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Kammu minor syllables in head-driven phonology

Harry van der Hulst and Nancy A. Ritter

1. Introduction

In this article we will 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 in Svantesson (1983), who describes a northern dialect of Kammu.

Kammu, like other Austroasiatic languages, displays a difference between two types of syllables called minor syllables and major syllables.[1] From a phonological perspective, minor syllables are characterised as syllables which lack a vowel contrast, although phonetically, especially in careful pronunciation, there is often a schwa or [ɨ]-like vocalic element present.[2] 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). Analysing a form like this as *one* syllable would entail allowing virtually unrestricted "onsets" and frustrate any serious attempt to develop a crosslinguistic theory of syllable structure.

In this article we wish to examine the representation of minor syllables in the context of a government / licensing approach to phonology. Our version of such an approach is based on the concept that phonology is driven by head-dependent relations and that such relations underlie phonological representations and are the key to understanding phonological processes. Consequently, we have termed our approach Head-Driven Phonology (HDP) in which the core of the model consists of licensing mechanisms that serve to authorise the units that comprise phonological representations by referring to head/dependent relations of various sorts. One of the goals of Head-Driven Phonology is to analyse complex phonotactic patterns in terms of a highly restricted set of maximally binary head/dependent relations. Clearly, Kammu phonotactics forms an interesting testing ground for such a theory.

[1] Minor syllables are also sometimes referred to in the literature as "presyllables", or "sesquisyllables" together with their base.

[2] According to Diffloth (1976) vocalic contrasts in minor syllables may be found in the Aslian branch of languages.

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, analyses 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 minds, 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 will be represented as empty-headed syllables, i.e. syllables in which the nuclear head (N°) does not dominate any segmental material. Apart from dictating a highly specific representation of minor syllables, HDP also contains mechanisms which control the distribution of these empty units. The central mechanism relied upon for this purpose, originally introduced under the name Proper Government in Kaye, *et al.* (1990), will be discussed in further detail in section 2. Given that minor syllables are represented as empty nuclei, then the principles (outlined in section 2.1) that underlie the mechanisms which control the distribution of empty nuclear positions, 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 utilised in other approaches.

The structure of this article is as follows. We offer a description of our general approach in section 2, outlining, i. the principles that drive head/dependent relations, ii. the way these relations translate into licensing mechanisms, and iii. how these mechanisms translate into what is referred to as phonotactics. In section 3 we turn our attention to Kammu. An important and perhaps somewhat surprising aspect of our analysis will be that forms like *lptrap* cited above, rather than forming one monosyllabic (prosodic) word, form a structure consisting of four "syllabic" type units organised into two binary branching feet. In section 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. Section 5 closes this article with a brief summary.

We wish to make it clear that our report on Kammu is a preliminary one and that we intend to pursue our study of this interesting language as part of a greater research project on the cognitive aspects of phonology across languages. The present report aims at indicating the direction of analysis that we think will prove useful. In addition, our current analysis attempts to offer explanations to certain aspects of Kammu phonology, made extremely explicit in Svantesson's study, which deal with the phenomenon of minor syllables.

2. Head-Driven Phonology

The fundamental contribution of Dependency Phonology (DP; Anderson and Ewen 1987) is the claim that phonological structure involves head / dependency

relations at all levels of organisation (including intrasegmental organisation). 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) that the notion of headed binary constituent structure defines what is in common between morpho-syntactic and phonological (often called prosodic) structure.

Government Phonology (GP; Kaye, Lowenstamm and Vergnaud 1985, 1990) takes a very similar perspective regarding both the Structural Analogy Hypothesis and the organisation 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 (cf. Ritter 1995) more clearly than DP does. 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

A central tenet in both the theories of DP and GP is the head/dependent relation. We follow the spirit of DP and GP and adhere to the importance of this tenet in our approach of Head-Driven Phonology to the extent that we understand this fundamental relation to be a part of the innate structure of UG which underlies representations as well as the computational system in both the syntactic as well as the phonological components. We claim that this is the result of the *Head/Dependency Principle* of UG stated below in (1).

(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 including, i. hierarchically structural constituent relations involving government, ii. linear syntagmatic content licensing relations which yield the effects of phonotactics, and iii. domination relations which refer to the constituent status of positions with respect to the licensing of their segmental content. This last type of licensing permits heads to allow maximal segmental contrast while dependents are constrained as to what segmental material is permitted in such positions.

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

(2) BINARITY PRINCIPLE

All head/dependent relations are maximally binary.

This principle, together with the principle as formulated in (1), allows for the presence of either a head alone, or a head and a dependent, but never a dependent alone. The principle in (2) also rules out the possibility of the same head governing two different dependents, either in a bidirectional fashion (*d←H→d) or in a nested fashion (*H→d1/d2).

According to the Head/Dependency Principle, every phonological object or entity (including elemental material) will either be a head or a dependent, and when a head at one level, this object can certainly form a unit which is a dependent at a higher level. This recursion yields the effect of subsuming all material into a hierarchical prosodic structure. Within this overall prosodic structure, we encounter a layer which counts as the maximal unit requiring no morpho-syntactic complexity. We refer to this unit as the *non-analytic* domain. This non-analytic domain, while defined by morphological simplicity, can certainly be composed of lexical items that are morphologically complex as well.

A statement must then also be made concerning the object which is the head of this non-analytic domain. We define the «head» of this domain to be the nucleus which projects as head at all levels up to the topmost node of the domain. This ultimate head (UH) is the strongest, most viable head in the structure, and, as a result, a condition on its content arises, 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. It thus becomes the site for maximal contrast (cf. Dresher and van der Hulst, to appear). It also follows from being free that the possibility of this ultimate head being empty never exists since, as will be discussed in section 2.2.2 below, the justification of an empty position is controlled by, and thus dependent upon, another nuclear position which would mean that this position could not be free if empty. Other nucleic heads, while heads in themselves, would be structurally 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.

2.2. Licensing mechanisms

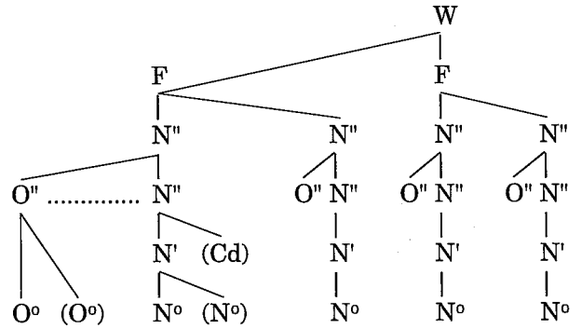
The principles of Head/Dependency and Binarity defined above work together and are manifested in terms of structural government-type relations and content licensing mechanisms.

2.2.1. Structural licensing

Structural government relations 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. In this case, we say that the head, which is the "governor", governs its dependent "governee" by virtue of the governor c-commanding its governee. In this way, the notion of strict locality with respect to government need not be stipulated but falls out as a result of the definition of government being a c-command relation between sisters of some mother node. This governing relation ultimately yields a universal structural schema of the onset (O) and rhyme (R/N") domains, the foot, the word, and in so doing, specifies the notion of the wellformedness of each of these constituent entities and how they relate to one another. Example (3) illustrates the hierarchical architecture based on this notion of government relations.

(3)



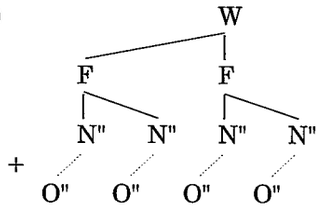
Beginning from the terminal points, it should be noted that in our approach we do away with skeletal x-slots. The zero-level constituents (such as Nº) serve as the markers which make the positions visible to the phonology as viable entities which are subject to the principles of headedness, binarity and, a third principle, discussed below in section 2.2.2, the Empty Category Principle. 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. Constituents which project from a zero-level head, however, are subject to the aforementioned principles since being at the zero-level identifies these objects as being phonologically relevant. Nuclei always have zero-level heads since they are the base-heads of the rhymal N" projection (which projection also potentially participates in an onset-rhyme domain) and higher level projections.

(4)

W	*word level*
F	*foot level*
N^{max}	*nuclear projection level*
Nº	*zero-level (nuclear head)*

It then logically stands to reason that there can be no projection, let alone any type of domain, if there is no head made visible to the phonology. This thus seems to imply that nuclei are always phonologically relevant and that their projections are what comprise a prosodic structure. Onsets, on the other hand, can be missing at the zero-level, and whether present or not, are not 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 positing onset constituents as *adjuncts* to N". This adjunction site could be considered as 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 (5) illustrates this concept.

(5)



This adjunction acts as an interleaving relation between the onset and nucleus and is in itself a type of head/dependent relation which allows the existence of a licensing relation of a particular type (a syntagmatic content licensing one; cf. 2.2.2 below) to hold at the zero-level between an onset head and a nucleus head. A further discussion of how syllable typology is derived from this type of licensing will be discussed below in section 2.3.

Returning to the notion of structural licensing and the hierarchical structure in (3), it should be noted that the direction of the government head/dependent relation is universally left to right (left-headed) within the most minimal of constituent domains, i.e. at the zero-level within the onset constituent and within the nuclear constituent. The direction of the government head/dependent relation above the onset/nuclear constituent interface level, namely between "syllables" (N") forming a foot is parametrically selected, as is the direction of government between feet to form a word.

The last point we which to address concerning the schema in (3) is the representation of the coda (Cd). The coda is analysed as a specifier of N". 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 cannot be governed in the sense of c-commanded by the nuclear head. The nuclear head can only c-command and thus govern its dependent complement under N'. The intermediate bar level (N') is not considered a head in our approach (only zero-level or maximal projections are heads) and therefore is also unable to govern the coda position. Consequently, the coda position is not structurally licensed

and requires extra licensing (in the sense of syntagmatic content licensing; cf. 2.2.2) for it to be anchored or integrated into the structure. Given the principle of binarity and the fact that a nuclear head projects a maximal constituent, namely N", then when there is no structurally licensed nuclear dependent, the specifier coda (being licensed from outside N") may be assumed into the N" constituent, allowing for some type of head/dependent relation to be created between the nuclear head and the more remote coda (perhaps one of content licensing). However, when the nuclear head structurally licenses its nucleic complement, the maximal scope of constituent branching is satisfied and the specifier position is precluded from being assumed into N". This predicament accounts for the mutually exclusive occurrence of the coda and the nuclear dependent in our approach.

The structural licensing relations given here also correctly predict that there is a closer relation between a nuclear head and its nuclear dependent than between a nuclear head and its specifier coda. Furthermore, by analysing the coda as a specifier and the onset as an adjunct to the maximal rhymal constituent (N"), such a representation points out that there may be a closer relation between a nuclear head and its following coda than between a nuclear head and its preceding onset.

2.2.2. Content licensing

As discussed above in the case of the coda, not all zero-level positions are structurally licensed; yet, for example, in languages that have codas, this coda position must somehow be incorporated into the structure. Since we claim that head/dependent relations are the underlying method of unification in cementing together a prosodic structure or constellation, we propose that there are other forms of head/dependent relations which participate in gluing together a prosodic structure. These types of relations, however, refer to licensing the content, or lack of content, within a position. There are two types of content licensing: one which is paradigmatic and refers to positional domination relations and the other which is syntagmatic resulting in phonotactic effects.

Paradigmatic licensing relations involve two types of situations. The first type makes 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 segmental 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 contrasts than dependent positions and that dependent positions display effects of neutralisation. The second type of paradigmatic licensing relation subsumes the notion of edge effects. A more in-depth discussion of these types of paradigmatic licensing relations can be found in van der Hulst and Ritter (in press, in preparation). The remainder of this section will focus on the other content licensing relation mentioned above, namely syntagmatic content licensing.

Syntagmatic content licensing occurs linearly between adjacent units but does not imply constituency. It can be within a constituent, e.g. labial dissimilation between an onset head and onset dependent within the onset constituent. It can

also be between zero-level positions belonging to different constituents (inter-constituent), e.g. homorganic nasals, partial geminates between a coda and following onset, or labial dissimilation between an onset dependent and following nuclear head. As will be discussed below, it is this type of relation that also accounts for the interleaving of the nuclear head and preceding onset head to yield the effect of alternating consonant/vowel patterns.

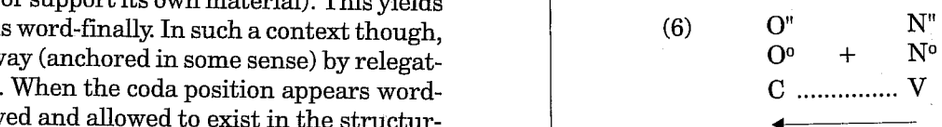
An example of how syntagmatic content licensing works between constituents can be seen with respect to the coda. Since the coda position is not structurally licensed, then when it appears at the end of a lexical item or prosodic unit, it cannot be maintained there and drops off. Correlatively, since this position is structurally unlicensed, it is unable to support dependent segmental material (assuming that structural licensing implies an object is "strongly" licensed in the sense that it can thus in turn license or support its own material). This yields the effect that there are no coda positions word-finally. In such a context though, this content can be licensed in another way (anchored in some sense) by relegating it to a viable licensed onset position. When the coda position appears word-medially, however, its content can be saved and allowed to exist in the structurally unlicensed specifier coda position by an adjacent following onset head position. The fact that this content can be saved word-internally follows from a head/dependent relation that takes the form of syntagmatic content licensing. Since this structurally unlicensed or weakly licensed coda position cannot support its own content, its content is dependent on the content of the head of this inter-constituent relation in which it finds itself, and, as a result, the content of this weakly licensed dependent position is severely restricted. This type of content licensing relation is so strong that by saving the content of a structurally unlicensed position, it saves the position as well. The Coda-Licensing Principle of GP (cf. Kaye 1990), which seems to be more of an ad-hoc stipulation than an actual principle, can now be explained as a consequence of structural licensing, including the notion of government as c-command, combined with syntagmatic content licensing, and thus no longer has to be posited as a separate and distinct principle in itself.

Another type of content licensing that exists is the licensing of empty content. In accordance with another principle of UG called The Empty Category Principle (ECP), empty positions must be licensed, in the sense of permitted to remain empty. This principle of the grammar serves to constrain *ad hoc* appearances of empty positions as well as the possibility of having a string of consecutive empty objects. Proper Government is the mechanism used in GP (cf. KLV 1990) to satisfy the ECP and describes an internuclear relation which allows the emptiness of a nucleus only if it is governed by an adjacent fully contentful nucleus that is itself not properly governed. In our HDP approach, we claim this internuclear relation stems from a head/dependent relation of content licensing which exists between a contentful nucleus (head) and an empty nuclear position (dependent). As in GP, in our approach when an empty position cannot be content licensed, it is not permitted to remain empty and thus must become audible

in some way.[3] Empty nuclei which can be validly content licensed can remain empty. However, as will be seen in the case of minor syllables in section 3, if an empty nucleus is also a structural governor, the governing status of this nucleus allows for the possibility (but not the necessity) of its being audible in only the most restricted way, namely as a schwa.

2.3. Deriving syllable typology

In the cases of languages where onsets are obligatory and nuclear heads must be preceded by onset heads, we analyse this as a strict form of linear syntagmatic content licensing which can only occur under adjacency. The content licensing mechanism relied upon here presupposes a head/dependent relation which is realised by the the O-N adjunction discussed above in section 2.2.1.

(6)


A vowel in such cases wants stricture to directly precede it and so has a strong need to license a preceding zero-level position which contains stricture. It is able to discharge this need to license when an adjacent contentful onset head precedes it. If this relation between a nuclear head and an onset head is not obligatory, i.e. it exists but need not at all times, then this allows for the possibility of no consonant preceding a vowel (∅V). Since content licensing of the onset head by the vowel occurs under adjacency, this also explains why languages which call for an obligatory onset, do not have branching onsets since the presence of an onset dependent would violate the adjacency required for the vowel to content license the onset head. However, when this form of content licensing is not obligatory, branching onsets are also allowed. The obligatory presence of an onset head is not a structural necessity nor a parameter but, rather, as we have tried to explain here, is a head/dependent relation between a nuclear head and an onset head. Given that such a content licensing relation exists, this predicts that CV is the unmarked syllable type and may more readily explain the markedness in languages of having a series of more than two vowel hiatus contexts.

This type of content licensing relation between an onset and nucleus is also able to explanatorily account for the observation that strict CV languages do not have codas. In some way, it seems as if the obligatory presence of the onset excludes the possibility of a coda. This follows from our analysis of codas having to be content licensed by a following onset. However, if the onset's content itself requires licensing by the following vowel, the onset, being an object that receives

[3] There are different ways in which languages choose to realise empty nuclear positions. For a fuller exposition on the subject of empty nuclear positions, nuclei with "schwa" as a reduction vowel, and nuclei with contrastive (high) central vowels, see van der Hulst and Ritter (in press, in preparation).

licensing, is not strong enough to be a content licenser, in turn, for another object. Since the onset is not a valid content licenser for the coda, the coda is not licensed and thus not subsumed into the prosodic structure. This notion of an object being unable to be a licensor if it, itself, requires licensing, is also found in the licensing of positions with empty content (cf. 2.2.2 above).

3. An HDP analysis of minor syllables

Kammu is analysed as a tone language with high and low tone. All major syllables contain a full vowel and bear a tone. According to Svantesson (1983:12) there are two types of minor syllables: tonal and non-tonal ones. Tonal minor syllables contain a consonant as their "syllabic element"; the consonant is usually a sonorant (as in the "free" type in (7) below), but due to assimilation (involving identity with the "coda" consonant of the major syllable; cf. section 4) obstruents may also be syllabic "in which case the syllabicity and tone is carried by a shwa". The non-tonal minor syllables are monoconsonantal, characterised 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 found. For the purpose of illustration, we extracted the following subset from his list (tone marks omitted). We have added a dot to indicate the separation between minor and major syllables.

(7)	*Non-tonal*	*Tonal*		*Gloss*
		Free	*Coda-assimilated*	
a.	c.mɔɔl			'to sow'
b.		cr.mɔɔl (cf. cmɔɔl)		'sowing season'
c.		hr.maal		'soul'
d.		km.mu?		'human being'
e.		sm.nis (cf. sis 'to sleep')		'sleep'
f.			**t**p.mia**p**	'flat, exp.'
g.			**l**p.tra**p**	'lie face down, exp.'
h.			**r**t.yuu**t**	'bellows'
i.			**l**c.pe**c**	'pointed, exp.'
j.			**s**.roo**s**	'to make angry'
k.			**t**t.ɲee**t**	'straight, exp.'

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 1983:78-81). 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 nominalising prefixes as well. In this article 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 start with an obligatory onset which may be branching [pl, pr, tr, cr, kl, kr, kw, khw]. Their 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 laryngealised glides which can be found in the onset, do not occur in this coda position).

Minor syllables can be monoconsonantal (namely, non-tonal cf. (7a)) 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. below). We, on the other hand, take another point of view and postulate the presence of a nuclear constituent that is void of segmental material. This alternative position is dictated by the theory we adopt here which requires the presence of a nucleic position as the head of an O-R domain (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, and Vergnaud 1990). 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". 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.

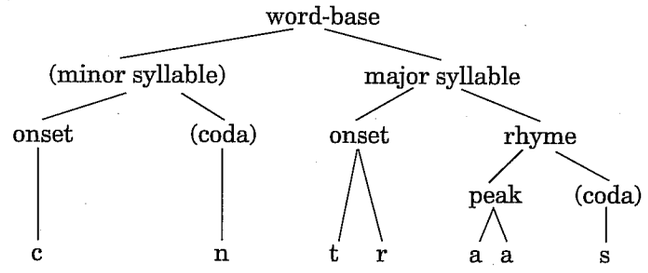
Words containing minor syllables can, but need not, be morphologically complex. Minor syllables may be prefixes themselves as in [p.ŋiim] 'to lay' (cf. [ŋiim] 'to lie', and [pn.kleʔ] 'to show' vs. [kleʔ] 'to appear') or they may be composed of a root segment and an affix segment. For example, Kammu has 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 article, so it should be clear that our rendering of the data is far from complete. In section 4 we will go into a few additional aspects.

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

(8)



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. Neutralisation of contrast is the typical exponent of head-dependent asymmetries (cf. Dresher and van der Hulst, to appear). 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 will argue below that the iambic unit is not a foot but a prosodic word.

The starting point for our argument is found in the following important generalisation made by Svantesson (p.16): "Except for assimilated minor syllables [cf. section 4], minor and major syllables can be combined almost freely (although far from all combinations occur)". We interpret this in such a way that no phonotactic restrictions have been found which 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 analysed 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-R) domain.

A correlative argument for the structure of biconsonantal tonal minor syllables can also be given. As has been noted in section 2, following Kaye (1990), coda-onset sequences are typically characterised by specific phonotactic restrictions which reflect what Murray and Vennemann (1987) have called the Syllable Contact Law: codas are not less (and perhaps, more) sonorous than the following

onset. 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 licensing relation of minor syllable coda and major syllable onset. Instead, we therefore analyse such a series of consonants as a sequence of onsets (...CØ.CV...). Consequently, given the phenomenon of minor syllable "coda assimilation", we will show in section 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 above, there must be an intervening nucleus (albeit empty in the sense of being devoid of melodic material) following the rightmost consonant of the minor syllable, which consonant we now analyse as an onset (cf. 9). 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 (*#CCØ.). Thus the leftmost 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-R 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) as well as the structurally unlicensed status of the coda, our model predicts a bisyllabic 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 post-nuclear coda consonant, this content is relegated to an onset position which, in turn, is followed by an empty-headed nucleus as prescribed by the theory.

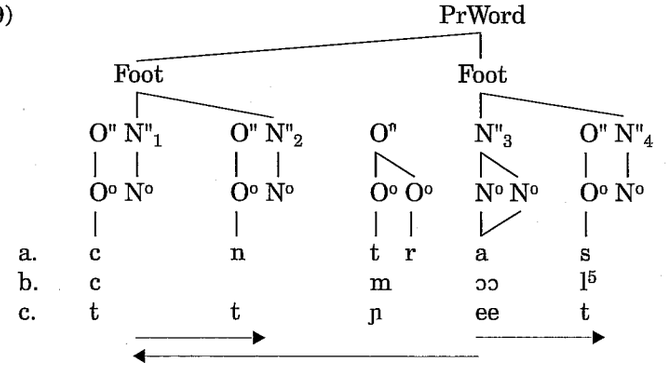
What then is the structural position of consonants that follow a short vowel? There are two indications that these consonants also form onsets of empty-headed syllables. Firstly, there is no difference between the consonants that may follow a short vowel and those that may follow a long vowel or diphthong.[4] It therefore seems that this similarity offers support in assuming that the consonantal

[4] 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 licensers, 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.

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 4) copies postvocalic consonants of the major syllable into the minor syllable coda (cf. footnote 4), irrespective of whether the vowel preceding the source of the copy relation is realised as a short vowel or long vowel or diphthong. This strongly suggests that the postvocalic 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 (8), 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 (8).

(9)



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

Notice that 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

[5] This example in (b) is not meant to suggest that there is an empty sequence NON. Rather, the structure of the minor syllable in this case will be monosyllabic with only an 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 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'.

binary branching feet organised in 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 analyse 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 analysed as branching in the final onset, since the maximal extent of branching of the fourth and final onset constituent is restricted due to its being the onset of the weak dependent of a foot. Given the claim that neutralisation 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 (9), 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 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.

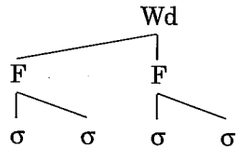
We will now address the question of what the role is, if any, of word-level iambic government. Let us turn back to what we have said about the vocalic properties of minor syllables. According to Svantesson, non-tonal minor syllables (which are monoconsonantal), as in [c.mɔɔl] are only required to contain an audible nucleus (a schwa sound) in careful pronunciation. In the casual style of speech, however, the nucleus of monoconsonantal minor syllables is empty. This is only possible if the iambic word-level government relation between N_3 and N_1 can license the occurrence of an empty-headed syllable in the dependent N_1 position.

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, or it contains a sonorant consonant which is syllabic. These facts are readily predicted by the approach we take here since the first nucleus N_1 must trochaically govern the second inaudible nucleus N_2 which is never realised. This initial nucleus by virtue of being a governor, allows a phonetic interpretation to surface in the form of a schwa. Furthermore, since biconsonantal minor syllables carry

tone, the stronger governor N_1 has the further duty of bearing the tonal accent. This analysis also implies that syllabic consonants (at least those that follow an empty-headed nucleus, as in (9a)) must be interpreted as realisations of empty nuclei when such nuclei have a governing role.[6] Thus if N_1 is a governor at the foot level, it must be audible even though it is 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 structure that HDP allows as wellformed. 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 *mac*[a]*roni*). The nucleus then that is most likely to reduce in the direction of silence is the second one (the dependent in the weak foot), as in English *mac*[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-headed syllables (just like Kammu does), i.e when the word ends in a consonant (...C∅). In such a case, the final overt vowel (emboldened) is the head of a foot: [(C)**V**C∅]=Foot. At this point, we believe 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 empty and those that are reduced (cf. van der Hulst and Ritter in press, in preparation) and 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. Instead a description of the options that occur and also of those that do not are summarised in (10) ("f" stands for "full" and "z" stands for "zero" i.e. inaudible).

(10)



Dutch	f	f	f	f
English	f	z	f	f
Kammu	f	z	f	z
Imposs.	z.....		.....	
Imposs.	.....		z	

[6] In fact, Smalley (1961) says syllabic nasals and liquids actualise as [i C] when syllabic and just [C] when nonsyllabic, i.e. when following full vowels or when onsets.

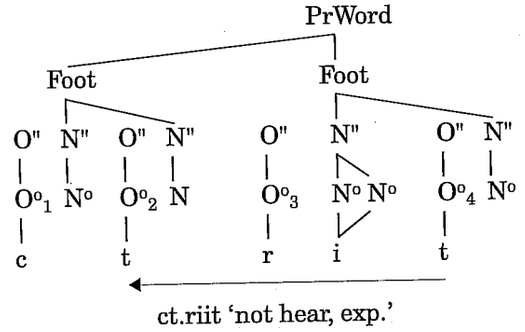
The typology in (10) reduces to the fact that heads (i.e. governing heads) cannot be inaudible, as claimed in section 2 (also cf. Rowicka, in press, this volume).

4. Interonset relations

Kaye (1990) proposes that an empty-headed nucleus can be licensed as silent by its being embedded within a governing domain comprised of two onsets in what he terms a (right-headed) interonset (IO) relation. The resulting effect is a "fake geminate". Cyran and Gussmann (in press) 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 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 may lie in the wish to limit the distribution of empty onsets. This seems to be validated by the fact that languages avoid consecutive repeated hiatus contexts. 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 this section we will not attempt to develop such a theory but rather "add to the confusion" by briefly looking at certain phonotactic patterns, different from those mentioned above, 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 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 neutralisation 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.

(11)

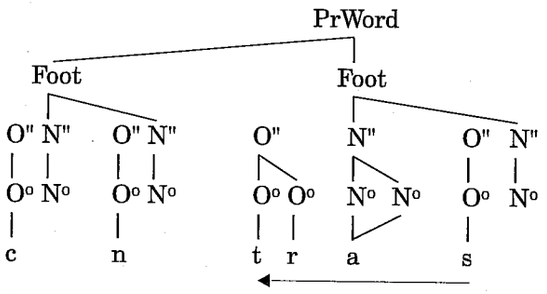


ct.riit 'not hear, exp.'

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 nonlocal 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.[7]

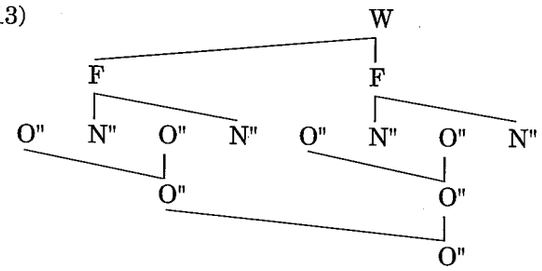
We have also observed another interonset relation. Major syllables that contain a branching onset almost without exception contain a closing consonant. This suggests a second licensing relation that radiates out from the rightmost onset O_4 such that the presence of O_4 is necessary to license the maximal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

(12)



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.

(13)



In the system of IO relations in (13), the rightmost 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

[7] A major syllable coda containing only a laryngeal element ([ʔ] or [h]) is not a strong enough licenser 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.mEh] 'become small, exp.' > [cEhmEh] 'small, exp.'.

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 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 rightmost onset governs the second onset (evidenced by the nonlocal geminate copying). There seems also to be a fourth IO relation found between the penultimate and antepenultimate 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**]).[8]

At this point we do not wish to elaborate on the speculative structure in (13). Clearly, more work is needed with respect to analysing 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 and Ritter in prep.).

5. Concluding remarks

In this article we have proposed an approach to the phonological word structure in Kammu. The traditionally recognised notion of minor syllable has been reconstructed in terms of our theory of Head-Driven Phonology. It will be clear that our analysis offers limited but somewhat better 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 far 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.

[8] Intrusive stop insertion could be a way of strengthening the governing onset by maximising 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.

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The prosodic hierarchy at work: lenition of voiceless spirants in Old Irish*

Krzysztof Jaskuła

This paper is devoted to spirant alternations in Old Irish. In this language original fortis fricatives alternate with their lenis counterparts in certain contexts. A number of scholars have regarded the distribution of spirants and the interchange between voiced and voiceless members of the class as irregular, and hence not susceptible to a principled interpretation. This is due to spelling inconsistencies and scribal errors, which in many cases obscured the cause of the phonological process of voicing and frequently led to misinterpretations. There exist, however, a number of examples which suggest that a certain regularity governed the distribution of both voiceless and voiced spirants. Moreover, the evidence suggests that lenis fricatives, unless they are original, occur only in contexts where lenition is regularly found, that is, in weak positions in a word.

The analysis presented below adopts the concepts and principles of *Government Phonology* (Kaye, Lowenstamm and Vergnaud (KLV) 1985, 1990, Charette 1990, Harris 1994). The paper is organised as follows: section 1 outlines some general principles of Government Phonology (GP) with regard to the notion of licensing; section 2 introduces the problem of spirant alternations in Old Irish; in section 3 it is proposed that the licensing principles of GP offer a possible solution to this problem.

1. Licensing in Government Phonology and the theory of elements

The concept of *phonological licensing* is central to Government Phonology. Licensing defines relations among units in the phonological hierarchy, both prosodic and melodic. Under *prosodic* licensing, each unit in the prosodic hierarchy must belong to some higher-order structure. *Autosegmental* licensing determines the attachment of melodic material to skeletal positions. The skeletal and constituent dimensions are integrated into a hierarchy of larger domains: the foot and the word. The ultimate head of the domain is the source of licensing power that is transmitted to the lower levels of projection. These relations are formalised in the following principle (Kaye 1990:306, Harris 1994:156).

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