studied by phoneticians; see for example Klatt (1976), Allen, Hunnicutt, and Klatt (1987), and the references cited there. As Coulter (this volume) observes, it appears to occur in ASL as well.

It is commonplace for a language to have both kinds of length, that is, both lexical and phonetically derived. My suggestion is that this is true for ASL as well. We can say that the difference between THAT'S-THE-ONE and STAY is a LEXICAL distinction. Under Perlmutter's theory, we could represent it using these underlying forms:

(4) a. STAY b. THAT'S-THE-ONE


On the other hand, many of the length alternations described in Perlmutter's paper should be described as the result of a PHONETIC rule adding length in phrase-final position. To illustrate this, I give representations below for THAT'S-THE-ONE in both nonfinal and final position. In the absence of a formal theory of phonetic length, I use a colon as a makeshift, to indicate increased duration at the phonetic level.

(5) a. THAT'S-THE-ONE (nonfinal position)  like [u] in English *two things*



b. THAT'S-THE-ONE (final position)  like [u:] in English *two*



Crucially, there is no PHONOLOGICAL difference between the two forms.

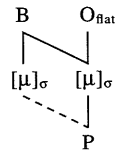
If this proposed bifurcation of holds is valid, two predictions follow. First, the hold in STAY should always be present, even when another sign follows within the phrase. This is because the hold forms part of the phonological representation, rather than being derived by phonetic rule. Some informal checking I have done with consultants suggests this prediction is correct. Second, the phonetically derived "holds" in phrase-final position should vary in both frequency and phonetic duration, since this holds true as well for final phonetic lengthening in spoken languages. The discussion by both Liddell and Coulter (this volume) suggests this is correct.

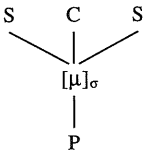
I turn now to the other criticisms in Liddell's paper, which mostly center on the claim that there are signs and derivations in ASL that cannot be represented in Perlmutter's system. I believe that this is simply not the case. In particular, if one assigns handshape to a separate tier (as in Sandler, 1986; Perlmutter, this volume), fairly straightforward representations are possible. Without discussing



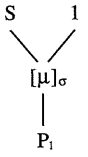
each case in detail, I propose some sample representations and derivations below, annotated with the relevant example number of Liddell's article. The notation $[\mu]_\sigma$ stands for a mora dominated by a syllable node.

a. DEFLATED (14) b. SHOCKED (15–16)

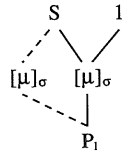



c. $\text{UNDERSTAND}_{\text{path}}$ $\text{UNDERSTAND}_{\text{nonpath}}$ (17)

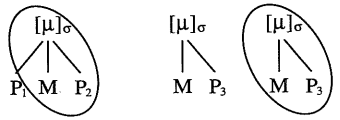




d. $\text{UNDERSTAND}_{\text{nonpath, emphatic}}$ (18)




(underlying form of emphatic prefix: /μ-/)

e. GOOD NIGHT GOOD^NIGHT (19–21)




( = deleted in compounding)

There may be other criticisms that can be leveled against these representations, but the basic claim of unrepresentability seems invalid.

At this point I shift from the details to the broader picture, summarizing the main accomplishments of both Liddell's and Perlmutter's models, and then suggesting a direction in which research might proceed further.

Liddell's work (and by this I include his collaboration with Robert Johnson) can be credited with the major advance of recognizing the existence of sequential segmental structure in ASL signs. Liddell has also presented the first explicit model of timing structure in ASL, the Movement/Hold model. In a 1988 paper, Liddell also presented much evidence for a multitiered representation for ASL. All of these clearly are important advances.

Perlmutter's contributions are in somewhat different areas. He has proposed a

typology of ASL syllable structure, supported by interesting evidence from handshape change and secondary movement. Perlmutter has also presented the first serious account of the problem of ARTICULATOR ALIGNMENT: how are handshape changes, secondary movements, and so on aligned in time with other movements? Finally, I credit Perlmutter with the effort to abstract away from surface phonetic detail: as Perlmutter has shown, the phonologically relevant structure is not necessarily what one sees in surface isolation forms.

Where should we go from here? I suspect that regarding sign language phonology, we have only just begun. Future theories of sign structure will bear a real debt to Liddell's and Perlmutter's work, but these future theories may only remotely resemble what Liddell and Perlmutter have proposed. Researchers in sign phonology should not feel themselves bound by current models—it is important to bear in mind the factual generalizations that earlier researchers have discovered, but as far as theorizing goes, the sky should be the limit.

## 3. AGAINST MOVEMENT

In the second part of these comments, I hope to encourage sign phonologists to develop new and different theories by presenting an idea that has been fruitful in the study of the phonology of spoken languages. The discussion that follows is based in part on the work of Stack (1988).

Phonological features can be classified into two groups, static and dynamic. A static feature describes a position of the articulators. Most features in oral phonology are static, for example [high], [round], [nasal], or [coronal]. A dynamic feature involves reference to time or motion. For example, a feature like [falling], as applied to tonal systems, involves reference to motion because the articulators responsible for pitch are in motion during the production of a falling tone. Some other dynamic features are [rising], [prenasalized], and [delayed release].

One should bear in mind that the static/dynamic distinction is an abstract one, relevant only at the phonological level. In actual phonetic forms, the articulators are in almost constant motion. It is the rules and representations of the phonological component that are relevant here, not their physical instantiation.

The crucial point is this: over the last fifteen years, it has become clear that there is little evidence from spoken phonology to support dynamic features. In every case where dynamic features have been proposed, one can argue that there is a better alternative that uses static features instead. Here is a simple example. Instead of the dynamic feature [falling] (7a), virtually all tonal phonologists now adopt an autosegmental representation, using static tonal features. In such a representation, falling tones are represented as high–low tone sequences linked to the same vowel, as in (7b).



(7) a. [V, +falling] b. V → [+high] [–high] = V → H L

There are good reasons for doing this (see, for example, Goldsmith, 1976). First, falling tones often derive phonologically from a high–low sequence. Second, there is an argument based on "edge effects": falling tones usually behave like high tones for processes that affect preceding segments, and like low tones for processes that affect following segments. Third, the putative feature [falling] is unlike other features in that it does not undergo assimilation: for example, a tone that assimilates to a preceding falling tone normally becomes low, not falling.

Contour tones are a typical case where it is better to model dynamic phonetic behavior as a sequence of idealized static targets. Although a contour tone may be entirely dynamic phonetically, the phonological evidence supports a static target treatment. The same kind of argument appears to apply to other dynamic features. For example, it can be argued on similar grounds (cf. Clements and Keyser, 1983) that affricates are best represented not by the dynamic feature [delayed release] (8a), but rather as a stop followed by a fricative, linked to the same prosodic position, as in (8b).

(8) a. [C, +delayed release] b. C → *t* *š*

Similarly, prenasalized stops are best represented sequentially (Anderson, 1976), rather than with a dynamic feature [prenasalized], as in (9).

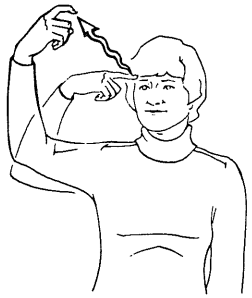
(9) C → [m͡b] = *m* *b*, not [C, +prenasalized]

In general, the evidence from spoken phonology is almost unanimous in its opposition to dynamic features. What about sign? It is clear that dynamic features have been used very often in the sign literature. But in recent work, the tide seems to be turning against dynamic features. To give one example, consider the features used to describe secondary movement, such as [hooking], [flattening], [squeezing], and so on. Such dynamic features appear in works such as Liddell and Johnson (1985) and Perlmutter (1989). But Liddell (1988) and Stack (1988) have presented persuasive analyses in which these secondary movement features are replaced with static-feature analyses. Instead of a secondary feature, Liddell and Stack describe the ENDPOINTS of the secondary movement, stipulating that the articulator moves back and forth rapidly between the two targets.

To give an example from Stack's work, the hooking that is found in the sign DREAM is analyzed as repeated alternation between two handshapes. These

handshapes occur independently in ASL, for example as the initial and final positions in the sign ASK.[2]

(10) a. DREAM b. ASK



= 1" to 1"", repeatedly = 1" to 1"", just once

The crucial point is this: in secondary movement, it is always the case that the endpoints of the movement are articulatory positions that exist independently within the ASL system. This is an important generalization, which is entirely missed if we describe secondary movement using dynamic features.

So from this case, it looks like sign may well be like spoken language, in that there is something gained by replacing dynamic features by a more abstract model in which motion is depicted as phonetic interpolation between two idealized, static targets.[3]

From this point of view, one becomes suspicious of all dynamic elements proposed in ASL. Let us consider the most central dynamic element of all, found in both Liddell's and Perlmutter's analyses: the movement autosegment M.

From the viewpoint of a spoken language phonologist, M looks very peculiar indeed. Consider, for example, the English word *gooey*. Here the tongue body first occupies a back position for the vowel /u/, then moves to a forward position for the vowel /i/. The gradual motion of the tongue body from one vowel position to the other is quite noticeable on a spectrogram or an X-ray film. Since *gooey* contains a movement, should we then say that its phonological representation contains an M segment, as in (11)?

(11) *g* *u* *i*


It seems clear that we should not. The motion of the tongue from /u/ position to /i/ position is already fully characterized by the endpoint segments. The M contributes nothing to the phonological form, because it is completely predictable in its distribution. There is no place in the underlying representations of English in which we would want to include an M segment, and it also appears that there are



no phonological rules that refer to M, either. The same would hold true, I think, for other spoken languages.

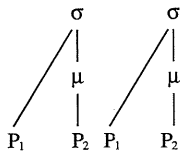
My suggestion is that ASL phonology may not be all that different from spoken phonology. In particular, I conjecture that under an appropriate analysis, M would be completely predictable in its distribution, just like in English, and thus should not appear in underlying forms. I also doubt that M plays a genuine role in the phonological rules of ASL. Finally, M in ASL is suspect for one more reason: as Liddell and Johnson (1986) point out, M must always be linked to two autosegments. In this respect it is unique; elsewhere in autosegmental phonology, the unmarked case clearly is one-to-one linking, and I know of no cases in which double linking is the only option.

For these reasons I think it worth considering a theory of ASL phonology that dispenses with M and that expresses all dynamic properties as interpolation between abstract static targets. In such a theory, we set up the phonological representation by positing as many idealized static targets as are needed to describe the motions carried out by the articulators. For example, in the sign NAME, shown in (12), the strong hand starts out near the weak hand, then strikes it twice. This would be represented with four segments, corresponding to the starting ($P_1$) and striking ($P_2$) locations.[4]

(12) NAME = $P_1P_2P_1P_2$

A fuller representation would include moraic structure (for representing lexical length contrasts) and syllable structure (for reasons outlined by Perlmutter, this volume). I conjecture the following:

(13) NAME

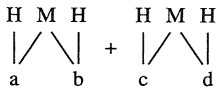



In this particular sign, the $P_1$ segments may be derived by a rule of Epenthesis, as

argued in Stack (1988). A complete representation would need some account of phonetic final lengthening, which I will not provide here.

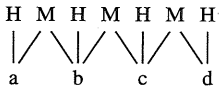
An advantage of an M-less approach is that phonological representations and derivations can be considerably simplified. Consider, for instance, Liddell and Johnson's (1986) derivation of the phrase GOOD IDEA. The derivation is rather complex. First, a rule of movement epenthesis inserts an M between the two distinct feature matrices marked b and c; then all medial holds are deleted by a rule of hold deletion.

(14) a. GOOD IDEA



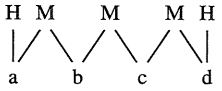

Underlying form

b.




Movement epenthesis

c.




Hold deletion

I would venture to say that the rules in this derivation do not reflect any inherent property of ASL, but rather are artifacts of the Movement/Hold theory itself. If we adopt a theory of sign phonology based on static targets, then the underlying forms and derivations can be considerably simplified. To exaggerate somewhat, what I have in mind is something like (15).

(15) a b + c d → a b c d
GOOD IDEA

This is obviously simplifying too much, but I suspect it is not far from the truth. To get from my output representation [a b c d] to the real output, it appears to be sufficient simply to specify that extra phonetic length is inserted initially and finally, deriving (16):

(16) [:a b c d:]

In addition, we would want to include moraic and syllabic structure, for reasons already alluded to above. The crucial point is this: for an articulator to occupy different sites at different times, it must move, and for this reason a representation like (14c) tells us nothing that is not already present in a representation like (16).

To conclude my proposal, it behooves me to take on what I think is the best argument that has been presented in favor of M: we need some kind of M segment present so we can indicate what kind of movement is being executed. To give two examples, we want to be able to distinguish straight-line movement



from arc movement, and we want to be able to distinguish stressed from unstressed movement. Such distinctions have motivated representations like (17) in the literature.

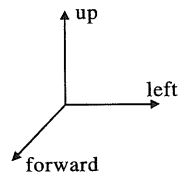
(17) a. [M +arc] b. [M +straight] c. [M +stress] d. [M −stress]

I can see three strategies for getting around this problem. First, we might simply assign these features to one of the endpoint segments that define the movement. The problem here would be to come up with a nonarbitrary way to decide whether the movement features should reside on the first endpoint segment, the second, or both.

Another possibility is to assign features or properties to the syllable as a whole. This seems to be a particularly promising line for the case of stress, since in spoken languages there is good evidence that stress is a property of syllables and not of segments.

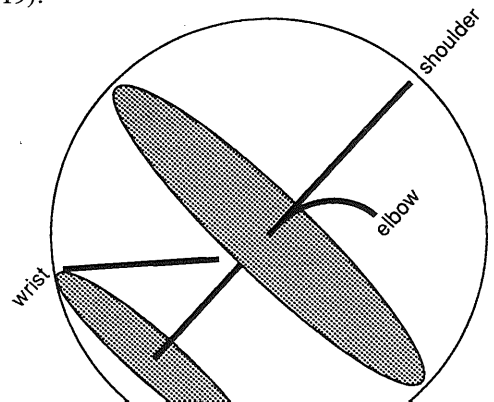
The third strategy is implicit in the work of Nagahara (1988). Nagahara attempts to develop a general theory for describing hand position in ASL. His most striking idea is to introduce multiple coordinate systems for hand position. For example, one coordinate system might simply be Cartesian space, defined relative to the body, as in (18):

(18)




But Nagahara's most interesting coordinate system is a polar one. Imagine a globe centered at the elbow, with the North Pole at the shoulder. On such a globe, we can depict many hand positions by specifying latitude and longitude (19).

(19)



Nagahara notes that an important generalization follows from this proposal: most arm movements defined under polar coordinates involve a change in latitude or a change in longitude, but not both at once.

For present purposes, the crucial point of Nagahara's coordinate systems is that they may allow us to dispense with movement features such as [arc] and [straight]. The reasoning is as follows. Suppose we specify the two endpoints of a movement using polar coordinates, as in (20a). It then stands to reason that the phonetic interpolation between them will follow an arc, along the surface of the globe. If, on the other hand, we specify the endpoints of a movement using Cartesian coordinates, as in (20b), the interpolation would follow a straight line.

(20) a. $\begin{bmatrix} x \text{ latitude} \\ y \text{ longitude} \end{bmatrix} \begin{bmatrix} x \text{ latitude} \\ z \text{ longitude} \end{bmatrix}$ = Movement on an arc

b. $\begin{bmatrix} x \text{ up} \\ y \text{ right} \\ z \text{ forward} \end{bmatrix} \begin{bmatrix} x \text{ up} \\ y \text{ right} \\ w \text{ forward} \end{bmatrix}$ = Movement on a straight line

Thus by using different coordinate systems, we can avoid having to use features like [arc] and [straight]—the distinction follows from a deeper distinction in the way that locations in ASL are specified.

To return to the original point, if we do not need features like [arc] and [straight], then we do not need an M node to put them on. Thus Nagahara's proposal brings us that much closer to being able to banish M (and dynamic elements in general) from phonological theory.

## 4. CONCLUSION

An important difference between the approaches of Perlmutter and Liddell is the following: while Liddell's representations are fairly directly relatable to what one observes in the signing stream, this is not always the case for Perlmutter's. For example, syllabic and moraic structures are not directly visible, and many movements are regarded by Perlmutter as transitional and not to be awarded formal representation.

Concerning this general difference in approach, I tend to side with Perlmutter: at least in spoken phonology, it seems clear that the form of phonological representations must often be determined through reasoning and cannot be read directly off the phonetic signal.

This view is compatible with the suggestion I have made here: to remove dynamic primitives, (e.g., [falling], [flattening], M) from phonological theory. It is easy for the analyst to observe a movement in the signing stream, give it a name, and incorporate this name into formal representations as a dynamic primitive. An approach that sees the movement as a mere transition between two targets often



lacks initial plausibility, because it is more abstract and removed from the phonetic data. But in many cases the more abstract approach has turned out to be better motivated when the data are examined more closely.

I have by no means developed a full and explicit static-target theory, but I have tried to show the directions in which such a theory might lie, and I have also tried to dispose of some of the more obvious objections to a static-target approach. I hope that in doing this, I have encouraged scholars with ASL expertise to pursue the idea of a static-target theory further.

I has often been emphasized that the study of sign languages is important to phonology as a whole, for the following reason. Many properties of phonology directly reflect the anatomy and physiology of the vocal tract, or correspondingly, of the body parts used in signing. But it is also likely that there are phonological properties that are properties of the mind, that represent fundamental principles of how phonological form is mentally represented and derived. Since the anatomical bases for speech and sign are so different, it is likely that any properties that are shared by both spoken and sign phonologies are likely to form part of the underlying cognitive system. These properties are likely to be quite abstract in character. I feel that the most interesting task of phonological theory is to find out what they are.

Here, I would like to suggest that one candidate for such a fundamental property, common to both speech and sign, is that the elements of phonological representation are inherently static, and that motion is always represented as interpolation between targets. I present this conjecture in the hopes of encouraging investigators of ASL phonology to give it a serious test.

## NOTES

[1] (1) is reprinted, by permission, from Supalla and Newport (1978).

[2] (10) is reprinted, by permission, from Humphries, Padden, and O'Rourke (1980).

[3] The work of Corina (this volume) on handshape change is an interesting challenge to this claim. It is worth noting that as in secondary movement, it is the case that endpoints in handshape change are positions that exist independently in the ASL system. For this and other reasons, Corina's analysis translates his dynamic feature [closing] into an autosegmental static-target sequence in the course of the phonological derivation. Further research is needed to determine if Corina's generalizations can be captured without use of the initial dynamic-feature representation.

[4] (12) is reprinted, by permission, from Humphries, Padden, and O'Rourke (1980).

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# SONORITY AND SYLLABLE STRUCTURE IN AMERICAN SIGN LANGUAGE*

***DAVID M. PERLMUTTER***

*Department of Linguistics*
*University of California—San Diego*
*La Jolla, California 92093*

## 1. GOALS

Speech is organized into syllables. Each syllable has a nucleus, and language-particular conditions govern the class of possible onsets and codas. The way phonological strings are organized into syllables depends on the relative sonority of segments. There is a sonority hierarchy that ranks classes of segments (or the features that characterize them) in terms of relative sonority. In a given phonological string, a segment higher in sonority than the segments on either side is a sonority peak. Each such sonority peak is the nucleus of a syllable. Segments between sonority peaks are included in the onset of the following syllable or in the coda of the preceding syllable. These characterizations of syllable structure, generally interpreted as universal, are based exclusively on oral languages.

Do these principles hold for the many signed languages used in Deaf communities throughout the world? Are signs organized into syllables? Do syllables have an internal structure consisting of a nucleus and possibly onset and/or coda? Is there anything corresponding to the sonority hierarchy in sign languages? Do sign languages have vowels and consonants? This article addresses these questions.

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Editors

STEPHEN R. ANDERSON
*Department of Cognitive Science*
*The Johns Hopkins University*
*Baltimore, Maryland 21218*

PATRICIA A. KEATING
*Department of Linguistics*
*University of California, Los Angeles*
*Los Angeles, California 90024*

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***Geoffrey R. Coulter***

*Department of Psychology*
*University of Rochester*
*Rochester, New York*

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