Studies in Generative Grammar 45

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(Editors)

The Syllable

Views and Facts

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1. Introduction

The fundamental units underlying spoken natural language comprise a vast array of possible sounds. The observable fact that one language differs from another with respect to the kinds of sounds used and the combinatory interactions among sounds stems from a language's choice of the possible sounds available in conjunction with a grammar that dictates the syntax of these sounds.

At first observation, the possible combinations of the members of this set of sounds or *segments* may seem to vary in each language, such that in some languages structures may be quite complicated (for instance in allowing for complex clusters of consonants to occur word-initially, finally, or medially) while in other languages such combinatory elaborations are non-existent.

Yet, upon closer investigation of cross-linguistic data, there seems to be a number of generalizations that can be made about how sounds are grouped together. Given that such generalizations can be extracted from languages which appear to have rather varied surface structures, the next logical step would be to try and motivate such generalizations in a principled way. The question arises, then, as to what kind of theory best captures the basic structure of phonological architecture at the segmental level.

While in the study of (morpho-)syntax there is a well-established concept of a system of principles and parameters, comprising the common core of innate knowledge known as *Universal Grammar* (UG), the study of phonology is often believed to be different and much less attention has been paid to developing a unifying set of principles and parameters which define the common core and potential variation in the architecture of phonological representations. This is actually rather surprising given the fact that the focus of attention in phonological theory has been on the *representational* aspect for so many years (from the mid-seventies to the early nineties). Despite the enormous progress which has been made in specific domains (such as foot structure), no overall parametric theory of phonological structure has emerged in mainstream generative phonology. In most textbooks and general studies, it still appears to be the case that different levels of phonological structure (segmental, syllabic, and

higher up) are of a rather diverse formal character. Although segments, syllables and feet are usually all represented as tree-like objects, the formal properties of these trees (in terms of headedness, recursion, binarity of branching etc.) are taken to be very different by most phonologists.

This chapter serves to outline an approach, called *Head-Driven Phonology* (HDP), in which the central claim is that phonological structure, at all levels of the hierarchical organization, is best characterized in terms of *binary head/dependent relations*. This approach incorporates proposals put forward within two closely related theories known as *Dependency Phonology* (DP; Anderson & Ewen 1987) and *Government Phonology* (GP; Kaye, Lowenstamm & Vergnaud 1990) and especially delineates the idea that some of the universal principles that have been proposed for syntax can also be claimed to relate to the phonological component (and vice versa). In this view then, phonology is *not* radically different from morpho-syntax. Contrary to the idea that the modularity of grammar entails the expectation that the modules are totally different formally, Anderson & Ewen (1987) introduce the *Structural Analogy Hypothesis* which expresses the initial expectation that morpho-syntax and phonology appeal to the same (or analogous) structural principles and parameters. Thus, this chapter disavows the claim that universal grammar is only synonymous with syntax and instead advocates the hypothesis that the notion of there being a universal grammar extends to the phonological component as well (cf. Ritter 1995).

The HDP model, then, claims that phonology is driven by asymmetrical head/dependent relations and that such relations underlie phonological representations and are the key to understanding phonological processes. HDP-relations are manifested in terms of *licensing mechanisms*, which serve to authorize the units that comprise phonological representations. In this chapter, we focus on how head-driven phonology is equipped to analyze complex phonotactic patterns in terms of a highly restricted set of maximally binary head/dependent relations.

We point out here that HDP, like DP and GP, is essentially a non-derivational, monostratal theory which also crucially incorporates the notion of parameters (Kaye 1995, van der Hulst & Ritter 1999, in prep.). Representations are well-formed within the range of parameter settings if all the principles and licensing mechanisms are satisfied.

The chapter is structured in the following way. In section 2, we preface the discussion of our approach with a characterization of the basic tenets of dependency and government phonology. We do not make an attempt in this section to cover the full history of government/dependency phonology and also wish to make it clear from the onset that we do not feel committed to presenting these theories in any canonical way. This means that we choose our own wording in order to express our comprehension of the essence and insights of these theories. We then offer a description of our general approach which differs from DP and GP in various ways, trying to develop a typology of licensing mechanisms. In section 3, we turn our attention to applying HDP to a case study (drawing on van der Hulst & Ritter 1998): the phonotactic organization of minor syllables in Kammu. Finally, in section 4, a brief summary with conclusions is presented.

2. An outline of Head-Driven Phonology

The fundamental contribution of DP is the claim that phonological structure involves head/dependency relations at all levels of organization (including intrasegmental organization). Intrasegmental feature classes, segments themselves, syllabic constituents (like onsets and rhymes), syllables themselves, feet, phonological words, and so on are all depicted as headed constituents. In fact, it is explicitly stated (in the form of the structural analogy hypothesis mentioned in the previous section) that the notion of a headed, binary constituent structure defines what is in common between morpho-syntactic and phonological (often called prosodic) structure.

GP takes a very similar perspective regarding both the structural analogy hypothesis and the organization of phonology proper. A major presentational or methodological difference between DP and GP is that much that is "implied" in DP is stated in a restricted manner and much more explicitly in GP. Additionally, GP seems to be an approach which incorporates the role of universal grammar into the phonological component more clearly than DP does (cf. Ritter 1995 for discussion). GP achieves this goal by providing a system of principles in conjunction with language-specific parameter settings which together define lexical items in an economical manner requiring minimal computation. In this way, a formal system is achieved for yielding well-formed representations from which the phonologies of individual languages can be construed.

2.1. Principles

We formulate the central head/dependency relations as follows:

(1) *Head/Dependency Principle*: an object is either a head or a dependent; if a dependent, it can only exist if it is in a relationship with a head to which it is adjacent at some level.

This principle, as it will be shown, subsumes all sorts of relations which are manifested in terms of (i) structural constituent relations of government (sisterhood), (ii) structural domination relations, and (iii) syntagmatic relations between elements that may or may not belong to different constituents:

(2) *HD-relations*

i. Structural relation of government: (H D)

ii. Structural (paradigmatic) relation of domination:

H
|
D

iii. Non-structural (syntagmatic) relation: (x $\longrightarrow$ y) or (x $\longrightarrow$ y)

(the direction of the head-dependent relation may vary)

(2ii) bears on the melodic content of skeletal positions and on the structural content of higher units. (2iii) will be argued to exist with reference to the content of skeletal positions only.

Another principle which we claim is an innate and necessary part of UG is the *Binarity Principle.*

(3) *Binarity Principle*: all head/dependent relations are maximally binary.

The two principles in (1) and (3) allow for the presence of either a head alone, or a head and a dependent, but never a dependent alone, nor combinations of more than one head or more than one dependent. With reference to the latter situation we note especially that the ternary branching structures in (4) are ruled out (where H = head, d = dependent, and HP = constituent):[1]

(4) a. * HP b. * HP

d H d H d_1 d_2

When, as in constituent structure, head/dependency relations are hierarchically layered, some unit that is a head can form a unit which is a dependent at a higher level. This recursion yields the effect of subsuming all material into a layered, hierarchical prosodic structure. In order to delimit the expanse of this recursive structure from continuing ad infinitum, it has been claimed that there is an upper limit to the number of domains or layers (Nespor & Vogel 1986).

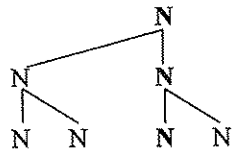
Starting from the smallest units, we adhere to the view that the prosodic hierarchy has at least the following layers:

(5) X^0 nucleus foot word phrase ....

Observe that we do not include the 'syllable' in this hierarchy. The reasons for this will be discussed below. We do not wish to commit ourselves here to a view regarding levels of organization above the phonological phrase, concerning ourselves in this chapter with structures that occur at the lexical level.

It follows from our two principles that a (phonological) word has the following maximal structure:[2]

(6)



Word level

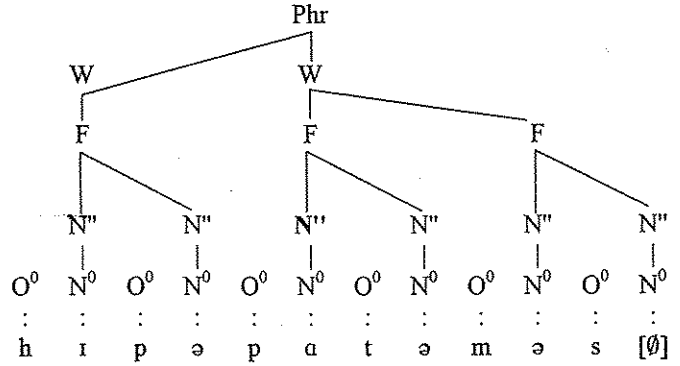
Foot level

Helsloot (1993, 1995) proposes that the word is a bounded constituent in precisely this sense, presenting an argument based on verse in Italian.[3]

We would now like to propose that the word in this sense equals what in GP is called the *non-analytic domain* (Kaye 1995), and what others have called the 'word-level' (cf. Chomsky & Halle 1968, Borowsky 1994). The object which we define as the overall head of the word domain, is the nucleus which projects as head at all levels up to the topmost node of the domain (shown as emboldened in 6). This (ultimate) head is the 'strongest', most viable head in the word, and, apparently as a result of this, a condition on its content exists, namely that its content is *free*, i.e. with no restrictions on its segmental material. Being free implies that there are no restrictions on what this head can dominate, in the sense that any vocalic segment can appear in this position. It thus becomes the site for maximal contrast (cf. Dresher & van der Hulst 1995, 1998). It also follows from being free that the possibility of this ultimate head (UH) being *empty* never exists since, as will be discussed in section 2.4 below, the justification of an empty position is controlled by licensing mechanisms. Other nucleic heads, however, while heads in themselves, are directly or indirectly dependent on the UH, thus allowing for the possibility (but not the necessity) of the content of these other nucleic heads to be restricted or to be empty. Heads of feet, though typically strong, do not necessarily show all contrasts. When the foot is not the strongest foot in the word, as our case study in section 3 will show, heads of structurally dependent feet can, in fact, be very restricted, showing no possibility for contrast at all (cf. also Ritter 1998a).

It follows from the above that words of more than four syllables must consist of more than one phonological word.[4] A simplex word like *hippopotamus*, with five syllables, forms, if we are right, two phonological words (as in 7):[5]

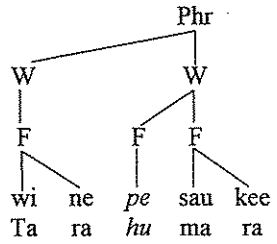
(7)



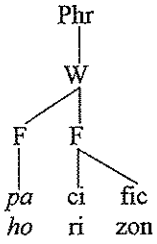
(Here, and henceforth, '[Ø]' underneath a skeletal point or zero-level position indicates that the position does not dominate content and is *inaudible*.)

Our approach postulates feet that do not bear stress (such as the final foot in 7) which implies that we do not assume a one-to-one relationship between being the head of a foot and bearing stress. The phenomenon of stress is a phonetic interpretation of metrical structure and it is consistent to say that, for example, only contentful heads of branching feet bear stress. The foot status of monosyllabic feet is evidenced by facts concerning the aspiration of stops and the occurrence of /h/ (italicized), which both have been claimed to be dependent on initial position in the foot (examples from Davis 1999):[6]

(8) a.



b.



We realize that our view on (lexical) prosodic structure needs more justification than we can give here and we refer the reader to van der Hulst & Ritter (in prep.) for that.

The claim made here suggests that, in general, analyses appealing to "unbounded iteration of foot structure" cannot be correct unless we assume that the resulting structure (as in the case of *hippopotamus*) contains more than one phonological word. Occasionally, the metrical literature has appealed to such intermediate structures. The analysis that Hayes (1995) proposes for Passamaquoddy groups syllables into feet, feet into 'cola' (singular colon), and cola into a word. In our theory, the cola are prosodic words and the resulting structure is a prosodic phrase; cf. van der Hulst (1997).

Another consequence of our view is that neither 'ternary feet' nor 'unbounded feet' can exist. This raises interesting issues with respect to the prosodic structure of words in languages with so-called ternary rhythms and so-called unbounded word accent. Here we will simply assume that ternary feet can be analyzed in terms of combinations of two feet (i.e. as prosodic words, as in the example above). Van der Hulst (1997) applies this analysis to ternary systems of the iambic type. Rifkin (1999) argues for prosodic word status of dactylic feet.

With respect to one variety of unbounded systems, lexical accent systems, Revithiadou (1999) has shown that there is, in fact, no need for unbounded constituents since lexical accents (for example in Russian) appear in positions which only allow the formation of well-formed phonological words. Yoshida (1995) proposes a bounded approach to another system that has been claimed to be unbounded, lexical accent structure in Standard Japanese (cf. Ritter 1998a).

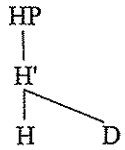
2.2. Licensing mechanisms

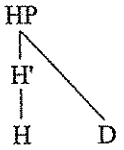
The principles of head/dependency and binarity defined above work together and are manifested in a variety of forms of licensing, exemplified in (2). We will now discuss these types of licensing in more detail.

2.2.1. The structural relation of government (sisterhood)

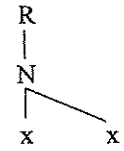
Structural relations of sisterhood are the framework for hierarchical constituent structure. In this type of head-dependent relation known as 'government', a head is able to project a constituent by virtue of its potential to form a governing domain with an adjacent sister dependent. Anticipating a discussion of the types of rhyme structure that government phonology allows, (9) gives two branching configurations. (9a) is an illustration of sisterhood, i.e. the first node that dominates the head also dominates the dependent. Let us call this *minimal c-command*. Example (9b) illustrates a context in which minimal c-command does not obtain since the intermediate node H' does not dominate both the head (H) and the dependent (D). Whether c-command is met or not, however, there

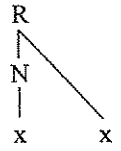
is a head-dependency relation in both cases which satisfies both the principles of head/dependency and binarity in that, in each of the two cases, the dependent unit is in an adjacent binary relationship with its head:

(9) a. 

b. 

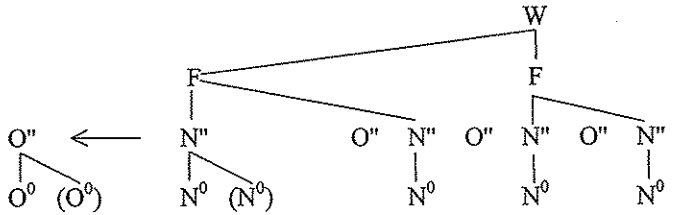
GP allows both structures in (9) as possible rhyme structures. (10a) characterizes long vowels, while (10b) is a rhyme constituent which contains a short vowel and a closing consonant:

(10) a. 

b. 

In section 2.2.1.5, we will argue that we can do without the structures in (9,10b)[7] and thus that minimal c-command is a necessary condition on branching structures.

The structural governing relation which only allows binary relations between sisters ultimately yields a universal structural schema of the onset (O) and rhyme (R) units, the foot, the word, etc., and in so doing, specifies the notion of the well-formedness of each of these constituents and how they relate to one another. Example (11) illustrates the hierarchical architecture, based on this notion of government relations, up to the word level:

(11) 

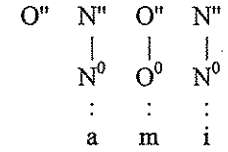
(Here and henceforth we use ⟵ to represent a head/dependent relationship.)

The special relationship between O" and N" is discussed in section 2.2.1.2. We will first start with the lowest level, the zero-level of the hierarchy. With respect to the higher levels of the foot and word, we have already established in section 2.1 that ternary and unbounded structures are disallowed, and we have also suggested how apparent occurrences of such structures can be analyzed without appealing to non-binary constituents. In the following discussion, we will make it clear where our views deviate from GP.

2.2.1.1. The skeleton

Beginning, then, from the terminal points, it should be noted that in our approach we *notationally* replace the traditional notion of skeleton (a string of so-called x-positions) with 'zero' positions. The zero-level units (such as N^0) are visible to the phonology and as such are subject to principles of headedness, binarity and a third principle, the *Empty Category Principle* (ECP), which we discuss in section 2.4.4. This zero-level unit dominates segmental expressions (mediated, in our approach, by a 'root node' which dominates phonological elements) and also encodes the notion of timing in order to differentiate between long and short segments (cf. section 2.2.1.6 on long vowels).

Constituents which do not have zero-level terminal heads merely serve as representative cognitive placeholders in the structural schema but do not contribute to any interpretation per se. They could just as readily be left out of the representation. For instance, words which begin with a vowel on the surface and also phonologically behave as vowel-initial will have a structure in which the initial onset constituent may be representationally present but its zero-level head will not be present, as in the French word *ami* 'friend' (masc. sing.) illustrated in (12) below (cf. Tranel 1987):

(12) 

(Here, and elsewhere, we suppress the intermediate N'-level, which we will get rid of entirely in section 2.2.1.5.)

Since the initial onset constituent contains no zero-level position, i.e. no head, it lacks the component which the computational system recognizes as necessary to make an object visible to the phonological system. Consequently, the lexical item in (12) is phonologically construed as vowel-initial. In cases, however, where an initial onset is claimed to be phonologically relevant, although it lacks any segmental content and appears silent on the surface, the onset constituent is headed by a zero-level position (O^0). Constituents which project from a zero-level head are subject to the aforementioned principles, since being at the zero-level identifies these objects as being phonologically

relevant to enter into licensing relations. Example (13) gives an illustrative representation of the phenomenon that has been described as *h-aspiré* in French, in which apparent vowel-initial words act as if they begin with a consonant, as with *haricot* 'bean' below.

(13)

O"	N"	O"	N"	O"	N"
O^0	N^0	O^0	N^0	O^0	N^0
:	:	:	:	:	:
[Ø]	a	r	i	k	o

Thus a contrast with respect to the presence or absence of the zero-level head is claimed to exist in the case of onsets which accounts for the variance in phonological relevancy of onset constituents which appear silent on the surface.

Whereas nuclei can co-occur with onsets that lack a zero-level position, it is not our position that the reverse situation is possible. In fact, we claim that onsets cannot occur with nuclei that lack a zero-level head. We derive this from the fact, discussed in the next section below, that onsets can only be prosodically anchored by being adjoined to a nucleus that is itself phonologically viable (i.e. has a zero-level head). This stems from the assumption that prosodic anchoring is a necessary condition for the interpretability of onsets and that prosodic viability implies the existence of phonological visibility. Since a nucleus lacking a zero-level position itself would not be visible to the phonology and thus could not be a potential recipient of phonetic interpretation, such a nucleus could not occur and therefore could not be an anchor for an onset. As a result, nuclei (as opposed to onsets) always have zero-level head positions.[8]

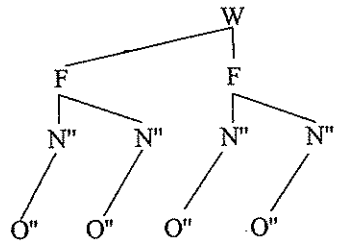
2.2.1.2. How do onsets fit in?

GP represents syllabic constituents like onsets and rhymes in sequence on a single tier or plane, as in (11). These two units do not form a syllabic constituent which GP rejects (cf. Brockhaus, this volume).

In this section, we present the somewhat different view that is adopted in HDP. Since onsets can be missing at the zero-level, they are not calculated, whether present or not, as being phonologically relevant in creating the prosodic structure. As a result, onsets seem to somehow stand outside of the prosodic hierarchy. In our approach, we represent this by also rejecting the syllable as a constituent in the prosodic structure. Lexically, there is a head-dependency relation between an onset and a nucleus, which we will refer to as 'anchoring' (or more neutrally: adjunction). This adjunction relation could be considered as creating an interface level between two planes, similar to the way Semitic root-and-pattern languages operate. In the case of the onset-nuclear interface, the

nuclear plane is the core which bears the notion of prosody, and the onset plane serves to demarcate prosodic peaks and carries with it some notion of semantic content. Example (14) illustrates this concept:

(14)



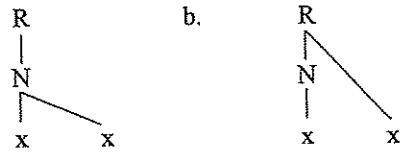
Anchoring/Adjunction

We assume, with government phonology, that every nucleus must be preceded by an onset (and vice versa)[9], but we place the two units on different planes to more clearly express that onsets do not partake in the prosodic hierarchy. We advance an observation here regarding reduction processes that, to our mind, has not been made in the literature before, and which strongly supports the idea that onsets do not form part of the prosodic hierarchy. It is well-known that vowels may reduce in weak metrical positions. One aspect of reduction is shortening or monophthongization. English is a clear case in point. However, reduction never seems to involve the change from branching onsets to simple onsets. In a pair like *photograph - photography* we note that the vowel of /graef/ reduces in the second form, while the cluster /gr/ remains in tact. Reduction fails to effect onsets, because reduction is triggered by occurring in strong or weak positions which are defined in terms of the prosodic hierarchy. Onsets do not partake in the prosodic hierarchy.[10]

2.2.1.3. Coda licensing

Government phonology, as we have seen in (10), repeated here as (15), makes a distinction between branching nuclei and branching rhymes:

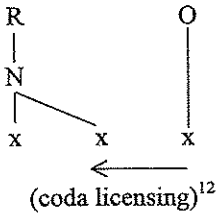
(15) a. b.



The 'coda' is analyzed as a specifier at the rhymal level. It is argued in Kaye, Lowenstamm & Vergnaud (1990) and Kaye (1990, 1995), that the 'coda' is not a constituent in itself because it cannot branch (i.e. there seems to be no empiri-

cal need for postulating branching codas)[11]. Since this coda position is removed by one projection (namely N) from the nuclear head and thus not an immediate sister of the nuclear head, the coda position is not minimally c-commanded by the nuclear head, as pointed out in section 2.2.1. Because the coda position is not minimally c-commanded, one could conclude that the relevant structure is simply ill-formed (a position that we will take in section 2.2.1.5). In GP, a milder position is adopted: the coda position is allowed, but it needs extra licensing. This is the way in which we view what Kaye (1990) calls *Coda Licensing*. According to this condition, a coda can only occur if followed by an onset which 'licenses' it:

(16)



(coda licensing)[12]

As Kaye (1990) points out, a consequence of coda licensing (i.e. the requirement that *all* codas be followed by an onset) is that closed syllables cannot occur word-finally. Yet, lexical items often have final consonants. In this context the consonants cannot be licensed by a following onset, but there is another way of licensing them if it is assumed that the consonants form onsets which are anchored to a following 'empty' nucleus.[13] The word *cat* would be represented in government phonology as in (17):

(17)

O	N	O	N
x	x	x	x
k	æ	t	[Ø]

In section 2.2.1.7, we will turn to the question as to whether coda licensing will be adopted in our approach. First, in the next section, we discuss another licensing principle that has been adopted in government phonology.

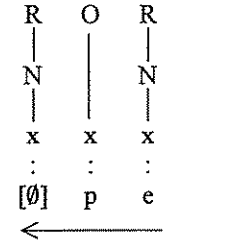
A final point with respect to coda licensing must be made. This principle ensures that onsets take priority over codas, since a string VCV, to be in agreement with coda licensing cannot be parsed as VC.V, because, in that case, the coda is not licensed by a following onset. Coda licensing also ensures that onsets are maximized (cf. the so-called Maximal Onset Principle) because, as pointed out in Kaye, Lowenstamm & Vergnaud (1990) and Kaye (1990), an onset can only license a preceding coda if the onset consonant is 'less sonorous' than the preceding coda (cf. Harris 1990 for a formalization of the notion 'sonorant' in terms of complexity). A string VbrV can thus never be parsed as Vb.rV because an /r/ can never coda-license a /b/. Such a string will be parsed as V.brV in a language that permits branching onsets, and as V.b[Ø].rV (i.e. with an empty nucleus after the /b/) if no branching onsets are permitted.

2.2.1.4. Government licensing

Before we turn to *Government Licensing*, it will be necessary to say a few words about another central mechanism of GP, viz. *Proper Government* (PG). We have seen that, in GP, nuclei are allowed to be empty, i.e. contain a skeletal point that does not contain any content. In order to avoid a proliferation of silent nuclei, GP demands that they be *licensed*. This demand is stated in the form of the so-called *Empty Category Principle*: An empty nucleus must be licensed in order to be inaudible.[14]

There are several licensing mechanisms pertaining to empty nuclei, which we discuss further in section 2.4. The most important of these is proper government. In essence, proper government obtains if the empty nucleus has a neighboring nucleus that is audible, i.e. either contentful or an empty unlicensed nucleus (and thus phonetically interpreted). In most GP accounts, PG is a right-to-left (iambic) relation:[15]

(18)



(proper government)

PG can be 'blocked' if there is an intervening consonant cluster (either a coda-onset sequence or a branching onset). This means that such consonant clusters cannot be *preceded* by an empty silent nucleus; cf. Kaye, Lowenstamm & Vergnaud (1990) for details. In section 2.4.4 we show how PG is integrated into HDP. With this background, we turn to Charette (1990).

Charette (1990) proposes a licensing principle that involves a relationship between some unit that licenses another unit to govern a dependent. The central observation is that in some cases it appears that inaudible nuclei cannot *follow* a consonant cluster, albeit coda-onset clusters or branching onsets:

(19) a. * R O R b. * O R
N N N
x x x x x x x
: : : : : : :
[a] l p [Ø] p l [Ø]
(coda licensing) (government)

In the relevant languages, empty nuclei, when followed by an audible nucleus (i.e. when properly governed), are permitted. Yet in the configurations in (19), the empty nucleus must be audible even when followed by an audible nucleus that governs it. Why would this be so? Observe that, according to the theory of GP, in both (19a) and (19b) the /p/-segment must govern another consonant, the government relation being indicated. In (19a) the /p/ must coda-license the preceding rhymal coda, while in (19b) the onset head must govern its dependent.

The proposal that Charette makes is that consonants that must govern a preceding (as in 19a) or following consonant (as in 19b) need to receive licensing power from a following nucleus, and in order to do this, a nucleus must be filled. She refers to this phenomenon as 'license-to-govern' or 'government-licensing': [16]

(20) a. R O R b. O R
N N N
x x x x x x x
: : : : : : :
a l p i p l a
(government licensing) (government licensing)

Yoshida (1992) extends the license-to-govern analysis to cases in which a long vowel cannot occur before an empty nucleus, namely in those cases in which the 'closed syllable shortening (CSS) effect' can be observed (cf. Kaye 1990). In this case the head of a long vowel must be licensed to govern its dependent vowel slot by a following non-empty nucleus:

(21) N O N O N
x x x x
: : : :
a -------> p i/[Ø]
(government licensing)[17]

In sections 2.2.1.6 (note 26), we show that the 'local' (or direct) form of government licensing in (20a) is needed. For the 'nonlocal' (or indirect) form in (20b) we propose an alternative in sections 2.2.1.7 and 2.2.3. In this chapter, we accept Yoshida's account of CSS (even though it is also nonlocal). In van der Hulst and Ritter (in prep.) we consider local alternatives to Yoshida's analysis.

2.2.1.5. Is the nucleus-rhyme distinction necessary?

Allowing the two structures in (15) raises the question of potentially combining the presence of a branching nucleus and a coda, thus creating a 'superheavy' syllable, as in (22). Government phonology wishes to ban such a construct (assuming that it is unnecessary for the analysis of languages) and does this by pointing out (referring to the notion of 'strict locality' of government) that in such a case, the head would not be adjacent to the coda dependent:

(22) R
N
x x x

This structure is one that might come to mind for rhymes that contain a long vowel and a closing consonant, a so-called 'superheavy' rhyme. We turn to the GP analysis of superheavy rhymes (both VVC and VCC) in section 2.2.1.6.

Another requirement that government phonology proposes on O/R structures is that of strict directionality: the head always governs to the right. This rules out a number of further structures:

(23) a. * HP b. * HP
H' H'
d H d d H d

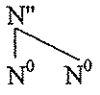
Such structures are, in fact, disallowed not only for rhymes but also for onsets. Structures as in (23) have occasionally been proposed for onsets consisting of three consonants (e.g. *spr* in English); cf. van de Weijer (1994) for discussion. In our mind, positing a structural position to accommodate special clusters (such as those involving initial /s/) seems to miss their special character. Thus, we believe that allowing such ternary structures will only and undesirably extend the descriptive power of the theory leading to a loss of explanatory power.[18]

Let us now focus on the two structures in (15) that *are* allowed in government phonology. The consequence of banning the ternary structure in (22), results in the fact that the structures in (15), stand in complementary distribution to one another with respect to the representation of the nuclear complement. In section 2.2.1, we announced that we would like to disallow the structure in (15b). We will now develop this idea that no intermediate bar-level exists.[19] Head-driven phonology, then, will only acknowledge the structures in (24):[20]

(24) a. 

b. 

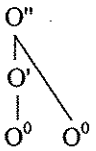
c. 

d. 

We stipulate (as in government phonology) that the direction of the government head/dependent relation is non-parametric, universally left to right (left-headed) within the most minimal of constituent domains, i.e. at the zero-level within the onset constituent (cf. 24b) and within the nuclear constituent (cf. 24d). At the adjunction site of O" and N", where N" is the head, the licensing relation is a right-headed one, following from the claim (cf. section 2.2.1.2) that prosodic structure (composed of nuclei only) is the foundation on which the onset is anchored.[21]

Thus we do not recognize a single-bar intermediate level as a constituent which can function as a head and enter into a head/dependent relation. Only 'zero level' heads and maximal projections can function as heads, suggesting that only units of the same bar-level can enter into a head/dependent relation.

An immediate advantage of adopting the position that minimal c-command is necessary is that this move rules out the onset structure in (25). GP, by allowing the analogous structure for rhymes, cannot explain why the same type of structure is not used for onsets:

(25) 

We realize that our proposal needs further support, which we will give by showing here and elsewhere (van der Hulst & Ritter, in prep.) that the resulting restrictive theory can account for all the relevant facts that we are aware of.

2.2.1.6. Do we need two structures for long vowels?

We now address the question as to whether the structure in (24d) represents both long vowels and short vowels followed by another segment. It has been argued, for example in Yoshida (1990) that long vowels can (and in some cases clearly must)[22] be represented as bi-nuclear structures (with an empty intervening onset as in 21). If we use (24d) for long vowels, this means that we have two structures in the theory for long vowels. We therefore propose to represent all vowels as in (26):

(26)
```
O"  N"  O"  N"
|   |       |
x   x       x
:   :       :
k   a ------->
      (spreading)
```

The vowel melody of the first nucleus 'spreads' to the second nucleus in the phonetic interpretation of this structure.

We propose, then, to restrict the branching nucleus option in (24d) to vowel-consonant sequences, where the 2nd member of such sequences includes glides (or approximants), liquids, homorganic nasals[23] and left halves of geminates.[24] This move also seems supported by the typological facts. The presence of long vowels does not imply the presence of closed syllables, and vice versa. If both are the consequence of parametrically allowing branching nuclei, then this mutual implication would be the expected result. We refer to van der Hulst & Ritter (in prep.) for further extensive discussion of long vowels (for consonants; cf. section 2.2.3). Here we limit ourselves to some remarks about the distribution of long vowels.[25]

It has been observed that long vowels fail to occur in 'closed syllables' either totally (type I), or only medially (type II). As shown in Kaye (1990), a language like Yawelmani belongs to type I: long vowels occur only 'in open syllables'. A

further restriction obtains, however, in that even in open syllables, long vowels are prohibited if word-final. The prohibition on the occurrence of long vowels can lead to alternations involving vowel shortening when underlyingly long vowels end up being in a 'closed syllable'. The shortening process has been termed *Closed Syllable Shortening* (cf. section 2.2.1.4). Arabic dialects have been mentioned as typical examples of type II: word-finally, long vowels followed by a consonant (creating 'superheavy' syllables) are allowed, but word-medially, long vowels can occur in open syllables only. The evidence regarding long vowels in final open syllables is less clear in type II languages. This distribution of VVC is usually paralleled by the distribution of VCC in that VCC either does not occur at all (type I), or only finally (type II).

Government phonology accounts for these facts as follows. Adopting a bi-nuclear representation of long vowels, we represent in (27a) a string that results in a surface superheavy syllable VVC. We then adopt the proposal in Yoshida (1992), based on Charette (1990), discussed in section 2.2.1.4, which claims that in languages that bar VVC altogether, the head of a long vowel (N_1), which is the nucleus dominating the vowel melody, must be *licensed to govern* the following empty nucleus (N_2) by a following contentful nucleus (N_3). Thus, if N_3 is not audible, as in (27a), the structure is ill-formed. Given this requirement of being licensed-to-govern, word-final long vowels are also prohibited.

Extending the argument to VCC 'rhymes', (27b) shows an ill-formed structure because N_2, being inaudible, is not properly governed by a following audible nucleus:[26]

(27) a.

N_1	O	N_2	O	N_3
|		|	|	|
x		x	x	x
:		:	:	:
a	------>		p	[Ø]

(government licensing not possible)

b.

N_1	O	N_2	O	N_3
|	|	|	|	|
x	x	x	x	x
:	:	:	:	:
a	l	[Ø]	p	[Ø]

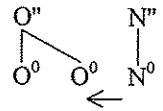
(PG not possible)

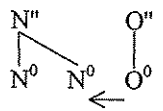
To account for languages of type II, which allow VVC and VCC finally, in which case N_3 is at the end of the word, we must postulate that word-final

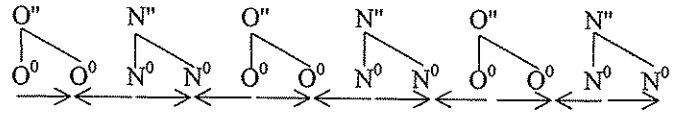
empty nuclei (unlike medial empty nuclei) do have the power to government-license, and to properly govern; cf. section 2.2.1.4 and note 16. Word-final long vowels are still prohibited because there simply is no following nucleus to government-license the head of the long vowel.[27]

2.2.1.7. Do we need coda licensing?

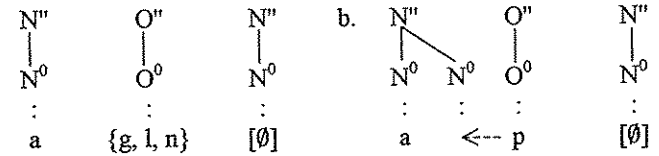
Having abandoned the difference in (15), we must review the evidence for coda licensing, i.e. the claim that a 'coda' consonant *must* be followed by an onset, barring the occurrence of domain-final consonants. A first observation we make is that the licensing relationship between a coda and following onset could be generalized by stating that *each* dependent (whether in the nucleus or in the onset) must be licensed by a following audible head. We have seen in section 2.2.1.4 that Charette (1990) proposes a principle (license-to-govern) which, among others, demands that an onset dependent can only occur when its head is licensed-to-govern its dependent by a following nuclear head (cf. 20). We argue in section 2.2.3 that the required result in this case can be derived from a (syntagmatic) licensing relation (as shown in 28a) that subsumes the coda licensing relation (displayed in 28b).This means that all zero-level positions are now formally 'linked', as shown in (28c), either in terms of left-headed government (→) or in terms of right-headed interconstituent syntagmatic licensing (←); licensing is the 'thread' that holds together the 'zero-level beads':

(28) a. 

b. 

c. 

Assuming that the coda position can contain glides (or approximants), liquids, nasals and left-halves of geminates, and adopting coda licensing as a necessary relation, we enforce that word-finally, glides, liquids and nasals must be onsets followed by an empty silent nucleus (cf. 29a). Final geminates would of course necessarily involve a final empty nucleus (29b):

(29) a. 

b.

In this chapter we assume along with Kaye (1990) that coda licensing is indeed an obligatory principle, but the matter is more fully discussed in van der Hulst & Ritter (in prep.). An issue that is relevant to this question is that in the government phonology approach, consonants (whether coda licensing is obligatory or not) can occur in three different environments:

(30) a. in an onset followed by an audible nucleus
b. in an onset followed by a silent, contentless nucleus
c. in a coda, licensed by a following onset

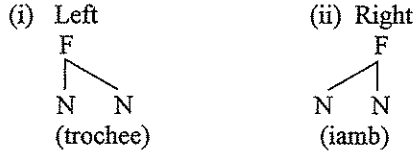
Loss of contrast typically occurs in (30b) and (30c), but since both positions are structurally different we expect different patterns of reduction. If consonants in the position in (30b) show unique behavior vis-à-vis reduction, that is, if occurring before an empty silent nucleus has a specific effect on the range of consonants that can occur in the onset, we can use this effect as a diagnostic to test whether the structures in (29a) and (29b) are indeed necessarily enforced by an obligatory form of coda licensing.

2.2.1.8. Prosodic parameters for head orientation

In accordance with the theory promulgated here, both feet and words, like onsets and nuclei, are maximally binary constituent types. This excludes, as we have argued, ternary feet and words containing more than two feet.

We have seen (i.e. stipulated) that onsets and nuclei are universally left-headed constituents, i.e. the choice of the edge for headedness is not parametrized. With respect to both feet and words, however, the literature (cf. Hayes 1981, 1995, van der Hulst 1999) allows variation with respect to the location of the head, demonstrated in (31) and (32), respectively.[28] In addition, for feet a third parameter has been proposed in the literature, i.e. direction of foot assignment.

(31) *Foot-level Parameter*



(32) *Word-level Parameter*

The existence of variable directionality at the foot level has been called into question by casting doubt on the need for the iambic foot (cf. van de Vijver 1998, van der Hulst 1997).[29] We do not take a stand with respect to that issue here. With respect to the word-level parameter, it does seem reasonable to assume that left-headed and right-headed structures are needed.

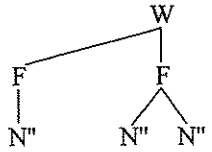
Turning to the direction of foot assignment, we wish to challenge the idea that the direction of foot assignment is a necessary independent parameter. Our point here introduces the next section in which we discuss paradigmatic licensing relations.

2.2.2. The structural (paradigmatic) relation of domination

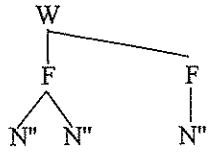
2.2.2.1. Paradigmatic licensing of structural complexity

With respect to the issue of directionality of foot assignment, we follow van der Hulst (1984) in assuming that the choice of the edge of the head foot of the word (i.e. whether the word is left-headed or right-headed, cf. 32) determines the direction of footing. This correlation can be seen as the consequence of a rather plausible paradigmatic licensing relation: the foot that is the head of the word must be branching. This statement entails that a tri-nuclear string is parsed uniquely. Example (33) below illustrates what occurs when each of the parametric choices is selected for the word-level parameter:

(33) a. *Word-level Parameter: Right*[30]



b. *Word-level Parameter: Left*



We argued in section 2.1 that 'directionality' effects do not exceed more than two feet, given that the word is a bounded constituent consisting of maximally two feet.[31]

Paradigmatic licensing relations, then, are top/down, head/dependent relations making reference to the constituent status of a position as either a head (i.e. a governor), or a dependent (i.e. a governee), with respect to the content which such a position is able to license, precisely because of its status. This type of licensing produces the effect that head positions allow greater complexity than dependent positions and that dependent positions display effects of neutralization (cf. Dresher & van der Hulst 1995, 1998).

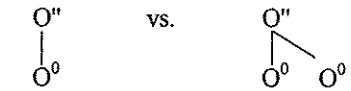
2.2.2.2. Paradigmatic licensing of content

In the previous section, we discussed a paradigmatic relation that is structural in which the head foot of a word (by virtue of being a head) requires greater complexity and thus must be branching. In this case the complexity asymmetry involves the ability to be binarily structurally branching. We will now consider paradigmatic relations as they bear on the *content* of zero-level positions. In understanding this type of licensing, we view head positions as positions of maximal contrast, i.e. the state of being a zero-level head licenses the ability of a whole array of segments to appear in such a position; thus a zero-level head position licenses its dependent segmental content to be segments from a large set of possibilities from the phonemic inventory of a language. Correlatively, structurally dependent, zero-level positions are claimed to typically allow less options, and thus select from a smaller, restricted set of possibilities. In comparison with their heads, then, dependent positions appear to be positions in which neutralization of contrast is seen. For instance, it is typically the case that only a limited set of consonants can occur in the onset constituent's dependent

position (typically only liquids or approximants). Moreover, it is also the fact that the nuclear dependent in the case of a heavy diphthong only allows vowel melodies like /i/ and /u/. The head/dependent relation that this approach promotes thus predicts in which positions we find neutralization of contrast.[32]

With respect to branching onsets and branching nuclei, there is an additional effect that we must consider. When the dependent position is present and a structural licensing relation holds between the head and its dependent, the presence of the dependent seems to narrow down the possible contrasts that can occur in the head position, in a paradoxical fashion. Example (34) illustrates this seeming contradiction with respect to what the head position of an onset constituent is able to license as its dependent segmental material when it is a lone head and when it is in a licensing relation.

(34)

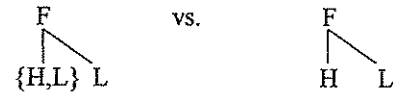


obstruent/sonorant obstruent liquid/approximant[33]

In the case in which the onset head participates in a licensing relation with a dependent, the onset no longer appears to be the site of maximal contrast since it is only obstruents that are typically found in the head position in this context. In this case, heads only allow 'prototypical' consonants, i.e. obstruents.

That this, in fact, is a natural situation can be shown by looking at quantity-sensitive feet. There appear to be two types of quantity-sensitive feet. In one variety, the dependent position can be occupied by light syllables only, whereas the head can contain heavy or light syllables (cf. 35a). In a second type (called 'obligatory branching' in Hayes 1981 and 'quantity-determined' in van der Hulst 1984), the situation is the same for the dependent position (only light), but in head position we only find heavy syllables (cf. 35b):

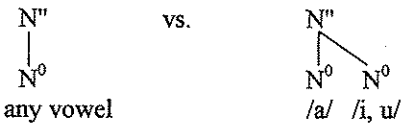
(35) a. quantity-sensitive b. quantity-determined



Apparently, onsets only allow the second option, which in this case we might call *sonority-determined*. As in the case of the direction of government, it seems that the foot level allows a parametric choice where the syllabic constituents allow only one.

This same effect can also be seen to operate with respect to nucleic constituents. A lone nucleic head allows for the licensing of any vocalic segment; how-

ever, once this head enters into a licensing relation with its nuclear dependent (restricted to either /i/ or /u/), the preferable vowel within the head position that can co-occur with such a dependent is /a/.[34]

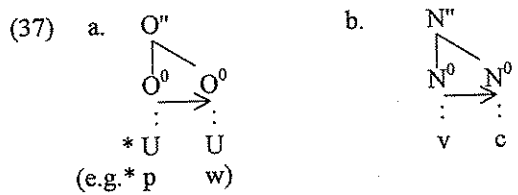
(36) 

Once again, the inherent nature of the constituent, in this case nucleic, shows up in the head position of that constituent in the form of the most prototypical nucleic segment, namely /a/. Segments which are more remotely removed from characterizing the nature of the constituent (i.e. in the vocalic case, segments which detract from the full openness of the oral cavity) appear in the dependent position. Therefore, it seems that, when two positions enter a licensing relation, a division of labor exists in which these two positions take on different roles, precisely due to their being in a head/dependent relation. As we have seen, for example, the head position of a branching constituent, the stronger position by virtue of its being the head from which the constituent projects, embodies the particular characteristic of the constituent while the dependent position, the weaker position, becomes the site for segments which are more remotely removed from characterizing the nature of the constituent. The range of contrasts defining a constituent are divided up over the two positions with the prototypical defining characteristics situated in the head of the constituent. In this light, then, the descriptive generalization of sonority sequencing, which has been traditionally relied upon to account for sonority differences, can be better understood now as a manifestation of the way head/dependent relations work.

2.2.3. The non-structural (syntagmatic) relation

The third type of licensing that we propose occurs between adjacent units at the zero-level. In this type of licensing, the content of the head has bearing on the type of content that can occur in the dependent. This results in what is usually called phonotactic restrictions. Non-structural content-licensing can occur within a constituent (in which case it happens to co-exist with structural licensing as well), but it can also occur across constituents.[35]

An example of intra-constituent licensing involves the effect of labial dissimilation between an onset head and onset dependent within the onset constituent, as illustrated in (37a):

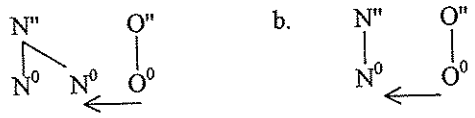
(37) 

Possibly, this restriction applies more generally to place properties.

The structure in (37b), we propose, displays the relationship between lax (or unchecked) vowels and a following consonant in languages such as German (Vennemann 1991) and Dutch (van Oostendorp 1995). As previously stated, we propose that lax vowels subcategorize for a consonant complement in such languages. Given the subcategorization frames of such vocalic segments and given what we have said about paradigmatic licensing, the head of the nuclear constituent will bear the prototypical nucleic objects, i.e. vowels in general, while the dependent will contain those segments more remotely removed from the characterizing nature of the nucleus, namely consonants. We explore this topic in greater detail in van der Hulst & Ritter (in prep.).

The direction of content-licensing in (37a,b) has been displayed as 'harmonizing' with the head/dependent relation of structural licensing within a constituent. In actual fact, it is difficult to decide whether the restrictions expressed in (37) are left-headed or right-headed. We return to this issue immediately below.

Interconstituent licensing can be seen in the case of homorganic nasals or partial geminates arising from the relation between a coda and following onset as in (38a):

(38) 

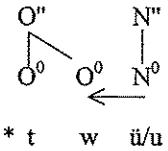
Observe that in (38a), which expresses the coda licensing relation discussed extensively above, the direction of the relation seems to correlate with the structural head status of its members, i.e. O^0 being a head and N^0 being a structural dependent of the preceding nucleus head. This form of licensing reflects assimilatory relations between onsets and codas and, in addition what Murray & Vennemann (1987) have called the *Syllable Contact Law*: codas are not less (and perhaps, more) sonorous than the following onset.

Integrating Charette's (1991) notion of government-licensing we will say that the O^0, in order to license N^0, must itself be licensed by an audible nucleus (or, in some cases, an inaudible final nucleus).

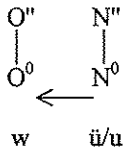
A potential example of the occurrence (or non-occurrence) of approximant onsets following a preceding vowel is represented in (38b). Such a relation can be assimilatory in that the approximant must be homorganic with the preceding vowel, or, the reverse, in that the vowel and approximant must be disharmonic (e.g. *CuwV... in English). In Dutch, for example, the vowel on the left determines the nature of the glide (in terms of palatality and labiality) that follows. This phenomenon of homorganic glide-insertion may, however, be entirely irrelevant given our claim that onsetless syllables have no zero-level onset position, and given that glide-insertion could also be attributed to the realm of phonetic interpretation.

Interconstituent relations between an onset and a following nucleus are displayed in (39):

(39) a.



b.



The kind of restriction that comes to mind as an instantiation of this relation again involves dissimilatory restrictions involving place, excluding both /twü/ and /wü/, as for example in Dutch and /twu/ and /wu/ in English.

The relation in (39a) also expresses what Charette (1991) captures in terms of indirect government-licensing. To cover the facts that motivate this relationship for Charette, we will simply say that an onset dependent must be licensed by an audible nuclear vowel (or a final silent one, in some languages).

All examples of inter-constituent relations are right-headed, while those of intra-constituent relations are left-headed. We conclude, at this point, that the opposite does not occur in line with the 'beads-and-thread'-model proposed in (28c).

2.2.4. Summary of licensing relations

We have discussed three types of licensing relations:

(40)

structural	government	→	involves building structure
	domination (paradigmatic)	→	involves restrictions on positions (structural and content)
non-structural (syntagmatic)		→	involves restrictions on zero-level positions (i.e. content only)

Following Harris (1994), and Ritter (in press), we also assume a class of licensing mechanisms with respect to segment-internal licensing which dictates the combinatorial possibilities of the elements that make up segments. Harris (1994), in general, offers a thorough discussion of the notions of licensing and government, stressing in particular the correlation between these relations and phonotactic restrictions.

2.3. Syllable typology

The approach that we have outlined above allows for a number of different language types, in terms of the set of O/N structures that they permit:

(41) i. CV
ii. CV, ØV
iii. CV, CCV, CVC, CCVC
iv. CV, CCV, CVC, CCVC, ØV, ØVC

ia. CV, CVC
iia. CV, CVC, ØV, ØVC

With respect to the onset, we could assume the usual two parameters:

(42)

onset obligatory? / onset branching	Y	N
N	i, ia	ii, iia
Y	iii	iv

An alternative would be to replace the 'onset obligatory' parameter by a syntagmatic licensing relation which strict CV languages must adhere to, viz. a requirement that the nuclear segment be preceded by stricture, i.e. a consonantal element. This approach, while descriptively equivalent to the parametric approach, is more appealing because it reduces prosodic parameters to 'decisions' on structural complexity, rather than the presence of structural nodes.

The nucleus is obligatory, as we have seen in section 2.2.1. We assume here, with respect to the nucleus, that a parameter specifies whether this unit allows branching or not. It has been claimed that languages cannot at the same time parametrically allow branching onsets, while parametrically disallowing branching nuclei, i.e. closed syllables (Kaye & Lowenstamm 1984). We interpret this as a so-called head-dependent asymmetry (in the sense of Dresher & van der Hulst 1995, 1998) which in this case implies that the complexity of dependent constituents cannot, parametrically, exceed that of head constituents. This implies that type i and type ii languages have a counterpart with closed syllables, whereas type iii and iv languages *must* have closed syllables.[36] In

section 2.4.1 we turn to another aspect of typology, which involves the parameter that is relevant for the licensing of final empty nuclei.

2.4. Emptiness

We conclude this section on head-driven phonology with a discussion of emptiness, starting with nuclei. We have seen that in GP and HDP nuclei must always contain a zero-level position, which can be either filled or empty. In order to constrain the distribution of empty nuclei, GP adopts a principle of UG, introduced in section 2.2.1.4, called the *Empty Category Principle* (ECP) which states that empty positions must be licensed to remain silent or inaudible. This principle of the grammar serves to constrain ad hoc appearances of silent empty positions including the possibility of having a string of consecutive empty objects. A number of mechanisms have been proposed in the GP literature in order to license the emptiness of such positions:

(43) a. Proper government
b. Final licensing
c. Interonset government
d. Magic licensing

Our goal here is not to discuss all four of these licensing principles in detail; cf van der Hulst & Ritter (in prep.) for that purpose. We already discussed proper government in section 2.2.1.4 above. Here we briefly explain the other licensing mechanisms as well, before we present our own 'typology of emptiness'.

2.4.1. Word-final empty nuclei

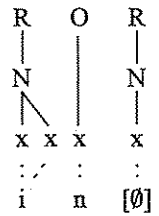
A first and most obvious circumstance in which the postulation of a final empty nucleus is necessary involves the occurrence and distribution of so-called 'superheavy syllables'. We anticipated this point in section 2.2.1.4. Most Arabic dialects allow words to end in sequences as in (44); the examples come from Cairene Arabic:

(44) a. VCC] e.g. katabt 'I wrote'
b. VVC] e.g. sakaki:n 'knives'

According to government phonology, these cases cannot involve tri-segmental rhymes. If we take the facts in (44) to imply that the restrictions on rhyme structure are wrong, or must be relaxed in word-final position, we would not

explain why the relevant sequences occur in word-final position only. The best explanation seems to be to assume that the final consonant is not tautosyllabic with the preceding VV or VC sequence. Standing by its own, then, it most likely forms an onset, which according to government phonology licensing principles must be followed by a nucleus. A GP representation of this phenomenon would be as in (45):

(45)



In languages like Arabic (and English), the presence of final superheavy syllables directly reveals the parameter setting for final empty nuclei. Perhaps more surprisingly, though, languages lacking final superheavy syllables (such as Yawelmani or Turkish) also get their final consonant analyzed as an onset. The argument (which we do not discuss here) in these cases relies on the analysis of word-internal consonant clusters and vowel shortening. To enforce final consonants to form onsets in such cases, Kaye (1990) states the principle (coda licensing) which expresses that a coda must be followed by an onset. In fact, Kaye proposes that no language has final coda consonants (cf. section 2.2.1.3).

A consequence of postulating final empty nuclei is that a licensing mechanism must be invoked to allow them to remain inaudible. The mechanism in question is called *domain-final licensing*. This mechanism, if parametrically active, states that a word-final or domain-final silent, empty nucleus is licensed simply because of its final position in the word (domain).

Languages, however, which do not permit domain-final consonants, such as Italian, will not license a final nucleic position to be silent, thereby ensuring or enforcing that this word-final nucleus will be segmentally contentful or audible. For word-final nuclei then, the absence of melodic content or the emptiness is licensed or permitted by parametric choice.

This way of looking at final consonants predicts that the occurrence of final 'closed' syllables is independent from their occurrence medially; in the latter case, closed syllables in government phonology result from setting the rhyme parameter to branching: yes (or, alternatively, by activating coda - onset junctural licensing). Kaye (1990) therefore claims that four types of languages can be expected to exist:

(46)

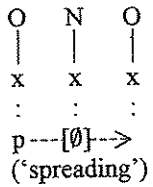
Br. rhyme	*Final EN*	*medial*	*final*	*languages*
yes	yes	CVCCV	CVC]	Arabic
yes	no	CVCCV	*CVC]	Japanese
no	yes	*CVCCV	CVC]	Gur languages
no	no	*CVCCV	*CVC]	Desano

Hence a pure CV language disallows both a branching rhyme and a final empty nucleus.[37] We accept domain-final licensing in HDP.

2.4.2. Interonset government

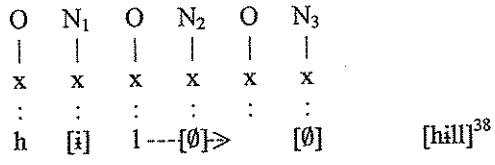
A second manner in which an empty position can be licensed in order to satisfy the ECP is by its being embedded within a governing domain comprised of two onsets in what has been termed an inter-onset (IO) relation.

(47)



Originally, this relation was motivated in Kaye (1986) to represent Semitic biliteral stems which map onto a triliteral template such that the second and final member of the root geminates in order to adhere to the regular pattern containing three consonantal positions (cf. Guerssel 1990):

(48)



This type of geminate creation is observed by Kaye (1990) to be a 'spurious' geminate.[39] Spurious geminates create a domain in which a nucleic position, N_2, is flanked by two onset positions that are 'united' by spreading. Kaye claims that by virtue of being in such a context, the emptiness of the intervening nucleus is justified and thus licensed. This predicts that if such an interonset relation could ever be destroyed, the nucleus, as a consequence of no longer being contained within such a context, could be phonetically realized under the right conditions.

Cyran & Gussmann (this volume) offer a quite detailed discussion of IO-licensing, addressing a rather different set of facts concerning Polish consonant clusters. They postulate (left-headed) IO relations to account for the fact that certain sequences of onsets have a structure not unlike complex branching onsets in the sense that the left-hand onset cannot be less sonorous than the right-hand onset.

A third potential area for postulating IO-relations (not relevant to the silence of empty nuclei) may lie in the wish to limit the distribution of empty onsets. This seems to be validated by the fact that languages avoid repetitions of consecutive hiatus contexts. We discuss this form of IO-relations in section 2.4.4. It seems to us, then, that there is ample evidence for postulating interonset relations, but we also believe that at this moment no consistent theory of such relations has been developed in the literature. In section 3.3, we also discuss a case of IO-licensing in Kammu.

2.4.3. Magic licensing

One final method of licensing the presence of nucleic positions devoid of audible segmental material targets a specific position that is claimed to precede clusters of the *sC* order. Kaye, Lowenstamm & Vergnaud (1990) have argued that such clusters are never tautosyllabic but, rather, are heterosyllabic, patterning the inter-constituent rhymal coda/onset relation, where /s/ resides in the coda position of a preceding rhyme (cf. Kaye, Lowenstamm & Vergnaud 1990 and Kaye 1992 for evidence in support of this argument). Given that the coda position, as has been motivated here, is a dependent position or complement, it follows that the presence of this position implies the presence of a rhymal nucleic head. Therefore, UG ensures that a nucleic position must be structurally present in such cases. Where previously in some approaches, the initial *s* of such clusters was considered to be a left-edge appendix of some type, GP has incorporated it into a well-formed prosodic domain headed by an empty nucleus:

(49)

Although the nucleic position is structurally requisite, this nucleus' inability to be phonetically realized must be justified. Kaye (1992) has called this type of licensing of a word-initial empty nucleic position *Magic Licensing* (ML). Of course, magically licensed empty nuclei involving /s/ need not occur at the word edge only, at least there is nothing in the formulation of magic licensing that requires this. Perhaps this means that M-licensing is too unrestricted since it allows /s/ segments to be distributed entirely freely.

Moreover, the possibility of allowing word-initial empty nuclei introduces a powerful tool into the government phonology model which can generate sequences of consonants on the surface, e.g. CØsC, VCCØsC, VCCØsCC, etc. A case in point is the analysis of Cyran & Gussmann (this volume) which invokes ML for Polish, allowing, in addition, that the magically licensed /s/ be preceded by an onset consonant. If this line of reasoning is possible, then having, for example, an additional coda-onset sequence preceding the M-licensed /s/ is also a possibility, as well as having a branching onset succeed it.

2.4.4. Proper government

Proper government (explained in section 2.2.1.4) is the most important mechanism used in GP (cf. Kaye, Lowenstamm & Vergnaud 1990) to satisfy the ECP. It involves an internuclear relation which allows the silence of an empty nucleus only if it is 'governed' by an adjacent fully contentful nucleus that is itself not 'properly governed'.

In our HDP approach, we derive the effect of 'proper government' in two steps. We assume that, first of all, there exists a structural government relation between an empty nuclear position and an adjacent filled position, forming a foot.[40] Given that this is so, we then establish a paradigmatic licensing relation which disallows heads to be silent. This disallows ungoverned empty nuclei from being silent since being ungoverned, these nuclei must themselves be heads and thus must be audible. This interpretation of proper government is based on the idea that phonotactics involves a kind of foot structure that is not necessarily isomorphic with the foot structure that produces rhythmic stresses. For discussion of this claim (which is not necessarily unproblematic), we refer to van der Hulst & Rowicka (1997), Rowicka (1999a,b), and van der Hulst (in press).

We would now like to argue that 'audibility' as such may not be the crucial property of ungoverned empty nuclei. As pointed out in Rowicka (1999b), Mohawk makes a distinction between two types of epenthetic vowels which in essence involves their 'phonological visibility'. Epenthetic vowels that are not counted in the computation of stress (the invisible ones) are precisely the ones that are properly governed by a full nucleus to their left. *Audibility*, then, is dependent on the segmental surroundings of empty nuclei, but their *visibility* depends on whether or not they enter into a head-dependency relation with a full nucleus.

At this juncture, we would like to formally distinguish three types of emptiness. In some languages we find nuclei that are invisible (and sometimes inaudible) when governed, while they must be visible (and necessarily audible) when they are ungoverned, and thus themselves heads. These we represent as nuclei which have a zero-level position that does not dominate anything. Strictly speaking, we refer to this type of emptiness as *empty zero-level position*, but in practice we use the term 'empty nucleus' interchangeably. If the empty content of such nuclei is not licensed, audibility results as a matter of phonetic interpretation; cf. van der Hulst & Ritter (1999) regarding the existence of a two-way discrepancy between phonetic events and phonological units. In phonological descriptions this phenomenon is usually called 'vowel epenthesis'. We assume that epenthesis does not involve the actual insertion of phonological elements, despite the fact that the 'epenthetic vowel' may vary from language to language (from schwa, to the high, non-front, unrounded vowel, to [i], or [u])[41]. The case of Mohawk demonstrates that even governed empty nuclei may be realized, showing that other factors may play a role in the realization of such nuclei. An empty nucleus can also be the head of a foot (in which case it becomes visible), but it can never be the ultimate head (UH) of a word, i.e. it can never bear primary accent. This idea is elaborated further in section 3.3 in our discussion of the phenomenon of minor syllables in Kammu.

In the second type of emptiness that we distinguish here, we encounter lexical non-epenthetic schwas which, like the previous type, can never be the UH of the word. However, these schwas are visible in that they count in the analysis of word accent. As pointed out in van der Hulst & Rowicka (1997) and further developed in Rowicka (1999a,b), the distribution of such schwas is thus parallel to the distribution of invisible empty nuclei. We propose that lexical schwas are represented as empty *segments*, rather than empty zero-level positions. By 'empty segment' we mean that the zero-level position dominates minimal segmental content in the form of a bare 'root node'. Such empty segments may arise through loss of the place node.

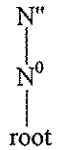
Finally, with respect to the third type of emptiness, there are languages that have non-low, non-front and non-round vowels in their phonemic inventory. Such vowels can be the UH of words. The representation of these high/back, unrounded vowels requires that a zero-level position dominate a root node filled with *the empty element*, formerly called the 'cold vowel'. In GP's original theory of elements (Kaye, Lowenstamm and Vergnaud 1985), this element had no 'hot feature' (i.e. no marked feature value, which in our view makes it contentless). Although some recent work in GP dispenses with this element, we maintain it in our theory (cf. Ritter 1995, 1998b), but distinguish it from the

elements A, I and U, by formally representing it as an 'empty' element. In fact, we might also equate this with the notion of empty place node. A case in point is the high central vowel in Turkish which has been proposed by Kaye (1990) to be represented by an empty nucleus. As pointed out in Polgárdi (1998), representing this vocalic segment in this way raises the problem that Turkish has a contrast between consonant-final words, which end in a silent empty nucleus, and words ending in a high central vowel on the surface. By appealing to the same type of representation, the distinction between the two different surface occurrences is lost (i.e. zero vs. [i]). The type of word ending in a high central vowel must be represented differently from the word-final nucleus that surfaces as silent. We claim that the difference between the two is that the overt, final high central vowel has an empty element (or empty place node; cf. 50c) while consonant-final words end in an empty nucleus devoid of any element or any root node (cf. 50a).

Summarizing we have argued for the following three types of emptiness:

(50) a. Empty zero-level position ("empty nucleus") Invisible (but possibly audible) if governed; otherwise, visible and audible cannot be the UH:

b. Empty root node ("empty segment") Visible and audible; cannot be the UH:

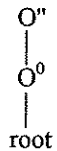


c. Empty place node ("empty element") Visible and audible; can be the UH:

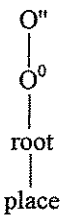
To complete this discussion of the notion of emptiness, we draw a parallel with the phenomenon of emptiness found in the domain of onsets. Here we find an additional type of emptiness, namely the O" place holder which lacks a zero-level position; cf. section 2.2.1.1. In addition, we find the analogues of (50), as shown below:

(51) a. Empty zero-level position ("empty onset") Inaudible, acting as a consonant (i.e. h-aspiré)

b. Empty root node ("empty segment") Audible laryngeals?

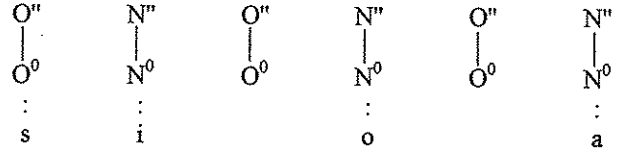


c. Empty place node ("empty element") Audible dorsals

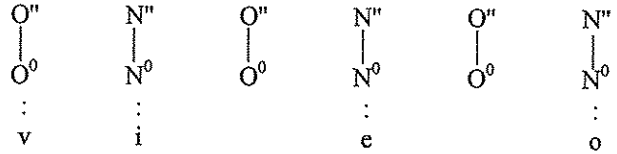


The question arises as to whether empty onsets are also subjected to some form of government. The claim that this might be so could be derived from the unlikelihood of finding non-initial, double hiatus contexts (52a, b):

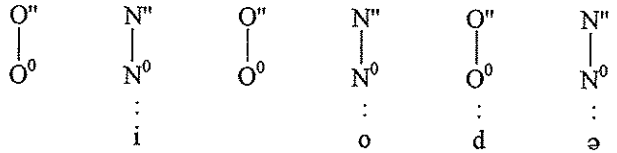
(52) a.



b.



c.



By observing the string in (52a) and (b) it would seem that a sequence of two empty onsets leads to ill-formedness, at least in a number of languages, whereas the presence of one empty onset is more acceptable (as in English *viola, piano, koala*). This could imply that an empty onset in such cases must be 'properly governed' by a following filled onset. The fact that (51c) is quite acceptable for a number of languages suggests that the reason for the more marked nature of

(52a) and (b) may be that an initial empty onset is licensed by the initial word-edge, just like an empty final nucleus can be licensed by the right word-edge (cf. 52c).

3. An HDP analysis of minor syllables

In this section, we examine the phonotactic word structure of Kammu, an Austroasiatic language spoken in a large area in northern Southeast Asia (Laos, Vietnam, Thailand, Burma, China). We base ourselves mainly on the excellent analysis of the phonology and morphology found in Svantesson (1983), in which a northern dialect of Kammu is described.

3.1. Introduction

Kammu, like other Austroasiatic languages, displays a difference between two types of syllables called *minor syllables* and *major syllables*.[42] From a phonological perspective, minor syllables are characterized as syllables which lack a vowel contrast, although phonetically, especially in careful pronunciation, there is often a schwa or [i]-like vocalic element present.[43] If these latter vocalic sounds can be construed as mere consequences of phonetic implementation, then the observed occurrences of consonant sequences created by minor syllables preceding major syllables seem to evidence very complex word-initial consonant clusters, such as *lptrap* 'lie face down (expressive)' (Svantesson 1983: 31). Analyzing a form like this as one syllable would entail allowing virtually unrestricted 'onsets' and frustrate any serious attempt to develop a cross-linguistic theory of syllable structure.

Minor syllables have recently drawn the attention of other researchers who propose analyses within a moraic approach to phonotactics and syllable structure. Shaw (1993), for example, analyzes minor syllables in terms of various types of 'degenerate syllable structure' (non-nuclear but moraic or non-nuclear and non-moraic syllables). Approaches of this sort do not address a question that, in our mind, is more fundamental than the question of 'representing' the minor syllables, namely the question of how minor syllables are distributed within words. In the HDP approach, minor syllables are represented as empty-headed syllables (empty zero-level positions), i.e. syllables in which the nuclear head (N^0) neither dominates a root node nor any segmental material. Apart from dictating a highly specific representation of minor syllables, HDP also appeals to licensing relations, discussed above in section 2, which control the distribution of these empty units. These central relations are discussed in further detail in section 3.3, showing that such licensing mechanisms readily offer a principled explanatory answer to the question regarding the distribution of minor syllables, without the need for resorting to templates, copying, melodic overwriting, or base-reduplicant correspondence constraints utilized in other approaches. An important, and perhaps somewhat surprising aspect of our analysis is that forms like *lptrap* cited above, rather than forming one monosyllabic (prosodic) word, form a structure consisting of several nuclei organized into two feet. In section 3.4, we draw attention to some interesting aspects of Kammu phonotactics which involve (long distance) relations between onsets which may be of importance for the development of a theory of interonset relations touched upon in section 2.4.2 above.

3.2. The data

Kammu is analyzed as a tone language with high and low tone. All major syllables contain a full vowel and bear a tone. According to Svantesson (p. 12), there are two types of minor syllables: tonal and non-tonal ones. Tonal minor syllables have a consonant as their 'syllabic element'; the consonant is usually a sonorant (as in the 'free' type in (53) below), but due to assimilation (involving identity with the 'coda' consonant of the major syllable; cf. section 3.4) obstruents may also be syllabic "in which case the syllabicity and tone is carried by a schwa". The non-tonal minor syllables are monoconsonantal, characterized by the absence of a 'syllabic' element, though they may contain a schwa in careful pronunciation only.

Svantesson (p. 31-34) presents a list of the minor syllables that he has found. For the purpose of illustration, we have extracted the following subset of items from his list (tone marks omitted). We have added a dot to indicate the separation between minor and major syllables:

(53) *Gloss*	*Non-tonal*	*Tonal*	
		Free	*Coda-assimilated*
a. 'to sow'	c.mɔɔl		
b. 'sowing season'		cr.mɔɔl (cf. cmɔɔl)	
c. 'soul'		hr.maal	
d. 'human being'		km.muʔ	
e. 'sleep'		sm.nis (cf. sis 'to sleep')	
f. 'flat (exp.)'			tp.miap
g. 'lie face down (exp.)'			lp.trap
h. 'bellows'			rt.yuut
i. 'pointed (exp.)'			lc.pec
j. 'to make angry'			ps.roos
k. 'straight (exp.)'			tt.ɲeet

The abbreviation '(exp.)' stands for expressive. This term refers to a class of Kammu words which have an 'iconic and connotative' meaning rather than a 'symbolic and denotative' meaning (Svantesson, p. 78-81). Expressives also have special phonological properties in the sense that certain consonant sequences which occur in the tonal, coda-assimilated minor syllable type (such as *tp.---, lp.---, lc.---, tt.---*, cited above) can only be found with expressives, although coda-assimilated minor syllables can also be found with causatives and nominalizing prefixes as well. We assume, however, that expressives do not have to be set apart from other words with respect to the analysis of minor syllables. Neither expressives nor other words seem to possess phonotactic properties which involve unique structural options.

Major syllables in Kammu start with an obligatory onset which may be branching (pl, pr, tr, cr, kl, kr, kw, khw). The nucleus contains a short or long vowel or a diphthong. Short vowels must be followed by a consonant. Long vowels may be followed by at most one consonant, but the range of consonants found in this position forms a subset of the total set of consonants permitted in the major syllable coda. The major syllable coda itself allows only a subset of the maximal consonantal contrasts found in the major syllable onset (i.e. aspirated stops, implosives, and laryngealized glides which can be found in the onset, do not occur in this coda position).

Minor syllables can be monoconsonantal (namely, non-tonal, cf. (52a)) or biconsonantal (i.e. tonal). According to Svantesson, a monoconsonantal minor syllable forms an onset without a following nucleus. A biconsonantal minor syllable, in his view, consists of an onset-coda sequence without an intervening nucleus. Hence, minor syllables do not allow branching onsets in his analysis. The consonants that may appear as minor syllable codas are drawn from the same set of consonants that appear in the major syllable codas except that *ʔ* and *h* cannot occur in the coda position of a minor syllable. As for the nucleus, we have already mentioned that minor syllables have no vowel contrast. Svantesson seems to represent this lack of contrast by omitting the nucleus constituent from his structural representation (cf. section 3.3). We, on the other hand, take another point of view and postulate the presence of a nuclear zero-level position that is empty. This alternative position is dictated by the theory we present here which requires the presence of a nucleic zero-level position as the head of the O"-N" adjunction site (cf. section 2.2.1 above), and is motivated mainly in the context of phonotactic patterns that involve vowel-zero alternations found in languages other than Kammu (cf. Kaye, Lowenstamm & Vergnaud 1985). As mentioned above, our main concern here is not the specific manner of representing 'degenerate syllables', but rather of representing their distributional properties.

A word in Kammu may consist of a major syllable alone, or a major syllable preceded by at most one minor syllable. Such types of words are called 'one-based words' by Svantesson. Words may also contain two or four word-bases, in which case we usually deal with words formed through reduplication. We limit our attention here to one-based words.

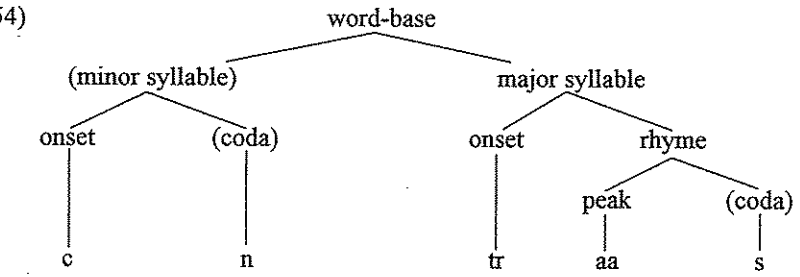
Words containing minor syllables can, but need not, be morphologically complex. Minor syllables may be prefixes themselves (as in *p.ŋiim* 'to lay', cf. *ŋiim* 'to lie'; and *pn.kleʔ* 'to show', cf. *kleʔ* 'to appear') or they may be composed of a root segment and an affix segment. For example, Kammu has left-edge infixes, as in *tr.nam* 'drumstick' which derives from *tam* 'to beat' and has the morphological makeup of /t +rn +am/. In such cases, the infixal consonants divide over the minor syllable and the major syllable. A minor syllable may also be part of a monomorphemic root as in *tr.haay* 'bee'. The conclusion, then, is that minor syllables are not morphological units. As Svantesson states (p. 35): "a minor syllable is a phonological (and phonotactic unit), while a prefix is a morphological (and semantic) unit".

A complete statement of the phonotactic structure of Kammu word bases is beyond the scope of this section, so it should be clear that our rendering of the data is far from complete. In section 3.3 we will go into a few additional aspects.

3.3. The HDP analysis

The structure of one-based words is analyzed by Svantesson (p. 15) as follows:

(54)



cn.traas 'lightning'

Looking at the structure of word bases from an HDP perspective, we immediately spot an obvious head/dependent relation between minor and major syllables. Minor syllables show the typical diagnostic property of a dependent: namely, that they lack several contrastive options that are possible for major syllables. As mentioned above, neutralization of contrast is the typical exponent of head-dependent asymmetries (cf. Dresher & van der Hulst 1995, 1998). The

structure that unites a minor and major syllable in the order of dependent-head has been identified as an iambic foot in various traditional and modern studies. However, we argue below that the iambic unit in question is not a foot but a prosodic word.

The starting point for our argument is found in the following important generalization made by Svantesson (p.16): "Except for assimilated minor syllables [cf. section 3.4], minor and major syllables can be combined almost freely (although far from all combinations occur)". We interpret this to mean that no phonotactic restrictions have been found that restrict the combination of the minor syllable consonants with the major syllable onset. This is important because the lack of phonotactic restrictions signals the occurrence of an intervening empty-headed syllable in HDP. Thus, in the case of monoconsonantal, non-tonal minor syllables, the lone consonant is analyzed as an onset followed by an empty nuclear position in our approach (#CØ.). This yields the effect that monoconsonantal minor syllables consist of one 'syllabic' (O"-N") domain.

A correlative argument for the structure of biconsonantal tonal minor syllables can also be given. As has been noted in section 2.2.3, following Kaye (1990), coda-onset sequences are typically characterized by specific phonotactic restrictions. The transition from minor to major syllable shows no sign of such restrictive patterns, and it therefore follows that the relevant consonants are not involved in an interconstituent syntagmatic content-licensing relation of minor syllable coda and major syllable onset. Instead, we therefore analyze such a series of consonants as a sequence of onsets (...CØ.CV...). Consequently, given the phenomenon of minor syllable 'coda assimilation', we show in section 3.4 that such a phenomenon is the result of an interonset relation between onset heads of the two syllable types. Given the view of constituent structure we have argued for in section 2, there must be an intervening nucleus (albeit empty in the sense of being devoid of both a root node and melodic material) following the right-most consonant of the minor syllable, which consonant we now analyze as an onset (cf. 55). Similarly, since no phonotactic restrictions are observed between the first consonant and the second consonant of a biconsonantal minor syllable, the possibility of these two consonants forming a branching onset is dispelled. Thus, the left-most consonant of a biconsonantal minor syllable is also postulated as being followed by an empty nucleus (#CØCØ.). Thus, we posit that biconsonantal minor syllables are 'bisyllabic' (containing two O"-N" domains) where each such 'syllable' is headed by an empty nucleus.

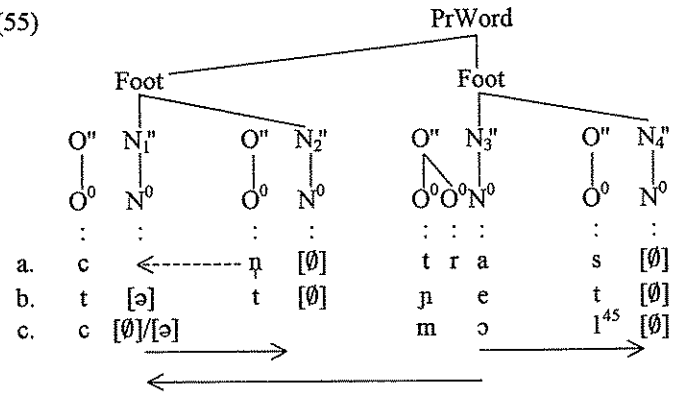
Looking more closely at the structure of the major syllable, we are forced to adopt a bisyllabic representation for it as well. We have seen that major syllables may contain either a short vowel, or a long vowel or diphthong. If they contain a short vowel, this vowel *must* be followed by a consonant. Long vowels and diphthongs can be followed by a consonant, but not necessarily. If we

focus on this last observation first, we have seen that, given the strict binarity claim of HDP (cf. section 2), the model predicts a bi-syllabic analysis for any VVC occurrence. This claim arises from the view that a consonant following a long vowel or diphthong cannot be licensed by the nuclear head since such a move would yield a ternary rhymal constituent structure containing three zero-level positions. In order to save the content of the surface post-nuclear consonant, this content is relegated to an onset position which, in turn, is followed by an empty-headed nucleus as prescribed by the theory.

What then is the structural position of consonants that follow a short vowel? There are two indications that these consonants also form onsets of empty-headed syllables. Firstly, there is no difference between the consonants that may follow a short vowel and those that may follow a long vowel or diphthong.[44] It therefore seems that this similarity offers support in assuming that the consonantal possibilities in both these cases occur in the same position, namely one that allows for a full range of consonantal contrasts, in other words, the onset head position. Secondly, the assimilation process mentioned earlier (which will be discussed in more detail in section 3.4) copies postvocalic consonants of the major syllable into the minor syllable coda (cf. note 44), irrespective of whether the vowel preceding the source of the copy relation is realized as a short vowel or long vowel or diphthong. This strongly suggests that the post-vocalic consonant occupies the same structural position in all cases. It is also interesting to note that while 'codas' of minor syllables can exist without a fully contentful vowel preceding them, 'codas' of major syllables must follow a full-fledged vowel. This asymmetry is predicted by our HDP approach which ensures that all positions within a non-analytic domain are licensed except for the ultimate head of the domain. In the case of the word-base in (55), the head of the entire prosodic structure is the first nucleus of the major syllable and, therefore, is always a contentful, audible vowel.

The above lines of reasoning (all very much dictated by standard aspects of HDP) lead us to postulating the following alternative to the structure in (54).

(55)



where: (a) = freely occurring tonal minor syllable
(b) = coda-assimilated tonal minor syllable
(c) = non-tonal minor syllable

One feature of this representation requires special attention. We posit final consonants to be represented as onsets, both following long and short vowels. We propose to represent the 'long' vowels as 'unchecked' vowels, i.e. phonologically short vowels that need not be followed by a consonant. Support for this view comes from the fact that Svantesson observes that 'short' vowels *must* be followed by a consonant. We take this to mean that these 'short' vowels are 'checked', i.e. phonologically short vowels that must be followed by a consonant within the same nucleus (cf. 37b).[46]

Notice that in (55) the word base has the structure of a full-fledged prosodic word, especially in the case of biconsonantal minor syllables. The word base consists of two binary branching feet organized into an iambic structure resulting in the prosodic word. The nucleus N_3 containing the full vowel forms the head of the prosodic word and bears the primary word accent. Since this is the maximal structure of a prosodic word in Kammu, and perhaps universally, the possibility of there being a second final consonant in the major syllable is obviated since the HDP model would analyze this consonant as an empty-headed syllable which would, in turn, project a degenerate foot that would be unable to be subsumed into the prosodic structure. Moreover, our approach also predicts the absence of having a possible branching 'coda' in the major syllable, which in our model would be analyzed as branching in the final onset, since the maximal extent of branching of the fourth and final onset is restricted due to its being the onset of the weak dependent of a foot. Given the claim that neutralization effects are found in dependent positions, the maximum branching structure of the onset is restricted to a singleton structure. The HDP model can therefore readily explain the absence of final consonant clusters in Kammu syllables.

In example (55), we have indicated by arrows beneath the words, some of the licensing relations that hold. These licensing relations hold within prosodic constituents. Thus they involve structural government relations between heads and dependents at two levels of prosodic structure: the foot and the prosodic word. Foot-level government is trochaic (cf. section 2), while word-level government is iambic.

In accordance with the distributional restrictions on empty nuclei, dependents within a foot are allowed to be empty-headed, if we assume that their emptiness is licensed by the foot head; and, indeed, in Kammu they always are (e.g. N_2 and N_4). Governors at this level, however, have so far been assumed to be 'audible'. This assumption is, as we have argued in section 2, quite crucial because it would otherwise be possible to line up an infinite number of empty-headed syllables forming binary groups (i.e. feet) of which the heads are as silent as the dependents.

We next address the question of what the role is, if any, of word-level iambic government. Let us turn back to what we have said about the vocalic properties of minor syllables. According to Svantesson, non-tonal minor syllables (which are monoconsonantal), as in /c.mɔɔl/ are only required to contain an audible nucleus (a schwa sound) in careful pronunciation. In the casual style of speech, however, the nucleus of monoconsonantal minor syllables is inaudible. This suggests that the iambic word-level government relation between N_3 and N_1 (the head of the word and its dependent, respectively) can license the occurrence of an empty-headed syllable in the dependent N_1 position. The audibility of governed, i.e. dependent, empty nuclei is not precluded, since, as in the Mohawk case (Rowicka 1999a,b) other factors than government may determine audibility.

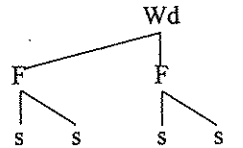
Turning to biconsonantal minor syllables, we note that the first nucleus N_1 is, in fact, always expressed phonetically. Either it contains a schwa sound (in the coda-assimilated cases), or it contains a sonorant consonant which is syllabic.[47] These facts are readily predicted by the approach we take here since the first nucleus N_1 (the head of the foot) must trochaically govern the second inaudible nucleus N_2 (the dependent of the foot) which is never realized. This initial nucleus, by virtue of being a governor, requires phonological visibility and thus a phonetic interpretation to surface in the form of a schwa or syllabic sonorant. Furthermore, since biconsonantal minor syllables carry tone, the stronger governor N_1 has the further duty of bearing the tonal accent. Thus if N_1 is a governor at the foot level, it must be audible even though it is, itself, iambically governed. It, therefore, follows that trochaic government supersedes the effects of iambic government.

Thus, we see that the complexity of Kammu consonantal clusters exhausts the maximum word structure that HDP allows as well-formed. The pattern that is found is predicted by the relations that hold within a prosodic word on the

condition that this structure is based on certain principles, most importantly binary relations holding at the foot and word level, which are trochaic and iambic, respectively. A prosodic word structure like this allows, of course, a sequence of four fully fledged syllables (as in Dutch *macaroni*). The nucleus that is most likely to reduce in such words in the direction of silence is the second one (the dependent in the weak foot), as in fact happens obligatorily in the English equivalent *m*[æ]*c*[ə]*roni*, which is also a possible option in Dutch. The weak syllable in the strong foot (i.e. the word-final nucleus) is much less likely to reduce; in fact, in Dutch and in English, reduction never takes place in this case. Notwithstanding this fact, both English and Dutch allow final empty nuclei (just like Kammu does), i.e. when the word ends in a consonant that follows a long or tense (unchecked) vowel.[48, 49]

In (56) we give the possibilities for the distribution of empty and silent nuclei in Dutch, English, and Kammu and we also list impossible patterns ('f' stands for 'full' and 'z' stands for 'zero' i.e. inaudible):

(56)



Dutch	f	f	f	f/z
English	f	z	f	f/z
Kammu	f	z	f	z
Imposs.	z	f	——	
Imposs.	——		z	——

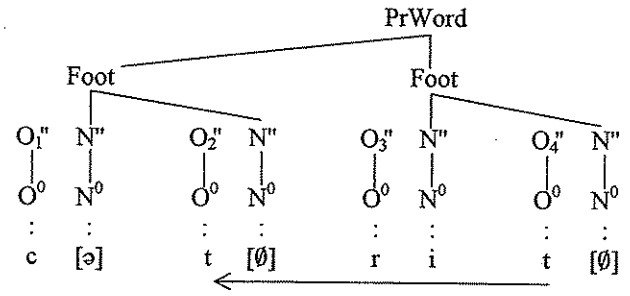
The typology in (56) reduces to the fact that governing heads cannot be inaudible, as claimed in section 2.

3.4. Interonset relations

In this section, we briefly look at certain phonotactic patterns, different from those mentioned in section 2.4.2, which also seem to point to the need for interonset relations. We start the discussion with the phenomenon of coda assimilation. Earlier we stated that the 'coda' (now identified as an onset) of minor syllables allows the same range of consonants that appear in the 'coda' (idem) of major syllables. It turns out, however, that the 'coda' of the minor syllables is much more restricted than the 'coda' of major syllables. In fact, this is what is to be expected if dependents typically show neutralization effects. Svantesson points out that the 'coda' of minor syllables may freely contain a sonorant

consonant, but that it can only contain an obstruent if this obstruent is identical to the obstruent occurring in the major syllable 'coda'. In other words, in the case of obstruents, the major syllable coda is reduplicated as the coda of the tonal minor syllable:

(57)

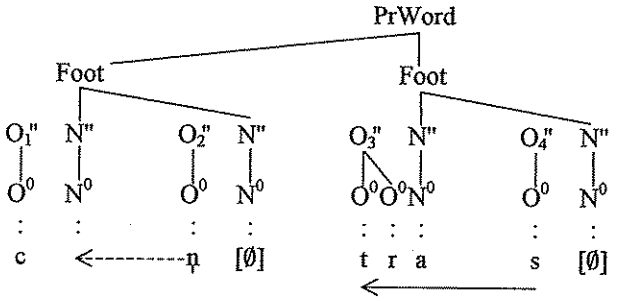


ct.riit '(exp.) not hear'

The pattern attested for the minor syllable 'coda' is very similar to a restriction on 'codas' in many languages, such as Japanese, in which the relevant position can only be occupied by a sonorant or the 'left half' of a geminate. The interesting fact in Kammu is that the "geminate" involves a non-local or long distance interonset licensing relation. We propose that in such cases, the 'coda' of the minor syllable, understood as O_2 above, is melodically empty and that one way of licensing it is by spreading melodic material from the major syllable 'coda' or O_4.[50]

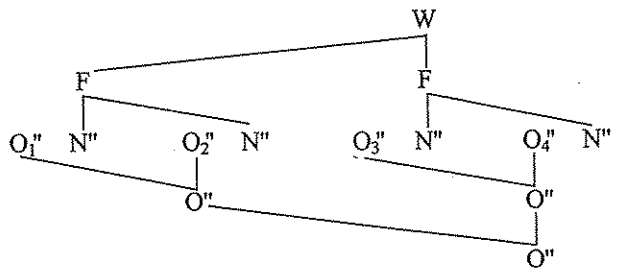
We have also observed another interonset relation. Major syllables that contain a branching onset almost without exception contain a closing consonant. This suggests a second licensing relation that radiates out from the right-most onset O_4 such that the presence of O_4 is necessary to license the maximal scope or range of the onset preceding it in terms of this O_3 onset's ability to branch:

(58)



We believe that the observed patterns point to a system of interonset relations which is quite independent from the system of internuclear relations sketched above. Given that we claim that onsets and nuclei reside on separate planes, indicating their independence, this proposal is neither problematic nor surprising:

(59)



In the system of IO relations in (59), the right-most onset governs the penultimate onset, evidenced by the fact that the presence of the final onset is required to license the branching penultimate onset. By analogy, we assume that the second onset governs the first. The only evidence for this that we have found so far comes from co-occurrence restrictions regarding what may occur in the onset and 'coda' positions of a minor syllable. For example, *l* and *r* cannot occur only as onsets in non-tonal minor syllables. Rather, their existence in the surface onset position of a minor syllable seems to depend on the presence of a segment in the coda position. Thus, in some way, minor syllable liquid onsets must be licensed by a following minor syllable onset in our approach. The third IO relation found to exist is when the right-most onset (O_4) governs the second onset (evidenced by the non-local geminate copying). There seems also to be a fourth IO relation found between the penultimate (O_3) and antepenultimate (O_2) onsets or, in other words, between the onset head of the major syllable and the 'coda' of the minor syllable. This relation results in occasional phonotactic events such as nasal assimilation, liquid dissimilation, and intrusive stop insertion between a nasal minor syllable 'coda' and a liquid major syllable onset (e.g. m.r > m.**br**).[51]

At this point we do not wish to elaborate on the speculative structure in (59). Clearly, more work is needed with respect to analyzing the IO relations here, and more generally, in order to gain a better insight into the workings of IO relations, which it seems to us are too poorly understood at the moment. We hope, however, that the above facts can be instrumental in developing an articulated theory of interonset relations. We pursue this enterprise elsewhere; cf. van der Hulst & Ritter (in prep.).

4. Concluding remarks

In this chapter we have proposed a theory that attributes a fundamental role to head-dependency relations and we have proposed a typology of such relations in the form of licensing mechanisms. We have applied our approach to the phonological word structure of Kammu to illustrate the workings of the theory. The traditionally recognized notion of minor syllable has been reconstructed in terms of our theory of head-driven phonology. It should be clear that our analysis offers explanatory insights with respect to surface facts that may at first seem perplexing and chaotic. In addition, we believe that our proposals nicely illustrate how a sharply articulated representational theory clearly leads the way to a particular approach. The resulting structures seem somewhat remote from the surface 'facts', but it must be borne in mind that the alternative of merely listing the initial clusters and concluding that Kammu has onsets that apparently violate binarity constraints or constraints that militate against complexity in general (the common practice in optimality theory today) because the output wishes to be faithful to the input, contains no explanatory value whatsoever. Structural descriptions of strings are cognitive and abstract by definition and structural descriptions that explain the observed patterns in terms of a limited set of structural principles and licensing relations, in our view, can make a reasonable claim to being explanatory.

Notes

1. In section 2.2.1.5 we discuss the exclusion of ternary structures involving embedding.
2. This is a right-headed word. In section 2.2.1.8 we discuss that the head at the word-level can be on the right or on the left.
3. Rifkin (1999) also proposes to impose a binarity constraint on the prosodic word.
4. Such longer words are often morphologically complex. Thus, words that are too long to form a phonological word, like compounds, prefixed words, and words derived with class II suffixes, typically form a prosodic phrase. While correlated with morphological simplicity, the (single) word domain can certainly be composed of lexical items that are morphologically complex as well. The morphology involved is what has been analyzed as 'level I' morphology in the treatment of English word structure.
5. We rule out the alternative structure $(\text{hippopota})_w$ $(\text{mus})_w$ by assuming that words with a schwa as the ultimate head are avoided. We justify this assumption in van der Hulst & Ritter (in prep.).
6. Even four syllable words can consist of two prosodic words: (cata)(maran), (a)(mérica). In van der Hulst & Ritter (in prep.) we argue that in the second case, rather than parsing this form into two prosodic words, a word embedded in another word (i.e. a clitic structure) may be also possible.

7. Except perhaps in the case of clitic structures, which seem to involve a structure in which a word (i.e. a non-analytic domain) is embedded within another word: [word X]$_{word}$; cf. Kaye (1995); cf. note 6.
8. That is not to say that the presence of onsets is completely arbitrary and not at all necessary. The presence of onsets, their inter-relations, and constraints on patterns of their absence are issues which will be broached later in section 2.4.2.
9. Polgárdi (1998) abandons this claim and assumes that onsets can occur without nuclei. The claim that nuclei cannot occur without onsets is a less compelling claim, even within government phonology, as has been pointed out in section 2.2.1.1.
10. Another indication for this is that processes like trisyllabic shortening (*contrite-contrition*) which are also prosodically-driven are not attested in onset clusters.
11. We discuss the GP representation of syllables that have been claimed to end in VCC in section 2.2.1.6. Cf. Brockhaus (this volume) on the GP treatment of very complex word-final clusters (involving the so-called 'appendix') in German. See also chapter 2, this volume.
12. In our typology of licensing relations this relation would be called a (non-structural) syntagmatic relation; cf. section 2.2.3.
13. In section 2.4.1 we show that, according to Kaye (1990), not all languages allow word final empty nuclei. It can therefore happen that 'coda' consonants are allowed word-medially, but not word-finally.
14. In early versions of GP (Kaye, Lowenstamm & Vergnaud 1990) empty nuclei would contain an 'identity element' or 'cold vowel'. This element would have no phonetic interpretation, producing an *inaudible* nucleus, unless the nucleus it was contained in was not licensed. In the absence of licensing, the identity element would be phonetically audible as a high, central vowel [i]. Alternatively, this element would, in such a case, receive the company of an 'inserted' element, like [A], producing a schwa-like sound. In later versions of GP, the identity element has been eliminated (cf. Kaye 1995), thus making an 'empty' nucleus truly empty. We abstract away from such distinctions here, the relevant point being that an empty nucleus must be licensed to remain inaudible, and will be audible if not licensed.
15. Van der Hulst & Rowicka (1997), Rowicka (1999a,b) make use of 'trochaic' proper government.
16. The more precise empirical observation is, however, that languages differ in enforcing audibility depending on whether the structures in (19) appear word-internally or word-finally ('yes' means 'allowed to remain silent'):

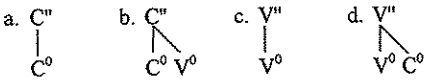
(i)	medial				final			
	cd-ons	nuc	br.ons	nuc	cd-ons	nuc	br.ons	nuc
Polish		yes		yes		yes		yes
French		no		no		yes		yes
English		no		no		yes		no
Tangala		no		no		no		no

To handle the cross-linguistic differences in this table, Charette must assume that the licensing power of silent nuclei is language-specific in two ways. Firstly, the licensing power of final silent nuclei can differ from medial empty nuclei. This happens in French, where final silent nuclei have licensing power while medial silent nuclei do not; the reverse, incidentally, is not attested in any language. In Polish, all silent nuclei have this licensing power. Secondly, the licensing power discriminates, according to Charette (1990), between whether the onset head must license a preceding coda (the silent nucleus, being adjacent, directly governs the onset head) or whether the onset head must act as a governor in a branching onset (the silent nucleus, being non-adjacent, in that case indirectly governs the onset head). In French final, silent nuclei license both directly and indirectly. In English, however, only direct licensing applies: again the reverse does not hold. These facts suggest two implications:

a. Medial licensing → Final licensing (i.e. final empty nuclei are stronger licensers than medial empty nuclei)
b. Direct licensing → Indirect licensing

Actually, the analysis of Charette is more complex in that the principle that enforces audibility is in conflict with proper government which allows empty nuclei to be silent if followed by a filled nucleus. Cf. Polgárdi (1998), Cyran & Gussmann (chapter 8, this vol.) and Ritter & Vago (1999) for different ways of treating this issue.

17. An alternative to Yoshida's analysis of closed syllable shortening is offered in van der Hulst & Rowicka (1997), Rowicka (1999a,b). The idea here is that the head of the long vowel shortens in an attempt to trochaically govern the empty nucleus.
18. Van der Torre (1998) uses the structure in (23b) for coda-onset sequences, thus making the coda a specifier to the onset.
19. This alternative has been suggested in Ritter & Vago (1999) to account for special cases of compensatory lengthening in which deletion of a coda consonant triggers lengthening of the preceding vowel (e.g. Hungarian dialectal [kü:d] vs. standard [küld] *küld* 'send'). In van der Hulst & Ritter (in prep.) we argue our case in greater length.
20. In the theory proposed in Van der Hulst (1995, 1996, 1999), the syllabic constituents have the following notation:

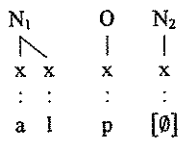


We do not adopt this notation here; cf. van der Hulst (in prep.) for discussion.

21. Onsets and rhymes are represented on different planes and thus not linearly ordered. Since, in HDP, the onset and rhyme constituents are part and parcel of the phonological representation, we could also assume that the linear order of segments within these constituents is not encoded phonologically. This issue is discussed in Golston & van der Hulst (1999), and in van der Hulst & Ritter (1999, in prep.).
22. Cf. Ritter (1995) on Hungarian.
23. The limitations arise from a syntagmatic requirement of homorganicity with the following onset (sect. 2.2.3), or paradigmatic restrictions on the position itself (sect. 2.2.2.2). We assume here that 'glides' can be in the nuclear dependent position, to form diphthongs, i.e. when they pattern with the closed syllables. In other cases, when they pattern with long vowels, diphthongs will be bi-nuclear; cf. van der Hulst & Ritter (in prep.).
24. At this point it might be better to replace the use of the term nucleus by the term rhyme.
25. The abandonment of treating long vowels as branching nuclei has also been proposed in the context of 'strict CV theory' (Lowenstamm 1996). cf. also Scheer (1996, 1998), Rowicka (1999b), Rennison (this volume). Lowenstamm, however, makes this proposal in the context of a theory that completely disallows branching syllabic constituents. Thus, what others analyze as branching onsets, are really two successive onsets for Lowenstamm, the first one being followed by an empty nucleus. In addition, no closed syllables are allowed, since nuclei cannot branch either. We do not follow Lowenstamm in his revolutionary proposal, although this does not exclude that many languages, which on the surface seem to display branching onsets and closed syllables, are in fact strict CV type languages. A case in point is the language Leti that van der Hulst & van

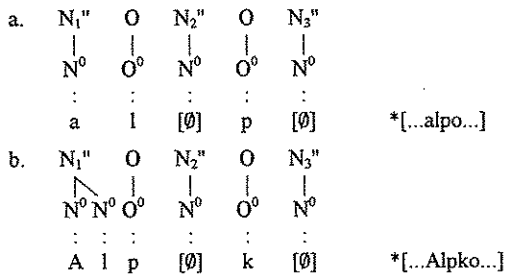
Engelenhoven (1995) and van der Hulst & Klamer (1986) analyze as strictly CV, despite the fact that words may start with two consonants, and exhibit occurrences of intervocalic consonant clusters and closed syllables word-finally.

26. The discussion of VCC is complicated by the fact that these strings could also involve a branching nucleus:



To block VCC in this case, we need Charette's (1990) notion of government-licensing; cf. (19a).

27. In van der Hulst & Ritter (in prep), we offer an analysis of cases in which the contrast in the vowel system does not involve length but a tense-lax opposition (as in Dutch; cf. van Oostendorp 1995, and German; cf. Vennemann 1991). Here we observe the phenomenon, that is parallel to what we have observed in type II languages, viz. that 'tautosyllabic' medial sequences $V_{tense}C$ and $V_{lax}CC$ are prohibited ('a' is a tense vowel, 'A' a lax one):



The analysis is that in such cases, parametrically, empty nuclei are simply not allowed medially. If, however, N_2 is the final nucleus in the domain, a domain-final empty nucleus being licensed, the structures [...al] and [...Alp] are well-formed. We propose a representation for lax vowels, as 'subcategorizing' for a nuclear dependent, in section 2.2.3, (37b).

28. In line with section 2.1, we do not reckon with so-called unbounded feet.

29. It has been claimed that if indeed feet are trochaic only, the head-orientation would switch with every subsequent level in the prosodic structure and this might lead to the expectation that the word must be right-headed:

onset/nucleus	left
syllable	right
foot	left
word	right

In our model, however, this tendency cannot be expressed, since the syllable is not a recognized level in the prosodic hierarchy. We will not dwell here on arguments against iambic feet; we see this as an independent issue.

30. In English, the word-head is on the right. This means that the rightmost foot is the head. Our example in (7) shows that there may be further conditions in the sense that the rightmost foot can only be the head *iff* it is branching and its head is a full vowel.

31. If a final syllable forms a monosyllabic foot and primary accent falls on the final syllable in a right-headed language, we must postulate a silent 'catalectic' syllable. The theory proposed here would otherwise skip the final non-branching foot, i.e. what has been called the 'LCPR'-effect (Liberman & Prince 1977).

32. In our theory, coda consonants also occur in the nuclear dependent position. This seemingly implies that the nuclear dependent position allows more contrast than the nuclear head. This paradox is addressed in van der Hulst & Ritter (in prep.)

33. As it may be noted, nasals are clearly absent from either the head or the dependent position when a licensing relation within the onset ensues. This is due to the ambiguous nature of nasals in that they bear characteristics of both sonorants as well as stops (prototypical obstruents). This hybrid state of nasals does not permit them to be construed as purely one or the other; therefore, they do not occur in dependent position due to their displaying occlusion in the oral cavity similar to oral stops, and they do not occur in the head position of a licensing relation due to their inclination to behave as sonorants.

34. There are other vowels which can be the first member of a heavy diphthong, such as /o/. In such cases, we rely upon our understanding of the structure of segmental expressions and claim that the internal structure of these segments contains the A element, the element most representative of vocalic pharyngeal aperture. In this way, the head position in a branching nucleic constituent either contains the A element by itself (realized as /a/) or some combination of the A element with another element.

35. An issue that needs further attention is to what extent inter-constituent licensing relations are bound to 'higher' constituents, such as the foot.

36. A language that allows branching onsets will not, however, disallow syllables like CCV, i.e. syllables that have a branching onset and a non-branching nucleus. The head-dependent asymmetry noted here holds between the parameters in this case and not between the onsets and rhymes that cooccur in a syllabic unit.

37. See Piggott (1991) and Polgárdi (1998) on the interaction between final licensing and coda licensing.

38. In this form N_1 is empty but not licensed and thus audible as [ɨ]. N_3 is licesend by domain-final licensing in this language.

39. The structure of a spurious geminate is claimed to be distinct from a true geminate (represented by a coda/onset domain) since spurious geminates permit long vowels to precede them while true geminates do not and, as a consequence, the latter show evidence of closed syllable effects such as vowel shortening. If spurious geminates are represented as two onsets, this predicts the possibility of either a long or short vowel before such type of geminate structure. A true geminate, on the other hand, comprising a relation between a rhymal coda and its following onset, would forestall the possibility of allowing a branching nucleus to precede this geminate relation for, otherwise, the resultant structure would contain a branching nucleus within a branching rhyme.

40. The term 'foot' here is not necessarily meant to coincide with the notion foot in metrical/stress systems, but rather is a term which captures the organization of nuclei; cf. van der Hulst & Rowicka (1997) for discussion of this point.

41. Why [a] is unlikely as the epenthetic vowel may follow from the high sonority of this sound. The optimal vocalic sound is an unlikely realization of a nuclear position that does not display vocalic contrasts.

42. Minor syllables are also sometimes referred to in the literature as 'presyllables', or 'sequisyllables' together with their base.
43. According to Diffloth (1976), vocalic contrasts in minor syllables may be found in the Aslian branch of languages.
44. There is an exception, namely that *ʔ* and *h* never occur after long vowels and very rarely after diphthongs. Perhaps this is due to the weak ability of these laryngeal segments, which lack any substantive place features/elements, to syntagmatically license the empty content of the adjacent nuclear dependent preceding them. Moreover, in further support of this notion that these laryngeal segments are weak licensors, it is also interesting to note that there is no minor syllable coda assimilation when *ʔ* and *h* do appear as major syllable codas following a short vowel.
45. This example in (b) is not meant to suggest that there is an empty sequence NON in the monoconsonantal minor syllable. Rather, the structure of the minor syllable in this case will be monosyllabic (i.e. one O"-N" domain) with only one empty nuclear position. Furthermore, it is not the case that the initial consonant /c/ could form a cluster with the major syllable onset /m/, since /cm/ is not one of the permitted onset clusters cited in the beginning of section 3.2 above. Moreover, even when a consonant has the phonotactic potential to become part of a major syllable onset cluster, it can still form its own minor syllable, producing minimal pairs such as *klook* 'bamboo bowl' and *k.look* 'slit drum'.
46. Short, or checked vowels cannot be followed in Kammu by more than one consonant. This implies that the coda position that lax vowels are subcategorized for must be empty (which is a type of requirement that occurs independently in languages which only allow the left-half of geminates to close syllables), and thus that final consonants following lax vowels are technically geminates; cf. (29b).
47. In fact, Smalley (1961) says syllabic nasals and liquids actualize as [iC] when syllabic and just [C] when nonsyllabic, i.e. when following full vowels or when onsets.
48. When the final vowel is short or lax (checked), a following consonant occurs in coda position, again like in Kammu.
49. At this point, we believe that the reason that the dependent syllable in the strong foot can be empty but not reduce stems from two notions: the first being that there are two different representations for positions that can be silent (i.e. an empty nucleus) and those that contain an overt schwa (i.e. an empty root node or an empty segment); section 2.4.4; the second being the role that paradigmatic domination relations play with respect to this position. A fuller explanation than this, however, cannot be given here due to space limitations.
50. A major syllable coda containing only a laryngeal element (*ʔ* or *h*) is not a strong enough licensor to license the O_2 position by melodic spreading. In such cases, the vowel of the major syllable must also be infixed in the minor syllable with the result that two prosodic words arise: *c.mɛh* '(exp.) become small' > *cɛh mɛh* '(exp.) small'.
51. Intrusive stop insertion could be a way of strengthening the governing onset by maximizing its structure since the ability of the major syllable onset to govern as a simple onset is impossible due to its being more sonorous than its dependent nasal onset.

References

Anderson, J.M. & C.J. Ewen
1987 *Principles of Dependency Phonology*. Cambridge: Cambridge University Press.

Borowsky, T.
1994 On the word level. In E. Kaisse & S. Hargus (eds.), *Studies in lexical phonology*. New York: Academic Press, 199-234.
Charette, M.
1990 License to govern. *Phonology* 7, 233-53.
Chomsky, N. & M. Halle
1968 *The sound pattern of English*. New York: Harper & Row.
Davis, S.
1999 On the distribution of /h/ and aspirated stops in American English. Ms. Indiana University. Paper presented at HILP 4 (Jan. 28-30, 1999).
Diffloth, G.
1976 Minor-syllable vocalism in Senoic languages. In P.N. Jenner, L.C. Thompson & S. Starosta (eds.), *Austroasiatic studies Part I.* University Press of Hawaii, 229-247.
Dresher, E. & H.G. van der Hulst
1995 Head-dependent asymmetries in phonology. In H.G. van der Hulst & J.M. van de Weijer (eds.), *Leiden in Last*. HIL Phonology Papers I. HIL Publications 1. The Hague: Holland Academic Graphics, 401-431.
1998 Head-dependency in phonology: complexity and visibility. *Phonology* 15/3.
Golston, C. & H.G. van der Hulst
1999 Stricture and structure. Minimalism in phonology. In B. Hermans & M. van Oostendorp (eds.), *The derivational residue*. Amsterdam and Philadelphia: John Benjamins.
Guerssel, M.
1990 On the syllabification pattern of Berber. Ms. Université du Québec à Montréal.
Harris, J.
1990 Segmental complexity and phonological government. *Phonology* 7, 255-300.
1994 *English sound structure*. Oxford & Cambridge: Blackwell.
Hayes, B.P.
1995 *Metrical stress theory: principles and case studies*. Chicago: University of Chicago press.
Helsloot, K.
1993 The prosodic word: an endless domain. *Proceedings* 17. Institute of phonetic sciences, University of Amsterdam, 129-146.
1995 *Metrical prosody. A template-and-constraint approach to phonological phrasing in Italian.* HIL dissertation 16. The Hague: Holland Academic Graphics.
Hulst, H.G. van der
1984 *Syllable structure and stress in Dutch*. Dordrecht: Foris Publications.
1995 Radical CV Phonology: The categorial gesture. In J. Durand & F. Katamba (eds.), *Frontiers of Phonology. Atoms, structures, derivations*. Essex: Longman, Harlow, 80-116.
1996 Radical CV phonology: The segment - syllable connection. In: J. Durand & B. Laks (eds.). *Current trends in phonology: Models and methods*. Vol. 1. CNRS/ESRI Paris X, 333-363.
1997 Primary accent is non-metrical. *Rivista di Linguistica* 8.
1999 Features, segments and syllables in radical CV phonology. In J. Rennison (ed.), *Phonologica 1996. Syllables!?* The Hague: Holland Academic Graphics.
in press Structure paradoxes in phonology. In Festschrift.
in prep. Principles of Radical CV phonology. Ms. HIL.

Hulst, H.G. van der & A. van Engelenhoven
1995 Metathesis effects in Leti. In H.G. van der Hulst & J.M. van de Weijer (eds.), *Leiden in Last*. HIL Phonology Papers I. HIL Publications 1. The Hague: Holland Academic Graphics, 243-267.
Hulst, H.G. van der & M. Klamer
1996 Reduplication in Leti. In C. Cremers & M. den Dikken (eds.), *Linguistics in the Netherlands 1996*. Amsterdam/Philadelphia: John Benjamins, 109-120. [Also appeared in M. Pearson (ed.), *Recent papers in Austronesian Linguistics*. UCLA occasional papers in linguistics 21, 1998, 147-158.]
Hulst, H.G. van der & N.A. Ritter
1998 Kammu minor syllables in Head-Driven Phonology. In E. Cyran (ed.), *Structure and Interpretation. Studies in Phonology*. Lublin: Folium, 163-182.
1999 No sympathy for opacity. Ms. HIL.
in prep. *The syntax of segments*. Monograph. HIL/Leiden University.
Hulst, H.G. van der & G.J. Rowicka
1997 On some parallels between unrealized empty nuclei and unstressed syllables. In G.E. Booij & J.M. van de Weijer (eds.). *Phonology in progress - progress in phonology*. HIL phonology papers III. HIL publications 5. The Hague: Holland Academic Graphics, 125-149.
Kaye, J.D.
1986 Government in phonology: the case of Moroccan Arabic. *The linguistic review* 6, 131-59.
1990 "Coda" licensing. *Phonology* 7, 301-30.
1992 Do you believe in magic? The story of s+C sequences. *SOAS working papers in linguistics and phonetics* 2, 293-313.
1995 Derivations and interfaces. In: J. Durand & F. Katamba (eds.), *Frontiers in phonology: Atoms, structures, derivations*. Essex: Longman, Harlow, 289-332.
Kaye, J. & J. Lowenstamm
1984 De la syllabicité. In F. Dell, D. Hirst & J.-R. Vergnaud (eds.). *Forme sonore du langage*. Paris: Hermann, 123-59
Kaye, J., J. Lowenstamm & J.-R. Vergnaud
1985 The internal structure of phonological elements: a theory of charm and government. *Phonology yearbook* 2, 305-28.
1990 Constituent structure and government in phonology. *Phonology* 7, 193-232.
Liberman, M. & A.S. Prince
1977 On stress and linguistic rhythm. *Linguistic inquiry* 8, 249-336.
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, ESRI, Paris X, 419-43.
Nespor, M. & I. Vogel
1986 *Prosodic phonology*. Dordrecht: Foris Publications.
Murray, R. & T. Vennemann
1987 Sound change and syllable structure in Germanic phonology. *Language* 59, 514-28.
Piggott, G.L.
1991 Apocope and the licensing of empty-headed syllables. *The linguistic review* 8, 287-318.
Polgárdi, K.
1998 *Vowel harmony. An account in terms of government and optimality*. HIL/LOT dissertation 3. The Hague: Holland Academic Graphics.

Revithiadou, A.
1999 *Headmost accent wins. Head dominance and ideal prosodic form in lexical accent systems*. LOT/HIL dissertation 15. The Hague: Holland Academic Graphics.
Rifkin, J.
1999 Ternarity is prosodic word binarity. Ms. MIT. Paper presented at HILP 4 (Jan. 28-30, 1999).
Ritter, N.A.
1995 *The role of Universal Grammar in phonology: a Government Phonology approach to Hungarian*. PhD dissertation. New York: New York University.
1998a Review of Y. Yoshida's dissertation 'On pitch accent phenomena in Standard Japanese'. *GLOT International* 3/6, 14-17.
1998b The unifying effects of proper government in Hungarian. In C. de Groot & I. Kenesei (eds.), *Approaches to Hungarian*, vol 6. Szeged: JATE, 41-60.
in press The effects of intrasegmental licensing. In M. Davenport & S.-J. Hannahs (eds.), *Proceedings of the Durham workshop on phonological structure*. The Hague: Holland Academic Graphics.
Ritter, N.A. & R.M. Vago
1999 Subsyllabic constituency in Hungarian: implications for moraic phonology and government phonology. In J. Rennison (ed.), *Phonologica 1996. Syllables!?* The Hague: Holland Academic Graphics.
Rowicka, G.J.
1999a On trochaic proper government. In J. Rennison (ed.) *Phonologica 1996: Syllables!?*. The Hague: Holland Academic Graphics.
1999b *Ghost vowels. A strict CV approach*. LOT/HIL dissertation 16. The Hague: Holland Academic Graphics.
Scheer, T.
1996 *A unified model of proper government*. PhD dissertation. University of Paris.
1998 A unified model of proper government. *The linguistic review* 15/1, 41-68.
Shaw, P.
1993 The prosodic constituency in minor syllables. In E. Duncan, D. Farkas & P. Spaelti (eds.), *The proceedings of the 12th west coast conference on formal linguistics*, 117-132.
Smalley, W.A.
1961 *Outline of Khmu? structure*. New Haven, CT: American Oriental Society.
Svantesson, J.
1983 *Kammu phonology and morphology*. CWK Gleerup.
Torre, E.-J. van der
1998 *sC-onset clusters and a new approach to rhymal adjuncts in government phonology*. Master's thesis. University of Leiden.
Tranel, B.
1987 *The sounds of French*. Cambridge: Cambridge University Press.
Vijver, R. van den
1995 *The iambic issue. Iambs as a result of constraint interaction*. HIL dissertation 37. The Hague: Holland Academic Graphics.
Vennemann, T.
1991 Syllable structure and syllable cut prosodies in Modern Standard German. In P. Bertinetto et al. (eds.), *Certamen phonologicum II*. Torino: Rosenberg & Selier, 211-244.

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