Parameters and scales in syllable markedness:
the right edge of the word in Malayalam

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1. Introduction

Cross-linguistic preferences in the form of asymmetries known as markedness effects occupy a central position in most currently entertained phonological frameworks. The convergence of markedness phenomena observed in language acquisition, typology, historical change, as well as synchronically attested patterns of segment systems and their phonological behaviour ensures that linguists cannot afford to lose sight of the significance of capturing these effects. Thus, the fundamental goal is similar to most approaches, even if the means may differ.

Among the typically discussed asymmetries are those involving subsegmental structures. For example, sonorants are generally found to be voiced, therefore, a combination [+nasal, -voice] must be treated as marked. In underspecification models the feature [-voice] must be present in the underlying representation of sonorants, while [+voice], which is predictable, may be supplied by redundancy rules. Markedness effects are also observed in the distribution of segments within a word. Word-final devoicing of obstruents in Polish is an example of positional neutralisation of contrast whereby a given position, say, the coda, is unable to maintain the marked laryngeal specification in this language. The direction of this neutralisation is towards the universally unmarked opposition among obstruents, that is, [-voice]. It should be noted, however, that models, which employ binary features, must resort to quite arbitrary statements concerning the marked values of particular features. These statements reflect the observable tendencies but do not explain why the opposite designation is ruled out. In this respect, systems with privative features seem to fare better.

Binary feature systems also suggest that the markedness oppositions are of a bilateral nature, however, multilateral oppositions involving markedness scales are frequently found in languages and deserve equal attention (e.g. Trubetzkoy 1939). One example of such a scale is the relative sonority of segments which at least when applied to the coda position predicts quite well the preferences for the types of segments that may occur in this context.

Another preference scale may be observed concerning relative syllabic complexity. It is generally accepted to treat CV as the optimal syllable structure. It is the only syllable type that is present in all languages regardless of the maximal complexity of its onsets and rhymes. The increasing complexity of syllabic structure goes hand in hand with its relative markedness. Thus, a language with branching onsets (CCV) is not only more marked than one with only CV, but it also must have the less marked structure in its inventory. Somewhere between the two types of syllabic complexity, of which CCV is not at all the maximal one, there is also a structure with an empty onset (V) as well as CVC, that is a syllable closed by a coda consonant. Kaye and Lowenstamm (1981) are the first to have pointed out the implicational relationship between complex onsets and branching rhymes which says that a language with branching onsets must also have branching rhymes, while the reverse implication is not possible. This paper attempts to capture the implications concerning the relative markedness of syllable structures within the model of Government Phonology by referring to the interaction between the licensing potential of different types of nuclei and the increasing licensing demand made by syllabic structures of growing complexity. The licensing of syllabic complexities will be shown to correspond to licensing of segmental complexity, which is discussed in, for example, Harris (1997).

The paper is organised as follows. In 2, we discuss the markedness scale proposed in Kaye and Lowenstamm (1981). Section 3 illustrates how the segmental and syllabic markedness may be expressed in Government Phonology and points to some necessary refinements of the model in order to capture the observations made by Kaye and Lowenstamm. Section 4 contains a discussion of the syllable structure in Malayalam, which is an apparent counter-example to the markedness scale of syllabic complexity. In 5, Malayalam is placed in a broader typology of syllable structures permitted at phonological level by the model presented in 3. Particular attention is paid to the distribution of segmental and syllabic structures at the right edge of the word in this language. It is proposed that a single mechanism, that is, the interaction between the complexity of structure and licensing potential of nuclei may be able to explain the cross-linguistic preferences that characterise the distribution of segments and syllable types.

2. Syllable structure markedness

Kaye and Lowenstamm (1981) propose that generally we are dealing with three groups of languages as illustrated below.

(1)

I	CV
II	CVC, CV
III	CCV, CVC, CV

Languages which belong to group I, like Desano or Zulu, have only the simplest syllable structure CV. Group II, with branching rhymes but still simplex onsets, e.g. Hungarian, constitutes a next step on the markedness scale. The third group allows for branching onsets, branching rhymes and simplex syllables, e.g. Polish.

In order to account formally for the implications shown in (1), Kaye and Lowenstamm propose to index the markedness scale in the following way (1981:292).

(2)

Onset	Rhyme	Markedness
C	V	0
∅	∅	1
CC	VC	2
CCC	VCC	3
$C_1...C_n$	$VC_1...C_{n-1}$	n

The markedness values are established separately for the onset and for the rhyme. For this reason branching onsets end up having the same markedness value as the branching rhyme contrary to the classification in (1) which suggests that the two structures must constitute separate levels. For this reason, Kaye and Lowenstamm postulate that the implication CCV ⊃ CVC may be handled by a separate condition stipulating that the maximum markedness value for the onsets *m* may be equal but should not exceed that for the rhyme *n* ($m \leq n$). A more fundamental problem for the proposal at the time when it was made was the necessary assumption that syllable structure be present in the lexical representation rather than supplied by rules.

The following section demonstrates that the basic insight of Kaye and Lowenstamm (1981), summarised in (1) above, may receive a fairly non-arbitrary description within the model of

Government Phonology, and that there is no need for a separate condition differentiating branching onsets and rhymes, because they are not of the same markedness value. The model also gets round the problem of lexical presence of syllable structure by assuming that all syllabification is due to governing relations contracted between consonants at the lexical level. The nature of the underlying representation is such that it may receive interpretation without resorting to derivation to a surface form. This is achieved by assuming autonomous interpretability of phonological elements (Harris 1990, Harris and Lindsey 1995).

3. Markedness scales in Government Phonology

Let us consider only one way to deal with markedness effects in Government Phonology, which involves making reference to the relative complexity of segments and syllables (Harris 1994, 1997).[1] The purpose of this section is to demonstrate that the same basic mechanism, that is, the interaction between the relative strength of licensers and the relative complexity of the structures requiring licensing may capture markedness and typological tendencies.

3.1. Segmental complexity

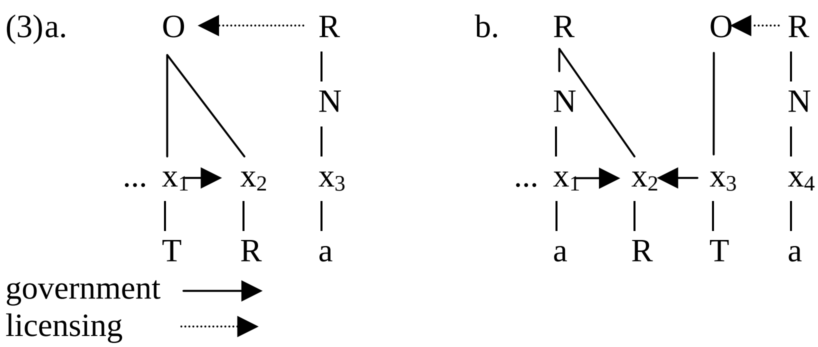
Segments in this model are composed of privative elements. Thus, vocalic systems are defined in terms of three main resonance elements I, A, U corresponding to the corner vowels [i, a, u], which are most commonly found across languages. The mid vowels [e] and [o] are combinations (A,I) and (A,U) respectively. They are more complex segments and are assumed to be more costly in terms of licensing, where the actual cost is calculated straightforwardly from the number of elements involved. It is to be expected that in prosodically weak contexts, the less complex segments should have better chances of survival than the compounds. This prediction is borne out by phonological phenomena such as lowering or raising of mid vowels in unstressed nuclei as in, for example, Bulgarian and Catalan (Harris 1994). Since each element is autonomously pronounceable, the reduction in complexity does not hinder interpretability of the remaining material.

Obstruent devoicing, as in Polish or German, is captured in exactly the same way as vowel reduction. Simply, the element defining the laryngeal activity is unlicensed in prosodically weak positions. Thus, the general principle responsible for markedness phenomena in segmental structure in GP is viewed as a distribution of various complexities within a word in such a way that the amount of phonological material tends to be greater in strong positions and reduced in weak ones. Harris (1997) proposes a coherent theory of neutralisation, which unifies the intimate relationship between the distribution of prosodic licensing within a word and the allocation of melodic contrasts. Later in this paper, we will see how the complexity of consonantal segments may account for cross-linguistic patterns of occurrence in word-final position. Below, we illustrate how syllable typology and markedness can be captured in GP by referring to the same concepts as in the case of segmental markedness, that is, complexity and licensing.

3.2. Syllabic complexity

Syllabification in GP is government driven (Kaye, Lowenstamm and Vergnaud 1990). Adjacent positions enter into asymmetrical relations where one of the participants acts as the governor (T) and the other as the governee (R). The assignment of these functions in a given string is determined by the elemental complexity of the two adjacent segments (Harris 1990). Thus, the direction of governing relations is resolved on the basis of substantive factors (complexity slope). Additional, formal conditions on government, such as adjacency and directionality, ensure that all possible syllabic constituents recognised in GP are maximally binary left-headed governing domains.[2] If the order of segments happens to be that of a less complex consonant followed by a more complex one, that is, RT, then the direction of the governing relation must be from right to left, in which case we are dealing with an interconstituent relation between an onset and the preceding rhymal complement (‘coda’). The two types of relations are illustrated below.[3]

(3)



(3a) illustrates constituent government, that is, a branching onset, as in the Polish word *mo**kr**y* ‘wet’, while in (3b) the rhymal complement (x_2) is governed by the following onset as in *Ma**rt**a* ‘name’.

Charette (1990, 1991) proposes that both types of governing relations must be licensed by the following nucleus, and distinguishes between direct (3b) and indirect (3a) government licensing as separate parameters defining licensing properties of nuclei. The positive setting of the two parameters is assumed to condition the presence of governing relations of the RT and TR type in a given language, and, in effect, of branching rhymes and branching onsets. It must be noted, however, that while the parameter on indirect government licensing may indeed be assumed to have direct influence on the presence of branching onsets, because the branching onset is nothing else but a left-headed governing relation which is licensed by the following nucleus, the same cannot be easily said about branching rhymes. Direct government licensing is responsible only for the governing relation between the onset and the ‘coda’ consonant in the preceding syllable. It is not clear how this should evoke a branching rhyme structure, which itself is defined, like any other branching constituent, by a left-headed relation between the nucleus (x_1) and the rhymal complement (x_2). This is probably the reason why the government licensing parameters never fully replaced the parameters on branching constituents.

The standard way of capturing syllable typology in GP is to refer to a set of parameters, which may allow the constituents to branch if set in the ON, or not if set in the OFF.

(4)

	Branching
Onset	ON/OFF
Rhyme	ON/OFF
Nucleus	ON/OFF

It follows that the model employs two overlapping though independent mechanisms to deal with the same aspect of phonological structure, that is, the presence of branching constituents. However, neither separately, nor in conjunction, are these mechanisms able to capture the observation made in Kaye and Lowenstamm (1981) concerning the implicational relationship between branching onsets and branching rhymes. To see this clearly, let us leave aside the parameter on the branching nature of nuclei and assume for the moment that either set of the parameters discussed above could suffice on its own. The possible choices concerning the parameters on branching onsets and rhymes are given below.

(5)

	parameters	a.	b.	c.	d.
TR	*branching onset = indirect gov. licensing*	ON	OFF	OFF	ON
RT	*branching rhyme = direct gov. licensing*	ON	OFF	ON	OFF
		English	Zulu	Hungarian	???

The problem lies in the nature of parameters in general, or rather in their independent status. Since each parameter is set separately, the only way to preclude (5d) above is to resort to arbitrary designation of such settings as marked or downright impossible.[4]

A more serious problem for GP is that as long as the parameters on government licensing properties of nuclei and parameters on branching constituents are allowed to coexist in the model, we cannot exclude conflicts between these separate types of parameters. For example, we must assume that the presence of branching onsets is due to two theoretically unconnected parameters - one which allows onsets to branch, and refers to the structure of the constituent, and the other, which is defining the licensing properties of the nuclei in a given language.

(6)

parameters	a.	b.	c.	d.
branching onset	ON	OFF	OFF	ON
indirect gov. licensing	OFF	ON	OFF	ON
	???	???	Zulu	Polish

What (6) illustrates is that it is not clear what the potentially possible conflicting settings of the two parameters would yield. They must be assumed, therefore, to be switched ON or OFF in conjunction to account for the observable facts, which suggests that either the two parameters require additional justification to be maintained in the grammar, or some external mechanism must be evoked to link them. Below, we will pursue yet another option.

Since, syllabification in GP is indeed a reflection of governing and licensing relations, let us assume that we can do without parameters on branching constituents and derive the syllable typology only by reference to licensing properties of nuclei. The latter will not be defined in terms of separate parameters but rather as a scale on which the cut-off points are defined by the complexity of syllabic structure to be licensed. Note that the elimination of parameters on branching constituents from the model does not affect such fundamental notions as, for example, the binary theorem. The maximally binary nature of constituents is guaranteed by the way governing relations are contracted and need not be doubly secured.

The table below recapitulates the hierarchy proposed in Kaye and Lowenstamm (1981) and illustrates the proposed interaction between syllabic complexity and relative licensing strength of the licenser, that is, the following phonetically realised nucleus.

(7)

		example	*language*
I	Ca	ci**ty**	Desano
II	C.Ca (RT-cluster)	wi**nte**r	Hungarian
III	CCa (TR-cluster)	**tra**p	English

C = any consonant, T = governor, R = governee, a = any vowel

The general proposal is that the complexity of syllable structure in a given language is due to the licensing properties of its nuclei rather than to some extraneous parameters or constraints. A selection of the actual strength of nuclei in a given language is arbitrary, that is, either of the three choices is available, but the scale itself is by no means arbitrary. The three steps, or ‘quantal regions’, to borrow a term from phonetic theory, along the scale of syllabic complexity are non-reversible or re-rankable.

That the licensing invariably goes from the nucleus to the preceding onset, which imposes varying demands on its licenser depending on its function within a string. Either the onset is simplex, or simplex but governing a ‘coda’, or complex, that is, branching. While the complexity difference between a simplex intervocalic onset and a complex, branching onset is pretty obvious and requires no further justification, the rigid placement of RT clusters, that is, rhyme-onset relations, in the middle of the scale may need to be further substantiated.[5]

The fixed nature of the complexity scale is not its only advantage. Notably, the simplex onset is at last treated as a genuine part of syllabic markedness rather than an implied structure in the presence of more complex ones. It is where the scale begins and thus it plays a crucial reference point on the scale. The scale also offers a fresh look at the concept of markedness itself. More complex structures need not be viewed as violations of any universal conditions or constraints, but rather, as utilisation of all logically possible structural configurations, except that some of them happen to be more costly to license than others. Additionally, the model of Government Phonology imposes limits on the structural possibilities themselves. These follow from the nature of government.

By eliminating parameters on branching constituents and modifying slightly the understanding of existing mechanisms in GP we are able to offer a fairly constrained theory of syllabification, which captures the observed tendencies across languages and, thanks to its simplicity, is not unviable in terms of, for example, learnability. However, given the fixed nature of the complexity scale it is very easy to falsify the proposal. Potentially detrimental to the model could be the existence of languages, which possess branching onsets (group III), but lack branching rhymes, that is, ‘codas’ (group II). Below we will consider an example of such a language and further extend the proposal by taking into account different types of nuclei and their place in licensing gradation.[6]

4. The syllable structure of Malayalam

The data from Malayalam are of interest to us for a number of reasons. First of all, this language has been claimed to have branching onsets but no codas, i.e. branching rhymes.[7] In this respect it may constitute a counterexample to the predictions which follow from the markedness scale introduced in 3.2. Secondly, the discussion of the issues concerning the syllable structure of this language will allow us to further clarify what is understood by ‘coda’ in our model as opposed to other current models of phonological description. Thirdly, Malayalam will be tentatively placed in a more general typology of syllabic organisation in terms of the licensing abilities of its nuclei. And finally, an attempt will be made to capture in a static kind of way the distribution of segments and syllabic types in Malayalam. This will be done mainly with respect to the right edge of the word. The main conclusion will be that Malayalam is not problematic for our typology. However, it appears that this language points to a need for a slight extension of the markedness scale to allow for a tripartite distinction between nuclei in terms of their licensing abilities, that is, a) a full vowel, b) a schwa, and c) an empty nucleus.

Initially, we will concentrate only on one problem, which is directly relevant to the markedness scale of government licensing introduced in 3.2. One of its predictions is that it is unlikely for a language to go as far as having branching onsets (V.TRV) without also having rhyme-onset relations (VR.TV).[8] The discussion is based on Steriade (1981), K.P. Mohanan (1982, 1986), and T. Mohanan (1989).[9] The data come from these sources.

4.1. The no-coda hypothesis

There are three main arguments that led K.P. Mohanan (1982) to postulate the no-coda analysis for Malayalam. The first two are based on what we can call word level phenomena and refer to native speakers' intuitions in surface, phonetic syllabification and in language games. The third argument is strictly phonological in nature and for this reason it will receive more attention than the other two.

The first argument is connected with the way speakers of this language syllabify words in experimental situations. For example [ampalam] 'temple', [b^{h}akt̪i] 'devotion' and [ḍabba] 'tin can' are broken up as [a-mpa-lam], [b^{h}a-kt̪i] and [ḍa-bba] respectively.[10] K.P. Mohanan (1982) claims that this indicates that the syllable structure in Malayalam has no codas and that for this reason all such medial clusters, regardless of their sonority make-up, must be linked to the onset.

This argument is based on native speakers' intuitions concerning syllable divisions and its strength depends strictly on the degree to which such intuitions are taken to be valid for the discovery of the syllable structure of a given language. One reason why phonetic syllabification should be treated with caution is that on many occasions such experiments bring contradictory results concerning the syllable structure of a given language.[11] Secondly, we cannot be sure that there is a direct connection between the principles underlying the intuitive divisions made by native speakers and the actual phonological principles of speech organisation. This view finds unexpected support in Malayalam itself, as we will see below, in that phonological facts from this language suggest something contrary to the native speakers' intuitions.

The second argument adduced by K.P. Mohanan (1982) in favour of the no-coda hypothesis is based on the effects observed in a language game in which a nonsense syllable 'pa' is inserted before each syllable. Compare the effects of the same game in different, though related, languages (T. Mohanan 1989:592).

(8)		Malayalam	Hindi	
	a. ban̪d̪^{h}anam	**pa**ba-**pa**n̪d̪^{h}a-**pa**nam	**pa**ban-**pa**d̪^{h}a-**pa**nam	'imprisonment'
	b. d̪aršanam	**pa**d̪a-**pa**rša-**pa**nam	**pa**d̪ar-**pa**ša-**pa**nam	'vision'

Note that while in Malayalam the sonorant-obstruent cluster remains intact, it is broken up in Hindi. The 'pa' insertion could be given a uniform formulation: "insert 'pa' before every syllable" for both languages only if the clusters in Malayalam are treated as complex onsets rather than coda-onset sequences. This, in a nutshell, is the argument for treating these clusters as onsets, and in effect, in favour of the no-coda hypothesis.

One must at least voice some reservations as to whether this necessarily means that any cluster, which is not broken up by ‘pa’, must be viewed as an onset. First of all, the formulation of the rules of the game could be justifiably different in the two languages. There is nothing in principle that enforces uniformity in how the nonsense syllable is inserted. Secondly, the different effects could easily derive from some constraint in the language, which disallows breaking up certain clusters. What we are talking about here are, for example, sonorant – obstruent sequences and geminates of which at least the latter structure consistently exhibits integrity and immunity to any process that would break them up (e.g. Hayes 1986).[12] In support of this view, we may mention the fact that Malayalam word-final rhyme-onset sequences exhibit similar integrity in that the [ə]-epenthesis, to be discussed below, takes place after the cluster rather than within it.

It appears that the two arguments supporting the no-coda hypothesis are of a particular kind. T. Mohanan (1989) refers to these phenomena as occurring at “the less abstract levels of representation”. Without completely discarding these arguments, we voiced some reservations as to their validity for the discovery of the syllable structure of the language. While the native speakers’ intuitions concerning surface syllable divisions may need to be treated with more caution, the language game argument seems to be open to alternative analyses.

The third argument in favour of the no-coda hypothesis is based on the process of obligatory [ə]-epenthesis that inserts a schwa vowel after every word-final consonant other than [m] and [n] (9a), unless the following morpheme or word begins with a vowel (9b).

(9)

a.	mar̄am	‘tree’				
	awan	‘he’				
b.	/kaat̪/	‘ear’	>	kaat̪ə	but	kaat̪ooka ‘ornament for the ear’
	/maaṣ/	‘teacher’	>	maaṣə	but	maaṣewite ‘where’s the teacher’

In fact, this argument combines the observation that the final position is highly restricted in terms of what segmental types it allows, and the regular occurrence of [ə] after the remaining consonant types, in the absence of a vowel that might be provided by the following word or morpheme.

In K.P. Mohanan’s view, the motivation for the epenthesis is precisely not to allow coda consonants. Thus the existence of words ending in [m] and [n] must be viewed as problematic for this account, especially that the group of the licit word-final sonorants can be extended in formal speech to, for example, [ḷ, r, ṇ]. The data below (from K.P. Mohanan 1986:74) illustrate this point.

(10)	*formal*	*colloquial*	*gloss*
a.	mar̄am	mar̄am	‘tree’
b.	awan	awan	‘he’
c.	aaṇ	aaṇə	‘male’
d.	awaḷ	awaḷə	‘she’
e.	paal	paalə	‘milk’
f.	wayar	wayarə	‘stomach’

One may wonder if the extended number of segment types found word-finally in formal speech should constitute enough, or better evidence that codas exist in Malayalam. It is not entirely clear from Mohanan's approach at what stage a subset of segmental contrasts occurring in a given context ceases, or begins to be exceptional, and can be ignored for the benefit of a more attractive generalisation. It seems that in the case at hand, the problem may lie in the nature of the generalisation itself. Note that the decision concerning the (non)-exceptionality of the subset of segments occurring word-finally tips the scale either in favour of coda or against it and thus involves a major decision concerning the syllable structure, which may impede its learnability. In this way of viewing things we could expect that the different registers of the same language may have quite disparate syllable structures depending on how many final consonants manage to convince us, or the learner, that the language has codas.

No such problem arises if we take a different view on the syllabification of final consonants, that is, one in which final consonants are always onsets (Kaye 1990, Harris and Gussmann 1998). In such a model, the various cut-off points for the number of acceptable final segment types do not affect the overall syllabic design of the language. The larger or smaller subset of final onsets is due to different settings of the licensing potential of the following empty nucleus. This approach allows for doing away with the cumbersome problem of exceptionality in the word-final context. What is most important is that the word-final consonants, whether restricted melodically or not, have nothing to do with the question of there being codas in the language.[13]

To conclude, in contradistinction to many currently held views, the word-final context is not where we should be looking for clues concerning codas. In this respect the argument in favour of the no-coda hypothesis, which refers to the restricted nature of the word-final consonants can be diffused.

This new situation calls for a different explanation of what motivates the [ə]-epenthesis. However, details of a possible analysis of this problem must be postponed until later. In short, it is not impossible to view the schwa epenthesis as resulting from the pressure exerted on the final empty nucleus by the consonants, which are more complex melodically than [m] and [n]. The realisation of the empty nucleus provides the necessary melodic licensing but does not involve resyllabification, because the final consonants were onsets from the start.

In Malayalam the major cut-off point for segmental licensing seems to be placed between sonorants and obstruents.[14] Any distinction along the traditional sonority scale can be easily and non-arbitrarily translated into the elemental complexity of segments in GP. In general, all we need to say is that different complexities require different strength from the nuclei that license them. Since obstruents are inherently more complex than sonorants it is not impossible to assume that perhaps [ə]-epenthesis occurs after those segments which require more licensing than a mere empty nucleus can discharge. For more details see section 5.3.

As for the distinction among sonorants - we will defer any definitive claims until later sections. However, we must mention some possible reasons why nasals may be easier to license than other sonorants, even the less complex ones. It can be observed cross-linguistically that nasals feature quite readily in restricted contexts, e.g. the Japanese nasal + obstruent is the only non-geminate coda consonant (cf. also the so called Prince languages), and [n] is the only consonant word-finally. More examples can be found in Bell (1971). Clearly we are not dealing here with an isolated phenomenon, typical of only Malayalam, and this phenomenon requires a principled explanation. Another line of inquiry seeking to explain the behaviour of nasals can also require looking at possible restrictions concerning other sonorants, especially the mono-elemental ones, that is, glides, which tend to display distributional restrictions of their own across-languages.

To conclude the discussion of K.P. Mohanan’s phonological argument for the no-coda hypothesis we must say it creates more problems than it provides answers. Firstly, it raises the problem of melodic exceptionality as the outcome of particular syllabic generalisations and forces us to make arbitrary decisions as to what is exceptional and what is not in quite an unrestricted way. Secondly, it is possible that the word-final context, on the basis of which the decisions concerning codahood are made in K.P. Mohanan’s model, need not be indicative of the presence of codas at all. Such problems disappear in a model in which the word-final consonants are onsets. Their restricted character is irrelevant to the overall syllabic pattern of the language, but it does not mean that the non-arbitrary patterns of word-final restrictions should not receive a principled account. In what follows, we will demonstrate that such an account is possible. But first, let us look at a couple of phonological facts, which make a rather compelling case for recognising coda as part of the syllable structure of Malayalam. Of course, the context where it appears is word-medial.

4.2. Basic facts of clustering in Malayalam.

Convincing arguments against the no-coda hypothesis for Malayalam, which are based on the distribution of consonant clusters in this language, can be found in Steriade (1981) and T. Mohanan (1989). (11) shows major patterns which will be commented on below.

(11)

initial	*medial*	*final*
#TRV	VTRV	VRT#
	VRTV	
	VRTRV	
e.g. pḷ, d̪r, t̪y, t̪w	dw, ty, pp, ṣṭ, nt̪, n̪d̪r̄, kt̪r	pp, ll, ṣṭ, mp

There are good reasons to believe that the clusters appearing word-initially are branching onsets. First of all, only two-consonant clusters are allowed there, and they are severely restricted in that sequences of falling sonority are ruled out just like in English.[15] More details of the initial clusters are given below.

(12)

a. *obstruent + liquid*	**pḷ**aawam	‘flood’
	dr̄umam	‘tree’
b. *obstruent + glide*	**t̪y**aagam	‘sacrifice’
	t̪wisa	‘luster’
c. *nasal + liquid*	**mḷ**eec^h^am	‘copper’
d. *sonorant + glide*	**ny**aayam	‘justice’

Word-medial clusters, on the other hand, are not subject to any particular restrictions. The sonority slope can tilt in either direction and, additionally, three-consonant clusters are also found in this context.

(13)

a.	t̪o**ṇṭ**a	‘throat’
	a**mp**alam	‘temple’
	a**ps**ar̄a	‘nymph’

b. i**n̪d̪r̄**am 'night'
wak**t̪r**am 'face'

As observed in Steriade (1981), the fact that word-medial clusters do not exhibit similar restrictions to the word-initial ones is quite surprising if we follow K.P. Mohanan's proposal that they are also complex onsets. One would have to assume that any conditions used to derive the initial restrictions, e.g. those connected with the Sonority Sequencing Generalisation, must be allowed to operate only word-initially, and be ignored word-medially. That this can not be the correct solution is proved by further facts from Malayalam consonant cluster distribution and their phonological behaviour. Let us look at the data from the right edge of the word.[16]

The word-final situation in Malayalam is most interesting. In colloquial speech, this language allows only [m] and [n] to occur finally. No other consonants or clusters appear in this context, except that, in formal speech, more sonorants become acceptable, as we saw in (10). The [ə]-epenthesis, however, is not limited to the sonorants other than [m] and [n]. It is proposed (see e.g. T. Mohanan 1989) that both obstruents and certain clusters can also be assumed to be underlyingly morpheme-final, in which case, the [ə]-epenthesis always occurs regardless of register. A representative set of facts concerning the word-final situation is given below.

(14)

a. payarə 'beans'
paalə 'milk'
paaṭə 'mark'

b. aṭuppə 'stove'
an̪assə 'status'
b^{h}raṣṭə 'excommunication'
pan̪ṭə 'ball'

In (14a) we have words ending in a single consonant, either sonorant or obstruent, while (14b) shows the licit final clusters. The pre-[ə] clusters, however, are interestingly limited only to those of falling sonority, i.e. RT#. There are no pre-[ə] clusters of rising sonority in the lexicon (T. Mohanan 1989). The clear cut-off point between possible underlying RT# and impossible *TR# suggests that some principled way of explaining this fact should be sought. Note that the [ə]-epenthesis creates a context identical to the word-medial position in which no restrictions on the possible clusters are found. It appears then, that the absence of pre-[ə] branching onsets in this language provides a strong argument in favour of the view that the licit RT# clusters are indeed morpheme-final, and that [ə]-epenthesis is a live process, because only by referring to the final position can the distinction between RT# and *TR# be explained, for example, by referring to sonority sequencing. Note that if the schwa were treated as an underlying vowel then the clusters would be medial rather than final, and medially, no such restrictions would be expected to hold.[17] Given that T. Mohanan's proposal concerning the underlying representations of the forms in (14) above is correct, it appears that stringent sonority restrictions hold not only word-initially but also word-finally, thus the facts from the right edge of the word in Malayalam further weaken the no-coda hypothesis, and the claim that word-medial clusters are all syllabified as onsets.[18]

In addition to the distributional arguments against the no-coda hypothesis, Steriade (1981) also adduces facts from poetic meter, which require that the medial clusters be treated as heterosyllabic, i.e. coda-onset sequences, for the purpose of distinguishing between light and heavy syllables. Though, admittedly, this type of argument should perhaps be classified together with the phonetic syllabification and the language game arguments used by K.P. Mohanan in support of an opposite proposal, its contradictory import must not leave our faith in word level phenomena unshaken.

It is clear that the phonological behaviour of the clusters and the patterns of their distribution point to the fact that Malayalam observes universal well-formedness conditions on syllabification. Thus, the three major types of sequences occurring in word-medial position should be syllabified as V.TRV, VR.TV and VR.TRV respectively. In fact, the universal assumptions concerning phonological syllabification, whether we use the Sonority Sequencing Generalisation principle (SSG), or the theory of government in GP, force us to say from the start that these are the necessary syllabifications. Since the complexity scale presented in 3.2. deals with a typology of syllable that holds at the phonological level rather than at the surface, these arguments should suffice to salvage our proposal.

One must remember that both Steriade (1981) and T. Mohanan (1989) assume that, although at the underlying levels Malayalam has the coda and observes SSG, there must be a switch at later stages of derivation to accommodate the facts that led K.P. Mohanan (1982) to the no-coda hypothesis. This is an attempt to reconcile the mutually exclusive facts of this language, which means that at some stage of derivation some readjustment rules and resyllabification must take place by means of which all medial clusters will be relinked to the onset. At this level SSG is assumed not to be operative.

We should remain sceptical of these procedures. For one thing, the model of Government Phonology, or any non-derivational model for that matter, must eschew anything akin to resyllabification or levels of derivation. Surface forms are basically what we find underlyingly in terms of structural relations. Differences, such as, for example, filling in of empty nuclei with melody in order to fulfil conditions on segmental and structural licensing may occur, however, they do not involve structural alterations. To put it differently, the theory of government must view the word level phenomena as lying outside the domain of phonology proper. Whether this is an advantage of the model or its doom is an empirical issue.

To conclude this part of discussion, we saw that the no-coda hypothesis has little grounding in the phonology of Malayalam. More importantly, Malayalam is not a language which lacks branching rhymes while having branching onsets, and does not constitute a problem for the typological patterns observed in Kaye and Lowenstamm (1981). The complexity scale in GP, which attempts to capture these patterns, is not making wrong predictions about this language. What is more, one of the merits of the scalar approach is that it predicts quite straightforwardly what situation should not be attested. It is not impossible that languages can be found with branching onsets but no rhyme-onset clusters.[19]

We have stressed the fact that if the final consonants are not identified with codas, a few analytical problems can be avoided, for instance, highly restricted strings instantiating a particular syllabic configuration no longer threaten our generalisations about the syllable structure itself. On the other hand, it was crucial for us to prove that Malayalam is not entirely deprived of codas, which, defined in GP as the rhymal complement followed by an onset, are found in this language, just as in any other, only word-medially.[20]

Let us now turn to two quite related issues that stem from this discussion of Malayalam. First, we will try to understand why only [m] and [n] are allowed word-finally and how this can be explained in terms of the licensing potential of empty nuclei as distinct from that which characterises phonetically realised nuclei. Note that in this language full vowels license all possible structures. Therefore, the discrepancy between the licensing potential of the two types of nuclei merits a discussion. Second, we will look at the lexical design of phonological strings at the right edge of the word, which becomes more transparent under the GP assumptions of syllabification, and can be captured by referring solely to the licensing properties that different types of vowels in Malayalam possess.

5. Licensing properties of nuclei

5.1. Full vowels vs. empty nuclei.

Languages make, to some extent, arbitrary choices as to how much they allow their vowels to license. The possibilities are selected along a scale, where the licensing potential is commensurate with the complexity of the licensed structure. The scale itself, therefore, is not arbitrary because it is rooted in the highly restricted phonological representation. In this section, we will consider the relationship between the differences in licensing potential exhibited by full vowels and empty nuclei with respect to syllabic structures, and discuss some limitations on the available choices. Then we will move on to segmental licensing.

Recall that the full vowels in Malayalam appear to license all types of structures, while the empty nucleus seems to be limited in its abilities to licensing simplex onsets only. This discrepancy may look odd or unprincipled at best, our goal is to demonstrate that there is order in this apparent chaos. Consider the full table of structural complexities, with the appropriate settings for Malayalam colloquial speech.

(15)

Malayalam		[a]	[ø]
I	C_		restricted
II	C.C_		
III	CC_		

[a] = any full vowel, [ø] = empty nucleus

The full vowels license all possible syllabic structures, that is, simplex onsets, as well as rhyme-onset relations and the most demanding branching onsets. The empty nucleus, on the other hand licenses only a subset of melodies in the least demanding structural configuration: the simplex onset. At no point is it able to license fricatives or stops, not to mention clusters of consonants. By comparison, in Polish, for example, the licensing abilities of the two types of nuclei go almost hand in hand. For convenience, a table with Polish facts is given below.

(16)

Polish		[a]	[ø]
I	C_		
II	C.C_		
III	CC_		restricted

In Polish, realised nuclei can license all types of governing relations and similar properties are displayed by the empty nuclei. The difference, however, is that at each level of licensing, be it a simplex onset, a rhyme-onset relation, or a branching onset, the number of possible segments allowed before an empty nucleus constitutes a subset of those with a following full vowel. For example, [ø]'s cannot license voicing in obstruents and also some contrasts such as secondary place of articulation, for example, palatalisation of non-coronals. However, the greatest restrictions are found within the highest level of licensing, i.e. the branching onset. Here we find [tr] as the best candidate in Polish, and very little else (Cyran, in press).

We may state our first hypothesis concerning the melodic restrictions in the following way: the most stringent melodic restrictions on onsets (C_), and their relations (C.C_, CC_) will occur at the highest levels of licensing that the empty nucleus reaches. This is in perfect accordance with the scalar system we are trying to develop here. Of course, the reverse situation in which Polish would exhibit a whole range of possible final branching onsets, but at the same time would have severe restrictions for simplex final onsets, say, similar to those in Malayalam, is ruled out by the model, and should not occur. Thus, in Polish, the restrictions are found at the level of branching onset, while in Malayalam they occur at the lowest level.

Probably the most striking language illustrating our hypothesis is Japanese (Yoshida 1996), which displays melodic restrictions at different levels of licensing for both full vowels and empty nuclei. In brief, it allows its full vowels to license simplex onsets and only two types of rhyme-onset relations, that is, geminates and nasal + obstruent, while its empty nucleus can only license one consonant finally: [n].

(17)

Japanese		[a]	[ø]
I	C_		restricted
II	C.C_	restricted	
III	CC_		

Thus it seems that we are very likely to find restrictions in the most complex structures that a language allows for and such facts are easily derivable from the licensing scale. Our hypothesis pinpoints the locus of potential melodic restrictions as the highest level of licensing allowed in a given language. Additionally, the comparison between Malayalam, Polish and Japanese seems to suggest that the licensing potential of full vowels and empty nuclei is set independently of one another.

In the following section we will attempt to present a typology of licensing discrepancies between the full vowels and empty nuclei in terms of which configurations are possible and which should be ruled out. Then we will return to the question of cut-off points for segmental licensing.

5.2. A typology of licensing discrepancies

The relevant facts here concern only the licensing of syllabic structures, i.e. the three possible levels. We have seen that the licensing properties of vowels and empty nuclei may be identical, as in Polish, or they may differ markedly, as in Malayalam. This is part and parcel of the model and this is where most surface typological variation between languages originates. Thus, despite the restrictiveness of the model as to the maximal size of syllabic constituents, i.e. binary constituents, a fair amount of variety follows from the fact that languages select the licensing properties of their empty nuclei independently of the properties displayed by full vowels. What is more, languages may choose not to have empty nuclei word-finally altogether. One language, typically mentioned in this context is Italian, which has no empty nuclei word-finally, at least in content words, but whose full vowels allow for a whole range of structures, i.e. I, II, and III.

Polish seems to take an opposite position to Italian in allowing for identical licensing possibilities for both filled and empty nuclei. In this context Malayalam represents one of the intermediate states/grammars, with its full vowels displaying similar properties to those of Polish and Italian, and empty nuclei only barely reaching level I. One can mention another option in this system, for example, Turkish, in which the full vowels license all structures, but the empty nucleus reaches level II. That is, word-finally, the language has both simplex onsets and rhyme-onset relations ([sart] ‘rope’), but it does not have branching onsets in contradistinction to Polish, French or Icelandic. The table below illustrates the points we have just made. The full vowel box refers to all four languages.

(18)

<table>
<tr><td></td><td></td><td>Pol,Tur,Mal,Ital</td><td>Polish</td><td>Turkish</td><td>Malayalam</td><td>Italian</td></tr>
<tr><td></td><td></td><td>[a]</td><td>[ø]</td><td>[ø]</td><td>[ø]</td><td>[ø]</td></tr>
<tr><td>I</td><td>C_</td><td style="background:#a6a6a6"></td><td style="background:#bfbfbf"></td><td style="background:#bfbfbf"></td><td style="background:#bfbfbf"></td><td></td></tr>
<tr><td>II</td><td>C.C_</td><td style="background:#a6a6a6"></td><td style="background:#bfbfbf"></td><td style="background:#bfbfbf"></td><td></td><td></td></tr>
<tr><td>III</td><td>CC_</td><td style="background:#a6a6a6"></td><td style="background:#bfbfbf"></td><td></td><td></td><td></td></tr>
</table>

It appears that there is no dependency between the selections made for full vowels and those for empty nuclei with respect to licensing abilities. To add to the variation we illustrate what would appear to be licensing scales for Hungarian, Japanese, Yucatec Maya and Zulu below. Hungarian allows both types of nuclei to reach level II, i.e. to license rhyme-onset sequences and, naturally, the lower, more simplex structures, but it excludes branching onsets (level III). Japanese allows for rhyme-onset sequences only before a full vowel, and simplex onsets before [ø]. Yucatec Maya has no adjacent clusters but allows for a single consonant word-finally, while Zulu only has full vowels and simplex onsets.

(19)

<table>
<tr><td></td><td></td><td colspan="2">Hungarian</td><td colspan="2">Japanese</td><td colspan="2">Yucatec Maya</td><td colspan="2">Zulu</td></tr>
<tr><td></td><td></td><td>[a]</td><td>[ø]</td><td>[a]</td><td>[ø]</td><td>[a]</td><td>[ø]</td><td>[a]</td><td>[ø]</td></tr>
<tr><td>I</td><td>C_</td><td style="background:#a6a6a6"></td><td style="background:#bfbfbf"></td><td style="background:#a6a6a6"></td><td style="background:#bfbfbf"></td><td style="background:#a6a6a6"></td><td style="background:#bfbfbf"></td><td style="background:#a6a6a6"></td><td></td></tr>
<tr><td>II</td><td>C.C_</td><td style="background:#a6a6a6"></td><td style="background:#bfbfbf"></td><td style="background:#a6a6a6"></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>III</td><td>CC_</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

It transpires that, contrary to our earlier assumptions, the relation between the settings for full vowels and empty nuclei are not entirely free. We have not seen a case where [ø] would license more material than a full vowel in a given language.

In fact, two restrictions must be mentioned that seem to hold in connection to the settings of licensing strength between full vowels and empty nuclei. First, what we do not expect in this model is a discontinuity of licensing potential reflected in the absence of intermediate structures as illustrated in (20a),

(20)

*a.		[a]	[ø]
I	C_		?
II	C.C_	?	
III	CC_		

*b.		[a]	[ø]
I	C_		
II	C.C_	?	
III	CC_		

The discontinuity of structures in which branching onsets are present but rhyme-onset relations are absent is exactly the problem that induced us to look at Malayalam. Likewise, no language should have complex onsets only, or have rhyme-onset clusters but not simplex onsets. These limitations refer to both types of licensers in (20a).

A second restriction that could be proposed concerns the possibility that a language may select higher licensing potential for its empty nuclei than for its full vowels (20b). This excludes a number of impossible systems. For example, one in which RT sequences are found word-finally but not word medially. This restriction also excludes languages in which full vowels do not license anything, i.e. systems with only an arbitrary repetition of onsets and empty nuclei.

Thus, problematic for our model would be a language which can only end its words with a vowel and complex clusters, as in (20b), or in which more complex structures are attested in the absence of less complex ones (20a). But even less extreme situations, like the hypothetical one in which we would find branching onsets word-finally but not initially or medially, would constitute a problem. What we expect is the opposite, that is, cases with initial and medial branching onsets but not final (e.g. Italian).

The first restriction expresses the simple implication that simpler structures must be present in systems which have more complex structures. A possible explanation for this implication, which would be compatible with the markedness scale, is not difficult to think of.

As for the second restriction, one of the reasons why the model disallows systems like (20b) is that empty nuclei constitute, by definition, weaker versions of their melodically sounded counterparts. This restriction may also be connected with the origin of empty nuclei, which presuppose full vowels in the system. It may be assumed that learners can only postulate [ø]'s if they can do it on the basis of an existing "non-defective" structure. Hence the implications illustrated in (21) below require no further grammatically driven justification.

(21)

[ø] implies [a] *(becase [ø] originates from [a], say, historically, and in language acquisition.)*

Cø ⊃ Ca (C = any consonant, a = any full vowel)
VC.Cø ⊃ VC.Ca (C.C = R.T)
V.CCø ⊃ V.CCa (CC = TR)

Though we will not elaborate much on this point here, it is possible to derive similar implications for empty and filled onsets.

What we have briefly illustrated above are fairly tentative approximations of what different nuclei can license in terms of syllabic structure and how these abilities may differ for individual languages thus producing a variety of surface syllable types. This is done in a model, which restricts the size of syllabic constituents to maximally branching ones, and possible syllable structures to three levels of complexity. In this context the Malayalam facts cease to look exceptional and in fact are welcome in that they fill in the factorial typology of syllabic types.

Below, we deal with two final though quite interesting points concerning Malayalam. The first one can be informally dubbed as the "fine tuning" of licensing properties of nuclei, that is, scalar effects in licensing of melodies within the licit syllabic structures. The second point gathers together the possible syllabic and melodic licensing properties of nuclei in Malayalam in order to demonstrate that the distribution of strings and segments at the right edge of the word in this language forms a pattern which directly reflects the relative strength of nuclei, and hence, it can be coherently described without reference to any additional constraints.

5.3. Melodic restrictions on final onsets.

So far we have looked closely at one type of complexity requiring different degrees of licensing strength from the following nucleus. Each time the recipient of licensing is the preceding onset which can be simplex as in Polish *tata* [ta**t**a] 'father', a simplex one with a preceding coda consonant to license as in *Marta* [ma**rt**a] 'name', or a complex one (branching onset), e.g. *mokry* [mo**kr**ɨ] 'wet'. The required licensing strength is different for each structure, and the syllabic complexity has cut-off points between levels I and II and between II and III. The type of complexity we are turning to now is measured in terms of the number of elements present in a segment. This type of complexity has been discussed in the GP literature by, for example, Harris (1990, 1994, 1997), Cyran (1996), Scheer (1996), Gussmann (1998), and Rennison (1998). The model that we will follow is that of standard GP (Harris 1990).

Syllabification can be understood as stemming from the interaction between different amounts of syllabic structure and the strength of the licensers, the nuclei, and there is asymmetry in the degree of structure that can be licensed by full vowels and empty nuclei. Similar asymmetry is to be expected in licensing of melodic material, which also exhibits complexity slopes. In this sense, the same principle governs the way in which licensing properties of nuclei can be applied both to syllable types and segmental material. This is a desirable situation given that governing relations, it will be recalled, are conditioned by segmental complexity of the consonants.

Segments in GP are composed of one or more elements, and in general, more complex segments should be more difficult to license than the less complex ones. For example, it should be easier to license mono-elemental or bi-elemental segments than those containing three or four elements. Below we illustrate what such a scale translates to in terms of segment types in GP. The model makes use of the following elements: A, I, U, ʔ, h, N, H, L.[21]

(22)

sonorants	(I) = j, (A) = r, (U) = w, (A,ʔ) = l, (U,N) = m, (A,N) = n
fricatives	(A,h,H) = s, (U,h,H) = f
stops	(U,h,ʔ,H) = p, (A,h,ʔ,H) = t

The representations above are not of any particular language. They are rather rough schemes corresponding to major classes and will have to be refined when a language is carefully analysed. Since simplex onsets typically exhibit a full range of segmental contrasts before a realised vowel, the complexity effects, logically, will be observed when the licenser is an empty nucleus, i.e. in the case of word-final consonants, but the whole picture does not exclude full vowels, as we will see below.

Let us look at the facts concerning the final simplex onsets in Malayalam. Initially, we will follow the assumption made in T. Mohanan (1989) that underlyingly both sonorants and obstruents can be found in word-final position. For the purpose of completeness we add a group of simplex onsets – simplex in the syllabic, not segmental sense – which are borrowings from Sanskrit where they appear as final. However, in Malayalam, they may not appear even underlyingly in this position. Such stems, marked as [+Sanskrit] are treated by the language as bound morphemes and always appear affixed, i.e. a full vowel must follow these consonants (T. Mohanan 1989: 622).

(23)

	informal	formal	example
Sonorants [m], [n]	[ø]	[ø]	awa[n] ‘he’ mar̄a[m] ‘tree’
[ḷ], [r], [ṇ]	[ə]	[ø]	awa[ḷə] ‘she’ waya[rə]’stomach’
Obstruents ~3 elements	[ə]	[ə]	kaṭalaa[sə] ‘paper’ wira[kə] ‘firewood’
Sanskrit obstruents	[a]	[a]	laa[b^ha]m ‘profit’ paa[$ṭ^h$a]m ‘lesson’ ma[d̪a]m ‘intoxication’

Necessary details of segmental representations in (23) need to be worked out. However, a general pattern seems to transpire even if such details are left aside. First, let us observe that the growing complexity of segmental types dictates a growing (corresponding) licensing strength that is required from the following nucleus.

Given the schemes in (22), there is no real problem to distinguish between sonorants on the one hand and obstruents on the other. All we need to say is that the cut-off point is more or less between two and three elements, in that more complex segments than bi-elemental cannot be licensed by [ø], even in formal speech. The problem for us lies in the description of the situation in colloquial speech where mono-elemental segments like I, A, U in [j,r,w] are worse-off than bi-elemental nasals [m] (U,N) and [n] (A,N). We mentioned this problem earlier and suggested some ways of dealing with it. Let us, however, not distract ourselves from the general pattern, which seems to be true.

It is interesting to note how Sanskrit words seem to be borrowed into Malayalam. Note that none of the Sanskrit consonants in (23) can be allowed finally in the underlying representation even though Malayalam possesses the process of epenthesis to deal with final consonants. One cannot fail to notice that these consonants might be a bit more complex than all those followed by schwa. In other words, the clues as to their class membership ([+Sanskrit]) are present in the segmental make-up (see also K.P. Mohanan 1986: 82). For example, some of the consonants are voiced, e.g. [d̪], which is not allowed finally in Malayalam.

Clearly, if we wanted to apply the universal sonority scale to account for the cut-off points in (23) we would be hard put to explain why a voiced obstruent as in [ma**d̪**am] is separated from sonorants by a voiceless, that is, less sonorous obstruent [wira**k**ə]. In other words, for the sonority scale the facts in (23) make no sense. In element theory, on the other hand, the actual factor responsible for this gradation of segments, can be expressed by the relatively more complex nature of [d̪], when compared with, e.g. [k]. This can be done by assuming that the voiced segment has an additional element specifying the laryngeal activity, i.e. has the element L, while [k] is neutral, or unspecified in this respect. Though it is only an assumption, and we will not attempt to verify it here, it is supported by the fact that the other consonants in (23) also bear obvious additional laryngeal specification. The word for 'lesson' has aspiration, that is, the element H is present. All in all, it seems non-accidental that the mark [+Sanskrit] appears to go hand in hand with a greater complexity of segments involved.[22] The lexical condition on what these consonants are followed by has a clear phonological basis.

It appears then, that the distribution of [ø], [ə] and the full vowel which follow the word-final consonants can be neatly captured by the scale of licensing required by the different types of segmental complexity. The empty nucleus can only license selected sonorants in colloquial speech, and a larger set of sonorants in formal speech.[23] The obstruents require a vowel with melody, hence they are always followed by schwa, and whether this schwa is lexical or epenthetic does not really matter because the even more complex segments of Sanskrit origin must be followed by a vowel of a different category, that is, a full vowel. Interestingly enough, the licensing requirements of the underlying final onsets are reflected in the licensing requirements of syllabic types. The full picture of the right edge of the word in Malayalam is discussed in the following section.

5.4.The right edge of the word in Malayalam

In 5.1, we established that full vowels in Malayalam are able to license all three types of syllabic structure, while [ø] only sanctions a restricted number of simplex onsets.

(24)

Malayalam		[a]	[ø]
I	C_		
II	C.C_		
III	CC_		

We also saw in the previous section that in surface terms the schwa vowel seems to occupy an intermediate position between the full vowel and the empty nucleus. It licenses more structure than the [ø] but less than the full vowel (a > ə > ø). This is particularly evident in the case of Sanskrit borrowings in which the final consonants appear to require a full vowel as opposed to a mere schwa, not to mention [ø]. Some support for the way we view these facts, that is, as stemming from the relationship between complexity and the licensing that the different complexities demand from the nucleus, can be found in the distribution of word-final syllabic types, which is basically a replica of the segmental scale in (23).

(25)

	medial	word-final	example
simplex onset C_	[a]	[ø]	awa[n] 'he' mar̄a[m] 'tree'
rhyme-onset C.C_	[a]	[ə]	aṭu[ppə] 'stove' pa[llə] 'tooth' paa[mpə] 'snake'
branching onset CC_	[a]	[a]	pa[t̪r̄a]m 'letter' in̪[d̪r̄a]m 'night'

Some melodic details will be supplied below in the final table depicting the distribution of segments and strings at the right edge of the word in Malayalam.

Let us concentrate on the word-final context. What the table illustrates is that there may be an underlying simplex word-final onset which will also surface as such, i.e. not followed by any type of overt vowel, e.g. [mar̄am]. Some word-final clusters are allowed at the underlying level but they must be of a particular type, i.e. RT#, which includes sonorant + obstruent, s + obstruent, or geminates. These sequences are followed by a schwa on the surface.

TR sequences never appear before a schwa.[24] For example, words ending in TR in Sanskrit are, like some of the segments discussed previously, treated as bound morphemes and must be affixed. In effect, then, they are followed by a full vowel. Again, let us look at some of the examples provided by T. Mohanan (1989:622).

(26) can̪[d̪r̄a]n ‘moon’
wak[t̪ra]m ‘face’
in̪[d̪r̄a]m ‘night’

That a full vowel is required to license a branching onset in Malayalam is no surprise to us - what is interesting is that there is a clear cut-off point between what a schwa can license (RT), and where only a full vowel can suffice (TR). Note that we predict that this relation cannot be reversed because the schwa is inherently weaker than a full vowel, as we have seen above in the segmental licensing scale.

Before we look at the complete table it is prudent to note that the more complex [+Sanskrit] structures, that require a full vowel as a licenser, involve all possible syllabic configurations, i.e. simplex onsets, e.g. [la**b**$^{\mathbf{h}}$am] ‘profit’, rhyme-onset sequences, e.g. [maa**rg**am] ‘way’, and branching onsets, e.g. [can̪**d̪r̄**an] ‘moon’. This is not necessarily an indication that the arbitrary lexical marking such as [+Sanskrit] is correct. Recall that it is the segmental make-up of the strings that we assume to be the reason for their higher complexity and hence, stronger licensing requirements. Since the segmental and syllabic complexities form one system in terms of their demand on licensing, these facts are not surprising at all. It should be noted that the requirement that the [+Sanskrit] root be treated as a bound morpheme refers to the roots ending in obstruents and not in e.g. sonorants which feature word-finally in many words of Sanskrit origin.

The following table attempts to capture the distribution of right edge strings in Malayalam as reflecting the markedness scale of nuclear licensing.

(27)

		[a]	[ə]	[ø]
I	C_	All Malayalam segments and [+Sanskrit] complex obstruents	Sonorants and Malayalam obstruents	Sonorants [m] and [n]
II	C.C_	All Malayalam and [+Sanskrit] RT	Malayalam C.C_ (RT and geminates)	
III	CC_	All Malayalam and [+Sanskrit] TR		

The fundamental observation that must be made about the distribution of [a - ə - ø], with relation to different types of segments and syllabic structures, is that the relative strength of the different types of nuclei as licensers aligns with the relative complexity of structure, i.e. the varying demand for a particular type of licenser. Note that the gradually decreasing licensing potential along the scale [a-ə-ø] supports in a palpable way our earlier assumption that the syllabic complexity scale I-II-III requires different potential from the licenser at each level, even if we are only dealing with full vowels in a given language.[25]

It seems that this tripartite distinction allows us to view the interaction between the licensing demand and licensing supply in a static way and in surface terms, without making any claims as to the nature of the [ə]-epenthesis. In other words, the [ə]-epenthesis can be viewed as a live process if one insists it must be, but the different licensing potentials displayed by the three types of nuclei, i.e. [a-ə-ø] fare equally well in a static kind of way. By referring to the gradation of licensing strength of [a-ə-ø] we are able to capture the relative markedness of segmental types and syllabic configurations in a uniform fashion.[26] Whether the perfect synchronisation of the syllabic and segmental scales with respect to the licensing properties of the nuclei, which we have observed in Malayalam, is a general cross-linguistic tendency or an accidental phenomenon seems to be an interesting question for further research.

6. Conclusion

We have seen how parameters in GP can successfully be replaced by scales, which, by their very nature, account for gradient phenomena such as markedness in a superior fashion. A coherent model based on the interaction between complexity and licensing can be achieved only if certain assumptions are made about the nature of phonological representations. Crucial in this model is the structure of segments, which are defined in terms of privative elements. Their number in a given segment provides necessary complexity slopes required for any two consonants to contract governing relations. The two types of relations, that is, R<T (right-to left) and T>R (left-to-right), which must be licensed by the following vowel, display an asymmetry as regards the licensing demand. Intersecting the complexity regions is another scale of vowel types ([a < ə < ø]), each of which is characterised by different licensing potential. The empty nucleus plays a pivotal role in the hierarchy of licensers, but more importantly, its presence in the model affords a fresh view on word-final consonants which may be viewed as onsets and be integrated into the system of preference scales in a straightforward fashion.

It appears that models, which do not allow for empty nuclei word-finally have to refer to a disjoint set of conditions or constraints in order to capture the scales discussed here. For example, the context before the final empty nucleus has to be taken care of by a separate constraint, i.e. (*Coda) and its interaction with further constraints on melody, while the contexts before the full vowel or schwa may not, because the consonant in that context will be an onset. In such models the markedness scale for segmental licensing would take the form as in (28a).

(28)

a. *context*	*effect*	b. *licensing scale*
_a	unmarked, no restrictions	_a
_ə	more marked, some restrictions	_ə
"in the coda"	most marked, severe restrictions	_ø

Because the contexts in (28a) do not constitute a uniform system, it appears that the placement of the context "in the coda" at the bottom of the markedness hierarchy above is arbitrary. In principle, there is no reason why it should not find itself at the top or even in between the schwa and the full vowel. The fact that it is at the bottom is due to the observation that this is where the most severe restrictions occur. In this way, the reference to coda in explaining segmental restrictions is circular, and has no explanatory value. The scale in (28b), on the other hand, is highly restricted in that re-ranking of the contexts is theoretically impossible. Note also, that the functioning of vowels as licensers in GP secures an intimate relationship between the contexts in (28b) and the distribution of segmental and syllabic types both within a word of a given language, and across languages.

As for the final complex clusters, the distinction between RT# and TR# can be captured by the same markedness scale which includes single final consonants, and no reference to a separate condition or constraint is required. All this is possible because some markedness is built into the way consonants contract governing relations (sonority slope = complexity slope). The different structures require different amounts of licensing and thus the cross-linguistic variation is derived by the sole reference to different licensing properties of nuclei. The government and licensing form one coherent system where both the licensing demand, that is, governing relations, and the licensing supply, that is, the types of nuclei that can do the job of licensing these relations, are parameterised in a scalar fashion. Though it must be stressed that the cut-off points along the scale are not arbitrary and can be quite precisely defined in terms of syllabic and segmental complexity.

The "quantal" regions on the complexity scale are levels I (CV), II (C.CV), and III (CCV) for syllabic configurations, and the number of elements 1-2 (sonorants), 3 and 4 (obstruents) for melodies. As for the scale of nuclear types, the maximal number of regions is three, i.e. [ø-ə-a], as in Malayalam. There may be two regions [ø-a], as in Polish, or one [a] (Italian?). An additional possibility should exist, i.e. [ə-a]. The linguistic variation depends on which "quantal" regions on the licensing properties scale are set to license particular regions on the complexity scale. One must add that, in accordance with the Licensing Inheritance principle (Harris 1997), the same types of nuclei may also exhibit slightly different licensing properties depending on their position in the licensing network within the word. In this respect the licensing scales and Licensing Inheritance are complementary aspects characterising the phonological representation in GP.

Notes

[1] Another way to handle sub-segmental co-occurrence restrictions and markedness in GP is to refer to licensing constraints, which define combinatorial properties of individual elements (e.g. Cobb 1993).

[2] The only constituents which are recognised in GP and which may branch are Onset, Nucleus and Rhyme.

[3] Though it is not impossible to assign a fixed function to some segments as typical governees (R), e.g. for glides, or typical governors (T), e.g. for stops, we will assume that these functions are always worked out for any given sequence. For example [f] is likely to be a governor when adjacent to a liquid, or a governee when followed by a stop.

[4] A similar problem of arbitrariness besets models of phonological description, which employ ranked constraints to derive the typology of syllable structure. In Optimality Theory, the relevant constraints responsible for the relation between branching onsets and rhyme-onset sequences, i.e. codas, are *Complex Onset and *Coda respectively. The tendency to avoid complex onsets in the absence of codas, would require that *Complex Onset be inherently ranked higher than *Coda with respect to Faithfulness constraints, or that *Complex Onset be undominated whenever *Coda is too. However, we must preclude the reversed ranking, or the reverse implication, i.e. if *Complex Onset is undominated, *Coda must be too. In this respect, constraint ranking faces the same problem as the parameter system of GP.

[5] The relevant distinction here is between RT and TR sequences, that is, direct versus indirect government licensing (Charette 1990). Though the relative complexity of these structures is implicit in the terminology proposed by Charette, one may think of quite a few arguments supporting the ranking in (X) and very few reasons to contradict it.

For example, it is characteristic of (true) branching onsets that they are much more constrained melodically than 'coda'-onset sequences, which could be taken to be a reflection of its more costly nature in terms of licensing (see Cyran, in preparation for more details).

[6] The reader is also referred to Kaye and Lowenstamm (1981) where apparent examples of onset complexity in languages, which are otherwise CVCV, are discussed and dismissed.

[7] It must be remembered that the rhymal complement, which is governed (licensed) by the following onset, is the only syllabic position that can be identified as coda in Government Phonology. In this sense, the same thing is meant when we use either of the following terms: branching rhyme = rhyme-onset relation = coda.

[8] R = sonorant or any consonant that can be governed by the following or preceding onset: a typical governee. T = a typical governor, i.e. an obstruent or any consonant that, in a given configuration, is able to govern R.

[9] For the sake of clarity we will exceptionally use the initials of K.P. Mohanan and T. Mohanan in this paper.

[10] We follow here the transcription used in T. Mohanan (1989), i.e. ç = retroflex, c̦ = dental, c̄ = palatalised.

[11] An example illustrating this worry is provided in Szpyra (1997) and concerns the principle of Onset Maximisation in Polish. Contrary to the results obtained in Rubach and Booij (1990), Szpyra concludes her experiment with a statement that there is no tendency to maximise onsets in Polish.

[12] Such constraints are not atypical. See Cyran (in preparation) for a discussion of a similar phenomenon in Polish, in which morpheme-internal clusters of the RT type are miraculously not broken up by the otherwise ubiquitous vowel-zero alternations.

[13] Recall that Japanese has only [n] word-finally, while it also has codas, though they are limited to complements of geminates and... a nasal. Italian, on the other, hand has no final consonants at all, but it abounds in medial codas. The opposite situation is also possible, Harris and Gussmann (1998) mention Luo as a language which has final consonants but no word-internal codas, that is, closed syllables. All these facts can be neatly captured in our model, as we will see in the following sections.

[14]We take the colloquial vs. formal speech distinction to be immaterial to the point at hand.

[15] Similarly to English, Malayalam has initial s + consonant clusters which we will ignore here. Additionally, this language has initial [mḷ] and [ny], none of which violates the expected sonority slope, though the sonority distance between the members of these clusters is very small.

[16] We view the word-final and the morpheme-final context as the same here for simplicity.

[17] This argument may be questioned though. See section 5.4 for a different take on the epenthesis in Malayalam.

[18] It is interesting to note that typically in languages SSG is violated at word edges and stringently observed word-medially as in, for example, Polish (Rubach and Booij 1990). Malayalam would have an exactly opposite situation if it were not for the fact that its word-medial clusters are exactly what is found in this context in well-behaved languages such as Polish or English.

[19] The typology of syllabic structures presented in Blevins (1995) generally supports the tendency which we wish to capture here, but she does quote a couple of languages which seem to have complex onsets but no codas, for example, Mazateco or Arabella. Such languages must be looked into in order to find out whether these are true or spurious clusters.

[20] A survey of rguments for treating word-final consonants as onsets followed by an unrealised nucleus can be found in Kaye (1990), Harris (1997), and Harris and Gussmann (1998).

[21] A = coronality, I = palatality, U = labiality, ʔ = occlusion, h = noise, N = nasality, H = aspiration, L = voicing.

[22] It is quite possible that it is the sole presence of the laryngeal elements L and H in this context that requires a full vowel following. Among the [+Sanskrit] loan words there are forms with final [h], which is by no means a complex segment, but it may be defined as H alone.

[23] Note that the extended licensing strength in formal speech does not single out a random additional pool of segments, but it picks the ones which are "next in line" in terms of complexity.

[24] Similar observations can be made also about Dutch and Irish (Harkema (1999), Cyran, in preparation).

[25] The reader is referred to Gussmann (1998) where a similar relationship is discussed concerning the structure of branching rhymes in English. It appears that a reduced head of the branching rhyme, e.g. schwa, can only license a subset of structures, for example, while [p**ɔmp**] is perfectly possible, *[...**əmp**] does not seem to be attested. One can also mention the 'magic' context s+C, in which, according to GP, [s] belongs to a rhyme of which the head is empty, that is, [ø]. The reader will have noticed that the reduced number of possible clusters depending on the shape of the head of the branching rhyme is parallel to the scales we observed in Malayalam.

[26] Recall, that the situation in formal speech, where more sonorants can be licensed by the empty nucleus, does not affect the table in any way. All we need to say is that in this register the empty nuclei are stronger licensers than in colloquial speech.

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