

9. This succinct characterisation of how the Universal Recognition Problem relates to parsing difficulty is taken from van de Koot (1995).
10. In Ristad (1990) the argument is somewhat different. It relies on the fact that the "stricture" feature, which essentially determines whether a segment is a C or V, is ellipsed and hence not available by inspection.
11. According to an early proposal in Harris (1994: 170–176) the direction of government was determined by the complexity gradient between adjacent segments, expressed in terms of an element count. In more recent versions of Government Phonology, most researchers argue for a reduced set of elements, rendering the complexity argument no longer workable. I do not take a stand on that issue here, since whatever the eventual resolution to the problem, the claim that constituent structure is fixed at the lexical level is taken to be axiomatic.
12. A possible counter-example to this claim comes from the absence of *t* in the coda in English (*-tp, *-tk). Since all stops would be expected to display the same governing properties, there must be some additional constraint operating to produce this distributional asymmetry. A speculative account is given in Harris (1994: 289n46), in which he proposes to explain the data by appeal to the absence of geminates in English.
13. A thorough Government Phonology analysis is given in Charette and Göksel [1994] (1996), [1996] (1998); Ploch (1998, 2002b).
14. Although Turkish does have long vowels (mainly in Persian, and Arabic loan-words, these are never vowel-harmonic. It is likely that these will turn out to be analysed as sequences of non-branching nuclei, as has been proposed for surface long vowels in Semitic languages.
15. One can object to these arguments on the grounds that they do not address the main implication of a derivational model, namely that more than one phonological level is recognised. If the same generalisations can be captured with a one-level model, then we should prefer that model on grounds of economy. My purpose here however is to defend the standard GP model against charges of computational inadequacy, rather than on its linguistic merits, which I am taking as given. This is not to say that GP cannot be improved upon, or that the same results could not in principle be achieved in a one-level system. Many phonological phenomena can be described in terms of surface-true generalisations, implying a one-level model. However I know of no phenomena that can be explained more successfully within a single level than in a two-level system. If derivations of other types of process within the GP framework turn out to require unfeasible amounts of computing resources, unlike the harmony process I have discussed here, I would then be convinced of the need to attempt to reduce phonology to a single level.

Structure paradoxes in phonology*

Harry van der Hulst

Introduction

Referring to arguments that suggest that phonological hierarchical structure is present both lexically and postlexically, I argue in this article that the latter is not built "on top of" the former but rather independently from it. This allows lexical structure (up to the maximal domain that the lexicon provides) to differ from the postlexical structure relevant to the corresponding domain. Allowing co-existing, different structures solves many of what I will call (phonology-internal) *structure paradoxes*.

One of the most difficult and most debated issues in linguistics is whether a principled division can be drawn between "words" and "sentences". Discussions of the dichotomy involve a great number of term pairs for both dimensions of language (or grammar). Linguists working on the structure of utterances from the view point of a correspondence in the compositionality of form and meaning, try to argue in favour (or against) a distinction between "morphology" (words) and "syntax" (sentences). Psycholinguists may talk about "storage" (words, but also idioms) and "computation" (sentences, perhaps including inflection). Phonologists, when addressing this issue, will refer to "lexical" (word) phonology and "postlexical" (sentence) phonology. Taking a historical perspective, I refer to at least one earlier, structuralist writer who has made a principled distinction between the notions word and sentence, e.g. E. Sapir (1921, chapter 2).

In this article I will focus on a specific consequence of making a distinction between "lexical phonology" and "postlexical phonology". Roughly, we can equate "lexical phonology" with the phonology of units that are stored or processed in the lexicon, whereas postlexical phonology applies to units that are constructed in the syntax. Needless to say that there is no way of knowing beforehand (i.e., on

theoretical grounds alone) which units are stored or processed in the lexicon and which units are constructed in the syntax. All the notions and distinctions involved are heavily theory-dependent and different linguists have proposed very different demarcations using many different types of evidence.

Turning to phonology, the distinction between two levels of phonology has been revived by Kiparsky (1978, 1985) in a model called Lexical Phonology. Within lexical phonology, various criteria have been mentioned to differentiate between so called lexical rules and postlexical rules; cf. the overview in Kaisse and Shaw (1985). Assuming that a distinction between lexical and postlexical phonology is warranted, I wish to focus on some specific issues that regard the division of labour between both levels.

The treatment of phonological phenomena that are limited to the word is, in principle at least, open to both lexical and postlexical analysis. This is because the word is available lexically (as the domain of maximal size, ignoring idioms), as well as postlexically (as the domain of minimal size). If hierarchical structure is exclusively assigned postlexically, processes or alternations that are conditioned in terms of hierarchical structure *must* be postlexical as well. We then expect these processes to always have the properties that have been argued to identify postlexical processes, such as exceptionlessness, variability, gradualness and blindness to grammatical information (cf. Kiparsky 1978, 1985; Kaisse and Shaw 1985).

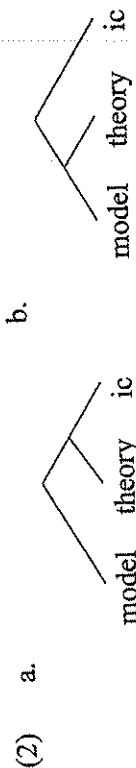
Arguments have been provided, however, for assigning or (to state it non-derivationally) having "prosodic" structure in the lexicon. In many phonological analyses and models it has been argued that syllable structure and even foot structure is present in, or assigned to, lexical representations in order to feed phonological constraints or rules that themselves are assumed to be lexical. Furthermore, it has also been proposed that lexical representations may involve a notion of "phonological" or "prosodic" word (sometimes called the "word level" and usually as the output of level I morphology) that does not coincide with the notion of morpho-syntactic (or grammatical) words, i.e., the output of the last level of morphology and the smallest unit of syntax.

The presence of hierarchical structure in the lexicon raises the question as to whether postlexical structure is built *on top of* the lexical structure (possibly with some adjustments) or from scratch. The latter view is often taken to involve 'deforestation' or 'erasure' of the lexical structure. Assuming, however, that postlexical structure is built from scratch does not necessarily involve such destructive measures. We could also hold the view that lexical and postlexical structure exist simultaneously in different planes (the x-line represents the phonological skeleton):

(1)	a.	xxxxxxxxxxxxxx	b.	-----
		lexical structure		lexical structure
		-----		xxxxxxxxxxxxxx
		postlexical structure		postlexical structure
		-----		-----

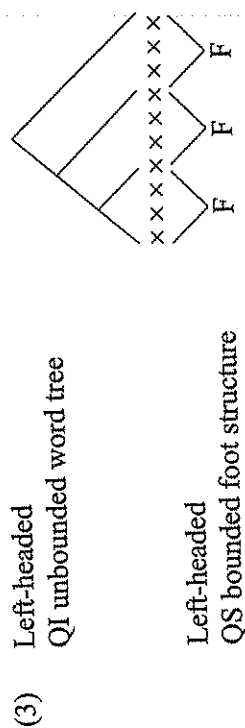
In a model like (1b), we will encounter the lower levels of organisation (syllables, feet, words) twice, both at the lexical level and at the postlexical level. The hypothesis in (1b) is not novel as such. J. Anderson and Ewen (1987: 122) defend it quite explicitly and so does Helsloot (1997). Some of the phenomena to be discussed here are also discussed in these works. At the level of syllabic organisation, Baumann (1996) has argued for two levels of representation. J. Anderson and Ewen (1987) make the important point that a specific lexical structure may correspond to various postlexical structures because postlexical structure is in part determined by factors like rate of speech and speech style/register.

In this article I wish to advance further argumentation in favour of model (1b) by showing that it provides a solution to many structure paradoxes in phonology. Before I proceed, I will explain the notion of "structure paradox". A structure paradox arises when a linguistic unit appears to have two (or more) incompatible structural descriptions, each being based on different types of arguments. The term has first been used in morphology, where a structure paradox refers to the fact that in words like *model theoretic* standard "level theory" demands that the structure is as in (2a), which is also motivated phonologically, while semantic considerations argue for (2b):



Referring to this ambiguity as a *paradox* seems to reflect the belief that the availability of two structures raises a problem; it is apparently assumed that it could not be the case that both structures (as morphological structures) have a right to exist. To solve the paradox one could argue against one of the structures. Another route is to say that both structures, being correct, belong to different "articulations": one is morpho-syntactic (2b), implying that standard level theory is just false, while they other, (2a), is phonological. In that case, even though two structures are argued for, their conflicting organisation is no longer suspicious because the structures exist in different modules (i.e., morpho-syntax and phonology).

Structure paradoxes have also been identified *within* phonology. Keyser and O'Neill (1985) suggest that Old English words have two simultaneous metrical organisations. The problem is the following. Primary accent is always initial, disregarding syllable weight, whereas secondary accent appears to be weight-sensitive. How can a metrical structure be weight-insensitive and weight-sensitive at the same time? Keyser and O'Neill argue that this can only be if two planes for metrical organisation are recognised:

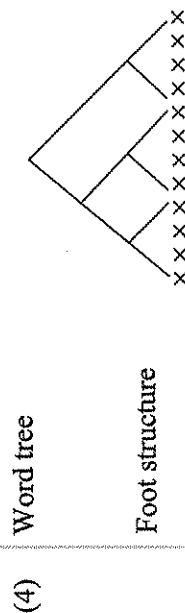


Dresher and Lahiri (1991) disagree strongly with postulating two metrical organisations and plead for what they call "metrical coherence", i.e., one level of metrical structure that accounts for all the

facts. They propose a new type of foot structure ("The Germanic Foot") for that purpose.

In a case like this it seems unlikely that one could accept both structures by arguing that they belong to different articulations since both structures quite clearly are "phonological" in nature. However, if one adopts the position in (1b), it can be argued that the two structures are both valid, one in the lexical plane and the other in the post-lexical plane. The stress (or accentual) facts of Old English would, in that case, be accounted for as a mix of lexical and postlexical constraints.

The consequences of this separation of a word's accentual structure over two planes are far-reaching. In this particular example, we would, in fact, be claiming that the treatment of primary accent and secondary accent are separated, and in particular that the former is not built on top of the latter. This contradicts the standard metrical view which (in derivational terms) builds feet first and the so-called word tree on top of that:



In my own work on word accentuation (van der Hulst 1984, 1996, 1997), I have argued in favour of the separation of primary and secondary accent, as in (3). More specifically, I have proposed a model in which primary accent is assigned first or independent of secondary accent. Often, indeed, assignment of primary accent is clearly lexical (making use of foot structure as a computational device to locate the syllable with primary accent), whereas rhythmic structure (represented in terms of exhaustive foot structure) seems completely insensitive to lexical information. I have therefore argued that rhythmic structure is assigned "later", the precise level remaining to be identified as either "late" lexical, or postlexical (in the domain of the prosodic word, clitic group or phrase). Rhythmic foot structure must pay

respect to the primary accented syllable, but not to the entire structure that was built to account for its location, if this indeed required more than one peripheral foot.¹

With respect to this particular example, I have not investigated whether foot structure in Old English is late lexical or postlexical. A decision depends on the nature of the kinds of processes that have been claimed to be foot-sensitive, and, in addition on the necessity and nature of such a distinction in the first place.

The general point I wish to make in this article is that many debates regarding the exact form of phonological structure involve structure paradoxes, and thus that these debates can be resolved by recognising that the opposing proponents are talking about structures at different levels.

The hypothesis of having parallel lexical and postlexical structures will be referred to here as the *Duality Hypothesis*. A sceptical note is perhaps in order before we proceed. The Duality Hypothesis is of course much less restrictive than the "coherence" view advocated in Dresher and Lahiri (1991). We are, after all, solving problems by adding additional structure. It is therefore important to evaluate the Duality Hypothesis critically and to see whether the proposed enrichment of the theory is counterbalanced by a healthy increase in insight into the nature of phonological phenomena.

1 Examples of structure paradoxes in phonology

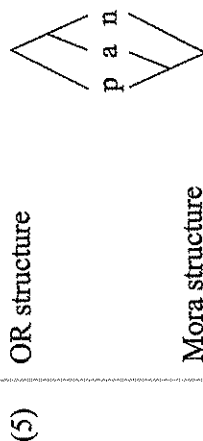
1.1. Syllabic structure paradoxes

Phonologists dealing with syllable structure often disagree on the question as to whether syllable onsets can contain more than two consonants. Proponents of Government Phonology, for example, claim that onsets can contain no more than two consonants (cf. Kaye, Lowenstamm, and Vergnaud 1990), and some (like Lowenstamm 1996a) even hold the apparently untenable claim that onsets are universally monosegmental. Other researchers, pointing to languages containing words that "audibly" begin with sequences of more than two consonants, argue that the Government Phonology claim is

clearly false. They propose instead models that allow a fairly liberal adjunction of consonants to the left hand side of the syllabic nucleus. The relative markedness of complex clusters remains unaccounted for in such models; cf. van der Hulst and Ritter (1999a) or Ewen and van der Hulst (2001) for an overview of various approaches.

Sometimes it is acknowledged, however, that the researchers in question may be talking about two different kinds of objects, viz. the *phonological syllable* and the *phonetic syllable*, respectively. Depending on what one means by terms like "phonological" and "phonetic", this distinction might come close to what I will argue for here (i.e., the lexical/postlexical distinction), except that I will use the terms "phonotactic syllable" and "prosodic syllable", which I both reckon to be phonological objects. It seems obvious that the prosodic syllable is much closer to the phonetic substance of utterances than the phonotactic syllable.

Besides the controversy concerning the amount of complexity that syllabic constituents like onsets and rhymes can take, a more fundamental disagreement exists between proponents of onset/rhyme theories and proponents of moraic models of the syllable. For a simple syllable like /pan/ the two approaches argue for the following two structures:



(Some moraic models adjoin prevocalic segments directly to the syllable node, rather than to the first mora.)

Proponents of both OR-models and mora-models typically base their case on quite different arguments. OR-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 then be seen

as alternating sequences of such units, possibly with the proviso that special types of onsets and rhymes are allowed at the periphery of words. A consequence of the latter possibility is that word edge often allow for a greater complexity than what is found word-medially. Moraic phonologists do not talk about phonotactics so much. They focus on the interaction between syllabic structure and higher prosodic structure, specifically foot structure. The relevant property of syllables is their relative prominence with respect to rhythmic foot structure, i.e., their "weight". As is well known, determining weight does not depend on the presence or complexity of onsets. The "invisibility" of onsets forms an embarrassment for OR-theories. A possible resolution to the OR-mora debate would be to argue that the level at which weight-sensitive foot structure is computed does not have access to onsets at all, because at this level syllables have a moraic structure. This moraic structure provides the prominence peaks relevant for rhythmic foot assignment. Compatible with this, given the moraic structure in (5), is that even though specific reference to (branching) onsets is impossible postlexically, prevocalic consonants may play a role in determining prominence. Goedemans (1998) indeed argues that this is the way to look at cases that have been put forward as involving onset relevance.

In line with the above proposed separation of lexical and postlexical structure it is now tempting to say that a moraic structuring of the syllable and the formation of rhythmic foot structure belong to the same plane, possibly the postlexical plane.

It has, in fact, been argued that the moraic type of organisation better fits the prosodic hierarchy in which each layer contains only one type of constituents (van der Hulst 1984, Nespor and Vogel 1986). The moraic structuring of syllables, indeed, much better fits in this hierarchical architecture than syllable nodes that dominate onsets and rhymes. In the latter case an additional problem is that weight must be computed non-locally, i.e., by-passing the syllable nodes since the structure of rhymes rather than the syllables themselves, is relevant for foot formation. The moraic model does not have this problem. A heavy syllable is a branching, a bimoraic syllable and a light syllable is non-branching.

A potential problem arises in connection with my claim that primary accent is lexical. If lexical syllable structure is OR-based then one might infer that we predict that weight differences can play no role in the computation of primary accent location. This, however, is not necessarily so. Weight distinctions can be computed lexically by making lexical structure sensitive to the structure of rhymes only. This more abstract manner of weight computation seems more at place at the more abstract computational lexical level. This proposal implies that there may be differences between weight distinctions at the lexical and the postlexical level. Below, I will show that this is the case in Dutch. Elsewhere I have argued that differences in what counts as heavy for primary and rhythmic stress indeed supports the separation between them (cf. van der Hulst 1984, 1996, 1997). From the present view point, lexical factors would involve structural complexity of the nucleus/rhyme, whereas postlexical factors would involve the more general notion of prominence, a point also made in Dresher and van der Hulst (1998).

The suggestion that lexical and postlexical syllabification differ as radically as discussed above needs further investigation. I am not committed to the idea that the postlexical syllable is moraic. Perhaps it is "flat" structure à la Kahn (1976). There are, however, several other syllabic structure paradoxes that could be mentioned, and solved along the same lines. One example involves the question whether or not intervocalic consonants can be "ambisyllabic". Ambisyllabicity does not go well with an OR-theory. Standard views on constituent structure disallow nodes to be dominated by two mothers. 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 postlexical rather than lexical. Phonologists adhering to an OR-approach at the lexical level usually assume rules of resyllabification to account for ambisyllabicity at later levels. Selkirk (1982) claims that this kind of resyllabification is precisely what characterises so-called *ambisyllabic* consonants. Again, we could approach this issue in terms of assuming different structures at different levels, rather than in terms of restructuring. We could say that postlexical syllabification allows ambisyllabicity, while lexical syllabification does not. There is no need

for resyllabification. This entails that phonological generalisations that demonstrably concern lexical structure should never need to refer to ambisyllabic consonants. Apparent lexical reference to "ambisyllabicity" can be avoided anyway since, as argued in van der Hulst (1985), surface ambisyllabic consonants can be represented lexically as geminates. No language seems to have a phonemic contrast between geminates and ambisyllabic consonants, a fact that is correctly predicted by this proposal.

A further interesting possibility arises if we recognise that a language may lack evidence for lexical syllabification all together. This, for example, is what we could claim for the much debated Tashlyt Berber situation. This language has received a lot of attention due to its amazing syllabification algorithm. Most discussion is based on the work by Dell and Elmedlaoui (e.g., 1985). Since in this language apparently any string of consonants can be "syllabified", I would like to argue that the only type of syllabification that we have is postlexical. There is simply no evidence for lexical syllable structure if there are no phonotactic restrictions on sequences of segments that form well-formed lexical words. Perhaps it is not surprising that there are no reported lexical (ir)regularities in terms of word accent either for this language. That languages with these kinds of consonantal strings appear to lack word accent may be because they just do not have any kind of headed structure at the lexical level, which may ultimately be caused by the fact that lexical items are mostly consonantal, and thus not syllabified word-like entities. Postlexically, there are undoubtedly rhythmic structures and accents that mark prosodic domain boundaries. The location of these accents may be "variable" and dependent on phrasal context, and factors such as rate and style of speech.

As Bolognesi (1998) argues, the driving force behind postlexical syllabification is rhythm, i.e., a regular alternation of prominence peaks and troughs. At this level, any kind of segment can apparently be a peak, even obstruents. In the perspective taken in this article, this potential of obstruents does not have a direct bearing on what is possible at the lexical level. Languages that show evidence for phonotactic regularities at the word level seem to make no use of obstruents, or any type of consonant, in the syllable head position. In ap-

parent cases, "syllabic consonants" can be represented as empty-headed syllables as proposed in Government Phonology approaches.²

Government Phonology has proposed very strong constraints on the maximal size of syllabic constituents and it would seem that these constraints are massively violated in many languages. However, if we simply abandon these constraints in favour of unlimited adjunction approaches, we essentially end up without a theory of syllabic organisation, and many phonotactic regularities, even with respect to seemingly unlimited consonant clusters, must be regarded as synchronically arbitrary. The Duality Hypothesis provides a way out by allowing the string of segments to be organised differently at different levels. The lexical organisation is primarily responsible for accounting for phonotactic regularities. This organisation contains "empty nuclei". The postlexical organisation is responsible for the rhythmic structure and many low-level regularities. It does not seem to make any reference to empty nuclei and it also does not seem to care so much about crisp edges.

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 can formulate a metrical algorithm (cf. van der Hulst 1984; Kager 1989; Trommelen and Zonneveld 1999). This algorithm must appeal to various properties of syllabic and foot structure (on the left-hand side in (6)) that eventually do not end up in the postlexical prosodic structure (which shows the right-hand side structures):

(6)	Lexical	Postlexical
a.	Geminate (c v c) (c v) l é m m a	Ambisyllabic consonant (lé(m)a)

- b. Empty syllable
(c v)(c o)
r á m o
- c. Monosyllabic foot
[{{(c v c)}} {{(c v c)}}]
h á r n a s
- d. Extrametrical syllable
[{{(c v)(c v)}} <(c v)>]
d ó m i n e
- Superheavy syllable
(rám)
- One foot
[{{(há r)(n a s)}}]
- Ternary foot
[{{(dó)(m i)(n e)}}]

(The square brackets indicate word boundaries, braces foot boundaries and parentheses syllable boundaries. Capital vowels represent lax vowels.)

The stress evidence shows that the so-called ambisyllabic consonants make the preceding syllable heavy. Thus we must either represent them as geminates or assume that they are codas only (cf. van der Hulst 1984; Trommelen 1983; Kager 1989). In both cases we set up a syllabic structure that is not supported by the surface syllabification in which a single consonant seems to belong to both syllables.

With respect to (6b), there is evidence that final superheavy syllables behave lexically like 'two syllables', like a branching foot. In the postlexical phonology we seem to be dealing with a single closed 'superheavy' syllable.

(6c) represents a quite interesting case. In order to arrive at a consistent metrical analysis, we must assume that final closed syllables form feet by themselves which, because they are monosyllabic, cannot be word heads. Gussenhoven (1993), however, points to intonational evidence which suggests a different kind of foot structure in such cases. On the basis of the 'chanter call' he points out that a word like *harnas* behaves like one foot.

In my view, (6) reflects several clear examples of structure paradoxes involving foot structure. Regularities at the lexical level (involving the location of primary accent) point to one structure, while 'later' regularities (in this case involving tune-to-text association) point to a different structure. In the kinds of surface feet that Gussenhoven needs, closed syllables are no longer prevented from occurring

in the weak position in a foot. This shows that the weight-criteria for lexical and postlexical feet are different. Helsloot (1997) reaches the same conclusion on rhythmic grounds.

It was suggested in van der Hulst and Moortgat (1981), in fact, that postlexically in Dutch weight primarily involves the distinction between full vowels and schwallables (a point also suggested in Bolinger 1981 for English) rather than a distinction between open syllables (with tense or long vowels) and closed syllables (with lax or short vowels).

There is further evidence for distinguishing between lexical and postlexical footing. The location of secondary accents does not really follow from the lexical algorithm which operates from right-to-left forming a right-headed structure. Secondary accent is governed by a separate algorithm that places a strong secondary accent on the initial syllable, which suggests that this is a left-to-right, left-headed organisation; cf. van der Hulst (1984).

I claim here that all these things follow from one fact: there are two metrical algorithms, one lexical (or phonotactic) and one postlexical (or prosodic). The lexical algorithm is right-edge oriented and sensitive to the difference between closed syllables (heavy) and open syllables (light); the latter may include schwallables, which are arguably always open; cf. Oostendorp 1995). The prosodic algorithm pays respect to the location of primary accent which has been lexically determined. This algorithm is left-edge oriented, placing a strong secondary accent on the first syllable. In terms of its further rhythmic effects it is weight-sensitive in the sense of distinguishing between full vowels and schwa.

Thus, we reconcile the findings of van der Hulst and Moortgat (1981) (arguing for the relevance of the full vowel – schwa distinction), of van der Hulst (1984) (arguing for a dependency of rhythmic structure on primary accent), and of Gussenhoven (1993) (arguing for the lightness of closed syllables).

As in the case of syllabification, languages do not necessarily have lexical feet. Seemingly endless debates regarding the question whether Indonesian has word stress or not, might very well relate to this. Perhaps the situation is as follows. Lexically, there is no word accent, but postlexically there is. One might say: postlexically there

will always be word accent since no language can escape from having a postlexical prosodic organisation which serves as the interface to the production and perception system. That postlexical accent is less easy to pin down is undoubtedly caused by two facts. Firstly, words may occur in various postlexical structures which may result in differences in word accentuation. Secondly, as mentioned above, there will be various postlexical structures depending on factors like speech rate and style.

French is probably another case in point. French words do not have lexical accent. Accentuation in French is a phrasal, postlexical phenomenon. This fact has the consequence that the treatment of schwa-zero alternation (which is, in part, dependent on accentuation) must also be postlexical.

Van der Hulst and Rowicka (1997), Rowicka (1999a,b) propose that the kinds of proper government structures that Government Phonology proposes for phonotactic reasons can be regarded as the lexical hierarchical organisation. In such cases the organisation is not manifested in terms of accentual cues, but is still needed for phonotactic reasons. Thus these authors argue that the distribution of silent empty nuclei is very similar to the distribution of unstressed syllables, while the two cannot be identified with each other. This point brings to the surface that even though the point of this article is to argue in favour of separating lexical and postlexical prosodic structure, thus allowing the two of them to be different, it would be quite unexpected to find that both kinds of organisations are of a completely different nature.

The argument often raised by those who argue against Government Phonology, i.e., that the empty nuclei that this approach postulates seem to play no role in accent assignment, is no longer valid. The proposal made here simply does not claim that such empty nuclei are present or visible postlexically. Thus, if in a language accent is postlexical, we expect empty nuclei to have no influence at all. If, on the other hand, primary accent is lexical, we do expect empty nuclei to play a crucial role. We have just seen that the latter is indeed the case in Dutch, which explains the behaviour of final superheavy syllables (cf. 6b).

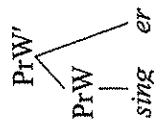
A question that must be addressed is whether in specific cases, the lexical foot level could account for both phonotactic facts and aspects of the accentual structure. S. Yoshida (1999) addresses this issue, arguing that in the case of Cairene Arabic one and the same structure accounts for vowel-zero alternations (in terms of proper government) and for accentual structure. For further elaboration of this point I refer to Rowicka (1999a) and van der Hulst and Rowicka (1997).

1.3. Word-level structure paradoxes

Let us now raise the question as to whether it makes sense to recognise a notion of phonological word at the lexical level? Inkelas (1989) gives an affirmative answer. She "translates" the morphology level I-level II distinction into lexical "prosodic" structuring. The output of level I is said to form the "alpha-domain", and the output of level II the "beta-domain". The output of level I has also been referred to as the "word-level" in, for example, Borowsky (1994). It seems to me that this word-level is also the domain that in Government Phonology corresponds to so called "analytic domain" (Kaye [1993] 1995). If I am correct in viewing government relations as lexical foot structure we expect that the analytical domain corresponds to the lexical phonological word and this is what I wish to claim; cf. also van der Hulst and Ritter (1999a). In line with the terminology introduced here, I will refer to this notion word as the phonotactic word.

It is interesting that the *phonotactic word* quite clearly does not correspond to the postlexical *prosodic word*. Consider the following example. Suffixes like *-ing* and *-er* in English and Dutch are considered to belong to level II, which implies that they fall outside the phonotactic word. Yet, postlexically, the final consonant of *sing* forms an onset to the vowel of the level II *-er* suffix, suggesting that both form one prosodic word. To solve this paradox several phonologists (e.g., Booij 1995) propose a recursive prosodic word level ("PrW" stands for "prosodic word"):

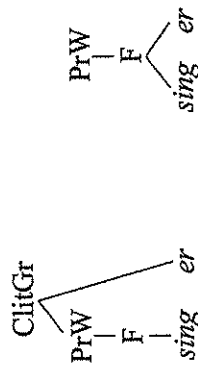
(7) Recursive prosodic word level (after Booij 1995)



McCarthy (1993) also proposes recursivity of PrW, but he discusses postlexical phenomena (the linking [r] in the *idea[r]is*) and it would seem that PrW' in his case replaces the postlexical clitic group; cf. Peperkamp (1997) for discussion.

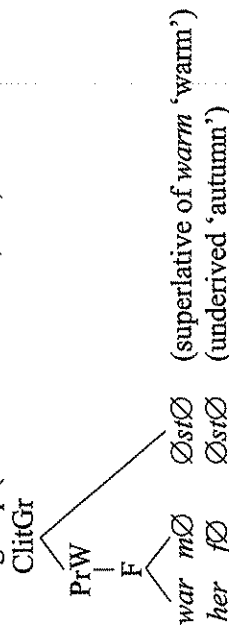
I would like to suggest that recursivity is the wrong way to go. I will assume that the structure of *singer* is as in (8a) at the lexical level and as (8b) at the postlexical level:

(8) a. Lexical level b. Postlexical level



In van der Hulst (ms.) I argue that we need the Clitic Group ("ClitGr") at the lexical level anyway, to make sense of the so called (syllabic) appendix which can be added to structures that have already reached the limits of what a phonotactic word can take, e.g.:

(9) The clitic group (after van der Hulst, ms.)



We can conclude from this that the lexical phonotactic organisation goes beyond the word level: in (9), we see a phonotactic clitic group.

Lexically, compounds also form hierarchical structures that consist of two phonotactic words, which we can call phonotactic phrases. It seems clear that we do not wish to project these prosodic units to the postlexical phonology as postlexical prosodic phrases. Postlexically, compound word accent is not more prominent than the word accent of non-compound words. The word accent of the right-hand compound member has the status of a secondary accent. Therefore, postlexically a word like *carnaval* may not be different from *muisjeval* ('mouse trap'). Again cf. Helsloot (1997) for similar claims and examples.

Finally, let me make it clear that the lexical level is not identical to the "old" structuralist, phonemic level. Borowsky (1994) has clearly shown that the "word-level" (which is here called the phonotactic word) is not strictly phonemic. She gives examples of several processes in a variety of languages that must apply at this level, while being allophonic. Interestingly, both diminutive formation and plural formation in Dutch, both level II operations, suggest sensitivity to secondary accents; cf. van der Hulst (1984). Since both morphological processes belong to what is usually called level II morphology, this suggests that the phonotactic word can be the domain for rhythmic foot structure and thus that the lexical structure does not only comprise the head foot (for primary accent), but is a more complete hierarchical structure that covers the whole word.³

Summary and conclusions

Summarising, we have seen that there is ample evidence for assuming hierarchical phonological structure in the lexicon. This structure is necessary to capture phonological generalisations of lexical units (lexemes, excluding idioms). These generalisations involve phonotactic patterns, accent location and also alternations in the segmental shape of morphemes. I have demonstrated that the required structures resemble postlexical constructs but in almost all cases are different (sometimes in subtle ways). Maintaining that postlexical structure is built on top of lexical structure would require numerous adjustments and destructive operations. The view that I advocate here is that post-

lexical structure is built independently, leaving the lexical structure untouched and intact.

That lexical prosodic structure resembles postlexical structure is not surprising. Regularities in the sound structure of languages start life at the postlexical 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 postlexical processes, making them opaque to a certain extent. This does not mean that these regularities are no longer worth capturing, but in order to do that one must be prepared to postulate more abstract structures that deviate from the structures that now predominate the postlexical hierarchy. In fact, it strikes me as evident that generative phonology has been founded on the idea that generalisations can hold with respect to different levels, thus causing the phenomenon of opacity. However, opacity is usually thought of as applying to the segmental phonology only, assuming that hierarchical structure is predictable and assigned at the end of the phonological derivation. Once, however, we allow that hierarchical organisation crucially conditions phonotactics, accent placement and morphology⁴, we should also recognise that the lexical and the postlexical phonology can have their own set of constraints on hierarchical structure.⁵

Notes

* An earlier version of this work was presented at the "OT on the HIL" workshop, held on December 9, 1996, in Leiden and at the MOT Phonology workshop held on February 7-9, 1997, in Toronto. Similar points are incorporated in van der Hulst and Rowicka (1997). For this publication, I have left the original ideas in tact. A further development of these ideas can be found in van der Hulst and Ritter (2000a,b) and van der Hulst (to appear).

1. I refer to my earlier articles for references to other work where similar ideas have been expressed.
2. If one were to propose a lexical syllabification for this language, Government Phonology would force every consonant to be an onset. The resulting structure, then, would contain a lot of so-called empty nuclei. An analysis along these lines is offered in van der Hulst and Ritter (in prep.).

3. In van der Hulst (to appear) I argue that both the lexical and the post-lexical structure are always present and exhaustive (i.e., covering the whole word). Thus, no language would lack lexical syllabification or footing. Rather, these lexical structures may no be manifested in the kinds of phonetic cues that we often associate with accent.
4. Indeed, further examples for structure paradoxes can be found in the area of Prosodic Morphology, where it seems evident that the kind of foot structure that is required is not the one that accounts for surface rhythmic structure; cf. Prince and McCarthy (1990); McCarthy and Prince (1993).
5. An issue that I will take up in a further elaboration of this hypothesis concerns the question as to whether the lexical and postlexical phonology make use of the same formalism. In the light of the recent emergence of Optimality Theory I suspect that an optimality-theoretical approach (involving language-specific ranking of constraints) is perhaps more likely to suit postlexical phenomena than lexical phenomena. Thus, it would seem that having two levels also allows us to solve paradoxes at a higher theoretical level (i.e., parameters *versus* ranked constraints).