Licensing Strength and Syllable Structure in Government Phonology.

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0. Introduction

The concept of *phonological strength* has a long history in phonological theory. It typically refers to some inherent properties of segments and is employed to account for distributional patterns of consonants within a syllable, or to explain historical change (e.g. Sievers 1901, Vennemann 1972, 1983, Hooper 1976, Foley 1977, Murray 1988). Thus, strength plays a crucial role in theories of syllable structure and contributes to the understanding of the nature of phonological processes.

Since strength is always defined by referring to relations between particular linguistic units with respect to given phenomena (distribution, propensity to processes, e.g. lenition, acoustic or physiological characteristics), it has been a common practice to establish scales of inherent strength values for these units / phonemes, which would correspond to the phenomena. This sometimes results in having a number of strength scales reflecting different strength phenomena (Foley 1977).

The aim of this paper is to discuss the place of strength in Government Phonology (GP) and demonstrate that the role of this concept is slightly different from other approaches. Strength will be defined as an abstract property of licensers – mainly vowels – characterising the ability to sanction particular structures which have varying complexity.[1] A distinction between two types of complexity will be made: *segmental / substantive complexity* which is directly calculated from the number of elements making up a segment, and *syllabic / formal complexity*, which will be defined in terms of different configurations in which the onset of the syllable is involved. The syllabic structure and indeed the linguistic variation with respect to this aspect of phonological representation will be derived from the interaction between licensing strength and structural complexity. The model will be applied to some aspects of Dutch and Polish phonology involving clustering of consonants especially at the right edge of the word.

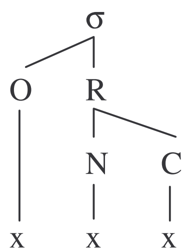
[1] In this respect it is the complexity of consonants that will correspond more readily to the concept of strength scales in, for example, Vennemann (1972), and Hooper (1976), while strength itself will be reserved for the licensers of the respective consonant configurations.

1. Syllabification

1.1. Basic facts

Let us first assume a fairly established structure of the syllable and provide some examples of uncontroversial syllabification using this template in order to be able to introduce the alternative model of syllabification which is advocated in Government Phonology. The syllable is often equated with the presence of a vowel which assumes the position of the nucleus. The consonant, or consonants preceding the nucleus belong to the onset, while those which follow the nucleus belong to the coda of the syllable.

(1)



O = onset, R = rhyme, N = nucleus, C = coda

Let us now observe how syllabic divisions are made in the following three words: *city, vulgar,* and *cobra*. The examples are deliberately rather uncontroversial.

(2)

a. *ci**.t**y* b. *vu**l.g**ar* c. *co**.br**a*

While most linguists will agree with the syllabification of the words above, the means to arrive at such divisions may differ across models. Also, views on the correctness of particular divisions may differ once more complex, or less obvious, clusters are taken into account.

As mentioned above, nuclei are said to be the most important ingredient of the syllable, therefore, they will be projected into the prosodic level first, as heads of the syllables. What we can at this stage ascertain is that all three words in (2) are bisyllabic. However, we must now make sure that the consonants are adjoined to the syllable heads in the way they figure in (2). There are two basic questions. First, what makes a single intervocalic consonant end up in the onset of the second syllable in *ci**.t**y* rather than as the coda of the first (**ci**t.**y*)? And second, on what basis are the consonant clusters in (2b) and (2c) separated by a syllable boundary (2b), or syllabified together as a branching onset in (2c)? We expect that a model which produces the intuitively correct divisions in (2) will also rule out the incorrect forms, e.g. **ci**t.**y*, **vu**.lg**ar*, **co**b.r**a*.

The answer of standard generative models to the questions posed above consists in establishing syllable building procedures, or rules intertwined with general cross-linguistic principles and language specific constraints. One such principle, which interacts with language specific constraints, pertains to the maximisation of onsets.

(3)

Maximal Syllable Onset Principle (Selkirk 1982)

In the syllable structure of an utterance, the onsets of syllables are maximised, in conformance with the principles of basic syllable composition of the language.

This principle ensures that the intervocalic consonant in *city* is assigned to the onset of the second syllable in (2a). It also tells us why **co**b.r**a* is not correctly syllabified. Given that *br* is a well-formed branching onset in English, which it is, it must be syllabified as such. On the other hand, **lg* is not a possible branching onset and this sequence must be separated by a syllable boundary, hence *vu**l.g**ar*. The choice between a well-formed branching onset and a coda-onset sequence is determined by a principle relating to the inherent sonority / resonance of segments, or inherent scale of segmental strength (Murray 1988).[2]

(4)

Sonority Sequencing Generalisation (Harris 1994)

An optimal syllable consists of a sonority peak, corresponding to the nucleus, optionally flanked by segments which decrease in sonority the further they occur from the nucleus.

Thus, we may say that **vu**.lg**ar* is incorrect because the sonority slope of the cluster decreases towards the syllable nucleus, while it should increase.

To summarise briefly, there are three aspects of syllabification which seem to be important; the supremacy of nuclei, the precedence of onsets in the syllabification of consonants, and principles of phonotactics.

With this simple introduction to syllabification let us now proceed to the discussion of the views of Government Phonology (GP) on the subject.

1.2. Syllabification in Government Phonology

Government Phonology translates the syllable contact laws into dependency or governing relations between consonants. Syllabification, therefore, proceeds from governing relations contracted between consonants. Whether a consonant is a *governor*, which we will symbolically represent by the capital letter *(T),* or a *governee-(R)* in such relations is determined by their segmental complexity (sonority differential). Since we will not introduce the GP views on the subsegmental structure it should suffice to say that to some extent complexity reflects sonority in that the more complex the segment the less sonorous it is.[3] Thus, a more complex segment always governs the less complex one regardless of their linear order in a string, as illustrated below in (5).

(5)

g → **l**			**l** ← **g**	
|	|		|	|
T	*R*		*R*	*T*

($\rightleftarrows$) = direction of government, *T* = governor, *R* = governee[4]

If *g* and *l* stand next to each other in a string, *g* will always be the governor because it is more complex than *l*. Note that this fact leads to two types of situations. One in which the governing relation goes from left to right and another one in which the direction of government is reversed.

In terms of the actual syllabic configurations, the rightward governing relation defines, what we traditionally understand as branching onsets (6b), and the leftward direction specifies a relation between an onset and the preceding non-vocalic complement of a branching rhyme, that is, the coda (6a). We illustrate that by providing syllable structures for the now familiar words.

(6) a. *vul.gar*

	R		O	N
v	**ʌ**	**l** ←	**g**	**ə**
		R	*T*	

b. *co.bra*

		O		N
k	**ɔ**	**b** →	**r**	**ə**
		T	*R*	

Government, however, should not be viewed as a mere theoretical translation of the contact laws and sonority sequencing. One advantage of the model is that the nature of government restricts possible syllabic types because in any given direction only two positions may contract a governing relation. This, effectively, allows only for maximally binary branching

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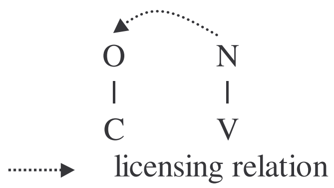
[2] The syllable contact law (Murray and Vennemann 1983) redefines the sonority hierarchy into one of consonant strength, where the values are the converse of the sonority. In this model a preferred syllable is defined as one in which the strength of consonants consistently decreases from the outer margins to the nucleus.

[3] In fact, the complexity of consonants which is defined in terms of the number of phonological elements present in their melodic make-up corresponds to a great extent to the strength scale proposed in Vennemann (1972). Since the complex consonants are the governors, applying the term 'strong' to them is also very apt.

constituents and deems that model as a highly constrained one. On the other hand, there is nothing in the standard generative models to constrain the size of syllables other than observations turned into language specific constraints.[5]

Having seen how consonantal clusters are syllabified in GP we must return to the question of the role of nuclei and also to the precedence of onsets in the syllabification of consonants. Like other approaches, GP assumes that vowels / nuclei constitute the indispensable part of the syllable. One reason for this assumption is the simple fact that while we can have monosyllabic words without an onset, that monosyllable cannot be deprived of the nucleus. Another reason for treating nuclei as special is their participation in higher prosodic organisation, that is, foot and word structure. In this respect, nuclei are assumed to be the carriers of prosodic information in the phonological representation. It is through nuclei that the prosodic licensing is distributed within the phonological word. Before we look at an example of prosodic phenomena connected with this type of licensing let us look at the lowest level of licensing relations, the one holding between the nucleus and its onset.

(7)



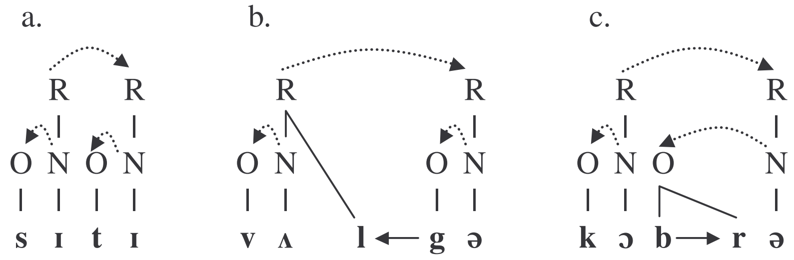
It is assumed that each nucleus must license its onset, a relation which encapsulates two aspects of syllabification which we discussed above. Firstly, it directly reflects the supremacy of the nucleus within the syllable. It is indispensable because it is the licenser. It is the organising agent in an utterance without which a syllable would not exist. Secondly, the existence of the relation with the preceding onset, and not with the following one, accounts for the fact that single intervocalic consonants are syllabified as onsets in words such as *ci.**t**y*. In other words, by recognising the existence of the licensing relation between the nucleus and its onset we are able to account for basic syllabification without resorting to additional principles such as *Onset Maximisation*, which in reality, merely state the facts and do not provide theoretical means to derive them. In this respect the model of GP appears to be more advantageous.

Let us briefly return to the forms *vul.gar* and *co.bra* whose syllabification was explained above in (6). Note that, in these cases, the nuclei which directly follow the clusters should also

[4] Disregarding the nature of complexity at this stage let us assume that in a sequence of two consonants (T), the governor, is of course more complex than (R), that is, the governee.
[5] Some cases of complex onsets where binarity seems to be breached will be discussed in section (5.3).

remain in a licensing relation with their onsets.[6] What is more, we may now view the governing relations between the consonants as an extension of the licensing coming from the nucleus. This way, each position within the word appears to be licensed one way or another. Assuming that the stressed vowel is the head of the prosodic domain called the word, the distribution of prosodic licensing, down to the level of interconsonantal relations can be illustrated in the following way.[7] For clarity of presentation the projection of the nucleus at the level of foot is represented as R = rhyme.

(8)



governing relation

licensing relation

In each case, the licensing from the nucleus goes to its onset which, on the other hand, may stand alone, for example, *t* in *city* (8a), or find itself in a governing relation with a neighbouring consonant of lower complexity (higher sonority). Rightward government defines the constituent called branching onset (8c), whereas a leftward relation obtains between consonants belonging to two separate constituents. Thus, in *vulgar* (8b), *l* belongs to the coda of the preceding syllable, while *g* is in the following onset. This type of relation is sometimes called interconstituent government, because the two consonants in a relation belong to separate syllabic constituents.

A careful reader will have noticed that now we may claim that indeed all syllabification is somehow connected with nuclei licensing their onsets which, in turn, find themselves in different prosodic arrangements. We will come back to this interesting issue in the following section. It must be stressed however, that this would be a completely different way of looking at syllabic grouping from the traditional division into onsets, nuclei, rhymes and codas, and it is worth checking if this new way of viewing syllabification makes any interesting predictions. One area where the new model may be expected to have something interesting to say is syllable markedness and linguistic variation.

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[6] It was Charette (1990) who first proposed that governing relations between consonants must be licensed by nuclei.

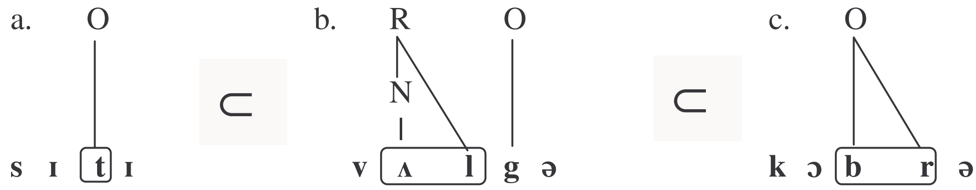
[7] See Harris (1997) for a fully worked out theory of prosodic licensing distribution and its role in such phonological processes as lenition and fortition.

Having observed a relation of licensing between a nucleus and the preceding onset, we may logically ask the question about the licensing properties of nuclei – assuming that they may differ across languages – with respect to the types of onsets that require the licensing. Such discussion demands that we observe effects of differing licensing properties of nuclei and that there is a phonologically definable property of onsets which would allow us to gauge the licensing abilities of nuclei. This is what we will turn to now.

2. Syllable markedness as a scale of complexity

Kaye and Lowenstamm (1981) observed an implicational relationship that seems to hold cross-linguistically between branching rhymes and branching onsets, that is between forms such as ***vul**.gar* and *co.**bra***. The observation stipulates that a language which has branching onsets must also possess in its syllabic inventory the structure of a branching rhyme. Since the implication cannot be reversed, the following scale of progressively marked syllabic structures is derived.

(9)



The implications illustrated above are traditionally understood in the following way. The least marked syllable structure is that with a simplex onset and a short nucleus (CV). The second step on the scale of markedness is represented by a syllable which has a coda (9b), that is CVC, and the presence of this structure obviously implies the unmarked structure in (9a). Finally, the most marked structure is that with a branching onset (9c), the presence of which necessarily implies the previous less marked structures.

Thus, Kaye and Lowenstamm divide the syllabic complexities into three major levels corresponding to the choices which languages make concerning their syllable structure.

(10)

Three levels of syllable markedness

I	CV	Zulu, Desano	=	(9a)
II	CV, CVC	Hungarian, Japanese	=	(9a,b)
III	CV, CVC, CCV	Polish, English	=	(9a,b,c)

The question that must be answered concerns the theoretical relationship between all these three structures, which must be established for the purpose of accounting for the markedness scale in a non-arbitrary fashion. Especially troublesome is the distinction between the branching onset and the branching rhyme, because the unmarked nature of CV appears to be rather uncontroversial.[8]

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.

(11)

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

Though the parameters may describe typological variation, they are unable to account for the syllable markedness observation made by Kaye and Lowenstamm, that is, for 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 consider all the possible choices concerning the parameters on branching onsets and rhymes which are predicted by the model.

(12)

	parameters	a.	b.	c.	d.
TR	*branching onset*	ON	OFF	OFF	ON
RT	*branching rhyme*	ON	OFF	ON	OFF
		English	Zulu	Hungarian	???

Note that the system in (12d), that is, one which has branching onsets but has no branching rhymes, is fully predicted by the model, even though it is precisely what Kaye and Lowenstamm (1981) have found to be impossible.

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 (12d) above is to resort to arbitrary designation of such settings as marked or downright impossible.[9] This

[8] It should be noted that the presence of a branching rhyme in effect means that there are RT clusters in the system. For reasons which are discussed elsewhere (Kaye 1990, Harris and Gussmann 1998) word-final single consonants are not treated as codas and this words like *pet* do not have a branching rhyme.

[9] 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

would be a highly unsatisfactory move, because there would be nothing in theory to prevent us from imposing similar constraints on the correct settings in (12a), or (12b). For this reason, below, we will pursue yet another option.

3. Syllabic complexity and licensing properties of nuclei

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 the syllabic structure to be licensed.[10]

As mentioned earlier, the primary function of nuclei in phonological strings is to license their onsets. These onsets, however, may find themselves in different configurations and each configuration requires different degrees of licensing strength from the following nucleus. Given the two types of governing relations between consonants discussed in an earlier section, we appear to have three possible structural configurations, or, to put it differently, there are three levels of formal complexity, each of which posing different demands on the licensor, i.e. the nucleus. These structures are repeated below.

(13)

a. *Licensing*

C N
T/R

b. *Direct Government Licensing*

C ← C N
R *T*

c. *Indirect Government Licensing*

C → C N
T *R*

T = governor, R = governee

In (13), we illustrate formal differences between particular configurations of onset licensing. (13a) represents the simplest arrangement, where a nucleus licenses a simplex onset of any substantive make-up. It may be any consonant which is present in a given linguistic system, be it a sonorant or an obstruent. (13b) and (13c) are formally more complex structures because the onset, which receives licensing from its nucleus, is itself in a relation with another consonant.

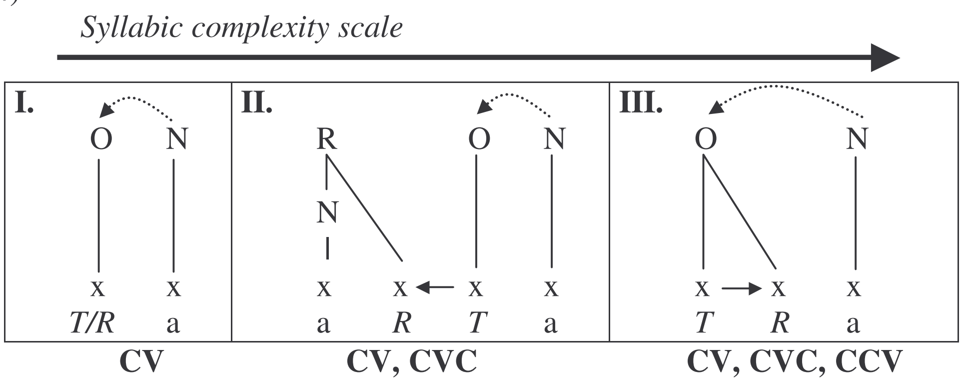
implication, i.e. if *Complex Onset is undominated, *Coda must be too. In this respect, constraint ranking faces the same problem as the parameter system of GP.

[10] 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.

It is clear that the latter two structures are more demanding in terms of licensing than (13a). However, the question is if there is any formal way to distinguish between the licensing demands imposed by (13b) and (13c) on the nucleus. For brevity of the argument, we will assume after Charette (1990) that the relevant distinction derives from the fact that in (13b) the nucleus is directly adjacent to the governor and therefore this structure is formally easier to license than (13c), in which the onset head is separated from the nucleus by the complement of the governing relation.

This formal difference should alone suffice to establish the relative markedness of the structures in (13). Note that this syllabic complexity scale, which is derived from government and licensing, corresponds to the levels of markedness proposed by Kaye and Lowenstamm.

(14)



The common formal denominator in establishing the complexity scale is the fact that in each instance there is a licensing relation between a nucleus and an onset.[11] The growing licensing demand at particular levels depends strictly on the function of the onset, that is, whether it is simplex or whether it is a governor. In the latter case it is the direction of government that determines the formal difference in the complexity of levels II and III. Thus the markedness levels above appear to act like regions in syllable complexity, where the increasing complexity of consonantal configurations directly corresponds to the growing demand on the nuclei which are called on to license these formal structures. We assume, then, that the deciding factor in systemic decisions as to how much syllabic structure is to be allowed can be reduced to one theoretical aspect of phonological organisation: the licensing properties of nuclei, or better, the licensing strength of nuclei.

Linguistic variation in this model consists in languages choosing arbitrarily how much their nuclei will license along the non-arbitrary complexity scale as illustrated in (15) below.

[11] It is clear that the formal complexity scale in fact corresponds directly to the relative markedness of syllabic types, though it must be acknowledged that further support for the formal distinction between levels II and III needs to be sought.

(15)

Licensing strength of nuclei

		example	*language*
I	C<u>a</u>	ci**ty**	Desano
II	C.C<u>a</u> (RT-cluster)	wi**nte**r	Hungarian
III	CC<u>a</u> (TR-cluster)	**tra**p	English

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

The above table 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.

To summarise briefly: 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. The onset is either simplex, or simplex but governing a 'coda' (RT), or complex, that is, branching (TR). 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.[12]

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 on syllabic constituents. A selection of the actual strength of nuclei in a given language is arbitrary, that is, either of the three choices (I-II-III) 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.

The fixed nature of the complexity scale – allowing for easy falsification – 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 the role of a crucial reference point. 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, some of which happen to be more costly to license than

[12] 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 (14) 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.

others. In this respect, complexity and markedness are synonymous terms.[13] Additionally, the model of Government Phonology imposes limits on the structural possibilities themselves. These follow from the nature of government. Since governing relations are contracted between two agents, the constituents formed in this way may be maximally binary, that is, may occupy maximally two positions, e.g. branching onset.

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).[14] Below we will consider the question whether nuclei may have differing licensing properties within a single phonological system.

4. Licensing properties of different nuclear types

4.1. The schwa vowel in Dutch

So far we have seen that nuclei containing a full vowel exhibit different licensing properties across languages. These properties were gauged against the complexity of syllabic configurations that demanded the licensing. Syllabification, therefore, appears to result from a tug of war between relative structural complexity of syllabic configurations and licensing strength of the licensers (nuclei). In this section, we will further extend the model by looking at different types of nuclei in order to see if also within a single language the nuclei may exhibit differing licensing properties. If we find such effects, and will be able to provide a fairly non-arbitrary account of those effects, the model will be further strengthened in our view.

Let us first concentrate on a situation which suggests itself immediately when we broach the subject of different properties of vowels as licensers within one linguistic system. We know that vowels may differ in quality and quantity, and it would be prudent to test if these distinctions have any bearing on their licensing properties. If we take licensing strength seriously we should predict that weaker vowels can license less, not more. To this end, we

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[13] Similar relationship between complexity and markedness has been observed at the subsegmental level of representation. For example, Harris (1994) notes that mid vowels which are composed of two elements in GP are more marked than high or low vowels which are composed of only one element. See also Dogil and Luschützky (1990) for similar observations within a feature geometric model.

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

will concentrate on the difference between full vowels (unreduced) and reduced ones, and then, go one step further.

English possesses the relevant distinction, as most of its unstressed vowels are reduced to the so called schwa [ə]. However, as the words *vulgar* [vʌl.gə] and *cobra* [kɔ.brə], which we have used throughout this paper, suggest, there is no difference in the licensing abilities between these two vowels in English. Let us provisionally assume that such a situation is possible: for our purposes, it would be really worrying if schwa licensed more than a full vowel.[15]

In order to see a neat illustration of differing licensing abilities of nuclei we will look at restrictions on consonantal clusters and the following vowel in Dutch.[16] Among many characteristics of the schwa vowel in Dutch the one which seems to be most interesting for us is its constrained distribution with respect to preceding clusters. Kager (1989) notes that pre-schwa clusters in Dutch behave as if they were word-final. In other words, schwa behaves as if it was a word boundary rather than a nucleus which is able to construct its own syllable. We will look at both rising and falling sonority clusters in pre-schwa position as they seem to behave in a way which suggests that the effects are not at all accidental. First, we take clusters of increasing sonority, that is, branching onsets (TR). Such clusters are said to occur only before full vowels, as the data taken from Kager (1989: 213) illustrate.

(16)

a. *[katr]	b. *[ka.trəl]	c. [ka.trɔl] *katrol* 'pulley'
*[dypl]	*[dy.plə]	[dy.plo] *duplo* 'duplicate'

There are no word-final clusters of rising sonority (16a), nor before a schwa vowel (16b). Branching onsets in Dutch require a full vowel to follow as shown in (16c). In terms of the model of licensing we have introduced so far the difference between (16b) and (16c) may be captured by referring to the weaker status of schwa as a licenser. To put it differently, the governing relation from left to right which is present in branching onsets can only be licensed by a full vowel. As yet, we have little to say about the forms in (16a) and why they are completely excluded.

Two more comments must be made about the data in (16). Firstly, although so far we have not discussed the phonological nature of word-final clusters such as those in (16a), it appears

[15] There are facts in English phonology, described in Gussmann (1998), which seem to suggest that in some contexts schwa is banned and only a full vowel can do. The phenomenon concerns the absence of sequences such as *...*əmp*, *...*əŋk*, etc. in this language, and, although, these facts are closely connected with our proposal, they will not be discussed here.

[16] The discussion is based on Trommelen (1984), Kager and Zonneveld (1986), Kager (1989), Booij (1995), and van Oostendorp (1995).

to be quite unusual that a word-final cluster, which is typically treated as a complex coda in standard generative (and even current Optimality) frameworks, should be compared to pre-schwa clusters which, as most linguists will agree, for most languages, constitute an onset. Secondly, it is not true that (16a) and (16b) are equally bad. While there are no word-final clusters with rising sonority in Dutch, one can find a few interesting exceptions to the pre-schwa context. First of all, there is a well-defined group of words, mostly of Greek origin, where clusters of rising sonority do occur before a schwa. Though, admittedly, these clusters do not look like well-formed branching onsets, e.g. *Dafne* [dafnə] (Kager 1989: 213). Secondly, good-looking branching onsets are found in pretonic position in words like: *fregat* 'frigate' [frəgat], *brevet* 'patent' [brəvɛt]. So, in fact we are dealing here with a sort of gradation of acceptability of clusters in the three contexts in (16); from absolutely excluded, through restricted, to fully acceptable. This scale is presented below in a symbolic way in order to be able to compare the restrictions on clusters of rising sonority with those of falling sonority to be discussed below.

(17)

*TR# < $^{*/ok}$TRə < ^{ok}TRa

The hierarchy should be read as follows: full vowel licenses better than schwa, which licenses better than #.

Before we begin discussing the distribution of RT clusters in the same three contexts, with particular focus on pre-schwa position, the reader will be reminded that in the licensing model presented in this paper the RT cluster should be easier to license because the nucleus which follows such clusters licenses the head of the governing relation directly. The relevant configurations are repeated here for convenience.

(18)

a. *Direct Government Licensing*

C ← C N
| |
R *T*

b. *Indirect Government Licensing*

C → C N
| |
T *R*

R = governee (more sonorous), *T* = governor (less sonorous)
(┈┈►) = licensing, (──►) = government

With respect to the pre-schwa clusters of falling sonority a similar claim is made, that is, that the schwa vowel behaves like a word boundary (#). However, the restrictions and effects are slightly different from what we have observed with respect to the TR clusters. First of all, the word-final context does not totally exclude RT# clusters as it was the case with *TR#. There are two types of RT clusters which are allowed word-finally: homorganic nasal+stop and sonorant+dental.

(19)

a. [damp] *damp* 'vapour'	b. [χɛrt] *Gert* 'name'
[daŋk] *dank* 'thanks'	[boelt] *bult* 'hunch'
[avənd] *avond* 'evening'	[vɛrs] *vers* 'fresh'

In the first set, the existence of partial geminates is accounted for by referring to integrity of such structures.[17] As for the dental obstruent in (19b) it is sometimes treated as an appendix or an extrametrical consonant in order to account for these forms (Kager and Zonneveld 1986). For our purposes the interesting fact is that this type of cluster is not entirely excluded from word-final context, whatever the nature of the exceptions. Recall that no such exceptions were found in word-final clusters of rising sonority (16).[18]

We may ask a question how RT# is less restricted than TR#. Traditional approaches have a ready answer here. Recall the Sonority Sequencing Generalisation (SSG) which we discussed in earlier sections, and which says that the sonority of the consonant clusters flanking a nucleus must decrease in sonority. Thus, nucleus+RT# complies with the generalisation whereas nucleus+TR# does not. This is all very well, but as we have seen in (17), and we will see again below, the word-final context (_#) is not independent in the treatment of consonantal restrictions in Dutch in that it forms an integral part of a gradation of restrictions. As it stands, the Sonority Sequencing Generalisation provides no platform for comparisons between the word-final, pre-schwa, and pre-full vowel contexts, and the hierarchy (#<ə<a) makes very little theoretical sense, in that reranked scales *(ə<#<a) or *(ə<a<#) can only be excluded on observational and not on theoretical grounds. Let us look at RT clusters in Dutch where neither homorganicity nor dentality of the obstruent is involved.

Clusters of a liquid and a non-dental consonant are subject to schwa epenthesis in two contexts: at the end of the word (syllable) and before a schwa (Kager 1989: 214). Thus, again the pre-schwa situation is identified with the end of the word. However, the status of the epenthesis in the two contexts is not identical. While epenthesis is almost obligatory in word-

[17] See e.g. Hayes (1986).

[18] It must be said that problems with the description of exceptional structures in syllabic analyses, and in effect, resorting to such contingencies as extrametricality or appendices, is a direct consequence of operating with syllabic constituents to establish syllable templates for a given system. In such approaches, exceptions ruin the otherwise clear-cut picture. A similar problem is discussed in Cyran (2001) concerning Malayalam codas.

final context (20a), it is only optional in pre-schwa position (20b) and completely excluded in the context preceding a full vowel (20c).

(20)

a. *ə-epenthesis obligatory* (RT# ⟹ RəT#)

[harəp] *harp* ‘harp’

[kɛrək] *kerk* ‘church’

[balək] *blak* ‘beam’

[hɛləm] *helm* ‘helmet’

b. *ə-epenthesis optional* (RTə ⟹ R(ə).Tə)

[kar(ə).pər] *karper* ‘carp’

[kɛr(ə).kər] *kerker* ‘dungeon’

[stal(ə).kər] *Stalker* ‘Stalker’

[hɛl(ə).mər] *Helmer* ‘first name’

c. *ə-epenthesis excluded* (RTa ⟹ R.Ta)

[har.pun] *harpoen* ‘harpoon’

[kar.kas] *karkas* ‘carcass’

[bal.kan] *Balkan* ‘Balkan’

[hɛl.ma] *Helma* ‘first name’

What we observe in (20) is a gradation of RT integrity depending on what follows the cluster, which is reminiscent of the restrictions on TR clusters (17). Compare the two scales below.

(21)

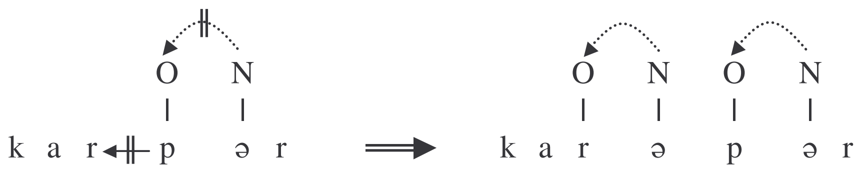
a.		b.		c.
*TR#	<	$^{*/ok}$TRə	<	^{ok}TRa
$^{*/ok}$RT#	<	$^{ə/ok}$R.Tə	<	^{ok}R.Ta

The only difference is that in each respective context RT fares better than TR, which is fully predicted in our model, as TR is formally more demanding. Thus, to use our terminology, a full vowel can license both RT and TR clusters (21c). Both direct and indirect government licensing obtains in the presence of this strong licenser, hence, Dutch is said to have both branching rhymes and branching onsets, or, to put it constituent-neutrally, Dutch full vowels license both leftward (R←T) and rightward (T→R) governing relations. A schwa is much weaker as a licenser in Dutch. It can only license TR in pre-tonic position, while its RT clusters often undergo optional epenthesis. What is interesting is that while epenthesis is excluded in RT followed by a full vowel, it is also excluded before a schwa if the cluster is of type nasal+homorganic obstruent or liquid+dental, e.g. [koel.tə] *culte* 'cult'. Recall, that these clusters are also found in word-final context.

The scales in (21) provide a general picture of the gradation of contexts with respect to the licensing of the two types of consonant clusters. Now, each of these individual situations merits a discussion with respect to the observed effects. Let us focus only on the optional epenthesis in the pre-schwa RT clusters. The analysis of the phenomenon within this model hinges on two aspects of Dutch phonology. Firstly, we must determine what the licensing strength of the schwa vowel is, and, propose some account for the optionality of epenthesis. Secondly, to account for the clusters which do not get broken up by epenthesis, we must propose some way to deal with exceptional strings.

The mechanism of epenthesis itself receives a fairly straightforward account within the licensing model. All we need to say is that in Dutch, the licensing strength of schwa is such that it can barely license level II of structural complexity. We use the word *barely* because schwa is able to license partial geminates, which we will assume to be the easiest RT clusters to license at level II. However, in words such as [kar(ə)pər] *karper* 'carp' (20b), where the cluster is of the "heavier" type, the licensing potential of the nucleus might not be sufficient to license the governing relation. For this reason, the cluster must be broken up by an epenthetic vowel.[19]

(22)



As for the optionality of epenthesis we are forced to say that, within a particular level of structural complexity the licensing abilities of nuclei will vary, from speaker to speaker and also between registers.[20] Note that schwa is able to license some leftward governing relations, e.g. [koeltə] *culte* 'cult', thus its licensing strength reaches level II of structural complexity

[19] We bypass the question of resyllabification as a result of epenthesis. Since all governing and licensing relations are (or are not) contracted in the phonological representation, where all the licensing strength settings are taken into account, we may assume that the difference between epenthesised forms and those which retain the cluster ([karpər]) lies in the different representations that can be constructed lexically. The absence of derivation makes such issues as resyllabification irrelevant. Another option which can be pursued is to assume a CVCV model of phonological representation where what happens phonologically is only filling a nucleus with melody, while the syllabic structure remains the same.

[20] In fact, a connection between epenthesis and register has been noted not only for Dutch. See e.g. Oostendorp (1995), Mohanan (1986).

and hence, fluctuations within this level are rather unsurprising. Recall that the licensing strength is a scale and not a set of parameters. This brings us to the question of the substantive weight of particular formal complexities.

4.2. Light and heavy clusters

We will not get into much detail concerning the distinction between light and heavy clusters here, terms which we find appropriate when we talk about licensing strength of nuclei. It is clear that such distinctions must exist to account for the exceptional pre-schwa and word-final RT clusters in Dutch. At this stage we may offer the following criterion. Since two consonants contract a governing relation on the basis of their complexity differential, we will assume that clusters with obvious, or greater differential will be easier to license, and clusters with near equal complexity will be heavier to license. In this respect, geminates (23a) and partial geminates (23b) are the easiest RT clusters to license because the complement of the governing relation has little melodic content or none.

(23)

ease of licensing

easy ⟵ *difficult*

a. *geminate*	b. *partial geminate*	c. *ordinary RT cluster*
$R \leftarrow T \quad N$	$R \leftarrow T \quad N$	$R \leftarrow T \quad N$
. < α	α β	α β
. < β	. < γ	(γ)
. < γ	. < δ	

The above scale demonstrates, somewhat broadly, that the complement of the governing relation in geminates may have zero complexity as against e.g. three in the governor position. Partial geminates have a smaller complexity differential, but still, some properties, e.g. place of articulation, are lodged in the head of the relation. On the other hand, ordinary RT clusters may have yet smaller complexity slopes or may be of even complexity (Harris 1990).

Another argument for this way of defining the substantive weight of governing relations comes from restrictions on well-formed branching onsets. Recall that in these structures the licensing is indirect, therefore, TR is much more constrained than RT, and compare this fact with the condition on sufficient sonority distance in branching onsets, which we can directly translate into “higher complexity slope” between the governor and the governee. The fact that branching onsets prefer a greater complexity differential supports the view that clusters with such complexity profiles will be easier to license.

It should be mentioned that this reference to complexity profiles between consonants in a governing relation is very much in the spirit of the syllable contact law (Murray and Vennemann 1983), which states that a preferred syllable structure of, for example, an RT sequence is one in which the difference in the strength values of the consonants is greater. In terms of elemental complexity which our model adopts the preference can be stated in an identical fashion. There are two major differences, however, between this model of licensing and that of consonantal strength. First of all the complexity of consonants is directly read off from the number of phonological elements which they are composed of, and not from an arbitrarily proposed scale. Secondly, such complexity directly defines the phonological "weight" of a segment or cluster which requires a particular strength from the licenser to be maintained in the representation, whereas the strength of consonants in Murray and Vennemann (1983) is very much an accidental term, with only a vague indication as to what strength does. On the other hand, there is another point of similarity between the two models in that both focus on the interaction between consonants in syllabification rather than on constituents which are clearly of secondary importance.

To conclude: by referring to complexity profiles, we may integrate the substantive weight of particular strings into our scale of syllabic complexity and licensing strength thus accounting for such apparent exceptions as the existing word-final RT clusters in Dutch. Let us now move to another aspect of phonological representation, that is, the word-final context and the role of # in the distribution of consonantal clusters in Dutch.

4.3. Word-final context and the scale of licensers

Dutch has provided us with data showing that licensers may differ in strength within a single language, and that the differences are closely connected with the melodic make-up of the nuclei.[21] However, this language provides us with much more information concerning the types of licensers. Both types of vowels, that is, a full vowel and a schwa, are stronger licensers than the word-final context. Note that with respect to both TR and RT clusters the word-final context is the weakest. However, while this context excludes TR completely, it does allow for a restricted set of RT clusters. In other words, the context (_#) behaves very much like other licensers except that it is consistently the weakest in the hierarchy.

[21] Although the difference between a full vowel and a schwa is clearly melodic, we must not forget that to a great degree this difference is connected with the prosodic position of vowels. Schwas are reduced, unstressed vowels, thus referring to melody as the distinguishing factor may be insufficient and we should rather refer to weak licensing characteristics of prosodically weak positions.

Given the gradation system shown in (21) above, we may reverse the initial observation of Kager (1989) and say that, it is not that schwa behaves like a word boundary but the word boundary (#) behaves like a nucleus. We will assume that # is in fact a nucleus, except that it is melodically empty.[22] Only then, are we able to compare the word-final context with the pre-schwa and pre-full vowel situations. Thus the observation that schwa in Dutch sometimes behaves like a word boundary was not entirely incorrect. Only that now we can define better what the alleged boundary is. The gradation of contexts in (21) is in fact a hierarchy of licensers.

(24)

$$\begin{array}{ccccc} \mathrm{N} & & \mathrm{N} & & \mathrm{N} \\ | & & | & & | \\ \emptyset & < & \text{ə} & < & \mathrm{a} \end{array}$$

The surface word-final clusters are of exactly the same syllabic configuration with the exception that they are followed by a nucleus deprived of phonetic content. With respect to licensing certain clusters, the schwa vowel in Dutch may be equal to an empty nucleus, but it is an inherently stronger licenser, allowing for more cluster types and optionality of epenthesis in the preceding RT cluster. Note that the comparison makes more theoretical sense now because we are not comparing apples and oranges any more but different melodic shapes of a nucleus.

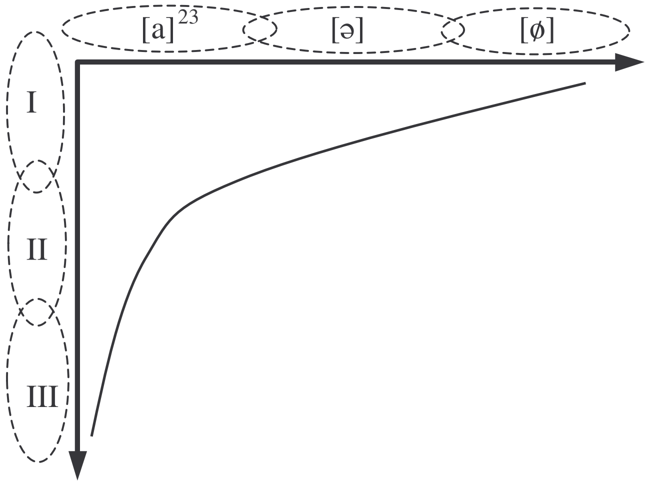
The nucleus is a prosodic unit which, just as any other prosodic unit, is independent of melodic content, otherwise there would be no point in positing additional levels of phonological representation. Note also that the empty nucleus is at the bottom of the hierarchy of licensers for a reason. If schwa, a melodically reduced vowel, is a weaker licenser than a full vowel, then it is logical that a nucleus which has no melody at all will be even weaker. Empty nucleus is thus not only part and parcel of the hierarchy, but the hierarchy itself is theoretically sound, in that no re-ranking is possible. Thus, this model is easily falsifiable. If we referred only to the Sonority Sequencing Generalisation and to the word-final clusters as complex codas, as do generative frameworks, then the gradation of the contexts would be completely arbitrary and there would be no theoretical reason why the word-final context should not license more than a schwa or a full vowel.

[22] We are not introducing anything new within the model of Government Phonology in which it has always been claimed that final consonants are not codas but onsets followed by an empty nucleus. See Kaye (1990) for the proposal, and Harris and Gussmann (1998) for a survey of convincing arguments against final codas. What is new here is that the syllable complexity and licensing strength model provides an additional support for the established views.

Given the three levels of formal complexity (I-II-III) and the three-way scale of licensers (a-ə-ø), which we have just established, the following abstract scheme of syllable markedness can be proposed.

(25)

An abstract scheme of syllabic complexity against licensing properties of nuclei



The full scale of nuclear types involves [a]-[ə]-[ø], which supports the existence of [ø]'s because now they are part and parcel of a system/scale of licensors. This scale interacts with the scale of structural complexity which, in fact, defines the licensing properties of each of the nuclear types separately. The curve symbolises the inherent hierarchy of both nuclear types and formal complexities. This means that neither the levels of complexity nor the types of licensers can be re-ranked. The overlapping circles around each level of complexity and each licenser type demonstrate that we are not dealing with points on the respective scales but rather with "regions of stability" with more typical / core properties and also peripheral properties. This flexible approach allows us to capture such nuances as the exceptional character of RT clusters in word-final position in Dutch.

From this scheme it follows that CV is the least marked syllable type, because it is the case of the easiest structure licensed by the strongest licenser. Thus we do not need any separate constraints or principles to derive this fact.[24] Each combination which goes beyond the CV will be more costly, and therefore, more marked. An additional point must be made. We assume that the existence of the more demanding structure in a given system must imply the existence of the less marked one. Thus, for example, if a language has branching onsets TR (level III) it should also have branching rhymes RT (level II). Likewise, if a schwa licenses

[23] [a] merely symbolises an unreduced vowel.

[24] "The unmarked" emerges from the basic theoretical assumptions on syllabification and not from a set of extraneous principles or constraints.

branching onsets, then a full vowel must be able to do that. However, the implications do not hold in the other direction.

Another consequence of the scheme in (25) is that it exhausts all possible syllabic configurations. This raises the question of the licensing properties of empty nuclei with respect to the three levels of complexity, but also, and more importantly, how the model deals with complex consonantal clusters, which exceed binarity. We will take these two points in turn after this brief summary of licensing properties of nuclei in Dutch which is tabulated below. The shaded box means that a given structural configuration is licensed by a relevant type of licenser.

(26)

Licensing properties of nuclei in Dutch

		[a]	[ə]	[ø]
I	C_			restricted (devoicing)
II	R.T_		restricted (easy clusters)	restricted (easy clusters)
III	TR_		restricted (pretonic position)	

The fact that full vowels in Dutch license all possible configurations is quite uncontroversial. Schwa, on the other hand, allows for a much more limited set of clusters. It is here that melodically and prosodically related restrictions begin to play an important role. Finally, severe melodic restrictions are found before an empty nucleus. Even simplex onsets are restricted in this context, hence, phenomena like devoicing occur, which are comparable to what happens in Polish or German. In the following section we will look more closely at the licensing properties of empty nuclei.

5. Empty nuclei, complex clusters and the right edge of the word

5.1. The role of empty nuclei in phonology

In the previous section we introduced a new entity to the inventory of phonological units, that is, an empty nucleus. The reasons for postulating this entity were based solely on the discussion of the licensing strength scale. It followed from the system that such a structure must exist if only to be able to account for the uniformity and relationships between the contexts: pre-vocalic, pre-schwa, word-final. This way, the relative markedness gradation in these contexts can be understood better than in standard approaches which identify the word-final context with the coda. It is enough to look at how the two competing models will treat the increasing markedness as illustrated in the table below to see the advantages.

(27)

Markedness effect	Context	
	Standard models	This model
unmarked, no restrictions	_a	_a
more marked, some restrictions	_ə	_ə
most marked, severe restrictions	"in the coda"	_ø

First of all, although the first two contexts seem to be identical in the two models it is only the licensing model that has a direct way of utilising the scale, while in traditional models the relationship is often overlooked and a separate machinery is employed to obtain the results, for example, the treatment of schwa as an appendix in Dutch (Kager and Zonneveld 1986). Likewise, the location of the context "in the coda" is at the bottom of the hierarchy only because we observe that such are the effects in the coda. Such argumentation is circular and of little theoretical value as it provides no answer to the question "why".

Another advantage of employing empty nuclei in phonological description concerns the word-final context in that it is now fully incorporated into a coherent system of syllabification which directly expresses the marked nature of the context. We will presently see how the word-final context in Polish can be captured in the licensing system. But first we must say a few more things about the nature of empty nuclei.

Empty positions play an important role in the theory of phonological government (Kaye 1990, Charette 1991, Gussmann and Kaye 1993, Harris and Gussmann 1998). Their presence is not only justified, but in fact, expected given the nature of phonological representation advocated not only in Government Phonology, but also in any other framework which adopts the three-dimensional model of phonological representation. It is true, however, that only GP treats empty nuclei as an indispensable aspect of representation. One objection, which is typically levelled against empty nuclei, is that such a construct is too abstract, although, we forget that anything beyond the melody level in the phonological representation is abstract. Abstract is the skeleton and the syllable with its constituents. However, these separate levels have been proposed and independently argued for, and it has been stressed that the three levels of representation are autonomous (Harris 1994).[25] In this respect the three-dimensional phonology predicts the existence of melodically empty onsets and nuclei, and if they are sufficiently argued for, they should be accepted just as any other abstract units of phonological analysis. We will assume that both filled and empty positions illustrated in (28) are theoretically predicted.

[25] The autonomy of levels of representation guarantees, for example, convincing analyses of compensatory lengthening in which a melody links up to a prosodic position vacated by some other melody.

(28)

$$\begin{array}{cccc}
O & O & N & N \\
| & | & | & | \\
x & x & x & x \\
| & & | & \\
\begin{bmatrix}\alpha \\ \beta\end{bmatrix} & & \begin{bmatrix}\alpha \\ \beta\end{bmatrix} &
\end{array}$$

Another justification for using empty positions can be drawn from processes of melodic depletion such as lenition of consonants (Lass 1984), and the historical shift from high vowels, through jers, to zero in Slavic (Stieber 1973), which we can also treat as depletion of melody (29b).

(29)

a. *opening lenition*

$$\begin{array}{ccccccc}
[p] & > & [f] & > & [w] & > & [\emptyset] \\
\alpha & & \alpha & & \alpha & & \\
\beta & & \beta & & & & \\
\gamma & & & & & &
\end{array}$$

b. *Slavic rise and fall of jers*

[u] > [ъ] ↘
[ø]
[i] > [ь] ↗

Concerning the scheme in (29a) we would only like to mention that the segmental complexity which is part and parcel of the model of Government Phonology seems to be entirely compatible with the fact that the target of the lenition of the opening type, which for the most part produces more and more sonorous segments, is silence, that is the least sonorous stage. In this model the lenition trajectory consists in reducing the complexity towards zero, and the last stage is not at all unexpected.

The rise and fall of jers in the history of Slavic languages (29b) may receive a similar interpretation. The jers are typically treated as reduced vowels which, at some stage, disappeared in some contexts. The question is if they disappeared as entire structures including the skeleton and the syllabic affiliation, or whether it was only melody that disappeared while the position continues to function in the representation.[26] A possible answer to this question will be offered presently.

In an attempt to keep the model of GP as constrained as possible, it is generally assumed that the distribution of empty positions, once we accept them, must be subject to certain restrictions. Thus, not only does the very occurrence of empty positions derive from the nature of the phonological representation involving government and licensing, but it is also in

[26] Abstract vowels in places where jers were lost have been proposed to account for vowel – zero alternations in the phonology of, for example, Polish (Gussmann 1980, Rubach 1984, Szpyra 1992, Rowicka 1999), thus some trace must be assumed, whatever the actual analysis.

the phonological representation that we seek to discover the mechanisms which would license such positions. The interaction between the source of the occurrence and the source of licensing of empty positions appears to underline the way these positions behave phonologically, that is, where they occur, and whether they remain empty or must surface melodically. To exemplify this interaction let us look briefly at the phenomenon of vowel-zero alternations in Polish.

For the purpose of this discussion, the chosen examples constitute only a subset of forms in which such alternations occur. The alternating forms in which the nucleus does not show up phonetically possess initial sequences of consonants which universally defy the conditions on the structure of branching onsets in any major framework. In GP, the forms contain an empty nucleus underlyingly, which shows up phonetically in some contexts and remains silent in others.

(30)

/møxø/	>	[mex]	~	[mxu]	<	/møxu/	*mech / mchu*	'moss/gen.sg.'
/lønø/	>	[len]	~	[lnu]	<	/lønu/	*len / lnu*	'flax/gen.sg.'
/wøbø/	>	[wep]	~	[wba]	<	/wøba/	*łeb / łba*	'head/gen.sg.'

Judging from the phonological forms such as /møxø/ ~ /møxu/, we may assume that the empty nucleus can remain empty if it is domain-final, or if it is followed by a full vowel. On the other hand, we are also able to pin point the context in which an empty nucleus must be vocalised. It is when it is followed by another empty nucleus. Thus, the restriction is that a sequence of two empty nuclei is banned (*ø–ø). Note that historically all the empty nuclei in (30) were jers, or if we move back in time even further, they were high vowels *i* and *u*.

Vowel-zero alternations within roots such as those in (30) are taken to be a palpable indication that an empty nucleus is indeed involved. As for the domain-final empty nucleus, its assumed presence after each surface word-final consonant, e.g. *cat* /kætø/, seems more advantageous than positing it contingently in order to account for vowel-zero alternations, especially, that the role of word-final empty nuclei is not limited to the phenomenon of vocalic alternation (Gussmann and Kaye 1993). It also functions in the system of syllable markedness which we introduced earlier.

Thus arguments justifying empty nuclei come from different quarters. There is a historical and synchronic justification, as well as purely theoretical. Finally, the existence of empty nuclei is predicted, or at least not excluded, by the very model of three-dimensional phonology in which the prosodic and melodic levels of representation are relatively independent of each other and argued for on various grounds (Harris 1994). Thus the argument for having empty nuclei which we have provided in this work, and which is based on the system of licensing strength, just adds to a pool of existing evidence which is quite independent of the complexity and licensing scales.

Before we turn to the function which the licensing scale plays in the analysis of Polish clusters let us make an additional claim concerning the source of empty nuclei in linguistic systems, which is based on its primary function in the phonological representation: since the job of nuclei is to license the preceding onset and the governing relations this onset enters into, we will assume that an empty nucleus can be used in a given system only if it is afforded some licensing properties. Otherwise, empty nuclei cannot be used and words in such a system will always end in a vowel, e.g. Italian.

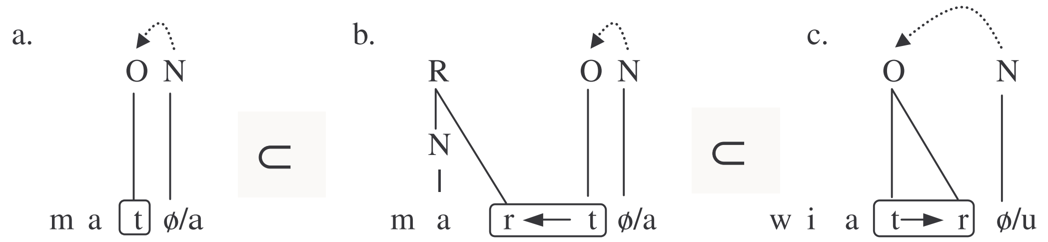
5.2. The right edge of the word in Polish

In the model described in previous sections a rearrangement of the scale of licensers [a>ə>ø] to, for example *[a>ø>ə] is impossible. On the other hand, what seems to be possible is a situation which we briefly mentioned about English and indeed Dutch, that is, one in which different types of licensers may come close to each other with respect to their licensing abilities. Recall our observation that schwa in English seems to license the same structures as full vowels, that is, *R.Tə* = *R.Ta* and *TRə* = *TRa*. On the other hand, schwa in Dutch may license the same structures as the empty nucleus. However, once we take the distinction between the empty nucleus and the full vowel into account, in English or Dutch, the differences become much more clear. For example, just like Dutch, English does not have word-final **TRø*, and even the *RTø* clusters are severely restricted (Gussmann 1998).

The question we want to investigate here is how strong an empty nucleus can get while being the weakest vowel in each system that makes use of it. The answer that follows from the abstract scheme described in the previous section must be that it can get as strong as the system allows for, but never stronger than the vowels which are higher in the hierarchy. We will look at Polish in which empty nuclei seem to utilise all the possible options. Yet they comply with the hierarchy of licensers. Let us look at the right edge of the word in Polish first.

In GP, surface word-final consonants are always followed by an empty nucleus phonologically. We stipulate that this nucleus can be employed only if it is able to discharge its duties as a licensor. This means that structurally, word-final consonants and consonant clusters should not differ from those in pre-vocalic position. Thus the pairs of words in Polish such as *mata / mat* 'mat/gen.pl.', *Marta / Mart* 'name/gen.pl., and *wiatru / wiatr* ‘gen.sg./wind’ will have identical syllable structures.[27] The only difference will lie in the nature of the nucleus which follows the relevant consonant or cluster.

(31)



Note that Polish vowels license all formal syllabic configurations. An empty nucleus, which, by definition, is a weaker licensor than its melodically filled congener, is able to license all three levels of syllabic complexity in Polish, which can be directly read off from the surface shape of the right edge of the word.[28] However, at each level of structural complexity, the empty nucleus is able to license less in terms of substance. For example, word-final context in Polish is the site of neutralisation of voice on obstruents and secondary articulations, that is, palatalisation on non-coronal consonants. Additionally, the word-final branching onsets are severely restricted in terms of possible consonant combinations.

Thus we have seen that empty nuclei may license different degrees of structural complexity. While in English and Dutch they go as far as licensing level II, that is, coda-onset clusters (RT), in Polish they allow for all structural configurations, yet not without restrictions, which follow from the defective nature of the empty nucleus. The linguistic variation illustrated above can be further developed to see all possible licensing settings involving full vowels and empty nuclei. The question mark (?) expresses doubt whether a given type of licensing is present, while the exclamation mark (!) expresses the restricted character of the licensed structure. A double exclamation mark (!!) means that we observe severe restrictions.

(32)

A typology of licensing discrepancies between [a] and [ø]

a.		Pol.Tur.Mal.Ital	Polish	Turkish	Malayalam	Italian
		[a]	[ø]	[ø]	[ø]	[ø]
I	C_		!		!	
II	C.C_		!			
III	CC_		!!			

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[27] One immediate advantage of this proposal is that inflection does not require re-syllabification of any sort, but only provides melody to the existing nucleus.

[28] This makes the model highly plausible from the point of view of language acquisition.

b.		Hungarian		Japanese		Yucatec Maya		Zulu	
		[a]	[ø]	[a]	[ø]	[a]	[ø]	[a]	[ø]
I	C_				?!				
II	C.C_								
III	CC_	?							

The table in (32a) illustrates variation among languages which have all three levels of syllabic complexity before a full vowel, that is, (*Ca, R.Ta, TRa*). However, each of them has different settings with respect to the empty nucleus. Hence, in Turkish, only RT clusters can be found in word-final position while TR clusters are broken up by epenthesis, very much in the way we saw about the Dutch RT clusters earlier. Malayalam allows only a subset of sonorants to occur in word-final context, while Italian must end its words with a vowel. In the latter language the empty nucleus is simply not afforded any licensing potential and therefore it is not utilised by the system.

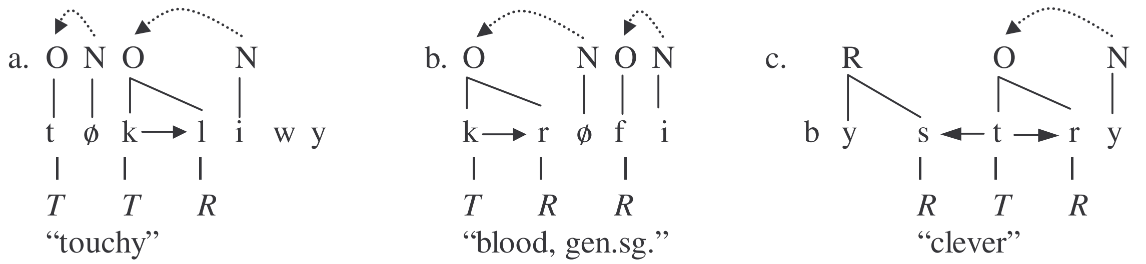
In (32b), we can see the remaining types of languages. In Hungarian and Japanese, full vowels allow only for RT clusters and there are no branching onsets, however, their empty nuclei differ. In Hungarian RT clusters are legal in word-final position, while in Japanese only a single consonant is allowed, if we treat the mora nasal as an onset (Yoshida 1996). Alternatively, Japanese would be an example of a language which does not employ empty nuclei, just as Italian. Zulu is an example of a language with no clusters, that is, with a CV syllable. Yucatec, however, is a very interesting case of a language which is generally a CV language except that it may have a consonant word-finally. In traditional terms, this language is said to have only final codas and no word-internal ones.

Having discussed the position of final empty nuclei in the typology of syllable structure we must turn to one more problem. Earlier, we saw that in Polish empty nuclei are not limited in their occurrence solely to the final position but may also be present in other contexts within the phonological word, e.g. *mech / mchu* ‘moss/gen.sg.’. This fact allows us to capture the initial clusters in this language which may contain up to four consonants. Recall, that one of the advantages of the model of government and licensing which was mentioned earlier was that governing relations limit the set of possible syllabic types. Given that each onset, or its relation with another consonant must be licensed, this is indeed the case, however, in a language in which empty nuclei are free to occur in various positions in the word and which have the ability to license all types of syllabic configurations we should expect that consonantal clusters in such a language may exceed two members. Below we provide a phonological representation of two such words.

5.3. Complex initial clusters in Polish

Languages like Polish may begin their words with clusters exceeding the number of two consonants, for example, [tklivɨ] *tkliwy* ‘touchy’ (33a), or [krfi] *krwi* ‘blood, gen.sg.’ (33b). These forms are not treated as ternary branching onsets but rather as a sequence of two well-formed onsets, which are separated by an empty nucleus which originates form a jer vowel discussed earlier. In fact, the empty nucleus in (33b) alternates with a vowel in [kref] *krew* ‘blood’.

(33)



As seen in (33a), the only two consonants with a sufficient sonority differential are /k/ and /l/, and they may contract a governing relation, while the first consonant must form a separate onset. In (33b) on the other hand, the first two consonants form a branching onset, while the third consonant forms a simplex onset. Both structures are licit in Polish because, as we saw earlier, empty nuclei are able to license both simplex onsets and branching onsets. It must be mentioned that the above analysis of the three-consonantal clusters is very much in the spirit of Kuryłowicz (1952), who also proposed to treat such forms as sequences of onsets. The only difference is that in GP these onsets must be separated by an empty nucleus.

The configuration illustrated in (33c) is the only possible cluster of three consonants which does not contain empty nuclei in the phonological representation. Note that the arrangement of the segments is such that a governor is flanked by governees on both sides. In syllabic terms, we are dealing with a branching rhyme followed by a branching onset.

In this model, to have initial sequences like those in Polish, a language has to fulfil a few conditions. First of all, it must allow for empty nuclei to be freely used in all positions within the phonological word. This condition constitutes, it seems, a major difference between Polish and English. The latter uses empty nuclei only word-finally but not in initial syllables. A second condition to be met in order to have complex clusters initially is, of course, allowing empty nuclei to license branching onsets. In this respect, the existence of words such as /v^{j}atrø/ *wiatr* ‘wind’ tallies with the presence of initial branching onsets which are also licensed by an empty nucleus, as in /krøtań/ *krtań* ‘larynx’. Needless to say, there is a need for a full and exhaustive analysis of consonantal clusters in Polish and their licensing within this model.[29]

6. Conclusions

We have defined a model of syllabification which is based solely on a licensing relation between a nucleus and an onset. It is this relation that lies at the heart of syllabification and not syllabic templates and conditions referring to minimal or maximal structure of constituents. We have seen that the syllable markedness and syllable typology can be handled by reference to licensing properties of nuclei which allow for various degrees of formal complexity along a scale defined by configurations in which the licensed onset finds itself. We also saw that licensers themselves form a scale of inherently strong – full vowels – and inherently weak licensers – empty nucleus. The linguistic variation of syllabic types is based on the interaction between the two scales: of structural complexity and licensing properties of nuclei. We are able to account for static facts like cluster distribution, and dynamic phenomena like vowel epenthesis. The inclusion of the empty nucleus into the scale of licensers has the advantage of enabling us to incorporate the right edge of the word into the system of licensing, as well as offers a way to account for complex initial clusters in languages like Polish. The scalar scheme of syllable markedness offers a uniform way of viewing exceptions, for example, the licit RT clusters at the end of the word in Dutch. The non-rerankable nature of the interacting scales of syllabic complexity and licensing strength leads to many predictions which need to be verified. One such prediction should be that we should not find languages with branching onsets, which would at the same time lack branching rhymes. In fact, one can immediately think of such an example, unfortunately. The so called law of open syllables eliminated internal codas (branching rhymes) in Common Slavic, while, as we know, there were still branching onsets which were inherited from Indo-European. Clearly, this is a subject for an in-depth study.

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[29] There are a few major contributions to the understanding of Polish clusters within the model of Government Phonology. Gussmann and Kaye (1993) and Rowicka (1999) focus mainly on licensing of empty nuclei in Polish, while Cyran and Gussmann (1999), which shifts the focus slightly to the licensing of clusters, deals mainly with the word-initial context.

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