

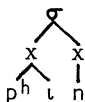
## ON THE WEIGHTLESSNESS OF SYLLABLE ONSETS

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The purpose of this paper is to provide a formal account of certain universal properties of syllable onsets which I shall interrelate within an approach to phonological structure first reported in Hyman (1983). In what can be referred to as "weight-tier phonology", I propose that there is a tier of weight units (WU's) or "beats" to which segments and autosegments associate, and out of which syllables may be constructed. An example is given in (1a).

(1) a.



b.



c.

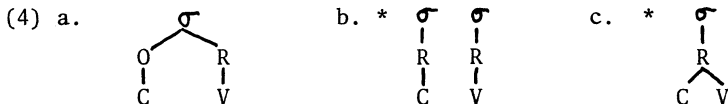


In the English word *pin* the initial consonant-vowel sequence constitutes a single WU (marked by an "x"), and the following consonant /n/ constitutes a second WU. The resulting structure contrasts sharply with the branching syllable representation in (1b) (see Pike and Pike 1947; McCarthy 1979 etc.), which recognizes the onset-rime distinction as the major constituent break within the syllable, or the "flat" syllable structure in (1c) (see Kahn 1976; Clements and Keyser 1983), which, without internal subconstituents, directly assigns the segment slots to the syllable node. Notice also that the x's in my system provide the same function as the C's and V's in three-tiered CV phonology or the X's in theories not recognizing the C/V distinction (Kaye and Lowenstamm 1981; Levin 1983).

Although the arguments for WU's come from a number of sources (see Hyman 1983), I shall be concerned here only with demonstrating that this conception of phonological structure provides the most revealing account of the properties of the so-called syllable onset. These properties are stated in (2) and (3) and hold at the level of "level 1" morphology in the lexical phonology (Kiparsky 1982, Mohanan 1981).

- (2) In a CV sequence, where C = [+cons] and V = [-cons], the C obligatorily is an onset linked to the following V in the same syllable (cf. Steriade 1982).
- (3) a. Onsets do not contribute to the "weight" of a syllable.  
 b. Onsets are not tone-bearing units (TBU's).  
 c. Onsets may not be syllabic.

In (2) it is observed that a [+cons][-cons] sequence is assigned by the initial syllabification rules to the onset-rime nodes of the same syllable, as seen in (4a). By some kind of universal principle the representation in (4b) is ruled out, since the C and V belong



to separate rimes in separate syllables, as is the representation in (4c), where the CV sequence has been erroneously assigned to the rime node, without an onset node having been created. The statement in (2) recognizes that onset-rime structure is highly dependent on the feature [cons], an improvement, I believe, over frameworks that begin with the ad hoc feature [syll].

The generalizations in (3) are crucial in motivating the WU's in weight tier phonology. Starting with (3a), we observe that syllable onsets are "weightless", i.e. they do not contribute to the overall quantity or weight of a syllable. As has been often noted, many languages distinguish between "heavy" and "light" syllables (see Newman 1972; Allen 1973; Hyman 1977 and references cited therein). The two common patterns are summarized in (5).

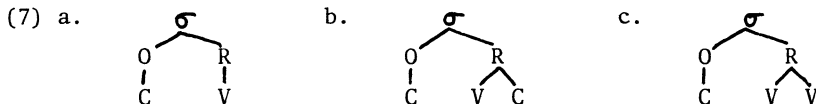
- (5) Type A : C<sub>0</sub>V vs. C<sub>0</sub>VC/C<sub>0</sub>VV [Latin; Cl. Arabic]  
 Type B : C<sub>0</sub>V/C<sub>0</sub>VC vs. C<sub>0</sub>VV [Mongolian; Huasteco]

In the Type B syllable-weight language, C<sub>0</sub>V and C<sub>0</sub>VC syllables both count as light, while C<sub>0</sub>VV counts as heavy, while in the Type A language only C<sub>0</sub>V counts as light, while both C<sub>0</sub>VC and C<sub>0</sub>VV are heavy.<sup>1</sup> While these and most syllable weight languages refer to the heavy-light distinction for the purpose of stress placement, Newman (1972) has discussed several Chadic languages where tone and morphology depend on syllable weight.

What is important for our purposes is that the onset plays no role in determining whether a given syllable will be heavy or light. Thus, in a Type A language, (6a) would be considered a light syllable even though it contains three onset consonants, while (6b) would be considered a heavy syllable by virtue of its one margin consonant, even though it has no onset.

- (6) a. CCCV (e.g. [stɾɪ]) b. VC (e.g. [tɰ])

How is the heavy-light distinction to be captured? McCarthy (1979) was the first to suggest that a heavy syllable in the Type A language could be characterized as one containing a branching rime. As seen in (7a),



the rime of a CV syllable would dominate a single vowel slot and hence would not be branching, while in (7b) and (7c) a rime dominating a VC or VV sequence would be branching. The fact that branching is an important factor only in the rime, not in the onset, is simply stipulated, as it is in characterizations involving "projections" (Halle and Vergnaud 1980) or "displays" (Clements and Keyser 1983).

These approaches have not only failed to account for the distinction between Type A and Type B languages, but also have neglected to unite as one formal property the universals of onsets stated in (2) and (3).

The proposal to substitute a weight tier for the CV- or X-tier of other models provides just the account we need. We begin with each segment having one of the representations in (8) and (9).

- (8) a.  $\begin{array}{c} x \\ | \\ t \end{array}$       b.  $\begin{array}{c} x \quad x \\ \diagdown \quad / \\ t \end{array}$       c.  $\begin{array}{c} x \\ / \quad \backslash \\ t \quad s \end{array}$       d.  $t$
- (9) a.  $\begin{array}{c} x \\ | \\ a \end{array}$       b.  $\begin{array}{c} x \quad x \\ \diagdown \quad / \\ a \end{array}$       c.  $\begin{array}{c} x \\ / \quad \backslash \\ a \quad i \end{array}$       d.  $e$

The (a) representations have one WU per segmental matrix and represent ordinary single consonants and vowels. The (b) representations have two WU's per segmental matrix, capturing the structure of geminate consonants and vowels. (8c) represents a complex consonant segment, in this case an affricate, while (9c) represents a short diphthong.<sup>2</sup> In (8d) we have a consonant matrix without a WU, a floating consonant as it were, while in (9d) we have a vowel matrix without a WU, a floating vowel.<sup>3</sup> These representations may be appropriate to handle segments that alternate with zero such as the liaison consonants, on the one hand, and schwa, on the other hand, both in French.<sup>4</sup>

Starting, then, with such representations in terms of WU's, the first rule of the phonology is the universal onset-creation rule (OCR) in (10).

- (10)  $\begin{array}{c} \textcircled{x} \\ \vdots \\ [+cons] \end{array} \quad \begin{array}{c} x \\ \vdots \\ [-cons] \end{array}$       e.g.  $\begin{array}{c} \textcircled{x} \\ \vdots \\ t \end{array} \quad \begin{array}{c} x \\ \vdots \\ a \end{array}$       [OCR]

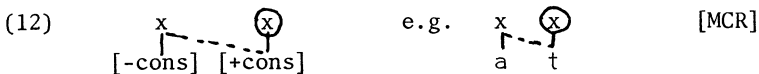
In level 1 lexical phonology, whenever there is a CV sequence, the [+cons] matrix associates onto the WU of the following [-cons] matrix, deleting the first WU, as indicated by the circle around the x. Since this universal rule precedes both syllable formation rules and stress- or tone-assignment rules, it is clear that a single consonant onset can never play a role in syllable weight.<sup>5</sup> If only the OCR applies and we then construct syllables out of the WU's, the three syllable shapes in (5) acquire the representations in (11).

- (11) a.  $\begin{array}{c} \sigma \\ | \\ x \\ / \quad \backslash \\ p \quad a \end{array}$       b.  $\begin{array}{c} \sigma \\ / \quad \backslash \\ x \quad x \\ / \quad \backslash \quad | \\ p \quad a \quad n \end{array}$       c.  $\begin{array}{c} \sigma \\ / \quad \backslash \\ x \quad x \\ / \quad \backslash \quad | \\ p \quad a \quad i \end{array}$

We now say that in the Type A language, a heavy syllable is a branching *syllable*, as in (11b) and (11c), while a light syllable is a non-branching syllable. The x's resulting from the OCR in (11) correspond to the traditional notion of the "mora", which is how syllable weight has been characterized in the pre-generative

literature (e.g. Trubetzkoy 1939/1969).

Concerning the Type B languages, I propose that the language-specific margin-creation rule (MCR) in (12), which is the mirror-image rule of the OCR in (10), removes the WU of the margin consonant:



This rule will apply to (11b), resulting in a syllable containing a single ternary branching WU. In a Type A language, the weight-sensitive stress or tone rule applies *prior* to the MCR, and the margin consonant therefore counts in calculating syllable weight. In a Type B language, the weight-sensitive rule applies *after* the MCR, making the margin consonant unavailable in calculating syllable weight. We thereby account for the difference between the two types of syllable weight languages in a principled way, and we make the correct prediction that no language will treat a CVC syllable as heavy without also treating a CVV syllable as heavy.

Let us see what else follows from this conception of phonological weight. It has been observed that compensatory lengthening is possible only within a rime (see Steriade 1982). Thus, we can have the process in (13a), but not the one in (13b):



The loss of a consonant can result in the lengthening of an adjacent vowel only if that consonant is in the syllable rime. In a theory lacking a weight tier this would have to be stipulated. In the present model it follows automatically from the OCR, as seen in (14).



In both (14a) and (14b) we begin with two WU's, each dominating a single segmental matrix. In the case of (14a) the /g/ deletes and the /a/ extends its association line to the right onto the second WU. The result is compensatory lengthening. In (14b), however, before any consonant-deletion can apply, the OCR must apply, removing the WU of the onset consonant. Now if the /g/ deletes, the only result can be a short vowel; hence, no compensatory lengthening in (14b).

A related case concerns desyllabification rules such as (15).



Let us first consider the gliding rule in (15a). Paulian (1974) reports the derivations in (16) from Kukuya (Bantu; Congo). Whenever a non-high vowel is followed by the high vowel /i/, the /i/ becomes the corresponding glide [y] with compensatory lengthening of the preceding vowel. This is accomplished by extending the association of the non-high vowel matrix onto the following WU, as in (17a).

- (16) /nkéí/ → [ŋké:y] 'drought'  
 /mù-bóí/ → [mù-bó:y] 'clay'  
 /lì-báí/ → [lì]-bá:y] 'lath'

- (17) a.  b. 

The corresponding mirror-image input in (17b) fails, however, to derive a [y] followed by a compensatorily lengthened vowel [a:]. This misderivation can be prevented if we assume that onset creation *precedes* all level 1 phonological rules. However, the OCR will not apply to (17b), since both segments are [-cons]. I have proposed elsewhere (Hyman 1983) that glides are [+cons], not [-cons] as they have been assumed to be from the days when there was no syllable structure in phonological theory. What we need, then, is a readjustment rule preceding the OCR which will change the high vowel to [+cons] in this context. Then the OCR will apply, guaranteeing that there will be no compensatory lengthening accompanying onset creation.<sup>6</sup>

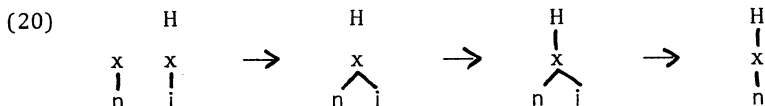
Let us consider now desyllabification of syllabic consonants. The rule in (15b) changes a vowel followed by a syllabic nasal into a long vowel followed by a non-syllabic nasal. As seen in (18),

- (18) a.  b. 

the representation of a syllabic nasal is simply a nasal segment dominated by a WU of its own. In other words, it is identical to a regular nasal consonant. In order for it to be syllabic on the surface, its WU, i.e. its beat or mora value, must be maintained. In (18a) the extension of the vowel association onto the following WU accomplishes both the compensatory lengthening in question as well as the desyllabification process, as we shall see below. What is crucial is that the representation of the syllabic /n/ in (18b), identical as it is to any single consonant segment, will result in an application of the OCR, and hence, no compensatory lengthening will be possible. The derivation in (19) from Dagur Mongolian (Martin 1961) shows how this will work:

- (19) /saiŋ+ini/ → [saiŋini] 'as for the good'

The final nasal of 'good' is normally syllabic, but when followed by a suffix vowel in level 1 morphology, it loses its syllabicity. No compensatory lengthening results. This follows from the OCR. Notice that no other model has made the prediction that desyllabification and onset creation are related in just this way. Finally, WU's provide a particularly suitable means of representing *derived* syllabic consonants. The derivation in (20), for example, where H = high tone, first applies the OCR, then maps the single H tone onto the one remaining WU, and then deletes the high vowel [i]. Since the nasal left behind is dominated by a WU of its own, it is a syl-



labic nasal. Notice that there is no need to shift the nasal from the onset to the rime as it acquires syllabicity, since the mapping of the tone is on the WU, not on the vowel.

This brings us then to the second point concerning onsets: the fact that they may not be tone-bearing. The normal assumption is that tone will be mapped onto vowels or perhaps onto syllables. It is of course known that many languages have syllabic consonants that also bear tone. We have just seen that such consonants have a WU of their own. Now, if we assume that tone mapping takes place on WU's, then it will never be the case that an onset--which by definition must be followed by a vowel--is assigned a tone on its own. Consider the example [ò.téérà] 'you pl. run' from Gokana (Cross-River; Nigeria) in (21).



In (21a) the H-L melody of the verb form is mapped onto the V slots of the so-called CV tier. The consonants must be skipped over, as seen. We note that the consonants in question are in fact onsets. In this approach the V slots are said to be "projected" and then the tone melody is mapped onto this projection. In (21b) no such stipulation is necessary: if the OCR applies first, we obtain a verb form with four surviving WU's, as indicated. The H-L melody then maps directly onto these WU's, and there is no need to have phonological projections at all. The OCR will thus not only capture the weightlessness of onsets, but also their tonelessness.

A corroborating example of the role of the OCR in predicting what will vs. will not be a tone-bearing unit (TBU) comes from Kom (Grassfields Bantu; Cameroon). The phrases in (22) are designed to show that Kom permits syllables having both  $\widehat{HL}$  and  $\widehat{HM}$  contour tones.

- (22) a. tē-wô tē fê-cwò 'wings of the squirrel'  
 b. tē-bí' tē fê-cwò 'kolanuts of the squirrel'  
 (' = H ; ' = M ; ` = L ; ^ =  $\widehat{HL}$  falling; ' =  $\widehat{HM}$  falling)

In (22a) a  $\widehat{HL}$  contour is on the stem of 'wings', while in (22b) a  $\widehat{HM}$  is on the stem of 'kolanuts'. (There is also a  $\widehat{HL}$  contour on the prefix of 'squirrel' in both examples.) Now consider the two nouns in (23).

- (23) a. ā-kôš 'slave'                      b. ā-sôŋ 'teeth'

The noun 'slave' in (23a) has a  $\widehat{HL}$  falling contour on its stem syllable, while the noun 'teeth' in (23b) has a  $\widehat{HM}$  falling tone on its stem. Both contours fail to appear in (24), however, where the stem

syllable is immediately followed by a vowel:

- (24) a.  $\bar{a}$ -kò's  $\bar{a}$  fê-cwò 'slave of the squirrel'  
 b.  $\bar{a}$ -sóŋ á fê-cwò 'teeth of the squirrel'

Since we saw in (22) and (23) that Kom permits  $\widehat{HL}$  and  $\widehat{HM}$  contour tones, why are these contours lost in (24)? Note that the vowel [ɔ] occurs in open syllable in the two head nouns in (24), after resyllabification takes place across the word boundary. Since the syllables permitting contour tones in (22) are also open, the only difference between the acceptable contour environment in (22) vs. the unacceptable contour environment in (24) is that there has been a *re*-syllabification in (24).

The representations that immediately precede this resyllabification are given in (25).

- (25) a.  $\begin{array}{c} L \quad H \quad L \quad H \quad L \quad L \\ \diagdown \quad | \quad \diagdown \quad | \quad \diagdown \quad | \\ x \quad x \quad x \quad x \quad x \quad x \\ | \quad \wedge \quad | \quad \wedge \quad | \quad \wedge \\ a-kò's \quad a \quad fê-cwò \end{array}$       b.  $\begin{array}{c} L \quad H \quad LH \quad H \quad L \quad L \\ \diagdown \quad | \quad | \quad \diagdown \quad | \quad | \\ x \quad x \quad x \quad x \quad x \quad x \\ | \quad \wedge \quad | \quad \wedge \quad | \quad \wedge \\ a-sóŋ \quad a \quad fê-cwò \end{array}$

The tonal associations reveal that a H tone spreads onto a following L tone WU. Thus, there are several instances in (25) of a single H autosegment being associated onto two WU's. In these representations I am claiming that there is a stage in the derivation where the second tone of the contour is associated onto the WU of the margin consonant. The relevant portions of (25) are repeated in (26).

- (26) a.  $\begin{array}{c} H \quad L \quad H \\ | \quad | \quad | \\ x \quad x \quad x \\ \wedge \quad | \quad | \\ k \quad ɔ \quad s \quad a \end{array}$       b.  $\begin{array}{c} H \quad LH \quad H \\ | \quad | \quad | \\ x \quad x \quad x \\ \wedge \quad | \quad | \\ s \quad ɔ \quad ŋ \quad a \end{array}$

It is important to note that the M tone is derived in Kom: the first H TBU following a L tone will be pronounced on a M pitch. Thus, in (26a), the /á/ will be M by virtue of the preceding anchored L tone, while in (26b) the H on the margin consonant /ŋ/ will be M because of the preceding floating L, creating the surface  $\widehat{HM}$  falling contour. It can be seen from (26) that when the resyllabification process is effected by reapplying the OCR, the WU carrying the second tone of the contour will be deleted, resulting in the forms in (27).

- (27) a.  $\begin{array}{c} H \quad L \quad H \\ | \quad | \quad | \\ x \quad x \quad x \\ \wedge \quad | \quad | \\ k \quad ɔ \quad s \quad a \end{array}$       b.  $\begin{array}{c} H \quad LH \quad H \\ | \quad | \quad | \\ x \quad x \quad x \\ \wedge \quad | \quad | \\ s \quad ɔ \quad ŋ \quad a \end{array}$

The L tone set afloat by the OCR in (27a) will result in the following H tone /á/ being realized on a M pitch (cf. (24a)). In (27b), however, it is only the H tone set afloat that could conceivably be lowered to M, and thus the following /á/ remains H tone to the surface.

What the above derivations show is that the OCR automatically accounts for the flotation of tones which become disassociated from a consonant that changes from being a margin to being an onset. The non-tone-bearing character of the onset need not be stipulated separately from the resyllabification process itself, and hence the weight tier approach provides a very satisfactory account of this non-accidental relationship.

So far it has been shown that the weight tier can account for the universal CV syllable in (2), for the weightlessness of onsets in (3a), and the non-tone-bearing nature of onsets in (3b). I shall demonstrate that WU's also make the correct prediction in (3c) that an onset may not be syllabic in initial syllabification rules. It is first necessary to state how syllabicity is defined in this system. I reject the notion that there is a feature [syll] and, as we have seen, there is no pre-existing rime or nucleus node in the syllable structure I have assumed in representations such as in (11) above. That the syllable cannot predict syllabicity is further demonstrated in my earlier work (Hyman 1982, 1983), where it is argued that at least one language, Gokana, does not have syllable structure at all. I propose that syllabicity be defined as in (28).

- (28) a. Each WU defines a "beat" or peak of sonority which can be referred to as "syllabicity".
- b. This syllabicity is realized on the *most sonorous* segment dominated by each such WU.

(28a) clearly states that syllabicity is defined independently of syllables. (28b) recognizes the need, pointed out by many before me, for a sonority hierarchy which places vowels above consonants, sonorants above obstruents, and so forth.

With the above characterization of syllabicity we now understand what was said about syllabic consonants in the preceding discussion. By the above definition, a representation such as in (29), as the word *pin* appears prior to the operation of the OCR,

(29)

x	x	x
p <sup>h</sup>	t	n

says that there is a "syllabic [p<sup>h</sup>]", a "syllabic [t]" and a "syllabic [n]", since each segment is the most sonorous dominated by its respective WU. Thus, what the OCR says, in effect, is that a [+cons] segment may not have weight, i.e. syllabicity, if it is directly followed by a [-cons] segment. On the other hand, a consonant which *follows* a vowel need not lose its weight, i.e. its syllabicity, by the language-specific MCR, since we know that syllabic consonants are well-formed in the would-be syllable rime. When a language such as Latin refers to the margin consonant as a "mora", i.e. as having weight, it is in effect treating that consonant as syllabic. If on the surface the consonant in question is not syllabic, then the MCR must apply after the weight-sensitive

rule in question (in this case, after the Latin stress rule).

I have applied this model to various phonological phenomena and have found that in many cases it provides a more elegant statement of the facts of syllabicity than approaches which are wedded to the syllable. I have argued, for example, that epenthesis rules can neatly be constrained as inserting phonetic materials on a single tier only. That is, they take the existing WU's and insert vowel or consonant features to make these WU's "pronounceable". A case in point is the Tamazight dialect of Berber, which has been studied by a number of linguists (see Saib 1976a,b; Guerssel 1978; and, for the most detailed account, Penchoen 1973). The derivations in (30) suggest a rule inserting a schwa in the two environments in (31).

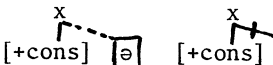
- (30) a. /x<sub>dm</sub> + x/ → [xəðmæx] 'I work'  
 b. /t + x<sub>dm</sub>/ → [θəxðəm] 'you sg.f. work'  
 c. /x<sub>dm</sub> + n/ → [xəðmæn] 'they m. work'

- (31) a. ∅ → ə / C \_\_\_ C #  
 b. ∅ → ə / C \_\_\_ C C

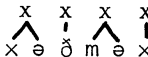
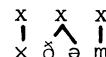
In the forms in (30), (31a) first inserts a schwa before the word-final consonant, and then (31b) inserts another schwa between the initial and the following two consonants. In (32), however, we note a slightly different story when there is an odd number of consonants:

- (32) a. /x<sub>dm</sub>/ → [xðəm] 'work'  
 b. /n + x<sub>dm</sub> + m/ → [n<sub>x</sub>əðməm] 'we work'  
 c. /t + x<sub>dm</sub> + m/ → [θ<sub>x</sub>əðməm] 'you pl.m. work'

The initial consonant in each form is produced with a beat, i.e. with weight. It is clear that we are dealing with a syllabic consonant, though we do not need to commit ourselves to saying that it actually constitutes a syllable.<sup>7</sup> The epenthesis rule that I have proposed (Hyman 1983) is given in (33).

- (33) 

The boxed schwa is inserted onto a [+cons] WU that is followed by another [+cons] WU that does not branch; i.e. when the second consonant is not itself followed by a V (which would constitute a branching WU). The representations of (30a) and (32a) after the application of rule (33) are seen in (34).

- (34) a.  b. 

The initial consonant of (34b) has a WU of its own and therefore is interpreted as syllabic; the other [+cons] WU's are removed by the

MCR. There is no need for the syllable and therefore no need to recognize defective syllables in which a voiceless consonant would constitute the nucleus. While syllable-based theories could conceivably treat the voiceless consonant as extrasyllabic, they cannot explain why an extrasyllabic consonant should have weight like a syllabic consonant within a syllable, rather than not have weight, like an onset (universally) or a margin consonant (usually).

The above example is intended to show that the WU approach to the "anchor tier" provides the most promising way of encoding the timing properties of phonological entities. The CV or X-tiers need to be supplemented by principles, conditions, or conventions in order to derive the appropriate outputs, while the WU tier defines the correct set of onset and other properties in a principled way.

The final question which I would like to raise is whether what I have said can be reduced to some kind of functional, phonetic explanation, or whether WU's, the OCR and the MCR are abstract grammatical properties. It has been my intention in developing this model to derive a representation of the phonological output that has the most realistic chance of serving as the input to phonetic realization rules and strategies. I am aware, however, that there are numerous surface examples that render opaque some of the generalizations I have referred to earlier. In particular, languages have syllabic consonants preceding vowels, suggesting the possibility of phonetic syllabic onsets. One need not go further than English to find numerous examples such as the ones in (35).

(35) a. [dɛvʃɪʃ] 'devilish'      b. [hæpənɪŋ] 'happening'

These syllabic consonants are of course derived by low-level rules. Assuming no underlying schwa, these words are represented as in (36).

(36) a.  $\begin{array}{c} x & & x & & x \\ \diagup & & | & & \diagup \\ d & \varepsilon & v & ʃ & ] & \iota & ʃ \\ & & & & & & \diagdown \end{array}$       b.  $\begin{array}{c} x & & x & & x \\ \diagup & & | & & \diagup \\ h & \text{æ} & p & n & ] & \iota & \eta \\ & & & & & & \diagdown \end{array}$

The right bracket separates the "neutral affixes" -ish and -ing from what is present in the level 1 morphology (Kiparsky 1982). As seen, the OCR need not reapply in English to level 2 morphology or to post-lexical CV sequences.<sup>8</sup>

Similar arguments for the universality of the OCR at level 1 can be made from other languages which on the surface have syllabic consonants immediately preceding a vowel. I have provided accounts for such specious OCR violations as those seen from Kpelle (Mande; Liberia) in (37a) and Idoma (Kwa; Nigeria) in (37b) (see Hyman 1983).

(37) a. [ŋ̩ē:] 'his mother'      b. [p̩ʔà] 'deceived'

In each case the syllabic consonant is tone-bearing and receives its syllabicity from a late rule. What this means is that the OCR is obligatory in level 1 lexical morphology, but may be violated on the surface by subsequent, often low-level rules. It is therefore hard to understand how the OCR, not being universally respected, phonetically, could represent a phonetic principle rather than a phonological one.

While this may be true, the concept of WU's has phonetic implications that should be investigated further. It has been suggested that the representation in (38a), if surviving to the surface, could only stand for a syllabic consonant followed by a syllabic vowel:

- (38) a.  $\begin{array}{cc} x & x \\ | & | \\ [+cons] & [-cons] \end{array}$       b.  $\begin{array}{cc} x & x \\ | & | \\ [-cons] & [+cons] \end{array}$

The only surface examples known of this kind of representation are those involving sonorant consonants as we have just seen in (35) and (37). In the case of (38b), we have said that this represents a syllabic vowel followed by a syllabic consonant. If this consonant is a sonorant, e.g. a liquid or nasal, this makes sense. But what if it is an obstruent, for example, a stop? What could this mean?

I would like to speculate that if the second WU of (38b) dominates a stop, (38b) represents a "released" consonant. Thus, the released and non-released versions of a word such as bat would be as in (39).

- (39) a.  $\begin{array}{cc} x & x \\ / \ \backslash & | \\ b & \text{æ} & t \end{array}$       b.  $\begin{array}{c} x \\ / \ \backslash \\ b & \text{æ} & t \end{array}$

A post-vocalic stop may not be syllabic, but it may be released. I would hypothesize on the basis of the different representations in (39) that a vowel in an English word should be shorter before a non-released consonant, with which it shares a single WU, as in (39b), than before a released consonant, which has its own WU, as in (39a).

Let's push this idea a little further. It is well-known that a non-released consonant is only barely or not at all audible when it follows another consonant, as in words such as in (40).

- (40) apt, sulk, can't, test, ramp, sink, etc.

When the stop in question is unreleased, one must rely on other cues to detect its presence--especially on the shortening of the preceding vowel or vowel-consonant sequence, perhaps also on nasalization in words such as can't and sink. Where a final consonant must of necessity be released, as in the case of a fricative or affricate, the different realizations in (41) represent, respectively, a syllabic fricative, i.e. with a beat of its own, vs. the normal non-syllabic fricative.

- (41) a.  $\begin{array}{cc} x & x \\ / \ \backslash & | \\ g & \text{æ} & s \end{array}$       b.  $\begin{array}{c} x \\ / \ \backslash \\ g & \text{æ} & s \end{array}$

English words ending in three or four consonants will generally assign only the first of these to the preceding WU, as seen in (42).

- (42) a.  $\begin{array}{cc} x & x \\ / \ \backslash & / \ \backslash \\ t & w & \text{æ} & | & f & \text{æ} & \text{θ} & s \end{array}$       b.  $\begin{array}{cc} x & x \\ / \ \backslash & / \ \backslash \\ t & \text{æ} & s & t & \text{æ} & s \end{array}$       c.  $\begin{array}{cc} x & x \\ / \ \backslash & | \\ t & \text{æ} & s & s \end{array}$

When the /t/ of *test*s drops out in casual speech, we obtain (42c), where there is an [s] followed by a second [ʃ] having its own WU and hence constituting a beat of its own.

Thus, in conclusion, while the WU framework adequately accounts for a number of phonological facts about onsets, syllable weight, and syllabicity in general, it also provides a straightforward way of representing low-level phonetic phenomena that are not neatly accounted for by reference to syllable structure alone. It is hoped that weight tier phonology, in addition to its phonological significance, will provide a meaningful contribution towards the prediction of timing relations between segments in the physical phonetic output.<sup>9</sup>

#### NOTES

<sup>1</sup>In (5) "VV" is intended to represent either long or tense vowels, as opposed to corresponding short or lax vowels. There is some question as to a possible weight continuum that would also recognize, among other things, full vs. reduced vowels, and which would place sonorant consonants in between vowels and obstruents in terms of their weight properties. Since this is where they fall in the sonority hierarchy, and since I later relate weight, syllabicity and sonority (see (28)), this is to be expected.

<sup>2</sup>I have recently come to question whether affricates should be represented as two fully specified [+cons] matrices, as indicated in (8c), rather than sequencing only those features that have opposite values, e.g. [-cont][+cont]. The same may be true for short diphthongs.

<sup>3</sup>A fifth possibility is for there to be a WU without any segmental material associated with it. This could be used where an adjacent segment lengthens in some morphological environment: the morpheme in question could be represented as a WU to which, e.g. the preceding segmental matrix extends its association.

<sup>4</sup>I at first rejected the notion that schwa could be represented as in (9d) in French and represented it as an empty WU in a paper entitled "Syllabicity without syllables in French". Discussions with Bernard Tranel have made me return to my original position in favor of (9d). The "floating schwa" serves the purpose of *blocking* the preceding consonant from joining the following consonant as a complex onset. A rule is needed to associate the floating schwa to the preceding [+cons] WU in the appropriate environments.

<sup>5</sup>The position I would like to take is that *all* onsets are created prior to the operation of weight-related phonological rules, if this can be made to work. I have not mentioned elsewhere in this paper (but see Hyman 1983) that we will need onset-adjunction and margin-adjunction rules which also will remove the WU's of consonants joining other WU's as onsets or margins.

<sup>6</sup>It is possible, however, to have a derivation such as *ja* → *yja* → *yaa* [ya:], where there is first glide-*insertion* and then assimilation as indicated.

<sup>7</sup>The generative Berber scholars have transcribed an initial

schwa in forms such as (32). I have verified with Jilali Saib, however, that it is a schwaless syllabic consonant, just as Penchoen (1973) transcribes it. A schwa is, however, present in the single case where contrastive stress is placed on the consonant.

<sup>8</sup>It may be that one will want to have the [+cons] sonorant link also to the WU of the neutral suffix without, however, deleting its own WU as would be required by the level 1 operation of the OCR. There are different low-level realizations of words such as in (36), and it is not clear which of the phonetic transitions should be represented by WU associations and which are simply part of the phonetic component of English.

<sup>9</sup>Much of this paper is drawn from Hyman (1983), parts of which have been presented at the University of California, Berkeley, the University of Southern California, and the University of California, Los Angeles. For helpful comments on earlier versions and in discussions I would like to thank Joseph Aoun, John Goldsmith, Bruce Hayes, Will Leben, Juliette Levin, David Pesetsky, Donca Steriade, and Bernard Tranel.

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