AGAINST THE DISTRIBUTIONAL SYLLABLE[1]

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ABSTRACT

In the past 20 years, Kuryłowicz, O'Connor and Trim, Arnold, Haugen, Greenberg, and Pulgram have advocated theories of the distributional syllable. The theories are based on two assumptions: The syllable can and should be defined formally, without reference to phonetic realization; and the syllable is derivable solely from the distributional properties of segments.

It is argued that theories of the distributional syllable are unsuccessful, both because they are not in reasonable conformity with the phonetic facts, and because they do not appear to be capable of supporting generalizations about phenomena beyond the segmental phonotactics on which they are based.

The nature of their failures suggests that the assumptions of the distributional syllable are unwarranted. It should be more promising to assume that segment and syllable are independent constructs; and that segments are organized in terms of syllables both phonetically and at more abstract levels.

1. The assumptions of the distributional syllable. 'Defining the syllable' has been a traditional task in linguistics, perhaps like 'squaring the circle' was to the geometers. It is attempted, it is done, but it remains to be done ever again. There is a particular genre within this tradition that is represented by a series of works spanning two decades whose authors represent a variety of linguistic schools: Kuryłowicz (1948), O'Connor and Trim (1953), Haugen (1956a,b), Greenberg (1962), and Pulgram (1969).[2] All have in common two basic assumptions: first, the syllable can and should be defined formally, without reference to phonetic realization. Second, the syllable is not an independent unit, but is derivable from the distributional properties of segments. I will thus call them definitions of the distributional syllable.

I think that these assumptions are questionable, and in particular, that the definitions of the distributional syllable afford them little support. I have no intention of refuting or disproving the definitions. As formal and self-contained constructs they are virtually immune to refutation anyhow except on grounds of internal inconsistency. I argue instead that they are unsuccessful theories, from two points of view. First, they do not meet the criterion for a successful phonologic theory imposed by Greenberg (1962) upon himself, reasonable conformity with the phonetic facts. Secondly, they have not met and appear to be incapable of meeting an equally important criterion: the ability to provide a basis for generalizations about phenomena beyond those for which they were specifically intended, in this case phenomena beyond segmental phonotactics.

2. Syllabicity. The definition of the syllable can be divided into two parts, syllabicity and syllabification. I will first discuss the problem

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of syllabicity, how to distinguish syllable nucleus from syllable margin.

2.1 The procedure of O'Connor and Trim. Pike's (1943:78) distinction between vowel and vocoid underscores a fact that linguists now commonly recognize: that the syllabicity of a segment cannot generally be predicted from its other phonetic features. On the other hand, a theory of the distributional syllable would maintain that the syllabic and non-syllabic segments of a language could be distinguished entirely by their formal distributional properties. O'Connor - Trim and Greenberg have proposed explicit procedures to make this hypothesis operational.

Both approaches start from the valid observation that speech segments are not strung randomly in sequence; but rather that marginal and nuclear segments more commonly alternate than succeed each other.

The alternation of margin and nucleus is nicely exemplified by a hypothetical language whose word canon is $[CV(C)]^n$. Call it language A. I will use it to demonstrate the mechanics of the two methods.

O'Connor-Trim take the first two and the last two positions of the word as defining. They compute the number of contexts each phoneme has in common with every other phoneme in each position. For example, if t occurs before all five vowels of a language in initial position, and b occurs before all except u, then in initial position the pair t-b have four contexts in common. Let us assume that language A has 5 segments of class V, and 20 segments of class C, and that they combine freely within the limits of the canon. As Table 1 shows, every pair in the class C will have, in the four positions, 5, 0, 5, and 5 contexts in common, a total of 15, or 100% of the number possible. Pairs from class V will have 0, 20, 20, and 20 contexts in common, again 100%. But no segment in C will have a common context with any segment in V, although both

occur in the final two positions. No other two classes of phonemes will show this pattern.

Table 1. O'Connor-Trim syllabicity in language A.

Classes of segment pairs	Common contexts by position				
	Initial	Post-initial	Pre-final	Final	
C - C	5	0	5	5	100%
V - V	0	20	20	20	100%
V - C	0	0	0	0	0%

2.2 Greenberg's procedure. Greenberg constructs a function called the 'maximum recurrence interval' to distinguish vowel from consonant. For a given class of phonemes, the maximum recurrence interval is the length of longest sequence of phonemes not belonging to the class that can occur between two members of the class or between a member and initial or final position. Greenberg's rationale for the use of this function is that 'since the maximal length of the sum of the margins of the syllable is necessarily greater than the center, the maximal interval for ... [the] recurrence [of nuclei] will always be larger than for the consonant class'. The class of nuclei is then defined as the smallest class of segments meeting two conditions: it must have a higher maximum recurrence interval than any other class, and every sentence must contain at least one of its members. In our language of illustration, the maximum recurrence interval for the class C is 1 (e.g. #CVC), and that for the class V is 2 (e.g. #CVCCV#). Furthermore, V is the smallest qualifying class, for if one of its members is removed, then there will be sentences in which the new reduced class does not occur.

2.3 Defects of the procedures: marginless syllables. The major weakness of the procedures is that they do not yield a classification into margin and nucleus which accords with phonetic realization for certain language

types where alternation of margin and nucleus is less prominent than in language A. Languages possessing syllables without margins are such a type.

These languages are necessarily difficult for the O'Connor-Trim procedure. One reason for choosing initial and final positions was to avoid counting intersyllabic contexts. This cannot be avoided, since it is certainly possible for a language to exhibit both nuclear and marginal sequences in initial and final positions. When this occurs, statistics based on common contexts of occurrence do not lead to a clear separation of margin and nucleus. I do not offer an illustration, partly because realistic examples are complex, partly because it has already been done. Arnold (1964), after unsuccessfully applying the procedure to Greek and Polish, concluded that it could only be expected to be successful for certain types of languages.

The conceptual basis for the O'Connor-Trim procedure is that distributional constraints on segments, particularly within syllables, are strongly determined by their membership in the classes of margin and nucleus, which is surely true. This concept could be implemented by finding an explicit measure of similarity of distribution between a pair of segments, and then grouping segments into two categories, called margins and nuclei, according to their similarity of distribution. The similarity between pairs of margins and the similarity between pairs of nuclei is in general assumed to be greater than the similarity between margin-nucleus pairs. A necessary condition for such a procedure to qualify as a formal definition of consonant and vowel is

(1) There exists, for any pair of segments in a language, a universal measure of similarity of distribution that leads, by some given clustering procedure, to a margin-nucleus categorization of the segments.

This implies that there is some set of universally definable contexts over which the margin-nucleus classification invariably dominates the many other

segment classifications as a determiner of distributional constraints.

There is no reason to believe that (1) holds. O'Connor and Trim's only explicit claim was to have found a procedure that was successful for English. Arnold (1955-56) was able to apply it also to French. But neither the original measures nor certain modified ones were successful when Greek and Polish were included (Arnold 1964).[3]

Although it has been much less influential, Greenberg's algorithm is superior in many respects to the statistical definition of O'Connor-Trim. His recurrence function is carefully constructed so that it will apply to any language, whereas the computational procedures of O'Connor-Trim are ad hoc and admittedly unsophisticated.

Greenberg's algorithm also automatically assigns the labels 'margin' and 'nucleus' to the classes it distinguishes, whereas the O'Connor-Trim procedure is only designed to distinguish two classes. They do point out that in English one class should be designated as nuclear because it is less common initially and finally, its members occur in sequence less often than those of the other class, and because some words contain only its members. However, Greenberg incorporates these tendencies of nuclear segments in a general and explicit way. Thus the difficulties encountered by his procedure may also be assumed to be a problem in the O'Connor-Trim approach.

A language type for which the Greenberg procedure gives unacceptable results is illustrated by language B. Language B has no sequences of marginal segments. Sequences of syllabic nuclei occur. No words consisting only of vowels are found in language B. This type of structure can be found in Hottentot, for example (Beach 1938). Occurring words are #CV#, #CV.V#, #CVCV#, #CVC#, etc.; nonoccurring are *#V#, *#CCV#, *CVCCV#, etc.

The maximum recurrence interval for the marginal elements is 2, 3, 4, or however many syllable nuclei can occur in sequence, e.g., in #CV.V#.

The interval for the class of nuclei is 1, e.g., in #CV.V#, since there are no clusters of consonants. The procedure thus assigns the formal label 'vowel' to the margins, and 'consonant' to the nuclei. The labels would similarly be reversed for a language like Guarani, in which sequences of two consonants and up to three nuclei can occur (Gregores and Suarez 1967). It is not unreasonable to suppose that there may exist languages whose maximum sequences of margins and nuclei are of the same length, and which contain no words of vowels only (although I know of no example). In such a case, the procedure would either not distinguish two classes, or else by virtue of unrelated distributional gaps, would distinguish entirely irrelevant classes.

What happened? The overt conceptual basis for the procedure, that a syllable does not have fewer marginal segments than nuclear segments, is sound enough.[4] However, the procedure also depends crucially upon the further hypothesis,

> (2) If there occur longer sequences of nuclei than sequences of margins in a language, then there will occur words composed only of nuclei.

This generalization does not hold.

2.4 Defects of the procedures: segments which may be syllabic or not.

The treatment of segments which may be either syllabic or nonsyllabic (most commonly high vocoids or sonorants) is difficult for any formal distributional theory. If both syllabic and nonsyllabic forms are represented at the given level of analysis, then no new problems arise. But frequently the two functions do not contrast, and both have the same formal representation. How could a formal method distinguish the nuclei of a sequence in this case? It is of course possible to maintain that it is unreasonable to require of a formal method that it distinguish margin from nucleus where it is formally irrelevant. Neither Greenberg nor O'Connor-Trim accept

this refuge. Greenberg states that such segments should be treated as two phonemes for the purposes of his procedure (1972:77). O'Connor-Trim explore another possibility, that such segments will exhibit contexts in common with both vowels and consonants, and that they can then be separated into two segments with appropriate distributions. Unhappily, segments in double function do not always show this pattern, and furthermore they are not the only kinds of segments that may do so. For example, in a language with no initial vowels or initial marginal clusters and a preconsonantal syllabic n, the measure of O'Connor-Trim would group n unambiguously with the consonants, revealing nothing of its double function. (Even if the syllabic segment has a separate label, if the language had no marginal sequences and no utterances with nuclei consisting solely of n, Greenberg's recurrence intervals would give the same result. The maximum recurrence interval for vowels would be 2, e.g. #nCV-. Including n with the vowels would reduce the maximum interval to 1, hence it is assigned to the consonants.)

If vowels occur initially (as in a number of Bantu languages) the O'Connor-Trim measure will show a double affinity for n. But then compare this to a case where instead of initial nC- sequences there were initial sequences of s+consonant, as in Alabaman (Rand 1968). In this case, s too would exhibit considerable commonality with vowels and consonants.

I think that it is fair to conclude that an explicit, non-phonetic, distributional characterization of vowel and consonant is not readily available, and that it can be no simple matter to achieve it. Before I turn to distributional theories of syllabification, let me remark that they are not unaffected by this conclusion. Syllable division is a matter of determining which marginal elements belong to which nuclei. A theory of

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syllabification must necessarily presume that segments have already been classified as margin or nucleus, if only to be able to indicate that consecutive nuclei belong to different syllables. Of course, it is possible to uphold a hybrid distributional theory, granting that syllabicity has an independent or phonetic basis, but that syllable division is essentially distributional.[5]

3. Syllabification; the Word-terminal Condition.

The key to distributional theories of syllabification is a principle first exploited systematically by Kuryłowicz (1948): roughly, that initial and final clusters of medial syllables conform to the same constraints as those in initial and final syllables. Stated as an empirical generalization, we have the Word-terminal Condition:

(3) If an intersyllabic sequence is analyzable into permissible word-initial and word-final clusters, then the perceived boundary does not fall between nonpermissible clusters.

Compared to most sweeping statements about the syllable, the principle has astonishing generality. Even so, it does not appear to hold universally. It is not hard to imagine plausible counterexamples.

One would run like this. Consider first a language with no initial clusters and only open syllables finally. Say that it has medial consonant sequences of two segments, all heterosyllabic, with syllable division falling between the segments. Now say, perhaps by vowel loss, some of the medial clusters end up occurring in initial position as well. The Word-terminal Condition predicts that just these clusters will become tautosyllabic, but it seems plausible that they might retain their original syllabification. Indeed something of this sort appears to have occurred in Huichol, which has a few initial clusters, for example pt-, pk-, and mt-;

no final consonants; and medial consonant sequences which include the initial ones. McIntosh (1945) reports that all medial clusters are heterosyllabic, and Grimes' (1959) description is in essential agreement. Alabaman is another language where the same process has led to a violation of the Word-terminal Condition (Rand 1968).[6]

The Word-terminal Condition is not itself a basis for a theory of syllable division. It leads to definition of a syllable boundary only where the sequence of marginal segments between two syllables can be analyzed into a permissible final and initial clusters in just one way. English dogma is an example. Call these uniquely analytic[7] sequences. But there also occur multiply analytic sequences, such as English extra, which has three possible divisions that satisfy the Word-terminal Condition. And, more rarely, one finds unanalytic sequences, for which no division yields permissible final and initial clusters. Spanish transcripcion is a stock example, since -ns does not occur at the end of Spanish words, nor does scr- occur initially.

3.1 Principles of distributional syllabification.

It is possible to arrive at a formal definition by dividing the multiply analytic and unanalytic sequences uniformly and arbitrarily, for example, by assigning the entire sequence to the first syllable.[8] The distributional theories of syllabification of Kuryłowicz, Haugen, O'Connor-Trim, and Pulgram all seek principled, nonarbitrary procedures to divide these sequences. They differ mainly in how they go about it. In the following discussion I will concentrate on the basic principles that their procedures embody, rather than discuss each in detail. Table 2 should help keep track of the connection between principles and theories.

Table 2. Principles of Syllable Division.

	W-T Condition Dominant	Uniform Divisibility	Open Syllable	Minimal Coda	Irregular Coda
Kuryłowicz	-	-	+	-	+
Haugen	-	+	-	-	-
O'Connor-Trim	+	+	-	-	-
Pulgram	+	-	+	+	+

The first principle that I have listed, labeled 'Word-terminal Condition dominant', has to do with whether a uniquely analytic sequence must be divided into permissible final and initial clusters, or whether there are exceptions governed by some other principle. Kuryłowicz relaxes the application of the condition only in favor of the Open Syllable Principle, which states that

(4) A single intervocalic consonant belongs to the following syllable.

This, by the way, would lead to syllabifications in English such as Singapore ['sI.ŋəpor], hangar ['hæ.ŋr], gingham ['gI.ŋəm].[9]

3.2 The procedures of Haugen and O'Connor-Trim.

Now what does the next principle, 'Uniform Divisibility', mean? This concept postulates that

(5) Medial sequences of the same length are divided in the same way for a given language.

It is the cornerstone of the theories of Haugen and O'Connor-Trim. As a general tendency, there seems to be some support for it. One expects a single consonant to syllabify with the following vowel, two consonants to be separated by syllable division, and so on, with certain exceptions owing to the Word-terminal Condition or to the presence of grammatical boundaries. As a universal principle, however, it has undeniable weaknesses.

If applied to all medial sequences, as Haugen, at least if taken literally, proposes, it leads to such unacceptable conclusions as the identical

division of the 3-segment sequences in anxious ['æŋkʃəs] and obstacle ['abstəkl]. Even if uniquely analytic sequences are excepted, the principle does not appear to coincide with descriptions of some languages. Luganda has medial sequences of nasal+stop as well as geminate obstruents. Both of these are unanalytic, since final syllables are open, and in initial sequences of nasal+stop or stop+stop the first element is syllabic. Their syllabification differs: nasal+stop sequences form a tautosyllabic cluster with the following syllable, whereas geminates are divided (Tucker 1962, Cole 1967). And in general, it is not difficult to find cases where certain sequences are tautosyllabic, typically sequences of obstruent and liquid or fricative and stop, whereas others are heterosyllabic. Sometimes the deviant clusters are uniquely analytic, as in Yakur, a West African language (Bendor-Samuel 1969), but sometimes they are not, as in Cham of Southeast Asia (Blood 1967).

Further, when we measure the principle of Uniform Divisibility against its utility in explaining wider phonological phenomena in terms of the syllable, again it appears to be lacking. I cite a few examples. A general statement of the Romance stress rule in terms of the syllable requires that some obstruent-liquid sequences be tautosyllabic. James Hoard (1971) has posited different syllabifications for English words like Hittite and Mitty, the tenseness and aspiration of the medial t in Hittite being explained by its syllable-initial position, as opposed to the syllable-final t in Mitty. Similarly, Theo Vennemann (1972) has recently pointed out that vowel lengthening in Icelandic can be stated very generally as occurring in open syllables if certain obstruent-sonorant sequences are taken to be tautosyllabic. This is not just an unmotivated trick. The same syllabification functions in other phonological processes in Icelandic.

The principle of Uniform Divisibility implies that neither the nature of the segments themselves, nor the accentual context in which they occur, plays

a role in syllabification of medial sequences. The available evidence does not support this hypothesis.

3.3 The procedures of Kuryłowicz and Pulgram.

I turn now to the theories of Kuryłowicz and Pulgram. They do not differ greatly in their conceptual basis. For brevity's sake, I will treat only Pulgram's theory of syllable division, it being more recent.

Unanalytic sequences are resolved by the principle of the Irregular Coda:

(6) If all divisions of a sequence yield a nonpermissible initial or a nonpermissible final cluster, the nonpermissible cluster must be the coda.

Thus Spanish trans.cripcion. I do not know any cases of medial sequences where neither a permissible initial nor a permissible final cluster would result. Venneman (1972) has pointed out an exception to this principle: German ['rā.dlə] 'I bicycle' where *dl- is not a permissible initial cluster. However, the Northern variant ['rāt.lə] suggests that the principle may have diachronic application.

Pulgram resolves multiply analytic sequences by the principle of the Minimum Coda, which includes the principle of the Open Syllable:

(7) If a medial sequence can be analyzed into permissible final and initial clusters in more than one way, the syllabification yielding the shortest coda is chosen.

Like the others discussed previously, this principle has a certain validity. In Cham, for example, medial obstruent+sonorant clusters are tautosyllabic, even though the obstruents in question occur finally. The opposite situation, in which final, but not initial clusters occur, is found in the indigenous words of Karačay, a Turkic language. The medial sequences of two segments that also occur as final clusters could then, by the Word-terminal Condition, syllabify with the preceding syllable, but they don't. All medial sequences are heterosyllabic (Hebert 1962).

Yet one need not go far afield to discover difficulties. They exist in English. One quickly finds that the phonetic transcriptions of Kenyon and Knott do not always have divisions with minimal codas. Examples are historic [hIs'tɔrIk], vestigial [vɛs'tIdʒIəl], Estonia [ɛs'toniə]. Pulgram's actual procedure would in fact give this same syllabification. This is because in such cases, the preceding nucleus is a lax vowel which does not occur finally. Hence a division placing the entire cluster with the following syllable is not permitted. But this is no more successful vis-a-vis Kenyon and Knott. For there we also find cashier [kæ'ʃir], effete [ɛ'fit], effluvium [ɛ'fluvIəm], necropolis [nɛ'krapəlIs], plurality [plU'rælətI], and so forth.

If we ask what phonological generalizations beyond segmental distribution a syllable based on the principle of the Minimal Coda leads to, I know of none. However, it is no more compatible than the principle of Uniform Divisibility (5) with the general formulations concerning Romance stress, English aspiration and tenseness, and the Icelandic vowel length mentioned earlier. The reason is that the principle of the Minimal Coda, like that of Uniform Divisibility, maintains that medial sequences of consonants will syllabify in the same way -- no matter what the nature of their individual segments, no matter what their accentual context of occurrence. The distinction that the principle of the Minimal Coda does make, by which different divisions are possible for medial sequences that do not have the same possibilities of analysis into permissible final and initial clusters, does not appear to yield an explanatory advantage.

4. Conclusions.

I have two conclusions. First, the specific theories of the distributional syllable that have been proposed are unsuccessful. They are unsuccessful

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because their implicit or explicit conceptual bases, (1) through (7), are stretched too far. They should not be adopted as a basis for language description, as has happened.[10] This practice is not harmless. It robs the linguistic community of whatever empirical observations about syllabic phenomena that might have been made.

Now one might grant that the present definitions of the distributional syllable are inadequate yet still maintain that the basic assumptions hold, their vindication awaiting only the discovery of the perfect formal definition of the syllable. To the contrary, my second conclusion is that the basic assumptions of the distributional syllable are unwarranted.

The problem of the syllable in phonological theory is the problem of the organization of segment strings. Segment strings exhibit strikingly regular patterns of organization, yet their possibilities of organization appear to be far too complex to be accounted for by constructs based on a few selected near-universal regularities of distribution, such as (1)-(7) discussed above. This means that it is unlikely that the syllable is a unit derivative from abstract phonological features, just as at the phonetic level it has not been possible to derive it from phonetic features. That the other basic assumption of the distributional syllable, abstraction from phonetic realization, is untenable, is shown by the nature of the failures of the theories. Their rectification does not seem possible to me unless some relationship with phonetic form is admitted.

I do not conclude that phonology can do without the syllable. For the concept of the syllable to contribute to phonology, it should be promising to assume, just as we assume that speech is organized into segments, that segments are organized into syllables, both phonetically and at more abstract levels. We should, however, guard against too narrow a view, against confusing a tool with the problem. 'Defining the syllable' and 'proving the

existence of the syllable' are probably psuedo-problems. The problem is segment organization. If an independent, phonetically related theory of the syllable can explain its regularities, so much the better. If not, we will be awaiting a more general theory of organization, and the syllable may enter the museum's Hall of Scientific Constructs, taking its place beside ether, the noble savage, and the like.

NOTES

1. This is a revised version of a paper read at the annual meeting of the Linguistic Society of America, December 29, 1971.

2. I have omitted works devoted mainly to specific languages, e.g., Holt (1949) and Baldwin (1969). The reader should realize that the works considered herein are part of a particular tradition in linguistics, and within that context represent a considerable achievement. Indeed, the ideas they embody still possess a considerable influence independently of the tradition. It is a tribute that they stimulate explicit opposition at this date.

3. For those who might wonder whether statistics based on token rather than type occurrences would be more successful, I can report that a preliminary attempt to apply this approach to English showed no promise whatsoever (Bell 1966).

4. At least under the usual assumption that nuclei contain but a single syllabic segment.

5. This is the conclusion of Kloster Jensen (1963).

6. The Alabaman clusters that occur initially are /st, sk, sw, sL/, which makes less tenable the explanation that the violation of the Word-terminal Condition is due to the inherent heterosyllabicity of segment sequences in question. Whether violation could occur with sequences of say, stop+liquid is open.

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7. The terms in 'analytic' refer to properties of marginal sequences. I think it is worth distinguishing them from those in 'divisible' on one hand and 'resolvible' on the other. My practice is to reserve 'divisible' for perceptual judgments (Bell 1970:40). Resolvibility, like analyticity, is a purely formal property and refers to the inclusion of shorter occurring or permissible sequences within longer ones. The notion is exploited by Greenberg (1965), who attributes the original concept to Hjemslev. The difference is that for resolvibility, the sequences in question occur in the same position (initial cluster including initial cluster, medial including medial, final including final); whereas analyticity is restricted to medial sequences and pertains to their inclusion of terminal clusters.

8. Koefoed (1967:177) uses this example, pointing out that it was actually adopted by Bjerrum (1944).

9. These and the following phonetic transcriptions of English words are taken from Kenyon and Knott (1953).

10. For example, McArthur and McArthur (1956) for Aguacatec, Sommer (1968, 1970) for the Kunjen dialects of Australia. I suggest that Sommer's theoretical orientation led him to claim that all medial margin sequences formed the coda of the preceding syllable, so that there were no syllables with onsets. Any discussion of other evidence for syllable division was omitted. Such evidence does exist, not supporting his unlikely conclusion (Dixon 1970).

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