

- Rice, Keren D. (1993), "A reexamination of the feature [sonorant]: the status of 'sonorant obstruents'", *Language* 69, 308-344.
- Sapir, Edward & Hoijer (1967), *The Phonology and Morphology of the Navaho Language*, University of California Publications Linguistics 50, University of California Press, Berkeley and Los Angeles.
- Skousen, Royal (1972), "On Capturing Regularities", in Peranteau, Paul M. et al., *Papers from the Eighth Regional Meeting Chicago Linguistic Society*, 567-577.
- Steriade, Donca (1993a), "Segments, Contours and Clusters", in Crochettier, André, et al. (eds), *Proceedings of the XVth International Congress of Linguistics*, Université Laval, Québec, 71-82.
- Steriade, Donca (1993b), "Closure, Release, and Nasal Contours", in Huffman, Marie K. & Rena A. Krakow (eds), *Nasals, Nasalization, and the Velum* (Phonetics and Phonology 5), Academic Press, Inc., San Diego, California, 401-470.
- Steriade, Donca (1994), "Complex Onsets as Single Segments: The Mazateco Pattern", in Cole, Jennifer & Charles Kisseberth (eds), *Perspectives in Phonology: Proceedings of the University of Illinois Phonology Conference*, CSLI, Stanford, California, 203-291.
- Tourville, Jose (1991), *Licensing and the Representation of Floating Nasals*, PhD dissertation, McGill University, Montreal.
- Vainikka, Anne (1988), "Finnish Consonant Gradation Unified", Manuscript, University of Massachusetts, Amherst.
- Young, Robert W. & William Morgan Sr (1987), *The Navajo Language: A Grammar and Colloquial Dictionary*, revised edn, University of New Mexico Press, Albuquerque.
- Walker, R. (1994), "Hierarchical opacity effects in nasal harmony: an optimality-theoretic account", to appear in *Proceedings of ESCOL 94*.
- van de Weijer, J.M. (1992), "The Manner Node", in Bok-Bennema, R. & R.W.N.M. van Hout (eds), *Linguistics in the Netherlands 1992*, John Benjamins, Amsterdam, 261-272.

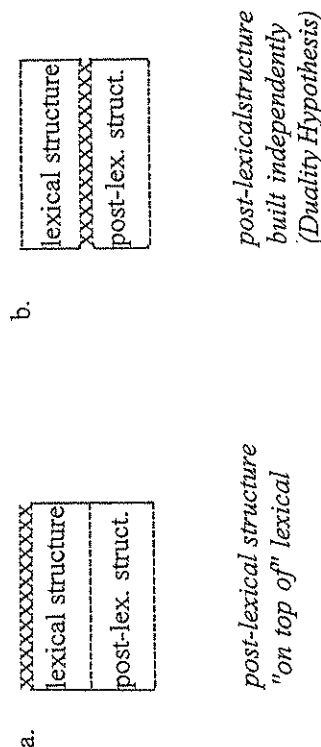
On Some Parallels between (Un)realised Empty Nuclei and (Un)stressed Syllables

Harry van der Hulst & Grażyna Rowicka

0. Introduction

Arguments have been adduced in the literature that prosodic structure is present both lexically and post-lexically (for an overview see Golston & van der Hulst, to appear). In various phonological models it has been argued that syllable structure and even foot structure is present in, or assigned to, lexical representations. Prosodic categories play a role in capturing lexical generalizations on segmental alternations, phonotactics, accent location, as well as about the canonical shape of morphemes or derived forms.

The presence of prosodic structure in the lexicon raises the question whether post-lexical prosodic structure is built *on top of* the lexical structure (possibly with some minor adjustments) or whether post-lexical structure is built independently on a string of segments. The latter view is often taken to involve "deforestation" or "erasure of information". However, this is not a necessary implication. We can also hold the view that lexical and post-lexical structures co-exist on different planes. This possibility is represented in (1)b. We refer to it as the Duality Hypothesis. (1)a represents the model where post-lexical structure is built on top of lexical structure, both being present on the same plane. Unlike (1)a, the organisation in (1)b implies that the lower level prosodic units (i.e. syllables, feet and prosodic words) can be found twice, at the lexical and at the post-lexical level.

(1) *Lexical vs. post-lexical prosodic structure*

where "xxx" denotes a string of segments

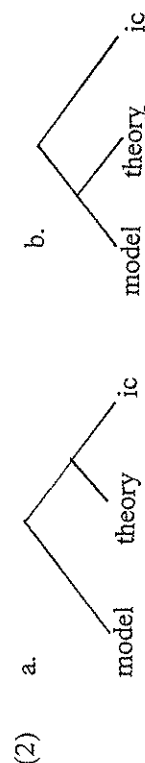
The Duality Hypothesis is not novel as such. Anderson & Ewen (1987, 122 ff.) defend it quite explicitly, and so does Helsloot (1995, 1997). At the level of syllabic organization, Baumann (to appear) argues for a lexical and post-lexical representation. In addition, Anderson & Ewen (1987) point out that a specific lexical structure may correspond to various post-lexical structures because post-lexical structure is in part determined by factors like the rate of speech and speech style.

The Duality Hypothesis allows lexical prosodic structure to differ from the corresponding post-lexical structure. Allowing such differences solves many of what we will call "structure paradoxes" in phonology.

In this article we will first briefly discuss some examples of structure paradoxes, confining ourselves to the level of syllable structure and foot structure. Then we will turn our attention to Proper Government relations which, within Government Phonology, are claimed to hold between contentful and empty nuclei. The point we want to make is that Proper Government relations can be identified with lexical foot structure. This interpretation fits within the Duality Hypothesis. In addition, we will show that identifying Proper Government relations with lexical foot structure allows us to reveal expected parallels between the distribution of unrealized empty nuclei and unstressed syllables at the post-lexical level. In this way the Duality Hypothesis can also make possible a more insightful analysis of Proper Government relations.

1. Structure paradoxes in phonology¹

A structure paradox arises when a linguistic unit appears to have two (or more) incompatible structural descriptions, each of these being based on different types of evidence. This situation is familiar from the study of morpho-syntactic structure. In words like *model-theoretic* standard level theory (cf. Siegel 1974, Allen 1978) demands that the structure is as in (2)a, which is also motivated prosodically, while semantic considerations argue for (2)b.



The availability of two different structures for one linguistic object can be called a paradox *if* it is assumed that both structures cannot exist at the same time. To solve the paradox one could argue against one of the structures. Alternatively, both structures can be claimed to be correct, but belonging to different articulations. This is the case in (2) where one structure is prosodic, while the other is morpho-syntactic.

However, structure paradoxes have also been identified *within* phonology. In cases like that, it seems unlikely that one could validate the truth of distinct structures claiming that they belong to different articulations if both are quite clearly "phonological" in nature. We claim that if one adopts the Duality Hypothesis, it can be argued that the two structures are both valid, one on the lexical plane and the other on the post-lexical plane.

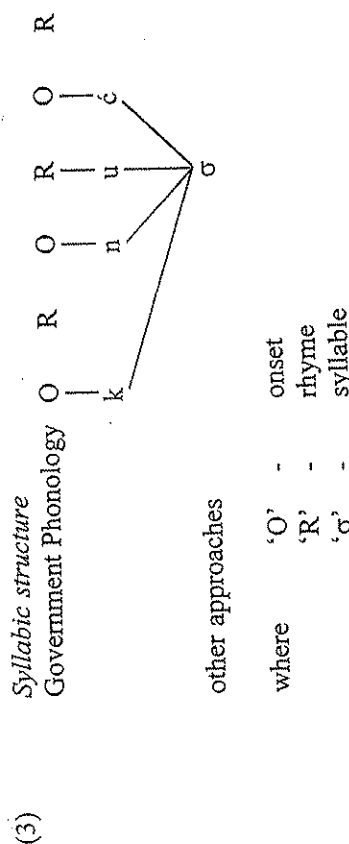
Below we will show that many debates involving syllable structure and foot structure may very well result from the fact that different linguists are talking about entities that belong to different planes, the lexical and the post-lexical plane.

1.1. Syllabic structure paradoxes

Phonologists dealing with syllable structure often disagree on the question of how many consonants syllable onsets can contain. For example, proponents of Government Phonology (GP; cf. KLV 1990) claim that onsets can contain no more than two consonants, and some even hold the

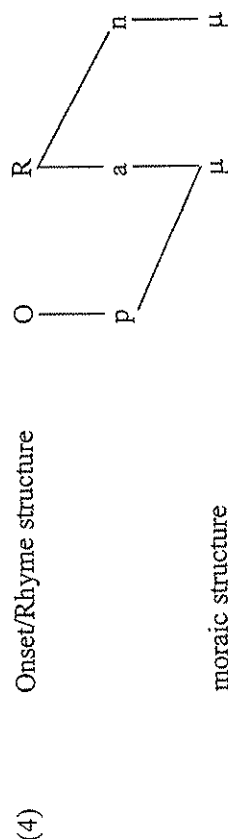
¹ This section draws on certain ideas from van der Hulst (1996b).

apparently absurd claim that onsets are universally monosegmental (cf. Lowenstamm 1996). Other researchers, pointing to languages (such as Polish or Georgian) where words can "audibly" begin with sequences of many more than two consonants, argue that the GP claim is clearly false. For example, given the two approaches, the Polish word *knuć* 'to plot' may either consist of one syllable (denoted by "σ" below) or three Onset/Rhyme sequences of the Government Phonology type:



It is sometimes recognised that the researchers in question may in fact be talking about two different kinds of objects, viz. the phonological syllable (or, an Onset-Rhyme sequence) and the phonetic syllable. Depending on what one means by terms like "phonological" and "phonetic", this distinction might come close to what we advocate here. We consider both types of units to be phonological objects, but one is lexical, while the other is post-lexical. The latter does stand closer to the phonetic substance of utterances than the former, but this does not make it a "phonetic event".

Besides the controversy concerning the amount of complexity that syllabic constituents like onsets and rhymes can take, an even more fundamental disagreement exists between proponents of Onset/Rhyme theories and proponents of moraic models of the syllable. For a simple syllable like /pen/, as in English *penguin*, the two approaches argue for two radically different structures. These are given in (4).²



It is not surprising that proponents of Onset/Rhyme-models and moraic models typically base their case on quite different types of arguments. Onset/Rhyme-phonologists point to phonotactic facts, i.e. generalisations regarding the segmental structure of lexical items. Here it seems that independent statements can be made for onsets and rhymes. Well-formed words can be seen as alternating sequences of such units, possibly with the proviso that special types of syllabic structure (e.g. involving empty onsets or rhymes) are allowed at word margins. This expresses the generalisation that word edges often allow for greater complexity than is found word-internally.

Moraic phonologists do not typically address phonotactics. They focus on the interaction between syllabic structure and higher prosodic levels, specifically foot structure. The relevant property of syllables in this case is their "weight". As is well-known, prosodic weight does not depend on the presence or complexity of onsets. Onsets are invisible to weight.³ This onset invisibility constitutes an embarrassment to Onset/Rhyme theories. Those varieties which, unlike Government Phonology, also recognise the syllable as a constituent have an additional problem that prosodic weight must be computed non-locally, i.e. by-passing syllable nodes. This is because the structure of rhymes, rather than syllables themselves, is relevant for foot formation. Moraic models do not have this problem. A heavy syllable is bimoraic and branching, and a light syllable is monomoraic and non-branching. Moraic structure nicely provides the prominence peaks relevant for rhythmic foot assignment.

A possible way out of this paradox is to argue that Onset/Rhyme structure functions lexically, where phonotactic generalisations must be captured, but that at the post-lexical level syllables have moraic structure.

³ Given the more abstract nature of the lexical system, and given that onsets are available as constituents lexically, one might still expect to find that *lexical* accent location may be sensitive to (the presence/absence or complexity of) Onsets after all. There are weak indications that this may in fact be the case (cf. Dainora & Steinberg, to appear, on Italian). However, Goedemans (1996) demonstrates that at least some cases where stress has been claimed to be Onset sensitive can be re-analysed. He also provides a general discussion of the issue.

² Some moraic models adjoin prevocalic segments directly to the syllable node, rather than to the first mora. This difference is irrelevant for the focus of the present discussion.

The (post-lexical) level where weight-sensitive foot structure is computed does not have access to onsets at all. Given the Duality Hypothesis both representations in (4) can be correct, but present on different planes.

The suggestion that lexical and post-lexical syllabification differ as radically as proposed above needs further investigation. There are, however, several other syllabic structure paradoxes that could be resolved if the Duality Hypothesis is accepted. One example involves the issue of whether or not intervocalic consonants can be "ambisyllabic".

Ambisyllabicity is not quite compatible with Onset/Rhyme theories. Standard views on constituent structure disallow nodes to be dominated by two mothers. It is perhaps not a coincidence that arguments in favour of ambisyllabicity are usually based on rather low-level processes, such as flapping in English or various other forms of lenition or weakening, which are arguably post-lexical rather than lexical. Phonologists adhering to an Onset/Rhyme approach at the lexical level usually assume rules of resyllabification to account for ambisyllabicity at later levels (see, e.g. Selkirk 1982).

This issue can be approached by allowing for different structure at different levels, instead of postulating restructuring. We can assume that lexical syllabification does not allow ambisyllabicity, while post-lexical syllabification does. Since the latter is built independently of the former, there is no need for resyllabification. This proposal entails that phonological generalisations that demonstrably concern lexical structure should never need to refer to ambisyllabicity. Where this seems to be the case (as in the Dutch stress system, cf. below) van der Hulst (1985) argues that the relevant structure involves lexical geminates. Consonants which are lexically represented as geminates surface as ambisyllabic. No language seems to contrast geminates and ambisyllabic consonants, which supports the idea that the two structures are present, but on different planes.

An interesting possibility arises if we recognize that a language may lack lexical syllabification altogether. For example, this can apply to the celebrated Imdlawn Tashlhiyt Berber situation (cf., for example, Dell and Elmedlaoui 1985). The language has been much discussed due to its amazing syllabification algorithm. Since in Imdlawn Tashlhiyt Berber apparently any string of consonants can be "syllabified", we would like to argue that the language has no lexical syllabification. There is simply no evidence for lexical syllable structure because there do not seem to be any phonotactic restrictions on sequences of segments that make up well-

formed lexical words.⁴ Syllabification only takes place post-lexically. At the post-lexical level any kind of segment can apparently function as a peak, even obstruents. In the perspective taken in this article, this potential of obstruents does not follow from and has no direct bearing on what is allowed at the lexical level. We claim that languages that show evidence for phonotactic regularities at the lexical level make no use of obstruents, or any type of consonant, in the syllable head position.⁵

If a language has no lexical syllabification, it has no lexical prosodic structure altogether. It is therefore not surprising that in Imdlawn Tashlhiyt Berber there are no reported lexical regularities in terms of word accent either. Post-lexically, there are undoubtedly rhythmic structures and accents. The location of these accents may be variable and dependent on phrasal contexts, rate and style of speech. This kind of variability is known to characterise post-lexical structure.

1.2. Foot-level structure paradoxes

Going one level up, to foot structure, we encounter again various cases of structure paradoxes. Let us consider the case of Dutch. In order to make sense of the regularities that we find in the location of word accent, we must appeal to lexical syllabic and foot structure that eventually does not show up post-lexically. The discrepancies between what seems to be the lexical structure and the corresponding postlexical organisation are summarised in chart (5).

⁴ There may still be some linear constraints on segment adjacency that make no crucial reference to syllabic constituents like onsets and rhymes.

⁵ In other words, the occurrence of syllabic consonants on the surface, such as 'l' in English *bottle*, does not necessarily imply, in our opinion, that in lexical representation such a segment is syllabified into a nuclear position.

(5)	<i>Prosodic structure of Dutch</i>		POST-LEXICAL
	LEXICAL		
a.	geminates (c v c) (c v) l e m m a	→	ambisyllabic consonants
b.	empty syllables (c v) (c ø) r a m ø	→	final superheavy (ra.m)
c.	monosyllabic feet [{(c v c)} {(c v c)}] h a r n a s	→	one foot
d.	extrametrical syllable {(c v) (c v)} <(c v)> d o m i n e	→	ternary foot

(5)c represents an interesting case. In order to arrive at a sensible analysis of primary stress we must assume that the final closed syllables form feet. They do not become word heads because they are monosyllabic (cf. van der Hulst 1984). However, Gussenhoven (1993) points to intonational evidence which suggests a different kind of foot structure. On the basis of the "chanted call" he points out that a word like *harnas* behaves like one foot.

In our view this is a clear example of a structure paradox. Regularities at the lexical level (involving the location of primary accent) point to structure A, while post-lexical regularities (in this case involving tune to text association) point to structure B. In the kind of surface feet that Gussenhoven needs, closed syllables are no longer prevented from occurring in the weak position within the foot. This shows that the weight-criteria for lexical and post-lexical feet are different. Heseloot (1997) reaches the same conclusion on rhythmic grounds. All these facts form evidence for the Duality Hypothesis.

Summarizing the above, we have seen that there is ample evidence for assuming prosodic structure in the lexicon. We have demonstrated that the required prosodic structures do not necessarily function post-lexically, where different organizations must often be postulated. Maintaining that post-lexical structure is built on top of lexical structure would require various adjustments. The view that we advocate here is that post-lexical structure is built independently.

That lexical prosodic structure resembles post-lexical structure is not surprising. Regularities in the sound structure of languages start life at the post-lexical level. Over time such regularities percolate into the lexicon, leading to restructuring of lexical entries. Meanwhile, or as a result of that, these regularities are overruled by new post-lexical processes which make them opaque to a certain extent. This does not mean that the lexical regularities are no longer worth capturing. However, in order to do so one must postulate structure that deviates from the structures which now predominate in the post-lexical hierarchy.

In the second part of our article we want to propose that the Proper Government structures that Government Phonology proposes for phonotactic reasons can be seen in terms of lexical prosodic organization, more specifically as lexical foot structure. In such cases, the lexical prosodic organization does not necessarily serve the computation of word accent, which we have argued to be the case with Dutch, but primarily phonotactic purposes. The parallel between Proper Government and metrical structure was part of the original idea behind the Government Phonology approach to vowel-zero alternations (cf. Kaye 1986-7), but, in our view, the foot character of Proper Government relations has never been sufficiently explored.

2. Proper Government as lexical foot structure

The role of internuclear relations in phonotactic patterns is exactly what Government Phonology has focused on. A typical feature of GP analyses is the postulation of empty syllabic structure. Such structure helps in accounting for systematic phonotactic patterns, but post-lexically there is hardly any evidence for it. In our view, postulating structure that is lacking post-lexically involves a structure paradox. By identifying Proper Government relations as lexical foot structure, with realised nuclei as heads and unrealized empty nuclei as dependents in such feet, we can give it a proper place in the theory of phonological representations. In this way we "demystify" the theory of Government Phonology. We put an end to misguided debates on whether there is any evidence for the empty syllabic structure in the post-lexical phonology. There is none, and we do not expect to find it either, since post-lexical structure is *not* built on top of lexical structure. What the post-lexical structure can "see" is the string of specified segments, and presumably information about lexical heads (cf. Anderson & Ewen 1987).

2.1. Empty nuclei in Government Phonology

2.1.1. Syllabic structure in GP

In its standard version (e.g. KLV 1990), GP claims that syllabic structure consists of recurrent Onset-Rhyme sequences. Both the Onset and the Rhyme are maximally binary. If onsets branch, their daughters must (roughly speaking) be an obstruent followed by a sonorant. An additional claim, the so-called Coda Licensing Principle (cf. Kaye 1990), is that a consonant can be in a coda preceded by a short vowel only if it is followed by a less sonorous consonant. If languages exhibit segmental sequences that violate these ground rules, GP postulates extra syllabic structure in the form of empty (nuclear) positions. Vowels alternating with zero are also represented as underlyingly empty nuclei which are always present in representation, but phonetically realised only under certain conditions.

It has always been recognised that postulating empty nuclear positions must come together with principles which delimit their distribution. We will argue that these principles should be identified with those which control the distribution of unstressed syllables. Our claim is that in both cases we are concerned with the assignment of (strong and weak positions in) prosodic structure, lexically and post-lexically. Accepting the view that Proper Government relations between contentful vowels and empty nuclei constitute lexical foot structure leads us to adopt certain revisions of the standard GP theory.

2.1.2. The Empty Category Principle and Proper Government

The presence of empty nuclei in representations is basically controlled by means of the phonological *Empty Category Principle*, formulated as in (6).

(6) *Empty Category Principle (ECP)* (KLV 1990: 219)

A position may be uninterpreted phonetically if it is properly governed.

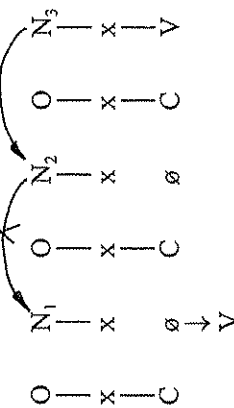
Proper Government (PG) is a special type of asymmetrical relation between a contentful nucleus and an empty nucleus which are adjacent on a nuclear projection level. The head nucleus in such a relation, i.e. the proper governor, may not itself be empty or properly governed by another nucleus. The dependent in a PG relation, i.e. a proper governee,

remains silent. An empty position which is not properly governed by an adjacent contentful nucleus must be realised phonetically.

In this formulation the focus of the ECP is the opposite of a stress assignment algorithm. Stress assignment concentrates on which positions must be strong and receive stress, rather than on which positions are allowed not to receive it. We will return to this point later and suggest a revision of the ECP.

Proper Government (PG) relations are said to be contracted under (right-to-left) directional analysis between nuclei which are adjacent at a nuclear projection level. Most cases of PG in the literature have been analysed as right-headed, i.e. the governor follows the governee. By analogy to stress, we will refer to such PG as iambic. Observe that the direction of analysis (right-to-left or left-to-right) is independent from the headedness of PG relations (right-headed or left-headed). The standard application of PG and the ECP is illustrated in (7). The level of the Rhyme, dominating the level of the Nucleus (N), is omitted as irrelevant.

(7) *Iambic Proper Government* (standard Government Phonology)



where

(iambic) Proper Government

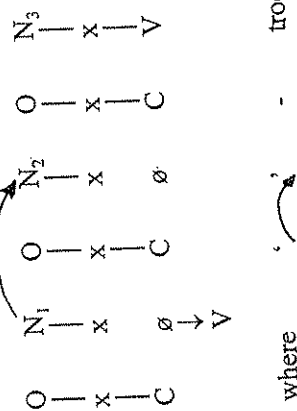
The contentful nucleus N₃ properly governs the preceding empty N₂, which therefore may remain empty. N₁ lacks a proper governor to its right and must become audible. The prediction is that in a sequence of empty nuclei every other one must surface.

The iambic head-orientation of PG to some extent stands in the way of identifying PG with lexical foot structure. In rhythmic stress systems the most common type of relation is a trochee, i.e. a left-headed foot (see, e.g. Dogil 1980). The right-headed iamb is a more marked option. Van de Vijver (1995, 1996) argues that an iamb is not a primitive of phonological theory in the way a trochee is, neither in stress nor in prosodic morphology. From this perspective one can expect left-headed,

or "trochaic" PG to be less marked than the right-headed, "iambic" PG of the standard theory.

Interestingly, the pattern analysed in terms of iambic PG in (7) above can equally well be accounted for in terms of trochaic PG, preserving the same (right-to-left) direction of analysis.⁶ This is shown in (8).

(8) *Trochaic Proper Government*



Here N_1 must be realised not just because it is not properly governed, but because it must itself properly govern N_2 . This line of analysis boils down to a fairly uncontroversial requirement that a governing head must be phonetically present.

As a matter of fact, the possibility of left-headed PG has already been considered (and rejected) by Charette (1991) for Korean, Wolof and Pulaar. Gibb (1992) argues for left-headed PG in Finnish, and Yoshida (to appear) in Arabic. On the basis of Yawelmani and Turkish long vowel shortening, Rowicka (to appear) argues that most, if not all, documented cases of PG can be reanalysed in trochaic terms. Below we briefly review the Yawelmani case, extending the analysis to include epenthesis.

2.2. Trochaic Proper Government: Yawelmani

We will concentrate on the verb forms. All our data come from Kenstowicz & Kisseberth (1979) and Noske (1993). A sketchy GP analysis is given in Kaye (1990), using of course iambic PG. We will demonstrate that iambic PG is not a prerequisite for an adequate analysis of the relevant facts. Trochaic PG works just as well. Then we will turn

⁶ However, as argued by Rowicka (to appear), the direction of analysis is not really crucial. Various independent well-formedness considerations can always be shown to be of relevance and interfere in determining the final output form.

to vowel shortening. Here we will show that standard GP has no satisfactory treatment to offer, whereas a trochaic account can handle such shortening as a lexical instance of "trochaic shortening" familiar from stress facts.

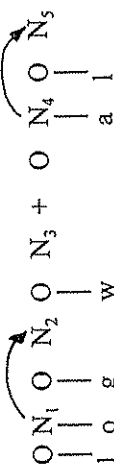
2.2.1. Epenthesis

Consider the examples in (9) where the epenthesized vowel is underlined.

- (9) *Yawelmani epenthesis*
logwol 'might pulverize'
logitwɪn 'pulverizes'

The stem is /logw/. When a vowel initial suffix is added no epenthesis takes place, but if the suffix starts with a consonant the vowel /i/ shows up. The analysis in terms of trochaic PG runs as shown in (10).

- (10) *Yawelmani and trochaic Proper Government*



Reduction (cf. Gussmann & Kaye 1993)

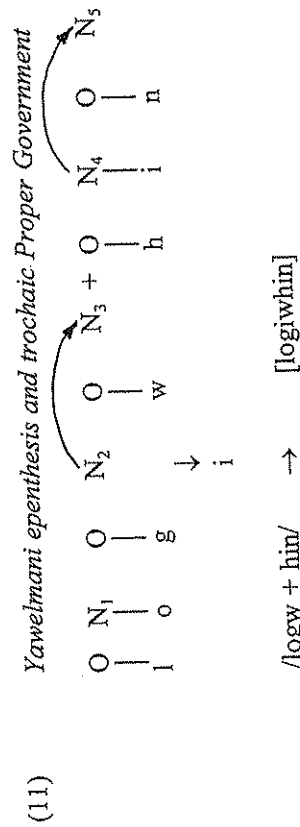
$$[\log w + o(1)] \rightarrow [\log w]$$

In (10) N_4 properly governs N_3 , and N_1 properly governs N_2 . The empty sequence consisting of N_3 and the following Onset, straddling the morphological boundary, is removed from the representation by a convention called Reduction. For the sake of simplicity, sequences subject to Reduction will be omitted from our representations.

Notice an advantage of trochaic PG over iambic PG which is evident from the representation in (10): no independent mechanism is needed to license final empty nuclei. N_3 is simply properly governed by the preceding vowel. It could not possibly be subject to iambic PG, because no potential governor follows. In such cases the standard theory must stipulate licensing by a parameter. Under the present approach, no special mechanism is necessary to license such nuclei. This seems an advantage of a model which assumes trochaic PG, given the fact that languages with word-medial empty nuclei generally also allow for final empty nuclei.

Word-final licensing parameter may still turn out useful though, for instance, in the analysis of languages which allow for more than one empty nucleus at the end of the word (cf. Yoshida, to appear, on Arabic).⁷

The analysis of epenthesis in Yawelmani is shown in (11).⁸ Here, again the final nucleus N_3 is properly governed by N_4 , but N_3 lacks a proper governor. The preceding nucleus is also empty. The representation is "repaired" when N_2 gets phonetically realised as [i] and may function as a proper governor for N_3 .

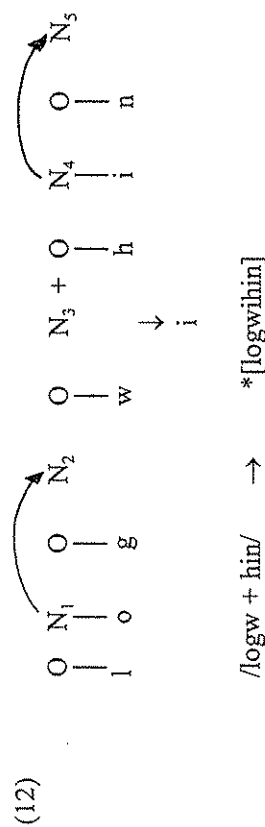


Epenthesis in (11) is then triggered by a sequence of two empty nuclei, or a "lapse" in representation. The realization of an empty nucleus is caused by the fact that the leftmost nucleus in such a sequence must act as the head of a Proper Government foot.

⁷ We note that under a trochaic analysis one does not expect to find empty nuclei word-initially, where they are not preceded by a potential proper governor. Evidence for the presence of initial empty nuclei involves the occurrence of 'il]-behaved', or unusual, consonantal clusters word-initially. In some languages ungoverned empty nuclei may have to be licensed in terms of interonset relations (cf. Cyran & Gussmann, to appear, on Polish). Initial empty nuclei are analogous to word-initial pretonic unstressed syllables. The latter are sometimes unavoidable, given the requirements on foot formation and the number of syllables in the word.

⁸ Nothing really hinges on the representation of the vowel [i] in the aorist suffix *-hin* as empty or contentful. Since it does not alternate with zero it was interpreted as underlying [i], e.g. by Kenstowicz & Kisseberth (1979) and Noske (1993). On the other hand, Kuroda (1967) and Archangeli (1984) analyse it as epenthetic, and Kaye (1995) as empty. The fact that the vowel is subject to rounding vowel harmony (as in *dubhūn* 'leads by the hand') is not conclusive because underlying [i] in suffixes, as in *-mi*, also harmonises with the root. Compare *xilmi* 'having tangled' and *dubmu* 'having lead by the hand'. In this paper, we represent the vowel as contentful for the sake of simplicity. However, the opposite assumption would not bear on our analysis since the nucleus surfacing as [i] is always followed by the morpheme-final empty nucleus which needs to be properly governed.

It is also conceivable that in order to solve the lapse epenthesis could target N_3 , rather than N_2 . This hypothetical form is represented below:



In (12) N_1 properly governs N_2 , leaving N_3 ungoverned. According to the standard formulation of the ECP, such an ungoverned empty nucleus must acquire phonetic realisation. And this is what happens in (12). However, this output form is not well-formed in Yawelmani. As a matter of fact, cross-linguistically a surfacing empty nucleus is generally followed by a silent one. In terms of trochaic PG, a surfacing empty nucleus must have a silent governor. This is not the case in (12) where surfacing N_3 is followed by contentful N_4 . The fact that such an epenthesis scenario is not acceptable suggests that the ECP needs to be reformulated. We will come back to this point shortly.

We have thus shown that the facts of epenthesis in Yawelmani can be straightforwardly handled in terms of trochaic PG. Now we will show that trochaic PG is more successful in accounting for the long vowel shortening phenomena in Yawelmani than the iambic approach.

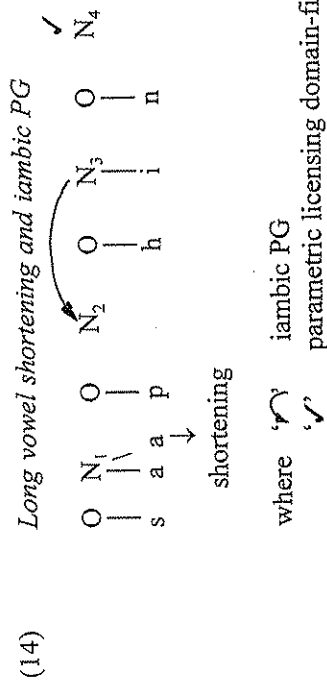
2.2.1. Vowel shortening

Consider now the examples of vowel shortening in (13).

- (13) *Long vowel shortening in Yawelmani*
- | | | |
|---------|----------|--------|
| NONFUT. | DUBITAT. | FUTURE |
| saphin | sapk'a | sapal |
| | | 'burn' |

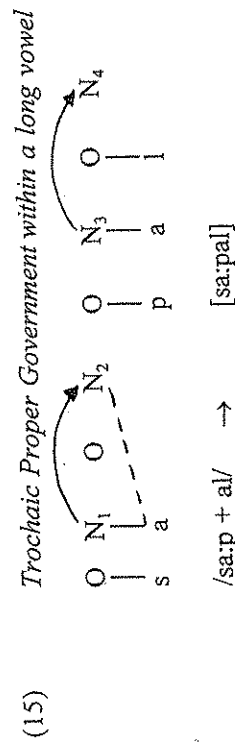
Kaye (1990) observes that the context for the shortening is a following empty nucleus. This is illustrated in (14). But since PG is iambic in the standard GP theory, the empty nucleus N_2 which triggers long vowel shortening is properly governed by N_3 . The shortening of the preceding

vowel does not seem to follow in any way. Specifically, it is not connected to PG. Therefore it must simply be stipulated.⁹



We believe that shortening makes more sense in the context of trochaic PG, which we will now demonstrate.

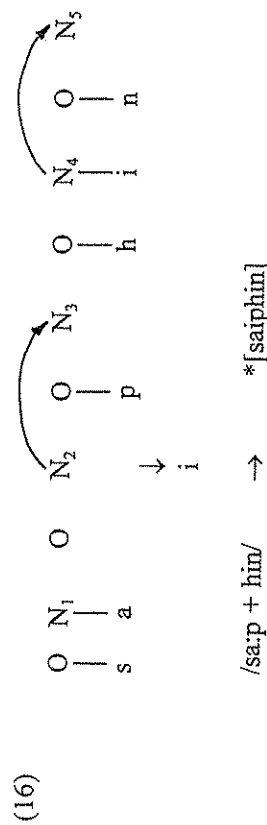
As argued in Rowicka (to appear), Yawelmani is a "CVCV" language where there are no branching constituents. Every vowel occupies a separate nucleus and every consonant occupies a separate onset.¹⁰ Long vowels are disyllabic. They exist by virtue of an empty ON (Onset + Nucleus) sequence which survives if the empty N is properly governed by the preceding contentful vowel, i.e. the head of the long vowel. Since no overt Onset intervenes between the proper governor and its governee, the governor spreads its melody to the empty nucleus. This is illustrated in (15). Notice that the empty nucleus N_2 below has the same status in terms of PG relations as N_4 . Both are properly governed and none of them supports any vocalic melody of its own.



⁹ A more principled account of this kind of shortening is proposed in Yoshida (1993) (but given up in Yoshida, to appear). For a criticism of this proposal see Rowicka (to appear).

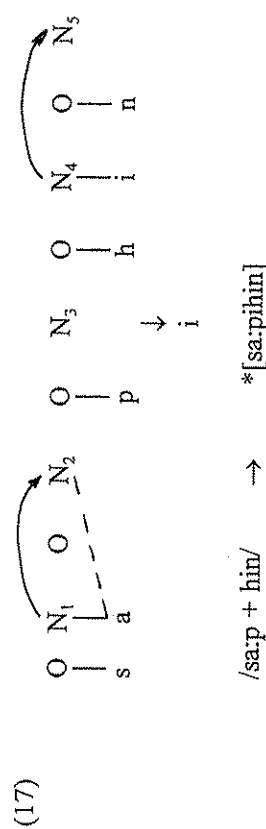
¹⁰ Hence the distinction between the Nucleus level and the Rhyme level is lost.

However, when the long vowel is followed by an empty-headed syllable with an overt onset, we end up with a sequence of two empty nuclei in adjacent syllables. One might expect that the one on the left should become contentful. This possibility is represented in (16).



The above form is not an actual word in Yawelmani and it seems very implausible. We believe that it must be ruled out universally, most probably in terms of an absolute constraint on hiatus. In fact, Yawelmani does not tolerate vowel hiatus at all. As for languages which do, we will stipulate at this point that in hiatus situations none of the two nuclei can involve the phonetic realization of an empty nucleus.¹¹

An alternative epenthesis scenario for the same word is shown in (17).

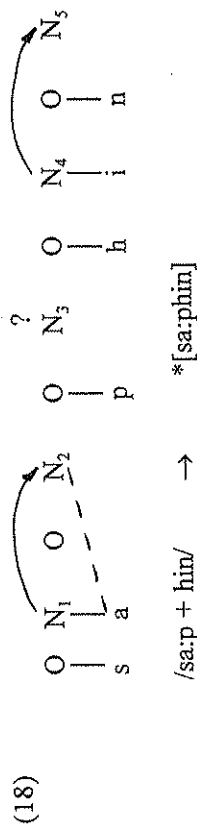


Here N_1 properly governs N_2 and a long vowel surfaces. On the other hand, N_3 is ungoverned and acquires phonetic realisation. The output representation in (17) does not contain an undesirable sequence of empty nuclei, but is not well-formed in Yawelmani. It is ill-formed in the same

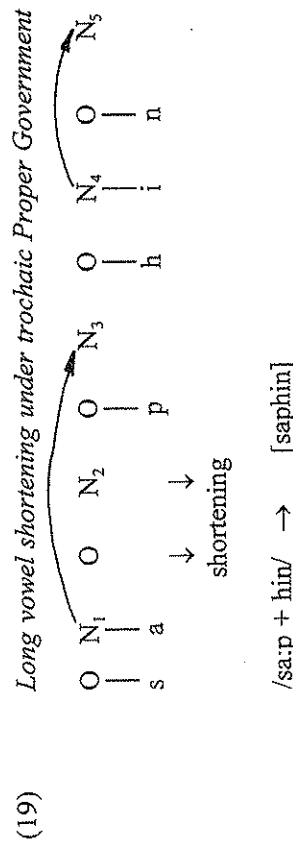
¹¹ Apparent counterexamples can, in fact, be found in Turkish. For instance, the word *ağır* 'heavy' is pronounced in careful pronunciation as [a+r] (cf. Sezer 1986). However, dialect pronunciations as well as spelling reveal that there is a contentful consonant position (the so-called 'soft g') in between [a] and [r] at the stage when PG relations are established. The deletion of 'soft g' intervocalically which results in vowel hiatus must be viewed as a late, 'close-to-the-surface' phenomenon.

as the representation in (12), discussed above: the surfacing empty nucleus N_3 is not followed by a potential governee. Realising it phonetically corresponds to creating a degenerate (non-branching) foot. Such feet are avoided cross-linguistically, both in metrical structure and in Proper Government.

Another conceivable output of the same word is one in which neither epenthesis, nor shortening takes place. Assuming trochaic PG, N_1 can only properly govern N_2 . Melodic spreading within a PG domain occurs and the long vowel [a:] surfaces. However, empty N_3 remains unlicensed because there is no potential proper governor to its left, N_3 being itself licensed. The resulting form, represented in (18), is therefore ill-formed. It contains a sequence of two empty nuclei N_2 and N_3 in consecutive syllables.



Let us now consider the final alternative. Notice that N_2 is part of an entirely empty syllable, whereas N_3 has a proper onset. In order to provide exhaustive licensing for empty nuclear positions one cannot remove the ON_3 sequence from the representation without deleting underlying melodic information, i.e. the features linked to the onset position. This is the reason why the empty syllable ON_2 is deleted instead and N_1 surfaces as a short vowel, as shown below.



Shortening is now directly related to PG. It is in fact just like the trochaic shortening effect that Hayes (1995) reports on in a number of stress

systems. Such an analogy is to be expected given our claim that Proper Government involves lexical foot structure.

2.3. The Empty Category Principle revised

Another point where iambic PG, as defined by the standard theory, seems not quite compatible with our approach is the formulation of the ECP. The standard ECP focuses on which positions are allowed to remain inaudible, while what we expect from a prosodic algorithm is to specify which positions are strong. We have pointed out above with reference to (17) that the standard formulation actually makes some wrong predictions when combined with trochaic PG. A revised version is given in (20) (cf. Rowicka, to appear).

- (20) *The revised ECP*
 An empty nucleus is phonetically realised *if* it properly governs another empty nucleus.

Under the new approach, the surfacing of an empty nucleus is analogical to assigning stress to a syllable. A syllable is stressed when it is the head of a foot and an empty nucleus surfaces if it is the head of a Proper Government relation.¹² (Some other factors which can also trigger the realisation of an empty nucleus are discussed in § 2.5 below.)

2.4. NO LAPSE

Another analogy between PG and rhythmic stress is their triggering force. Rhythmic stress on every other syllable has been attributed to a well-formedness condition against lapses created by a sequence of unstressed syllables (cf. van der Hulst 1994). We have pointed out that Proper Government is also triggered by a "lapse" in representation created by a sequence of empty nuclei. We argue that the same prosodic condition,

¹² The revised definition of the ECP maintains the original idea that empty positions are either audible or inaudible. A proper governor is always required to be audible. However, it is left open whether or not a properly governed position can be phonetically realised. Indeed, as Rowicka's (1997) study of Mohawk reveals, the relevant distinction between unlicensed and licensed nuclei is not just that of phonetic audibility, but that of phonological relevance. In Mohawk a properly governed nucleus may be phonetically realised. However, its governor status is manifested in the nucleus' invisibility to stress, in contrast to proper governors which are phonetically realised *and* visible to stress.

NOLAPSE given in (21), triggers Proper Government in lexical and rhythm in post-lexical prosodic structure.¹³

(21)	a.	NOLAPSE post-lexically * w w σ σ	b.	NOLAPSE lexically * N N ø ø
------	----	---	----	--------------------------------------

NOLAPSE is not always satisfied in stress: sequences of unstressed syllables do occur. To use an Optimality Theoretical term, NOLAPSE is a "soft", or violable, constraint. Similar NOLAPSE violations involving sequences of phonetically unrealised empty nuclei can also be found lexically. Consider, for instance, the case of Polish, where clusters of up to 5 consonants occur, no doubt with empty nuclei sandwiched in between. Some relevant data can be found in Rowicka (in press) and Cyran and Gussmann (to appear). The circumstances under which such NOLAPSE violations in lexical prosodic structure can be tolerated in various languages need to be further looked into.¹⁴ However, in the case of Yawelmani data examined here, NOLAPSE is always satisfied, either by making an empty nucleus audible or by deleting an empty ON sequence.

2.5. Some further issues

We have argued that the following analogies exist between PG and post-lexical foot formation.

¹³ As Honoré Kamany (p.c.) has pointed out to us, the postulation of NOLAPSE makes it largely redundant to assume PG relations between a contentful nucleus and the following empty nucleus. It is still possible, however, that other type of phonotactic considerations may necessitate this type of relation. The issue here is comparable to choosing between a grid-only version and a bracketed grid version of metrical theory. We will not pursue it here further.

¹⁴ For instance, in the analysis of word-initial sequences of silent empty nuclei in Polish Cyran and Gussmann (to appear) argue for the licensing of some empty nuclei by Interonset Government. As far as word-final sequences of silent empty nuclei are concerned, Yoshida (to appear) attributes the occurrence of such sequences in Cairene Arabic to the combined effect of trochaic PG and parametric licensing domain-finally.

- An empty nucleus must surface if it is the head in a Proper Governing relation (cf. the revised ECP (20)). Similarly, a syllable is assigned stress if it is the head of a stress foot.
- Left-headedness, i.e. trochaicity, is the unmarked option in both Proper Government and stress.
- Sequences of empty nuclei and sequences of unstressed syllables are both ruled out by the well-formedness condition NOLAPSE (21).

We would like to point out that, according to the approach advocated here, Proper Government does not have to fully determine the behaviour of empty nuclei. The occurrence of phonetically realised and unrealised empty nuclei may also be subject to other well-formedness requirements. Again, drawing on the analogy with stress assignment, we look first at the factors that may determine whether a syllable is stressed. These are listed in (22):

(22)	<i>Factors determining stress assignment</i>
a.	Rhythm (=foot formation)
b.	Edge location
c.	Weight effects

Syllables get stressed (a) because they end up in a foot head position, (b) because they occupy an edge position in a word, i.e. they are initial or final, or (c) because they are heavy. We have pointed out the correspondence between lexical Proper Governing relations and post-lexical foot formation. As a matter of fact, factors (b) and (c) can also be shown to play a role in lexical prosodic structure. This is summarised in (23). For instance, the surfacing of empty nuclei in Polish prefixes is due to a left-edge oriented prosodic well-formedness requirement, as argued in Rowicka (in press). An equivalent of weight effects in the behaviour of empty nuclei can also be found: empty nuclei are generally not found in closed syllables.

(23) *Prosodic factors determining empty nucleus surfacing*

- a. Foot formation
Proper Government.
- b. Edge location
e.g. domain-initial empty nucleus surfacing in Polish
(cf. Rowicka, in press);
nucleus surfacing to fulfil a prosodic minimality condition
at the right stem-edge (cf. Rowicka & van de Weijer, 1994);
- c. Weight effects
empty nuclei disallowed in closed syllables.

All of the factors we have considered in this article are prosodic in nature. We do not believe that *all* aspects of phonotactics can be handled in terms of relations between nuclei. We think, for instance, that at the lexical level relations between onsets must also be taken into account. Nuclear relations and onset relations presumably form two parallel systems which both have a bearing on the well-formedness of strings. Cyran and Gussmann (to appear) have reached a similar conclusion with respect to Polish.

3. General conclusions

This article has defended the Duality Hypothesis. This hypothesis enables us to eliminate a number of structure paradoxes from the literature involving prosodic structure. We have concentrated on one specific case, which perhaps so far has not even been identified as a paradox. It involves the postulation of syllabic material that is not present post-lexically. We have argued that such abstract syllabic structure is involved in lexical foot structure. We have supported this by showing that the constraints on this type of structure are largely parallel to the constraints that bear on post-lexical foot structure. The Duality Hypothesis allows us to identify most of the principles that control the realization of empty nuclei as prosodic in character and therefore demystifies the programme of Government Phonology.

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References

- Allen, M.R. (1978). "Morphological Investigations". PhD diss., University of Connecticut.
- Anderson, J. & C. Ewen (1987). *Principles of Dependency Phonology*. Cambridge University Press, Cambridge.
- Archangeli, D. (1984). "Underspecification in Yawelmani phonology and morphology". PhD diss., MIT.
- Bauman, M. (to appear). "Lexical syllables precede postlexical syllables. Psycholinguistic evidence for two levels of syllable structure." In Rennison (ed.).
- Charette, M. (1991). *Conditions on phonological government*. Cambridge University Press, Cambridge.
- Cyran, E. & E. Gussmann (to appear). "Consonantal clusters and governing relations: Polish initial consonant sequences". In H.G. van der Hulst & N. Ritter (eds.). *The syllable: views and facts*. Oxford University Press, Oxford.
- Dell, F. & M. Elmedlaoui (1985). "Syllabic consonants and syllabification in Imdawn Tashlhiyt Berber". *Journal of African languages and linguistics* 7, 105-130.
- Dogil, G. (1980). "Elementary accent systems". In W.U. Dressler, O.E. Pfeiffer & J.R. Rennison (eds.). *Phonologica 1980*. 89-99.
- Dainora, A. & E. Steinberg (to appear). "Redefining the mora in the wave model of the syllable". In Rennison (ed.).
- Gibb, L. (1992). "Domains in phonology: with evidence from Icelandic, Finnish and Kikuyu". PhD diss., University of Edinburgh.
- Goedemans, R. (1996). "Syllable weight and prominence". In Goedemans at al. (eds.). 115-164.
- Goedemans, R., H. van der Hulst & E. Visch (1996). (eds.) *Stress patterns of the world. Part I: Background*. Holland Academic Graphics, The Hague.
- Golston, C. & H. van der Hulst (to appear). "Structure and structure". In B. Hermans & M. van Oostendorp (eds.). *The derivational residue*. Reidel, Dordrecht.

- Gussenhoven, C. (1993). "The Dutch foot and the chanted call". *Journal of linguistics* 29, 37-63.
- Gussmann, E. & J. Kaye (1993). "Polish notes from a Dubrovnik Café. I. The Yers". *SOAS Working Papers in Linguistics and Phonetics*, University of London, 427-62.
- Hayes, B. (1995). *Metrical stress theory: Principles and case studies*. The University of Chicago Press, Chicago.
- Helsloot, K. (1995). *Metrical prosody. A template-and-constraint approach to phonological phrasing in Italian* [HIL Dissertations, 16]. Holland Academic Graphics, The Hague.
- (1997). "The relation between lexical and phrasal prosodic structure". Manuscript. University of Amsterdam/HIL.
- Hulst, H.G. van der (1984). *Syllable structure and stress in Dutch*. Foris Publications, Dordrecht.
- (1985). "Ambisyllabicity in Dutch". In H. Bennis & F. Beukema (eds.), *Linguistics in the Netherlands 1985*. Foris Publications, Dordrecht. 57-67.
- (1994). "Notes on foot typology and Optimality Theory". Manuscript. University of Leiden/HIL.
- (1996a). "Separating primary and secondary accent". In Goedemans et al. (eds.), 1-26.
- (1996b). "Structure paradoxes in phonology". Manuscript. University of Leiden/HIL.
- Kaye, J. (1986-7). "Government in phonology: The case of Moroccan Arabic". *The Linguistic Review* 6, 131-59.
- Kaye, J. (1990). "Coda Licensing". *Phonology* 7, 301-30.
- Kaye, J. (1995). "Derivations and interfaces". In J. Durand & F. Katamba (eds.), *Frontiers of phonology*. Longman, Harlow, Essex. 289-332.
- Kaye, J., J. Lowenstamm & J.-R. Vergnaud (KL V) (1990). "Constituent structure and government in phonology". *Phonology* 7, 193-231.
- Kenstowicz, M. & C. Kisseberth (1979). *Generative phonology*. Academic Press, New York.
- Kuroda, S.-Y. (1967). *Yawelmani phonology*. MIT Press, Cambridge, Mass.
- Lowenstamm, J. (1996). "CV as the only syllable type". In J. Durand & B. Laks (eds.), *Current trends in phonology. Models and methods*. Vol. 2. CNRS, ESRL, Paris X. 419-43.
- Noske, R. (1993). *A theory of syllabification and segmental alternation: with studies on the phonology of French, German, Tonkawa and Yawelmani*. Niemeyer, Tübingen.
- Rennison, J. (to appear). (ed.). *Syllables!?*. Holland Academic Graphics, The Hague.
- Rowicka, G.J. (to appear). "On trochaic Proper Government". In Rennison (ed.).
- (in press). "Prosodic optimality and prefixation in Polish". In R. Kager, H.G. van der Hulst & W. Zonneveld (eds.), *The prosody-morphology interface*. Cambridge University Press, Cambridge.
- Rowicka, G.J. (1997). "On Mohawk ghosts". Manuscript. University of Leiden/HIL.
- Rowicka, G.J. & J.M. van de Weijer (1994). "Prosodic constraints in the lexicon of Polish: The case of Derived Imperfectives". *The Linguistic Review* 11, 49-76.
- Selkirk, E. (1982). "The syllable". In H.G. van der Hulst & N. Smith (eds.), *The structure of phonological representations. Part II*. 337-84. Foris, Dordrecht.
- Sezer, E. (1986). "An autosegmental analysis of compensatory lengthening in Turkish". In Wetzels, L. & E. Sezer (eds.), *Studies in compensatory lengthening*. Foris, Dordrecht. 227-50.
- Siegel, D. (1974). "Topics in English morphology". PhD diss., MIT.
- Vijver, R. van de (1995). "For the love of trochees". *Phonology at Santa Cruz*, vol. 4, 69-83.
- (1996). "Accidental iamb". In M. Nespor & N. Smith (eds.), *Dam phonology. The HIL Phonology papers 2* [HIL Publications, 3]. 191-224. Holland Academic Graphics, The Hague.
- Yoshida, S. 1993. "The case of Palestinian vowel harmony". *The Linguistic Review* 10, 127-59.
- Yoshida, S. (to appear). "Inter-nuclear relations in Arabic". In Rennison (ed.).