Chapter 2
Formal complexity

1. Introduction

In the previous chapter it was shown that sub-segmental representation in terms of the elements of Government Phonology may directly account for quite a range of melodic phenomena, such as vowel reduction, vowel quality alternations, neutralization of voice, consonant mutations, phonotactics, or even the segmental inventories of given languages. In most of these phenomena the complexity of the representation, measured in terms of the number of elements, appears to be as important a factor as any other, such as, for example, the actual elements involved, homorganicity, etc. We also saw that it is possible to derive some markedness effects from the melodic (*substantive*) complexity. More importantly, substantive complexity has been shown to play a key role in how consonants interact in syllabification. In this respect, complexity profiles may replace sonority and strength scales in determining the syllabification of consonants.

The aim of this chapter is to demonstrate how exactly substantive complexity is incorporated into the higher level of phonological organization. We will be mainly concerned with syllabic organization in its formal aspect, that is the structure of syllabic units. It will be shown that complexity effects are also observed at this level. Since they concern structural configurations, the term *formal complexity* will be used. The relative complexity of syllabic structure, if captured correctly in a formal model, provides direct access not only to the definition and understanding of individual systems and syllabically driven phonological processes, but also to syllabic typology and markedness.

The attraction of deriving syllabic markedness from a formally defined complexity scale is evident. However, to achieve this goal, a few serious modifications of the model of Government Phonology will have to be introduced consisting mainly in simplifying its apparatus to the bare minimum. In general, this minimum involves the presence of governing relations between consonants and licensing relations between nuclei and onsets. On the other hand, some principles and parameters which defined phonological structure and constituted the core of standard Government Phonology in the past will be eliminated from the model and replaced with formally defined scales. This modified model will be shown to be fully compatible with the hypothesis that syllable structure is in fact a sequence of simplex onsets and nuclei, that is CVs (Lowenstamm 1996).

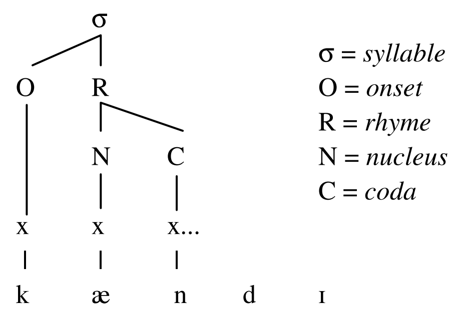
Descriptively, we will look at phenomena which are crucial for the understanding of syllabification, such as the distribution of clusters, vowel epenthesis, and vowel – zero alternations in Dutch, French and Polish. It will be shown that the modified model of Government Phonology is fully falsifiable, and that, apart from being able to capture all the phenomena connected with syllabification, it provides tools which may enable us to understand dialectal and register variation, historical shifts, the acquisition of syllable structure, the interaction between phonology and morphology, and the role of phonology in determining word structure, an issue which will be addressed in more detail in chapter 3. We begin the discussion by reviewing some basic facts concerning syllabification.

2. Syllabification

2.1. Basic facts

The structure we assume for the syllable is fairly well-established. We begin by providing some examples of fairly uncontroversial syllabification using this template, in order to be able later 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)



Let us now observe how syllabic divisions are made in the following three words: *baby, vulgar,* and *cobra*.

(2)
a. *ba.by* b. *vul.gar* c. *co.bra*

While most linguists will probably agree with the syllabification of the words above, the means of arriving 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 onto the prosodic level first, as heads of syllables. What we can ascertain at this stage is that all three words in (2) are bisyllabic. However, we must now prove that the consonants are adjoined to the syllable heads in the way illustrated in (2). There are two basic questions. First, what makes a single intervocalic consonant end up in the onset of the second syllable in *ba.**b**y* rather than as the coda of the first (**ba**b.**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. **bab.y*, **vu.lgar*, **cob.ra*.

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 maximization of onsets.

(3) ***Maximal Syllable Onset Principle*** (Selkirk 1982)

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

This principle ensures that the intervocalic consonant in *baby* is assigned to the onset of the second syllable in (2a). It also tells us why **cob.ra* is not correctly syllabified. Given that *br* is a well-formed branching onset in

English, which it is, it must be syllabified as such.[1] On the other hand, **lg* is not a possible branching onset and this sequence must be separated by a syllable boundary, hence *vul.gar*. 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 an inherent scale of segmental strength (Murray 1988).[2]

(4) ***Sonority Sequencing Generalization*** (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 the division in **vu.lgar* is incorrect because the sonority slope of the cluster decreases towards the syllable nucleus, while it should increase. In the previous chapter, it was demonstrated that in the Element Theory this aspect is dealt with by means of complexity slopes.

To summarize 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. The latter term covers a wide area as it first of all involves language specific decisions concerning the types of formal structures to be allowed, for example, whether branching onsets or coda-onset clusters are present. These major parameters or constraints are further supplemented by conditions on what good branching onsets and good coda-onset contacts are. This can be controlled in terms of sonority, strength, or complexity distance between consonants, as we saw in the previous chapter. However, these conditions are dependent on major syllable structure decisions, and are immaterial in systems which have no clusters at all.

In more recent models such as Optimality Theory (Prince and Smolensky 1993), syllabification procedures are replaced with an interaction of markedness constraints pertaining to the syllable structure in the output.

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[1] The data from Polish to be discussed below will demonstrate how naive this statement in fact is. The fact that *br* is a well-formed branching onset does not guarantee that this structure should be imposed on any such surface string.

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

For example, the respective phonological constraints ONSET, NUCLEUS, *CODA, *COMPLEX CODA, and *COMPLEX ONSET express the observation that preferred syllables have onsets and nuclei and avoid having simplex or complex codas, and complex onsets. The unmarked syllable structure, that is CV, does not involve the violation of either of the above listed constraints. However, a violation of any of these constraints is possible, thus producing more marked syllable types, relatively speaking.[3]

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

2.2. Government

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 differential. It will be recalled from the discussion in the previous chapter that, to some extent, complexity reflects sonority to the effect that the more complex the segment the less sonorous it is.[4] Note that complexity profiles are comparable with sonority or strength slopes, and the theory of government finds a role for these slopes to play. Thus, a more complex segment always governs a less complex one, regardless of their linear order in a string, as illustrated below.

(5)

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

(⇄) = *direction of government*, *T = governor*, *R = governee*

[3] This approach echoes earlier generative work on syllable markedness and evaluation of structural markedness (e.g. Cairns and Feinstein (1982).

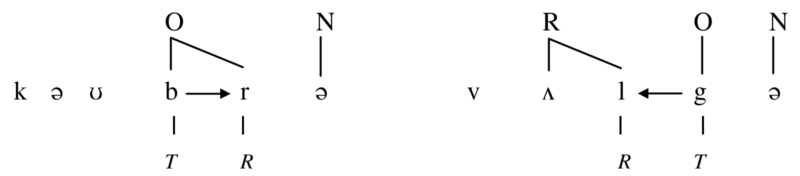
[4] In fact, the complexity of consonants which is defined in terms of the number of phonological elements present in their melodic make-up corresponds to a large extent to the strength scale proposed in Vennemann (1972). Since the complex consonants are governors, applying the term ‘strong’ to them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

Let us disregard the exact substantive complexities of *g* and *l* at this stage and assume that in a sequence of two consonants *T*, the governor, is more complex than *R*, that is, the governee. Though it is not impossible to assign a fixed function to some segments as typical governees, for example, glides, or typical governors, for example stops, we will assume that these functions are always worked out for any given sequence.[5] For example, *f* is likely to be a governor when adjacent to a liquid, as in *fling* or *alpha*, or a governee when followed by a stop, as in *hefty*.

In general, as we saw in the previous chapter, obstruents have more complex representations than sonorants, therefore, when *g* and *l* stand next to each other in a string, *g* will always be the governor because it is more complex than *l*.[6] 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, and the leftward direction specifies the relation between the onset and the preceding non-vocalic complement of a branching rhyme, that is, the coda. We illustrate this by providing the relevant fragments of the syllable structures of the now familiar words.

(6) a. ***co.bra*** b. ***vul.gar***

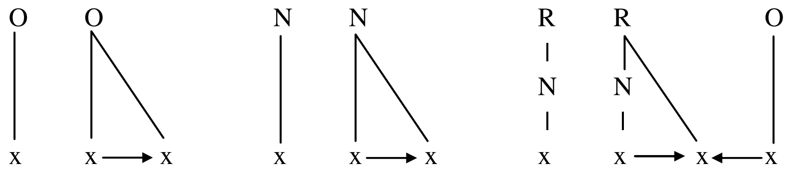


Government, however, should not be viewed as a mere theoretical rephrasing of contact laws and sonority sequencing. One advantage of the model is that the nature of government restricts possible syllabic types, because in any given direction only two positions – the adjacent ones – may contract a governing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

[5] Such labelling of consonants with a fixed function was attempted in the early Element Theory (Kaye, Lowenstamm and Vergnaud 1985). It is known as the Theory of Charm and was promptly abandoned in GP (see e.g. Harris 1990).
[6] Unless we are dealing with a system like Irish or Welsh, discussed in the previous chapter, in which a mono-elemental *g* can hardly be considered a good governor.

branching constituents: branching onsets, nuclei, and rhymes. This makes the model highly constrained. On the other hand, there is nothing in the standard generative models or Optimality Theory to constrain the size of syllables other than observation turned into language specific constraints. All the possible syllabic constituents which are recognized in standard GP are listed below.

(7) a. ***onset*** b. ***nucleus*** c. ***rhyme***



As for the simplex structures, it must be mentioned that a non-branching rhyme is in fact identical to a non-branching nucleus and refers simply to a short vowel. Logically, since the nucleus is subsumed under the rhyme, the latter may contain a branching nucleus as well, which is not shown in the above structures. Branching constituents, on the other hand, may be defined as involving governing relations which are from left to right. The only governing relation which goes in the opposite direction is that between an onset and the preceding rhymal complement as in (7c). Note that ternary structures would either violate adjacency between governor and governee, or the directionality of governing relations. Therefore, there are no ternary branching constituents.[7] The model allows for a simple definition of the syllable structure of a given system in that what is required is a statement concerning the ability of particular constituents to branch, a statement which may be couched in terms of parameters, for example.

It is interesting to note that in standard GP a branching rhyme involves a very complex structure in which not only is the rhymal complement governed by the head from the left, but is also governed by the following onset (7c). It will be shown later that this rhymal complement is in fact the only structural instance in which we may speak of a coda. What should be borne

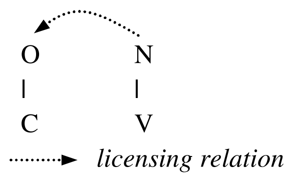
[7] Some cases of complex onsets and rhymes where binarity seems to be breached will be returned to. This problem concerns, for example, Polish initial consonant clusters and English super-heavy rhymes, in which the branching rhyme contains a branching nucleus.

in mind, however, is the fact that the structure of the branching rhyme would not be possible without the two relations.[8]

2.3. Licensing

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 an indispensable part of the syllable. One reason for this assumption is the simple fact that while we can have monosyllabic words without an onset consonant, a monosyllable cannot be deprived of a melodically filled nucleus. Another reason for treating nuclei as special is their participation in higher prosodic organization, 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 examine 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.

(8)



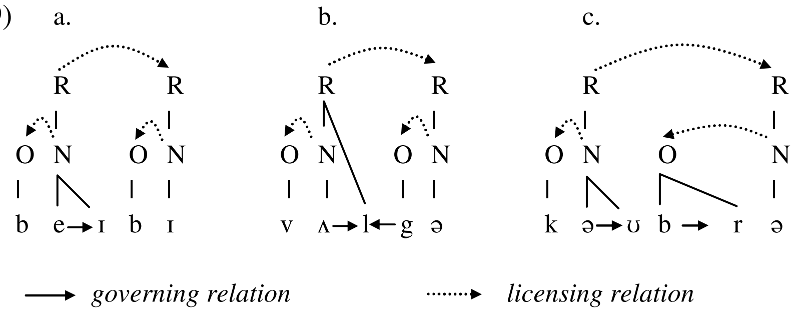
It is assumed that each nucleus must license its onset, a relation which encapsulates the two aspects of syllabification which we discussed above. Firstly, it directly reflects the supremacy of the nucleus within the syllable. It is indispensable because it is the licenser. It is the organizing agent in the utterance, without which the 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 *ba.by*. In other words, by recognizing the existence of the licensing relation between the nucleus and its onset, we are

[8] In the ensuing discussion it will be shown that a branching Rhyme is not an independent constituent. More detailed discussion and a concrete proposal concerning this problem can be found in chapter 3. See also Lowenstamm (1996), Takahashi (1993) and Scheer (1996) for similar conclusions.

able to account for basic syllabification without resorting to additional principles such as *Onset Maximization*, which in reality, merely state the facts and do not provide the theoretical means of deriving them.

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 remain in a licensing relation with their onsets.[9] 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.[10] For clarity of presentation the projection of the nucleus at the level of the foot is represented as R = rhyme.

(9)



In each case, the licensing goes from the nucleus to its onset which, on the other hand, may stand alone, for example, the second *b* in *baby* (9a), or find itself in a governing relation with a neighbouring consonant of lower complexity (higher sonority). Rightward government defines the constituent called a branching nucleus (9a), branching rhyme (9b), or branching onset (9c), whereas a leftward relation obtains between consonants belonging to two separate constituents (9b).

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

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

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

come back to this observation in the following section. Having noted the licensing relation between a nucleus and the preceding onset, the next logical question should be whether languages may differ with respect to the licensing properties of their nuclei, leading to a cross-linguistic variation in types and sizes of the onsets. To answer this question, we must establish how the licensing properties of nuclei may differ. As well as this, we need to find out whether 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.

3. Syllable markedness as a scale of formal complexity

In the previous chapter, we considered only one way to deal with markedness effects in Government Phonology, which involves making reference to the relative complexity of segments, that is, *substantive complexity*. The purpose of this section is to demonstrate that the same basic mechanism, that is, the interaction between licensing and the relative complexity of the structures, may capture markedness and typological tendencies concerning syllabification. To refer to these structural effects, the term *Formal Complexity* will be used.

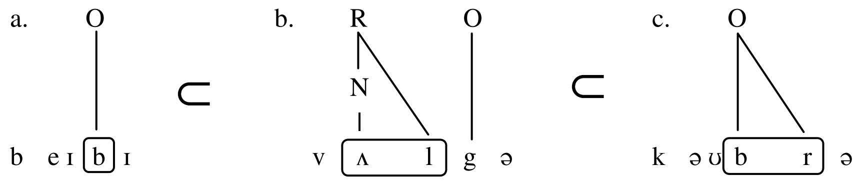
Recall that since segments in this model are composed of privative elements, the actual cost of licensing particular objects is calculated straightforwardly from the number of elements involved. It is to be expected that in prosodically weak contexts, the less complex segments should have a better chance of survival than compounds. This prediction is borne out by phonological phenomena such as the lowering or raising of mid vowels in unstressed nuclei as in, for example, Bulgarian and Catalan (Harris 1994). 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 the distributing 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), for example, proposes a coherent theory of neutralization, which unifies the intimate relationship between the distribution of prosodic licensing within a word and the allocation of melodic contrasts.

Later in this chapter, we will see how the complexity of consonantal segments may account for cross-linguistic patterns concerning their occurrence in word-final position. First, however, 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. Let us begin by reviewing some facts concerning syllable markedness.

3.1. Syllable markedness

Kaye and Lowenstamm (1981) observe 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.[11]

(10)



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 (10b), that is CVC, and the presence of this structure obviously implies the unmarked structure in (10a). Finally, the most marked structure is that with a branching onset (10c), 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.

[11] For a discussion of typology and markedness in syllable structure see, for example, Blevins (1995), Cairns and Feinstein (1982), van der Hulst and Ritter (1999), Kaye, Lowenstamm and Vergnaud (1990), McCarthy and Prince (1994), Prince and Smolensky (1993).

(11) ***Three levels of syllable markedness***

I	CV	Zulu, Desano	=	(10a)
II	CV, CVC	Hungarian, Japanese	=	(10a,b)
III	CV, CVC, CCV	Polish, English	=	(10a,b,c)

The question that must be answered concerns the theoretical relationship between all 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 there seems to be no formal connection between the two structures. On the other hand, the unmarked nature of CV appears to be rather uncontroversial.

In order to account formally for the implications shown in (10), Kaye and Lowenstamm propose to index the markedness scale in the following way (1981: 292).

(12)

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 (11) which suggests that the two structures must constitute separate levels. To amend this situation, 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* ($m \leq n$). Despite this little glitch, one cannot but admire the ingenuity of the observation, given that no obvious formal connection between branching onsets and branching rhymes can be readily supplied in any phonological model to this day.

The following section demonstrates that the basic insight of Kaye and Lowenstamm (1981), summarized in (10) and (11) above, may receive a fairly non-arbitrary description within a slightly modified 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.

3.2. Problems with parameters

From our earlier discussion of syllabification in standard GP it transpired that governing relations between consonants are not only indicative of the presence of branching constituents. They in fact restrict the maximal structure of branching constituents to binary relations. Thus, given that government is able to define all syllable types, that is, cover the syllable typology while retaining binarity, it may be possible to define syllabic systems by means of simple parameters on branchingness.[12] This is, in fact, the standard way of capturing syllable typology in GP, which is illustrated below.

(13) ***Branching***

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

If the parameter for branching onsets is set in the OFF position, the system only has simplex onsets. If the parameter is switched ON, the system possesses both branching and simplex onsets. The same concerns nuclei. On the other hand, the parameter for branching rhymes in fact determines the existence of internal codas, and, in a system which has long vowels, the possibility of having super-heavy rhymes, e.g. *bold*, *find*, etc. A discussion of the latter problem is delayed till chapter 3.

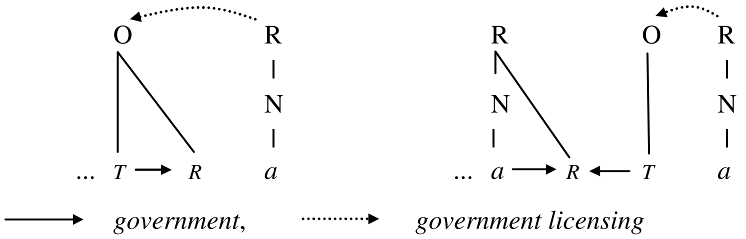
According to this set of parameters, the syllabic systems of Polish and English differ in terms of one parameter: in Polish the parameter for branching nuclei is switched OFF. This effectively deprives Polish of long vowels and super-heavy rhymes. Otherwise the systems may be said to be similar; however, the complex initial and final clusters in Polish require an additional explanation.[13]

[12] In section 5.4 we deal with cases of structures seemingly exceeding binarity.
[13] Some discussion of Polish clusters will be offered later in this chapter and in chapter 3. For more extensive analyses, the reader is referred to, for example, Bargiełówna (1950), Cyran and Gussmann (1999), Gussmann and Kaye (1993), Kuryłowicz (1952), Rubach (1977), Rubach and Booij (1990a, 1990b), Rowicka (1999).

Before we show how the above mentioned parameters fail to account for the basic markedness tendencies discovered in Kaye and Lowenstamm (1981), let us look briefly at the other ingredient of syllabification which was mentioned earlier, namely, licensing.

Charette (1990, 1992) proposes that both types of governing relations between consonants, that is, rightward (*b*→*r*) and leftward (*l*←*g*), must be licensed by the following nucleus. She distinguishes between *indirect* and *direct* Government Licensing (GL), respectively, as separate licensing properties of nuclei. The distinction direct vs. indirect takes into account the adjacency of the licenser and the licensee at the skeletal level, because at the constituent level no such distinction really exists, as can be seen in (14).[14] The following symbols are used below: T = governor, R = governee, *a* = any vowel.

(14) a. ***indirect GL*** b. ***direct GL***



Because the distinction between direct and indirect GL in Charette (1990, 1992) is not used for broad typological purposes, but rather for concrete analyses of the interaction of licensing with Proper Government, that is, relations between nuclei, it is not clear if the distinction corresponds to that between two independent parameters.[15]

The positive setting of the two parameters may be assumed to condition the presence of governing relations of the T→R and R←T type in a given language, and, in effect, of branching onsets and branching rhymes. It must be noted, however, that the relationship between the individual government licensing parameters and the corresponding branching constituents is not identical. The parameter for indirect government licensing refers directly to the two consonants that form the branching onset. In a sense, then, the ef-

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[14] This is one of the reasons why the constituent-based views of standard GP will be modified later in this chapter.

[15] See however the table in Charette (1992:289) where direct and indirect GL are treated as separate parameters.

fect of this parameter overlaps with the parameter on branching onsets. The same cannot be said about the relationship between direct government licensing and the existence of 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 could evoke a branching rhyme structure, which itself is defined in standard GP, like any other branching constituent, by a left-headed relation between the nucleus and the rhymal complement. This mismatch is probably the reason why the government licensing parameters have never fully replaced the parameters for branching constituents. It must be noted, though, that the two types of parameters, that is, those referring directly to branching constituents and those which define the licensing properties of nuclei, are overlapping and potentially conflicting.

Let us now see how these two types of parameters, that is, parameters for branching constituents and parameters for the presence of government licensing, fare separately and in conjunction with respect to the observation made in Kaye and Lowenstamm (1981) that there is an implicational relationship between branching onsets and branching rhymes. We begin with the parameters for branching constituents.

Though the parameters for branching constituents can describe typological variation, they are unable to account for the syllable markedness observation made by Kaye and Lowenstamm. To see this clearly, let us consider all the possible configurations concerning the parameters for branching onsets and rhymes which are predicted by the model.

(15)

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

Note that the system in (15d), that is, one which has branching onsets but no branching rhymes, is fully predicted by the model, even though it is precisely what Kaye and Lowenstamm (1981) found to be impossible.[16]

[16] Kaye and Lowenstamm (1981) discuss some apparent cases corresponding to the settings in (15d) and dismiss them. The following chapter offers an extensive analysis of similar systems in the history of Slavic. See also Cyran (2001) for a discussion of a similar problem in Malayalam.

The problem lies in the nature of the parameters in general, or rather in their independent status. Since each parameter is set separately, the only way to preclude (15d) above is to resort to the arbitrary designation of such settings as marked or downright impossible. This 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 (15a-c).

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, that is, internal codas, are *COMPLEX ONSET and *CODA respectively. While it is difficult to see how the two constraints could interact with each other, 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, the reverse ranking, or the reverse implication must be somehow precluded. That is, if *COMPLEX ONSET is undominated, *CODA must be too. In this respect, constraint ranking faces the same problem as the parameter system of GP, because there is nothing inherent in the model that would express this implicational relationship.

A more serious problem for standard GP is that as long as parameters for the government licensing properties of nuclei and parameters for branching constituents are allowed to coexist in the model, we cannot exclude conflicts between these two 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 another, which defines the licensing properties of the nuclei in a given language.

(16)

parameters	a.	b.	c.	d.
branch onset	ON	OFF	OFF	ON
indir. gov. lic.	OFF	ON	OFF	ON
	???	???	Zulu	Polish

What (16) illustrates is that it is not clear what the 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. The same applies to the interaction between the parameter for branching rhymes and direct government licensing. Since the two disparate types of parameters must be switched in conjunction, the problem signalled in (15d) remains unsolved. Below, we will pursue yet another option which consists in modifying the approach to parameters in a dramatic way, though the model of Government Phonology will be changed only slightly.

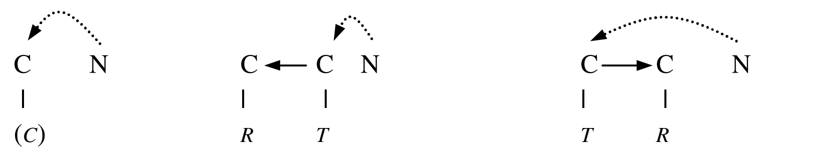
3.3. Syllabic complexity is scalar

Since syllabification in GP is indeed a reflection of governing and licensing relations, let us assume that we can do without parameters for branching constituents and derive the syllable typology only by reference to the 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 configuration to be licensed.[17]

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 puts different demands on the licenser, that is, the nucleus. These structures are repeated below.

(17)

a. ***Simple Licensing*** b. ***Direct Government Licensing*** c. ***Indirect Government Licensing***



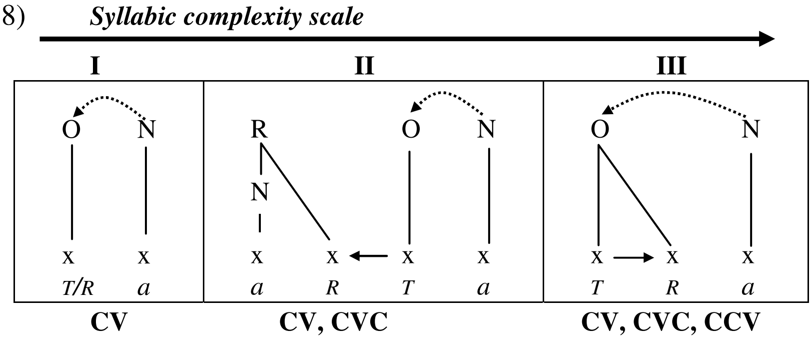
[17] Note that the elimination of parameters on branching constituents from the model does not affect such fundamental notions as, for example, the binary theorem. The maximally binary nature of constituents is guaranteed by the way governing relations are contracted and need not be doubly secured.

In (17), we illustrate the formal differences between particular configurations of onset licensing. Thus, (17a) represents the simplest arrangement, where a nucleus licenses a simplex onset of any substantive make-up whatsoever. It may be any consonant which is present in a given linguistic system, be it a sonorant or an obstruent.[18] It may also be an empty onset, if the language-particular settings allow for it. The structures (17b) and (17c) are formally more complex because the onset, which receives licensing from its nucleus, is itself in a relation with another consonant.

It is clear that the latter two structures are more demanding in terms of licensing than (17a), which explains the unmarked status of CV syllables. On the other hand, to distinguish between the licensing demands imposed by (17b) and (17c) on the nucleus, we will assume after Charette (1990) that the relevant distinction derives from the fact that in (17b) the nucleus is directly adjacent to the governor and therefore this structure is formally easier to license than (17c), in which the onset head is separated from the nucleus by the complement of the governing relation. Since syllabification is now viewed as the interaction between formal complexity and the licensing strength of the nuclei which sanction such structures, the relative distance between the licenser and the licensee should rightly play a role in the relation. This model, therefore, predicts that the opposite placement of the relevant structures, that is, one in which branching onsets would be simpler structures than coda-onset clusters, should be theoretically impossible.

This formal difference should alone suffice to establish the relative markedness of the structures in (17). Note that the syllabic complexity scale, which is derived from government and licensing, directly corresponds to the levels of markedness proposed by Kaye and Lowenstamm (1981) and discussed under (11). An extended version of the picture in (17) is given below.

(18) ***Syllabic complexity scale***



[18] Hence, we use the symbol *C* rather than *R* or *T*.

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 the preceding onset. 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.[19] Thus the markedness levels above appear to act like stable 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 crucial factor in systemic decisions as to how much syllabic structure is to be allowed can be reduced to one theoretical aspect of phonological organization: the licensing properties of nuclei, or better, their licensing strength.

Linguistic variation in this model consists in languages choosing arbitrarily how much complexity their nuclei will license along the nonarbitrary complexity scale, as illustrated in (19) below.[20]

(19) ***Licensing strength of nuclei***

	structure	*example*	*example language*
I	*Ca*	ba**by**	Desano
II	*R.Ta*	wi**nte**r	Hungarian
III	*TRa*	**tra**p	English

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

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

[19] Though the relative complexity of these structures is implicit in the terminology proposed by Charette, that is, direct vs. indirect GL, one may think of quite a few arguments supporting the ranking in (19) 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 their more costly nature in terms of licensing. Thus, sufficient sonority distance in branching onsets is nothing else than making the governing relation ‘easier’ for the indirect licenser, where ease is defined as relative to the steepness of the complexity slope.

[20] At this stage, the term nucleus is tantamount to an unreduced vowel. In the following sections a finer distinction is made between different types of nuclei.

phonetic theory, along the scale of syllabic complexity are non-reversible or re-rankable.

The above table recapitulates the hierarchy proposed in Kaye and Lowenstamm (1981) and solves the problem of the formal expression of the markedness values for branching onsets and branching rhymes. They are not equally marked. The branching onset is formally more costly.

The fixed nature of the complexity scale – allowing for easy falsification – is not its only advantage. The simplex onset in CV syllables is the least marked because this 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 the utilization of all logically possible structural configurations, some of which happen to be more costly to license than others. In this respect, complexity and markedness are synonymous terms.[21] 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. a branching onset.[22]

One should mention a few consequences of the model presented above, which will be taken up in chapter 3. One of them concerns the fixed nature of the complexity scale. It is very easy to falsify the proposal, in that the existence of languages which possess branching onsets (level III), but lack branching rhymes, that is, codas (level II) should be ruled out. This is because, nuclei that can license the most complex structures are predicted to license the less complex / marked ones.[23]

Another problem concerns the status of branching rhymes. In standard GP, this structure involves a governing relation between the head, that is, the nucleus, and the rhymal complement which is at the same time governed by the following onset. In the model presented here, the crucial aspect of what has hitherto been considered to be a branching rhyme is shifted to the governing relation between the consonants. The consequences of this move are far-reaching. First of all, the status of the branching rhyme is now un-

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[21] Recall that a similar relationship between complexity and markedness is observed at the sub-segmental level of representation (see chapter 1).

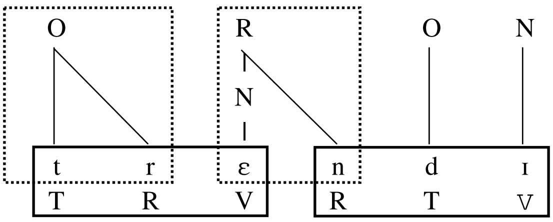
[22] Cases where government is not contracted between two consonants, as well as consonant sequences exceeding binarity will be discussed shortly.

[23] This problem is referred to as ‘skipped steps’ in Cairns and Feinstein (1982).

dermined, and the phonological phenomena typically ascribed to this structure, for example, closed syllable shortening and stress attraction in English, will have to be captured in a different way. More importantly, we predict that whether a given system has internal codas depends on the licensing strength of the nucleus in the following syllable, thus undermining the status of the syllable itself as a linguistically valid unit.[24]

We may illustrate the shift in focus by the following diagram. The dotted area illustrates the traditional way of looking at syllabic constituents. This perspective required reference to parameters on branching constituents. The solid-line area marks the domains of interaction that transpire from our discussion, which allow for a scalar understanding of syllable markedness.

(20)



The consequences of this move will be discussed in the remainder of this book.[25] The syllable typology given in (19) above deals with variation in the licensing strength of nuclei across languages. As such, it must be treated

[24] Government Phonology has always claimed that there is no such prosodic unit as the syllable (Kaye, Lowenstamm and Vergnaud 1990). Takahashi (1993) and Scheer (2004) claim that governing relations can effectively replace any notion of syllabic constituency, a position which is supported by this discussion. For other proposals denying the existence of the syllable see e.g. Dziubalska-Kołaczyk (1995, 2002) and the references therein.

[25] A similar shift from arboreal structure to lateral relations in phonological representation, although in a slightly different model, can be found in e.g. Scheer (2004).

as an observation-based proposal which requires further substantiation. For this purpose, we will now consider the question whether nuclei may have differing licensing strengths within a single phonological system.

4. The 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 the syllabic configurations that demanded the licensing. Syllabification, therefore, appears to result from a tug of war between the relative structural complexity of onset configurations and the licensing strength of nuclei. In this section, we will further extend the model by looking at different types of nuclei in order to see if within a single language they may also exhibit differing licensing properties.

We know that vowels may differ in quality and quantity, and it would be prudent to see if these distinctions have any bearing on their licensing properties. If licensing strength is taken seriously, it predicts that weaker vowels can license less, not more. The question, of course, is what is a weak or weaker vowel. We will first 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* [kəʊ.brə] suggest, there is no difference in the licensing abilities of full and reduced vowels in English. For our purposes, it would be worrying if schwa licensed more than a full vowel. We therefore provisionally assume that the two kinds of vowels may have similar licensing properties in this language.[26]

In order to neatly illustrate the differing licensing abilities of nuclei we will look at restrictions on consonantal clusters and following vowels in

[26] There are facts in English phonology, described, e.g. in Gussmann (1998), which seem to suggest that in some contexts schwa is banned and only a full vowel will do. The phenomenon concerns the absence of sequences such as **...əmp*, **...əŋk*, etc. in this language. Although, these facts are closely connected with our proposal, they will not be discussed until chapter 3.

Dutch.[27] Among the many characteristics of the schwa vowel in Dutch, the one which is most interesting for us is its constrained distribution with respect to preceding clusters. Kager (1989: 212) 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.

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

There are no word-final clusters of rising sonority (21a), or before a schwa vowel (21b). Branching onsets in Dutch require a full vowel to follow as shown in (21c). In terms of the model of licensing we have introduced so far the difference between (21b) and (21c) 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 illicit forms in (21a) and why they are excluded.

Two more comments must be made about the data in (21). Firstly, although so far we have not discussed the phonological nature of word-final clusters such as those in (21a), it appears to be quite unusual for a word-final cluster to be compared to pre-schwa clusters which, as most linguists will agree, in most languages constitute an onset. Secondly, it is not true that (21a) and (21b) are equally unacceptable. While there are indeed 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, although, admittedly, these clusters do not look like well-formed branching onsets, e.g. *Dafne* [dafnə] (Kager 1989: 213). Secondly, well-formed branching onsets are found in pretonic

[27] The discussion is based on Booij (1995), Kager (1989), Kager and Zonneveld (1986), Trommelen (1984), and van Oostendorp (1995, 2000).

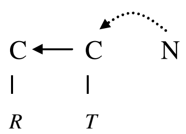
position in words like: *fregat* [frəgat] ‘frigate’, *brevet* [brəvɛt] ‘patent’. So, in fact we are dealing here with a sort of gradation of acceptability of clusters in the three contexts in (21); from absolutely excluded, through restricted, to fully acceptable. This scale is presented below in a symbolic way. This will facilitate the comparison of the restrictions holding in clusters of rising sonority with those of falling sonority to be presented below.[28]

(22) *TR# < */okTRə < okTRa

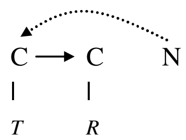
The hierarchy should be read as follows: a full vowel licenses better than schwa, which licenses better than #, that is, the word-final context.

Before we begin discussing the distribution of *RT* clusters in the same three contexts, with particular focus on the pre-schwa position, the reader will remember that in the licensing model presented here, 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.

(23) a. ***Direct Government Licensing***



b. ***Indirect Government Licensing***



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

(24) a. [damp] *damp* ‘vapour’
[daŋk] *dank* ‘thanks’
[avənd] *avond* ‘evening’

b. [χɛrt] *Gert* ‘name’
[boelt] *bult* ‘hunch’
[vɛrs] *vers* ‘fresh’

---

[28] ‘a’ stands for a full vowel

In the first set, the existence of partial geminates is accounted for by referring to the integrity of such structures.[29] As for the dental obstruent in (24b), it is sometimes treated as an appendix or an extrametrical consonant (Kager and Zonneveld 1986). In fact, both sets of data involve some kind of homorganicity. It will be recalled that similar conditions are found in Irish, in which *RT* clusters retain their integrity if homorganicity comes into play.[30] However, for our purposes, the interesting observation concerning the data in (24) is that this type of cluster is not entirely excluded from the word-final context, whatever the nature of the exceptions. Recall that no such exceptions were found with clusters of rising sonority (21).[31]

We may ask a question why *RT*# is less restricted than *TR*#. Traditional approaches have a ready answer here. Recall the Sonority Sequencing Generalization (SSG) which was mentioned in earlier sections, and which says that there must be a decrease in sonority in consonant clusters flanking a nucleus. Thus, the string *nucleus+RT*# complies with the generalization whereas *nucleus+TR*# does not. This point notwithstanding, we have seen in (22), and we will see again below, that the word-final context (_#) is not exceptional in the treatment of consonantal restrictions in Dutch in that it forms an integral part of the gradation of restrictions. As it stands, the Sonority Sequencing Generalization provides no platform for comparisons between the word-final, pre-schwa, and pre-full vowel contexts, and the hierarchy (_a>_ə>_#) makes very little theoretical sense.[32] The reranked scales *(_a>_#>_ə) or *(_#>_a>_ə) can only be excluded on observational and not on theoretical grounds. To see this better, 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, once again the pre-schwa situation is identified with the end of the word. However, the status of the epenthesis in the

[29] See e.g. Hayes (1986).
[30] See section 3.2. in chapter 1.
[31] It must be said that there are problems with the description of exceptional structures in syllabic analyses, and in effect, resorting to such contingencies as extrasyllabicity 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.
[32] The hierarchy (_a>_ə>_#) simply says that the pre-full vowel context is better for clusters than pre-schwa, and pre-schwa is better than word-final.

two contexts is not identical. While epenthesis is almost obligatory in word-final context (25a), it is only optional in pre-schwa position (25b), and it is excluded in contexts preceding a full vowel (25c).

(25) 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 (25) is a gradation of *RT* integrity depending on what follows the cluster, which is reminiscent of the restrictions on *TR* clusters depicted in (22). Compare the two scales of contextual strength below.

(26)

	a.		b.		c.
	$^{\text{ok}}$TRa	>	$^{\text{*/ok}}$TRə	>	*TR#
$^{\text{ok}}$R.Ta	>	$^{\text{ok/ə-epen}}$R.Tə	>	$^{\text{ə-epen/ok}}$RT#	

The similarity in the distribution of *TR*s and *RT*s lies in the fact that in both cases we are dealing with the same scale of contexts (_a>_ə>_#). The crucial difference is that in each respective context *RT* fares better than *TR*, which we mark by shifting the *RT* scale of integrity slightly to the left.[33] These effects are fully predicted in our model, as *TR* is formally more de-

[33] Although before an unreduced vowel (_a) the full set of *TR* and *RT* clusters can be present, the slanted line is used to express the fact that the two types of clusters will still display different degrees of melodic freedom.

manding. Thus, to use our terminology, a full vowel can license both *RT* and *TR* clusters (26a). 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 in constituent-neutral terms, Dutch full vowels license both leftward (*R*←*T*) and rightward (*T*→*R*) governing relations. The schwa is much weaker as a licenser. 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 a nasal+homorganic obstruent or liquid+dental, e.g. *culte* [koel.tə] 'cult'. Recall that these clusters are also found in word-final contexts.

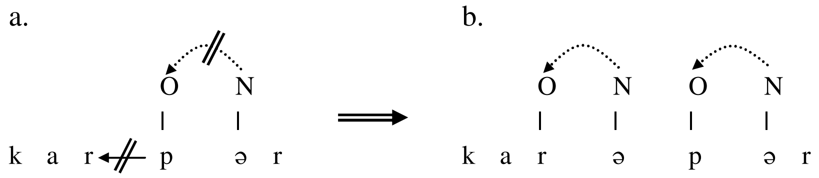
The scales in (26) provide a general picture of the gradation of contexts with respect to the licensing of the two types of consonant clusters. Now, each of these individual situations merits a discussion with respect to the observed effects. Here we focus only on the optional epenthesis in the pre-schwa *RT* clusters. The analysis of this phenomenon within our 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 the 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 *karper* [kar(ə)pər] 'carp' (25b), where the cluster is of the 'heavier' type, optionality of the effects are predicted. Either the licensing potential of the nucleus is sufficient to license the governing relation, or it is not. For this reason, the cluster may be broken up by an epenthetic vowel, or not.[34] Note that the failure

[34] We bypass the question of resyllabification as a result of epenthesis. Since all governing and licensing relations are contracted in the phonological representation, we may assume that the difference between epenthesized forms and those which retain the cluster ([karpər]) lies in the different representations. Another option which can be pursued is to assume a CVCV model of phonological representation where all that happens phonologically is that a nucleus is filled with a melody, while the syllabic structure remains the same. See section 6 for more discussion.

of schwa to license *rp* de facto leads to a situation where a branching rhyme in the preceding syllable is impossible, which is exactly what the model predicts. Thus, we seem to have found some empirical support for the assumption that a branching rhyme is determined by the nucleus in the following syllable, as it were.

(27)



In (27a), we see that the nucleus is unable to directly government license its onset. Hence, the governing relation, and thereby, a coda-onset contact is impossible. Epenthesis is a strategy providing a licenser for the liquid (27b). 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.[35] Register difference in this model is viewed as manipulation, conscious or not, of the licensing strength of the nuclei. The schwa in Dutch is able to license some leftward governing relations, e.g. *culte* [koeltə] 'cult', thus its licensing strength reaches level II of structural complexity and hence, fluctuations within this level are rather unsurprising. Note that such manipulation of the licensing properties of nuclei must be viewed as an abstract phenomenon, because we are not dealing with a stronger articulatory effort – a schwa is a reduced vowel and remains so. It is its licensing properties that are up- or down-graded depending on the register. Let us now expand the idea of easy and difficult governing relations.

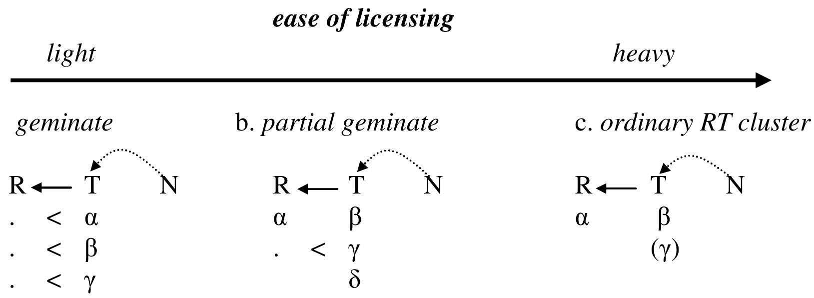
4.2. Light and heavy clusters

We will not go into much detail concerning the distinction between light and heavy clusters here, terms which we find quite appropriate for a model operating with the 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, which was briefly mentioned in the previous chapter when we discussed the dif-

[35] A connection between epenthesis and register has been noted for languages other than Dutch. See e.g. van Oostendorp (1995), Mohanan (1986).

ferences between English and Polish *fr/vr*, and the complexity-based conditions on Irish epenthesis. Since two consonants contract a governing relation on the basis of their complexity differential, it may be assumed that in clusters where the differential is greater, government will obviously be easier to contract. Such clusters will also be easier to license than clusters with near equal complexity. In this respect, geminates (28a) and partial geminates (28b) are the easiest *RT* clusters to license because the complement of the governing relation has little melodic content or none.

(28)



The above scale demonstrates, somewhat broadly, that the complement of the governing relation in geminates may have zero complexity as against e.g. three-fold complexity 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), and the two positions do not share any properties. Recall that in Irish epenthesis the only surviving non-homorganic *RT* clusters are those in which the governor is a voiceless stop. Thus, for example, *circe* [k´ir´k´ə] 'hen, gen.sg.' retains the cluster while *feirge* [f´er^{ə}g´ə] 'anger, gen.sg.' does not. It appears then, that the interaction between the formal settings of the licensing properties of nuclei and the complexity slopes within governing relations must also be taken into account, thus allowing for much more subtle accounts of linguistic facts.

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* clusters are much more constrained melodically. Thus, the condition on sufficient sonority distance in branching onsets can be directly translated into a 'steeper complexity slope' between the governor and the governee. Branching onsets prefer a greater complexity differential because clusters with such complexity profiles will be easier to license. Thus, the condition on sufficient sonority distance in branching onsets falls out from this model rather naturally. One must add that sub-segmental complexity cannot be viewed as the only condition on licensing particular clusters. For example, languages like Polish will prohibit geminates, while others will have severe restrictions with respect to, for example, homorganicity. There are also purely phonetic conditions (see e.g. Ohala 1992, Flemming 1995). However, internal complexity seems to be important from the point of view of contracting governing relations, and their licensing.

Let us return briefly to our earlier discussion of English and Polish *fr/vr* in chapter 1, where we noted that *vr* in Polish has an identical complexity slope as *fr* in English, and therefore the status of these clusters is similar in the two systems. It was suggested that *fr* in Polish and *vr* in English, on the other hand, are more restricted because the complexity slopes are smaller. In English *fr*, the governor has three elements (U,h,H) while the governee has only one (A), whereas in *vr*, the relation is (U,h) vs. (A). Polish has a different specification for voicing, therefore the respective structures for *vr* and *fr* are (U,h,L) vs. (A), and (U,h) vs. (A). In other words, English *fr* and Polish *vr* are equally good, as opposed to the less preferred English *vr* and Polish *fr*.

The problem that was left unanswered was the fact that while the worse constructs have identical complexity slopes in the two languages, the degree to which they are treated as worse in these systems is markedly different. Namely, while *vr* in English is not utilized in any meaningful way, the *fr* in Polish is quite licit. The missing aspect in the differentiation between English and Polish lies in the licensing strength of nuclei. Polish nuclei seem to be stronger in that they license branching onsets which are less restricted than the English ones. This claim will be further supported in the following sections devoted to Polish settings for licensing strength.

It should be mentioned that the 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 the preferred syllable structure for e.g. an *RT* sequence is one in which the difference in the strength values of the consonants is greater. In terms of the elemental complexity of our model, the preference can be stated in an identical fashion. There are two major differences, however. 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 in order 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.[36] 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.[37]

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. The 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.[38] 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.

Given the gradation system shown in (26) above, we may reverse the initial observation of Kager (1989) and claim that it is not that schwa behaves like a word boundary, but that the word boundary (#) behaves very much like a nucleus. Let us then assume that # is in fact a nucleus, except

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[36] Similar criticisms may be applied to sonority sequencing, and such concepts as sonority distance or degrees of sonority steepness.

[37] In this respect the recent development within Natural Phonology called the Beats and Binding Theory (Dziubalska-Kołaczyk 1995, 2002) is a very similar proposal.

[38] 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 the weak licensing characteristics of prosodically weak positions. See chapter 3.

that it is melodically empty.[39] 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. What is new here is that the model which draws on syllabic complexity and licensing strength provides additional support for a view which has been put forward by other authors. Only by assuming that words ending with consonants on the surface structurally end with an empty nucleus, are we able to compare the word-final context with the pre-schwa and pre-full vowel situations in a coherent and meaningful way. Thus the observation that schwa in Dutch sometimes behaves like a word boundary was not entirely incorrect. Only now, we can define better what the alleged boundary is.[40] The gradation of contexts in (26) is in fact a hierarchy of licensers.

(29) ***Scale of licensers***

```
N     N     N
|     |     |
a  >  ə  >  ø
```

This assumption, which will be further illustrated in the following section, solves two problems. Firstly, *TR* and *RT* clusters before a final empty nucleus are now formally identical to the same clusters in pre-schwa and pre-full vowel contexts. *TR*s are always branching Onsets, as it were, and *RT*s are Coda-Onset sequences in all three contexts. Secondly, the scale of contextual strength (_a > _ə > _ø) receives a non-arbitrary explanation now, in that a full vowel licenses better than a prosodically weaker schwa. Both schwa and the final empty nucleus are weak licensers, but schwa has melody and is therefore a better licenser than the empty nucleus. The theoretical difference between the contexts _# and _ø cannot be underestimated. This is illustrated below.

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[39] See Kaye (1990) for more discussion concerning this proposal, as well as Gussmann and Kaye (1993), and Harris and Gussmann (1998) for a survey of convincing arguments against final codas and in favour of final empty nuclei.

[40] In the following discussion we refer only to the licensing properties of empty nuclei in word-final position.

(30)

a. ***context*** (traditional)	***effect***	b. ***licensing scale***
_a	unmarked, no restrictions	_a
_ə	more marked, some restrictions	_ə
_#	most marked, severe restrictions	_ø ↓

Clearly, the contexts understood in the traditional way as in (30a) do not constitute a uniform set, and the placement of _# at the bottom of the markedness hierarchy is arbitrary and based only on observation. On the other hand, the scale of licensers in (30b) leaves no space for re-ranking. An empty nucleus cannot license more than a schwa, and a schwa cannot license more than a full vowel. Thus, this model is easily falsifiable. As regards the licensers, a discrepancy to the effect that more melodic material (substantive complexity) or more syllabic structure (formal complexity) can be found before weaker licensers than before stronger ones would be potentially detrimental to this model. Likewise, given that branching onsets are more marked than coda-onset contacts, a system with *TR* but no *RT* clusters would also be problematic.[41]

4.4. The syllabic space

Given the three levels of formal complexity (I–II–III) and the three-way scale of licensers (a–ə–ø), the following syllabic space and syllable markedness can be proposed. *C* stands for any consonant, [a] is any full vowel. *RT* is a coda-onset contact, which means that it is not a word-initial cluster. *TR* is a branching onset in any position in a word.

(31) ***Syllabic space***

		[a]		[ə]		[ø]
I	C_	Ca	⊂	Cə	⊂	Cø
		∩		∩		∩
II	RT_	RTa	⊂	RTə	⊂	RTø
		∩		∩		∩
III	TR_	TRa	⊂	TRə	⊂	TRø

[41] See chapter 3 for a discussion of an apparent example of such a system, that is, Common Slavic. The other example, Malayalam, is discussed in Cyran (2001).

The syllabic space in this model is defined by the interaction between the vertical vector of the structural complexity scale (I–II–III), where government, its presence and type, plays the key role, and the horizontal vector of the scale of licensers (a–ə–ø). Neither the levels of complexity nor the types of licensers can be re-ranked, and the syllabic space as defined by complexity and licensing is finite.[42]

From this scheme it follows that for any given licenser the same full typology of possible syllabic structures and the same markedness relationships are available. That is, potentially, each type of nucleus can license a single onset (CV), an onset governing a preceding coda (*RT*), and a branching onset (*TR*). The difference, of course, is that the melodic and structural options will decrease as we move away from *Ca*, that is, a CV syllable containing a simplex onset licensed by a full vowel.

Ca is the least marked syllable type because here the easiest structure is licensed by the strongest licenser. Thus we do not need any separate constraints or principles to derive this fact. The 'unmarked' syllable type emerges from the basic theoretical assumptions on syllabification and not from a set of extraneous principles or constraints. *TRø*, the word-final branching onset, is on the other hand the most marked structure. Markedness increases with the extension of one or both vectors, that is, (I–II–III) and (a–ə–ø).

The vectors allow us to establish the implicational relationships between structures in a straightforward fashion. For example, the presence of *RT*ə in a given system ensures the existence of *Cə*, *RT*a and *Ca* by direct implication or transitivity. On the other hand, the presence of *TRø* suggests that all possible configurations shown in the syllabic space scheme in (31) should be also present.

The integration of the empty nucleus in the licensing scale unifies structural licensing in that the typology and markedness of the right edge of words may be given the same account as word-medial simplex onsets and clusters.[43] This includes the fact that word-medially the maximal number of consonants in a cluster is typically three. Note that so far, there was no mention of three-consonant clusters or bigger. However, the syllabic space, as defined in (31) does in fact predict the existence of three-consonant

[42] Note that the syllabic space does not include empty onsets, long vowels and clusters of consonants that are not in a governing relations. Some of these will be discussed in the following sections.
[43] See Harris and Gussmann (1998) who point to the similarity between intervocalic and word-final phonotactics in English.

clusters. Recall that the structural complexity is defined by the presence of government. The conditions on government in GP allow a relation between only two consonants in a given direction. Government is bidirectional. Therefore, if a governor *T* governs one complement to the right and one to the left (*R*←*T*→*R*), then what we obtain is a licit ternary cluster, which, however, should not be confused with a ternary syllabic constituent. An example of such a configuration word-medially can be easily found in a language like English. In fact, the very name of the language contains a ternary cluster (/ɪŋ←g→lɪʃø/).

A ternary cluster is also possible word-finally, although it is very rare. In Polish, which has word-final branching onsets as in *wiatr* [v^{j}atr] < /v^{j}at→rø/ 'wind', there are a few examples of ternary clusters in this position, which can be given the same structure as the one witnessed in *English*, except that they are word-final. These forms are, for example, *sióstr* [ɕustr] < /ɕus←t→rø/ 'sister, gen.pl.', and *mantr* [mantr] < /man←t→rø/ 'mantra, gen.pl.'.

Let us look closer at the crosslinguistic empirical facts concerning the shapes of the right edge of words.

(32)

Markedness scale		*The shape of right edge*	*Example*
a. ...VC_0#	→	...Ca	Italian
b. ...VC_1#	→	...Cø	Malayalam
c. ...VC_2#	→	... RTø	English, Turkish
	↘	...TRø	Polish, French
d. ...VC_3#	→	...RTRø	Polish
e. ...VC4#	→	...???	Polish
f. ...VC5#	→	...???	Polish
g. ...VC6#	→	...???	???

(32a) illustrates languages in which words cannot end even with one consonant. Traditionally, such languages are said to end words with open syllables. The next step on the markedness scale is a situation in which words may end with one consonant. Phonologically, we claim that these words end with an empty nucleus. Thus, from the typological perspective, the distinction between (32a) and (32b) can be expressed by means of some parameter allowing empty nuclei word-finally. In the model presented here, it is enough to say that the empty nucleus is granted licensing properties in (32b), but only to sanction a simplex onset (level I of structural complexity).[44] No such properties are granted in system (32a).

The facts in (32b-d) are neatly expressed in the syllabic space discussed above. The empty nucleus, once it is granted licensing power, may license all three levels of complexity, as in Polish, two levels, as in English, or just one, as in Malayalam. Additionally, the licensing properties in Polish predict that a three-consonant cluster may also be found word-finally in that language (32d). Naturally, such clusters are predicted to be even more restricted melodically than the final branching onsets. This is because, the final empty nucleus has in fact three, not two consonants to license.

Thus, there seems to be a theoretical continuity between (32a) and (32b-d), which depends first on whether the final empty nucleus is able to license anything, and if it is, on the amount of structure that it can support – complexity scale. Given the syllabic space defined in (31), this continuity cannot go beyond (32d). However, the empirical facts seem to show differently. The situation in (32e) and (32f) can be illustrated with existing examples from Polish. There are words ending in four and five consonants respectively, e.g. *lekarstw* [lekarstf] 'medicine, gen.pl.', *następstw* [nastempstf] 'consequences, gen.pl.'. These forms will be discussed at length in chapter 3 and demonstrated not to contradict the syllabic space. The hypothetical situation in (32g) will not be considered.

4.5. Licensing scale and linguistic variation

One source of linguistic variation concerning the scale of licensers (a–ə–ø) follows from the fact that the licensing properties are set independently for each of these licensers. The only relationship between them is that of relative strength, in that a schwa can never license more than a full vowel, and an empty nucleus cannot license more than a schwa. The table below, summarizes the licensing properties of Dutch nuclei. The ticked off boxes express the fact that the given level of formal complexity is licensed.

[44] Standard GP uses the domain-final parameter, which will be returned to in the following sections.

(33) ***Licensing properties of nuclei in Dutch***

	[a]	[ə]	[ø]
I C_	✓	✓	✓
II RT_	✓	✓	✓
III TR_	✓	✓	

Substantively speaking, the structures which are licensed by nuclei weaker than a full vowel may exhibit various degrees of restrictions. In Dutch, full vowels license all possible configurations. 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. The licensing properties of the word-final schwa are such that a variation is possible to the effect that the preceding *RT* cluster may be optionally epenthesized. Finally, severe melodic restrictions are found before an empty nucleus. Even simplex onsets are restricted in this context, hence a phenomenon like devoicing can occur, just as it does in Polish or German. Structurally speaking, the licensing properties of schwa and the final empty nucleus in Dutch are very similar, which is one of the reasons why the Dutch schwa has been claimed to behave like a word boundary.

Very similar licensing properties of nuclei are found in English. Both Dutch and English disallow word-final branching onsets, that is *TRø*. However, the schwa vowel in English seems to be a better licenser than its Dutch congener. Its strength is more similar to that of the full vowels, that is, *RTə* is equally good as *RTa* and *TRə* is equally good as *TRa*.

Another language which seems to make use of the full scale of licensers is Malayalam, in which, interestingly enough, each type of licenser has a different setting. Full vowels license all three levels of formal complexity, schwas license only two levels, while the domain-final empty nucleus can only license a simplex onset, which is additionally limited melodically to sonorants (Cyran 2001).

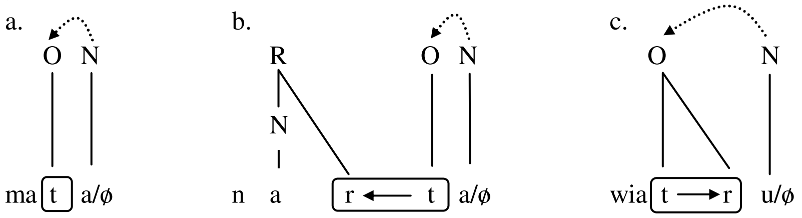
(34) ***Licensing properties of nuclei in Malayalam***

	[a]	[ə]	[ø]
I C_	✓	✓	✓
II RT_	✓	✓	
III TR_	✓		

It is not always the case, however, that the full scale of licensers (a–ə–ø) is utilized by linguistic systems. Polish, for example, has no vowel reduction and uses only two types of licensers [a] and [ø]. Additionally, the licensing properties of the two types of nuclei are very similar as regards the amount of formal structure that they license.

The pairs of words such as *mata / mat* 'mat, nom.sg./gen.pl.', *narta / nart* 'ski, nom.sg./gen.pl.', and *wiatru / wiatr* 'wind, gen.sg./nom.sg.' illustrate the properties. Note that due to the presence of the final empty nucleus in the genitive forms each pair has an identical syllable structure.[45]

(35)



The empty nucleus, which, by definition, is a weaker licenser than its melodically filled congener, is able to license all three levels of syllabic complexity in Polish. However, at each level of structural complexity, the empty nucleus is able to license less in terms of substance. For example, the word-final context in Polish is the site of neutralization of voice on obstruents and of secondary articulations, that is, palatalization on non-coronal consonants. Additionally, word-final branching onsets are severely restricted in terms of possible consonant combinations.[46]

(36) ***Licensing properties of nuclei in Polish***

	[a]	[ø]
I C_	✓	✓
II RT_	✓	✓
III TR_	✓	✓

The obvious question that can be raised at this stage concerns the status of the scale of licensers. Polish seems to exemplify a system which does not

[45] One immediate advantage of this proposal is that inflection does not require resyllabification of any sort, but only provides a melody for the existing nucleus.
[46] These facts are discussed in more detail in section 6 below.

use the full scale. Recall, that the scale of formal complexity precludes skipped steps, in that the presence of branching onsets necessarily implies the presence of coda-onset contacts. Why should the scale of licensers be different? The answer is simple. The role of nuclei is to license structure, be it substantive or formal. It is immaterial what phonological shape the nuclei assume, as long as they are granted the necessary licensing power.

One may point to two criteria determining the shape of the scale of licensers. With respect to schwas, it is the presence of vowel reduction, or the presence of lexical schwas. As far as empty nuclei are concerned, the condition on their occurrence word-finally has been identified earlier and boils down to granting a melodically empty nuclear position the ability to license. At this stage, we predict the following linguistic systems in terms of the types of licensers they employ.

(37) ***Licenser types***

a.	[a]				
b.	[a]	–	[ə]		
c.	[a]	–	[ø]		
d.	[a]	–	[ə]	–	[ø]

The above typology stems directly from the phonological representation. A nucleus may either have melody, or not. Just like onsets. Nuclei, may additionally be melodically reduced to schwa.[47] System (37a) does not have any distinctions among licenser types. It has no word-final consonants and no vowel reduction. (37b) illustrates a system which has schwas but no word-final consonants. Polish represents system (37c). It has no reduced vowels, but allows word-final empty nuclei to license consonants and clusters. The full scale in (37d) has been discussed at length above. It is a matter of further research to establish if it may be further expanded, for example, to include distinctions in licensing strength between different melodies of full vowels.

To summarize, linguistic variation concerning syllable structure stems from the choice of the types of licensers in (37) and the settings defining the strength of these licensers. The strength is in a sense gauged against the

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[47] At this stage we refer to the object called schwa without making its definition very precise. An attempt to provide a clear functional definition will be made in the following chapter.

formal complexity scale, which itself is defined by the presence and type of a governing relation between consonants.

The model of complexity scales and licensing also points to impossible systems. Two restrictions must be mentioned that seem to hold in connection with the settings of licensing strength between two types of licensers in a given system, for example, between full vowels and empty nuclei.

(38) ***Impossible systems***

*a.	[a]	[ø]
I C_	✓	?
II RT_	?	✓
III TR_	✓	

*b.	[a]	[ø]
I C_	✓	✓
II RT_	?	✓
III TR_		

First, what we do not expect in this model are skipped steps, that is, a discontinuity of licensing potential of a given licenser, as illustrated in (38a).[48] A second restriction concerns the possibility that a language may select higher licensing potential for its empty nuclei than for its full vowels (38b). This excludes a number of impossible systems, for example, one in which consonant clusters are found word-finally but not word medially or initially. 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.

4.6. Complexity Scales and Licensing model – a first approximation

We have seen in the above sections how parameters known from standard GP, such as those on branching constituents or government licensing, 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 of Complexity Scales and Licensing (CSL) based on the interaction between substantive and formal complexity scales and licensing strength of nuclei can be achieved only if certain assumptions are made about the nature of phonological representations. Crucial in this model is the structure

[48] The typology of syllabic structures presented in e.g. 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 chapter 3, we discuss a similar problem concerning Common Slavic.

of segments, which are defined in terms of privative elements. Their number in a given segment provides the 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 nucleus, display an asymmetry as regards the licensing demand. Hence the formal complexity scale (*C–RT–TR*). Intersecting the complexity regions is another scale of nuclear types ([a–ə–ɸ]), reflecting the gradation of relative 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 regarded as onsets and integrated into the system of preference scales in a straightforward fashion.

So far, in our discussion of the three types of licensers (a–ə–ɸ), we were mostly concerned with the right edge of words. This was the only context in which we saw the empty nucleus in action. Until further evidence is found, we assume that full vowels will have identical licensing properties in a given system, regardless of their position in the word. On the other hand, in the case of the schwa vowel, we noted an interesting variation concerning its licensing power in Dutch. Namely, the word-final schwa could not license branching onsets (*TR*s), while a pretonic one could, e.g. *brevet* [brəvɛt] 'patent'. This is not an entirely surprising fact.

In accordance with the Licensing Inheritance principle (Harris 1997), the same types of nuclei may exhibit slightly different licensing properties depending on their position in the licensing network within the word. In this respect the licensing scales discussed in this book and Licensing Inheritance are complementary aspects of the phonological representation. We return to Licensing Inheritance in chapter 3 when we discuss the law of open syllables in Slavic. In what follows, we look at the consequences of utilizing empty nuclei in other contexts than the word-final one. We review the conditions on the distribution of empty nuclei in standard GP and propose to shift the focus of the phonological apparatus from licensing of empty nuclei to their own licensing properties, which would be more compatible with the tents of the CSL model.

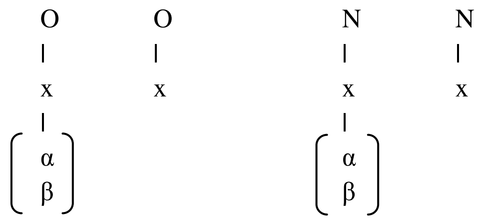
5. Sources of empty nuclei and licensing mechanisms in standard GP

5.1. Introduction

In the previous sections we introduced a new entity into the inventory of phonological units, that is, an empty nucleus. The reasons for postulating this object 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, and word-final. This way, the relative markedness gradation can be understood better than in other approaches which identify the word-final context with the coda. Thus, the word-final context is now fully incorporated into a coherent system of syllabification in which the right edge is the most restricted because it is licensed by the weakest possible licenser.

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. 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. This overlooks the fact that anything beyond the melody level in the phonological representation is abstract. The skeleton is abstract, and so is the syllable with its constituents. These separate levels have been proposed and independently argued for as autonomous (Harris 1994). In this respect three-dimensional phonology predicts the existence of melodically empty onsets and nuclei, and if they are sufficiently argued for, they should be accepted, just like any other abstract units of phonological analysis. We will assume that both the filled and empty positions illustrated in (39) are theoretically predicted.

(39)



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

(40) a. ***opening lenition***

[p] >	[f] >	[w]>	[ø]
α	α	α	
β	β		
γ			

b. ***Slavic rise and fall of jers***

[u] > [ъ] ↘ [ø]

[i] > [ь] ↗

Since the two phenomena have been discussed at length in chapter 1, they will not be given an airing here.[49] It is worth mentioning however, that while empty consonantal positions are widely accepted in phonological theory, abstract vowels which can be to some extent equated with empty nuclei, also have their own history in the literature. Abstract vowels in place of lost jers have been proposed to account for vowel – zero alternations in the phonology of Polish in, for example, Gussmann (1980), Rubach (1984), and Szpyra (1992), to name but a few proposals.[50]

In an attempt to keep the model as constrained as possible, it is generally assumed in standard Government Phonology 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 in the phonological representation itself one may seek to discover the mechanisms which would license or justify such positions. The interaction between the source of the occurrence, and the source of the licensing of empty positions appears to underline their distribution, that is, where they occur, and whether they remain empty or must surface melodically. Below, a summary is given in a tabular form of the contexts in which empty nuclei may occur in phonological representation as well as of the mechanisms which license them. Although most of the examples will come from Polish this is not meant to be a full analysis of Polish phonotactics.

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[49] The problem of historical jers is also discussed in chapter 3.

[50] See Scheer (2004, 2006) for an elaborate discussion of the connection between these proposals and the status of empty nuclei in GP.

In general, one may speak of a sort of assumed equilibrium between the sources of the presence of empty nuclei and the licensing mechanisms which make sure that such empty positions remain silent. In the absence of licensing, the nucleus must be phonetically realized.

(41)

context	***source (due to)***	***licensed by***
word-initial # øs+C...	**governing relations** (s + C = interconstituent government	**parameter** ('magic')
word-medial ...CøC...	**governing relations** (køto) **grammar** (parameter on Branching: OFF) **lexicon** (v ~ ø)	**Proper Government** **Interonset Government**
word-final ...Cø #	**governing relations** (coda licensing) **domains** (...ø]...ø])	**parameter** (domain-final)

The contexts provided above suggest that empty nuclei may in fact occur in all possible positions within the word. However the licensing mechanisms for dealing with these instances differ depending on the context. Let us begin the discussion by defining the way governing relations introduce empty nuclei into representations. This source of their existence appears in all three contexts.

5.2. Governing relations and empty nuclei

To see how government enforces the presence of empty nuclei let us first recall the basic conditions underlying this relation.

(42) ***Conditions on government***

a. *melodic complexity profiles* (in which the governor, symbolized as (*T*), is melodically more complex than the governee (*R*).

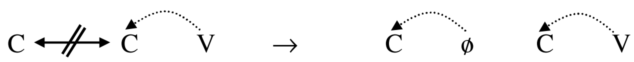
b. *adjacency* (the two consonants must be adjacent in the relevant sense).

c. *licensing* (governing relations, just as simplex segments, require licensing from the nucleus following such a segment or relation).

Condition (42a) refers to the necessary complexity differential between the governor and the governee, and expresses more or less the same principle as the Sonority Sequencing Generalization. Hence, government is responsible for phonotactics. Adjacency, (42b), is defined in standard GP at the level of skeletal positions. This effectively means that two consonants separated by an empty nucleus are not adjacent and therefore they cannot contract a governing relation. This is because an empty nucleus has a skeletal point. It just lacks a melody linked to it. The third condition, (42c), is self evident.

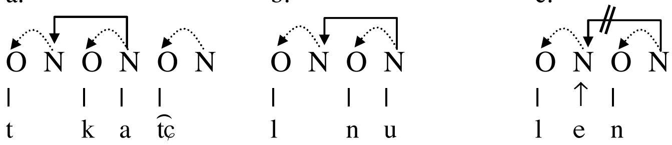
If all the above conditions are fulfilled, government between two consonants must be contracted. On the other hand, a failure of one of these conditions entails a failure of government and the two consonants must be separated by an empty nucleus. The resulting structure is a bogus or false cluster (43b).

(43) a. ***Government failure*** b. ***False cluster***



The false clusters are also subject to conditions. Note that the onset followed by the empty nucleus must be licensed by that nucleus. We predict that false clusters may occur only in those systems which grant licensing properties to such empty nuclei. Let us look at concrete examples from Polish.

(44) a. b. c.



tkać [tkat͡ɕ] 'weave' *lnu* [lnu] 'flax, gen.sg.' *len* [len] 'flax, nom.sg.'

Since two obstruents and two sonorants do not form sufficient complexity / sonority slope, they must be separated by an empty nucleus. Now, if this empty nucleus is granted licensing power, the false cluster may be grammatical, provided that the empty nucleus is itself licensed by the following full vowel. The relation responsible for this licensing in standard GP is known as Proper Government and is marked by a solid arrow in (44). Thus, there are two conditions on false clusters. Firstly, the empty nucleus inside that cluster must be a licenser. And, secondly, the empty nucleus must be properly governed by the following melodically expressed nucleus. If one of these conditions is not fulfilled then, either the given cluster is ungrammatical and therefore impossible, or the empty nucleus must be vocalized as in (44c).

Thus, there is a precisely predicted typology of effects concerning two adjacent consonants of particular melodies. If the three conditions on government listed in (42) are fulfilled then the two consonants contract a governing relation. We may call such surface consonant sequences true clusters (45a), as opposed to those, in which no governing relation can be contracted. The false clusters (45b) have their own conditioning: the empty nucleus must be a licenser for its onset, and it must be itself licensed by the following vowel through a relation of Proper Government. If one of these conditions fails, then no surface cluster is possible (45c).

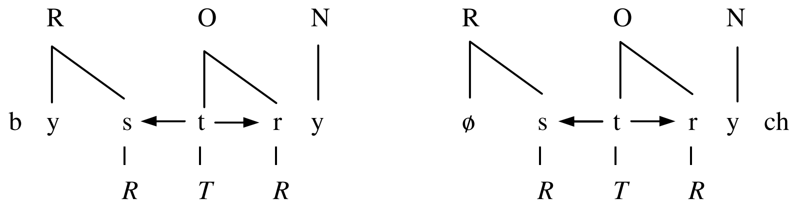
(45)

C_1 C_2 → a. *R←T, T→R* true clusters (governing relations)
| | → b. *CøC* false clusters
α β → c. no cluster

Thus, clusterless languages are those which cannot have governing relations between consonants, or do not allow empty nuclei to license their onsets word-internally. The situation in (45c) in fact subsumes a number of possible effects. For example, let us imagine a situation that a given language may have true clusters but not false ones. If for some reason two consonants cannot contract a governing relation in that system, then we predict a number of possible outcomes. Firstly, the two consonants will be separated by an epenthetic vowel as in Dutch *harp* [harəp] ‘harp’. A consonant simplification or deletion may also be expected. We will return to the distinction between true and bogus clusters below. Let us briefly look at two other examples where the nature of government enforces the presence of empty nuclei and point to the mechanism of their licensing.

The first one concerns the word-initial context and the problem of ‘s+C’ clusters. It is claimed in standard GP that such clusters always form a leftward governing relation (Kaye 1992) in which ‘s’ is in the coda and not in a branching onset with the following consonant. Recall that governing relations depend on the complexities of the participants. Word-medially, this presents no problem, as can be seen in (46a) below. On the other hand, in word-initial context this has far-reaching consequences. If in a sequence [str], the fricative is governed to the left, then it is automatically assigned to the coda of the preceding rhyme. This word-initial rhyme must contain the head, the nucleus, which is empty (46b). Note, that the syllabic configurations for the string [str] are identical, that is, coda+branching onset, and recall that the same structure is also given to this string word-finally, e.g. in *sióstr* [ɕustr] < /ɕus←t→rø/ 'sister, gen.pl.', which we discussed above in connection with the right edge of words.

(46) a. b.



[bɨstrɨ] *bystry* 'clever' [strɨx] *strych* 'attic'

The structure in (46b) is enforced by the nature of government, although, admittedly, the argumentation is fairly indirect. As to the licensing of this empty nucleus, no obvious mechanism connected, for example, with segment interaction can be evoked. Proper Government from the following nucleus should be blocked by the presence of the intervening governing relations (Charette 1991). Therefore, Kaye leaves this question open and introduces a parameter called 'magic licensing' to express the fact that the matter has yet to be understood.

Moving now to the word-final context, one of the early arguments for the empty nucleus in that position is similar in its indirect connection with the nature of government. The domain-final empty nucleus as in *cat* /kætø/ follows somewhat indirectly, from the *Coda licensing* principle formulated in Kaye (1990: 311). This principle says that a coda (a non-nuclear rhymal complement) must be licensed by a following onset. Since a simplex word-final consonant, as in *cat*, has no following onset to license it, it must be an onset itself, and consequently, since there are no onsets without nuclei, such an onset is followed by an empty nucleus /kætø/.

The domain-final empty nucleus, which appears to be a rather roundabout consequence of the coda licensing principle, has since been argued for independently on the basis of a vast amount of empirical material (e.g. Gussmann and Kaye 1993, Harris 1994, Harris and Gussmann 1998, Scheer 2004). Additional support for the existence of word-final empty nuclei follows from the syllable markedness scale which was introduced earlier in this chapter.

As in the case of ‘magic licensing’ there is no ready mechanism in the phonological representation that would license the final empty nucleus. For example, being final, it is never followed by a proper governor.[51] For this reason, a parameter has been proposed to license this nucleus. The parameter is switched ON in, for example, English or Polish, which have word-final consonants. On the other hand, in languages like Italian, in which all content words end with a vowel, this parameter is assumed to be switched OFF.

5.3. Other sources of empty nuclei in phonological representation

Let us now concentrate on the remaining sources of empty nuclei, which, however, do not produce any new structures. The most important of the remaining contexts in which empty nuclei are found is the end of phonological domains.[52] We have already seen one example of a domain-final empty nucleus which is licensed by parameter, namely, the nucleus which follows word-final consonants. Phonological domains may coincide with morpheme boundaries, especially if analytic morphology is involved (Kaye 1995).[53] Let us consider one example illustrating the use of domains in GP.

Gussmann and Kaye (1993) make use of domains in the analysis of vowel – zero alternations in Polish. For example, the morphologically simplex word for ‘dog’ in Polish is *pies* [p´es], which can be represented phonologically as /[p´øsø]/. The first empty nucleus is posited on the basis of the alternation with *psa* [psa] ‘dog, gen.sg.’. The phonetic interpretation in the nominative, with the vowel [e], is due to the fact that a sequence of two empty nuclei is disallowed because the first nucleus cannot be properly governed by another empty nucleus.[54] The final empty nucleus, on the other hand, is licensed by parameter.

The diminutive form of *pies* is *piesek*, that is [p´esek]. If the diminutive constituted one phonological domain, then given the fact that the diminu-

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[51] Unless we redefine Proper Government as applying from left to right (Rowicka 1999).
[52] Normally square brackets [] are used in phonological representations to denote boundaries of phonological domains in GP. To avoid confusion with phonetic forms the domains will be embedded in the slashed brackets typically referring to phonological representation, that is /[]/.
[53] Gussmann (2002: 54) also suggests that phonological domains may be present lexically, independent of morphology.
[54] Not to mention the fact that some vowel must be realized in this word to provide a prosodic head for the domain.

tive suffix itself also contains an alternating [e], the phonological representation /[p´$\emptyset_1$s$\emptyset_2$k$\emptyset_3$]/ should be realized as *[psek]. This follows from the assumption that Proper Government is applied iteratively from right to left. Thus, while the final nucleus ($\emptyset_3$) is licensed by parameter, the second nucleus ($\emptyset_2$) from the right would have to be realized, thus providing the licensing for the first nucleus ($\emptyset_1$). In order to account for this problem, it is proposed that the diminutive suffix is analytic, that is, it constitutes a domain of its own /[[p´$\emptyset_1$s$\emptyset_2$]$\emptyset_1$k$\emptyset_2$]/. This gives two sequences of empty nuclei, which are independent of each other because they occur in different cycles. The two domain-final empty nuclei are licensed by parameter. Therefore, in each sequence only the first nucleus ($\emptyset_1$) is realized, yielding the correct phonetic form [p´esek]. The genitive form of this diminutive is *pieska* [p´eska] < /[[p´$\emptyset_1$s$\emptyset_2$]$\emptyset_1$ka]/, in which the internal cycle is interpreted in the same way as in the nominative, while the suffix, which now contains only one empty nucleus followed by a proper governor, is realized without [e]. The domain-final parameter must be therefore viewed in a broader sense than just word-final.

Finally, we turn to the grammatical and lexical sources of empty nuclei, which are very similar in character. Let us imagine a language in which the parameter settings, whatever their nature, disallow branching onsets or certain types of branching onsets. Thus, any such surface *TR* cluster would have to be considered a sequence of two onsets separated by an empty nucleus. The cluster *tl* in English might serve as an example here. This cluster is not considered to be a good branching onset, because of the homorganicity constraint. However, *tl* appears in some positions, as in, for example, *bottling* [bɔtlɪŋ]. To deal with this fact, it may be proposed that this is a spurious cluster, represented phonologically as /bɔtølɪŋ/, where the empty nucleus is due to grammatical settings.

A good example of the lexical source of empty nuclei, on the other hand, is provided by what happens with word-final *TR* clusters in Polish. Some of them are broken up by the emergence of [e], while others stay put. For example, we find alternations like *sweter / swetra* [sfeter ~ sfetra] 'jumper /gen.sg.' alongside forms like *wiatr / wiatru* [v´atr ~ v´atru] 'wind /gen.sg.'. There is no way of knowing when this type of cluster is to be broken up because Polish has branching onsets, and it also allows them word-finally, e.g. *wiatr*. The representational difference lies in the presence or absence of an empty nucleus in between the two final consonants, that is, /sfetørø/ vs. /v´at→rø/. The former has a sequence of two empty nuclei of which the first one must be realized as [e]. The latter form contains only one, the domain-final empty nucleus which is licensed by parameter. Thus, it follows that the distinction between the grammatical and lexical sources of empty nuclei is rather subtle, but it exists.

5.4. Interonset Government

To conclude the discussion of the distribution of empty nuclei in standard GP let us consider the last licensing mechanism, that is, Interonset Government.[55] In Gussmann and Kaye (1993) this mechanism was used to deal with a group of initial clusters in Polish where to all intents and purposes the underlying representation contained a sequence of three onsets separated by empty nuclei. Some of the relevant examples with the phonological representations are given below.

(47)

tknąć	[tknoɲt͡ɕ]	< /tø$_1$kø$_2$nõt͡ɕø/	'to touch'
mgła	[mgwa]	< /mø$_1$gø$_2$wa/	'mist'
mknąć	[mknoɲt͡ɕ]	< /mø$_1$kø$_2$nõt͡ɕø/	'to speed'
tchnąć	[txnoɲt͡ɕ]	< /dø$_1$xø$_2$nõt͡ɕø/	'to breathe'[56]

Note that, leaving aside the word-final empty nucleus in the verbs, which is always preceded by a full vowel, the phonological forms contain a sequence of two empty nuclei inside the cluster. Some support for postulating the empty nuclei comes from the word *mgła* 'mist'. It alternates with *mgieł* [mg´ew] in the genitive, proving that there is definitely an empty nucleus inside the sequence [gw] < /gø$_2$w/. On the other hand, [mg] is not a possible governing relation word-initially, so it also must be a sequence of onsets /mø$_1$g/.

Of the familiar licensing mechanisms only Proper Government can be called upon to do the licensing of the empty positions. The sequence is followed by a vowel, but this vowel can only properly govern one of the empty nuclei, preferably the one which is closest. In other words, we should expect phonetic forms like *[teknoɲt͡ɕ] or *[megwa]. Since this is not what happens in Polish, Gussmann and Kaye (1993) propose that these forms may have a similar interpretation as *tkliwy* [tklivɨ] 'tender', in which

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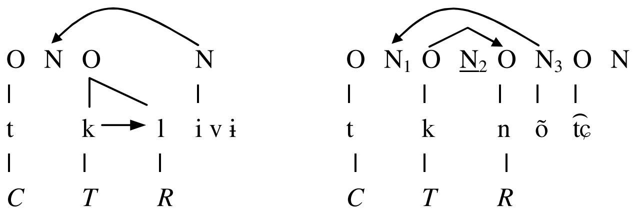
[55] For early discussion of Interonset Government see e.g. Kaye (1990) and Gussmann and Kaye (1993). See also Cyran (1996a, 1997), Cyran and Gussmann (1999), Rowicka (1998, 1999), Scheer (1996, 1998a), van der Hulst and Ritter (1998, 1999).

[56] The voiced obstruent /d/ in /døxønõt͡ɕø/ is postulated on the basis of the related forms such as *dech* [dex] 'breath' and *oddychać* [od-dɨxat͡ɕ] 'breathe'.

there is one empty nucleus to take care of because the following sequence of two consonants is a branching onset (48a). The difference is that, [kn] is not acceptable as a branching onset in standard GP. Therefore, the two consonants must be separated by an empty nucleus, and the governing relation between the consonants is of interonset nature. Compare the forms with and without a branching onset.

(48) a. b.



[tklivɨ] *tkliwy* 'tender' [tknoɲt͡ɕ] *tknąć* 'touch'

Since the forms of the type illustrated in (47) consistently display the pattern /*CøTøRV...*/, that is, a consonant (C) followed by a sequence with rising sonority, it is assumed that a governing relation of the interonset type is contracted across the second empty nucleus ϕ_2, thus providing a licensing mechanism for this nucleus (48b).[57] Now, the melodically filled nucleus N_3 is free to properly govern the first empty nucleus ϕ_1 parallel to what happens in *tkliwy* (48a), as it is the only empty nucleus left that requires licensing. The empty nucleus which is 'locked' within an interonset relation is not visible to the phonology. It is not seen by other nuclei. Therefore, it does not call for Proper Government and it does not cause vocalization of the preceding empty nucleus. In this respect, the governing relation between onsets functions in a similar way as the branching onset.[58]

5.5. Lured by *mgła*?

There are a few fundamental problems with the analysis in (48b). One of them is connected with the difference in status between the governing relation defining the so called branching onsets and the relation of government contracted between two separate onsets. Recall that N_2 in (48b) is postu-

[57] From now on, such 'locked' empty nuclei will be underlined. When they appear in text, it means that there is a governing relation between the surrounding onsets.

[58] The problem whether there is any need to distinguish between these two structures will be discussed in section 6.

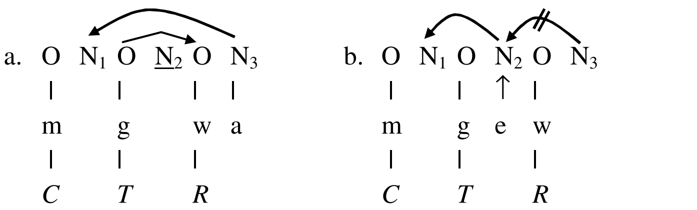
lated because, supposedly, [k] cannot govern [n]. On the other hand, once the empty nucleus is in place, this impossible relation becomes possible. What is more, the interonset relation seems to be required only to solve the problem created by the alleged inability of the two consonants to contract government – the additional empty nucleus in the representation which needs to be licensed.

Another problem concerns adjacency. The two onsets which contract a governing relation across an empty nucleus are not adjacent at the level of skeleton. Thus, this condition on government needs to be redefined to hold either at some level of the projection of onsets, or at the level of melodies. These are the only two levels where the two consonants might see each other.

Finally, the analysis in (48b) appears to involve two competing licensing mechanisms which are potentially conflicting. We must somehow make sure that the interonset relation is contracted prior to the application of Proper Government to obtain the correct results. This would suggest some sort of ordering or ranking of the licensing principles, a consequence which is at odds with the non-derivational stand of GP.

Even if we accept the position that Interonset Government takes precedence over Proper Government, this would have some grave consequences for the latter, in that it would be reduced to nothing more than a kind of 'sweep-up' mechanism with very limited application in Polish phonology. To see this better, let us return to the standard analysis of the three-consonantal clusters involving two empty nuclei (Gussmann and Kaye 1993, Cyran and Gussmann 1999). For the purpose of illustration we choose a form which exhibits a vowel – zero alternation, which is typically dealt with by means of Proper Government (44b-c).

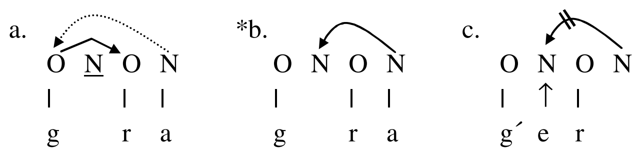
(49)



[mgwa] *mgła* 'mist' [mg´ew] *mgieł* 'mist, gen.pl.'

The analysis is as follows. In (49a), the two onsets, which constitute a rising sonority pattern, contract an interonset governing relation, thus locking or licensing the intervening empty nucleus. The final vowel N_3 is, therefore, able to properly govern the first empty nucleus N_1 and the form is rendered grammatical. In (49b), on the other hand, the final nucleus N_3 is empty and disallows an interonset relation. Therefore, the preceding empty nucleus N_2, must be realized phonetically because it is not properly governed. However, having received melody it is able to properly govern N_1.

Forms like *mgła / mgieł* cannot be overestimated as they prove independently, through the vowel – zero alternation, that there is indeed an empty nucleus $\emptyset_2$ in the pattern $C\emptyset_1 T\emptyset_2 RV$.[59] However, the consequences of the analysis involving Interonset Government in such forms are quite detrimental to the model of standard GP. One upshot of this analysis, which was already mentioned above, is that Interonset Government takes precedence over Proper Government not only in those rising sonority clusters like [kn], where standard GP inserts an empty nucleus because they are not acceptable as branching onsets, but also in clusters which could form licit branching onsets, but they cannot due to the lexical presence of an empty nucleus. This lexical presence of the empty nucleus in *mgła / mgieł* follows from the presence of the vowel – zero alternation. This in turn means, that a fair number of regular cases of vowel – zero alternation, occurring in the strings of the pattern /$T\emptyset RV$ ~ $TeR\emptyset$/, which were traditionally viewed as instances of the application of Proper Government, must now be reanalysed as involving Interonset Government. This concerns both word-initial and word-final strings, for example, *gra / gier* [gra ~ g´er] 'game, nom.sg. /gen.pl.', *cukier / cukru* [t͡suk´er ~ t͡sukru] 'sugar, nom.sg. /gen.sg.', etc. Thus the correct analysis of *gra* should be that in (50a) and not (50b).

(50)


In the analysis of such alternations, we must assume that the final vowel does not properly govern the preceding empty nucleus because it will be superseded by Interonset Government (50a). The vowel may, at best, provide licensing for the interonset relation, and it is the latter mechanism that licenses the intervening empty nucleus. On the other hand, in *gier* (50c) we must say that the first empty nucleus is realized because there is no proper governor or interonset relation to license it, therefore, it must surface. In other words, the mechanism of Proper Government is needed in the ac-

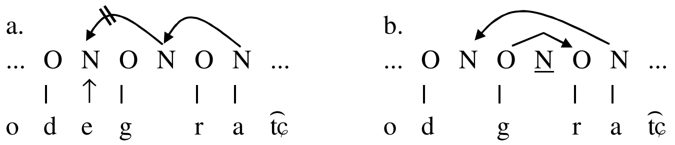
[59] There are about three examples of this pattern: *mgła / mgieł* 'mist, nom.sg. /gen.pl.', *źdźbło / źdźbeł* 'blade of grass, nom.sg. /gen.pl.', and *pchła / pcheł* 'flea, nom.sg. /gen.pl.'.

count of these forms only to say that its absence causes vocalization of the empty nucleus.

It is more than obvious that some simplification of the model is in order and Proper Government appears to be a good candidate for elimination. This is possible if some proposal can be made concerning the forms in which Proper Government seems to be the only licensing mechanism available, for example, with initial clusters which do not exhibit a rising sonority profile /*TøRV*/, e.g. *kto* [kto] < /køto/ 'who', *lnu* [lnu] < /lønu/ 'flax, gen.sg.', *łba* [wba] < /wøba/ 'head, gen.sg.'.

Finally, the analysis of *mgła / mgieł* presented in (49) introduces a structural problem, which will be only briefly mentioned here. It appears that the interonset relation is simply meant to make sure that the [gw] in *mgła* (49a) and the [kn] in *tknąć* (48b) behave like the branching onset [kl] in *tkliwy* (48a). In other words, we seem to witness an overlap in behaviour between two different structures. The uniform effect that we observe is that the empty nucleus which precedes the two disparate structures is grammatical and may remain silent. In itself, structural overlap is not unknown to phonological theory or unwelcome, as long as it is consistent. This, unfortunately, is not true.

Word-initially, the interonset relation, which we must postulate in alternating forms such as *gra /gier* 'game, nom.sg. /gen.pl.', does not behave like a branching onset in that it leads to vowel – zero alternation in the prefix. For example, the verb form *grać* 'play' frequently vocalizes the empty nucleus in the prefix, as in *odegrać* [odegrat͡ɕ] < /odø-gørat͡ɕø/ 'take revenge', *rozegrać* [rozegrat͡ɕ] < /rozø-gørat͡ɕø/ 'play a game'. These forms clearly show that, contrary to what the analysis of *mgła / mgieł* leads us to believe, the cluster [gr] in *grać* must contain a visible empty nucleus which causes the vocalization of the preceding one (51a). An interonset relation, which should be the correct analysis for the sequence /*gørV*/ (50a), would lock that empty nucleus in the stem, which would result in the absence of vocalization in the prefix (51b).

(51)


a. [odegrat͡ɕ] *odegrać* b. *[odgrat͡ɕ]

In fact, the same outcome as in (51b) would be expected, if the cluster [gr] were a branching onset. For example, the verb *grodzić* [grod͡ʑit͡ɕ] < /g→rod͡ʑit͡ɕø/ 'to build a fence', in which the cluster [gr] is never broken up by a vowel and is therefore assumed to be a branching onset (/g→r/), does not cause vocalization in the prefix *od–* in *odgrodzić* [odgrod͡ʑit͡ɕ] < /odø-g→rod͡ʑit͡ɕø/ 'fence off'.

Interestingly enough, there are also forms involving the stem *grać* 'play' where no vocalization occurs in the prefix. For example, in *zgrać* [zgrat͡ɕ] 'synchronize', the empty nucleus in the prefix remains silent, which means that the cluster [gr] is either a branching onset (/zø-g→rat͡ɕø/), or the empty nucleus in the stem is locked inside an interonset relation (/zø-gørat͡ɕø/), and it is invisible to the nucleus of the prefix.

Whatever the source of the distinction between the stems which cause vocalization in the prefix and those which do not, it is obvious that branching onset and interonset relations behave identically, and both can be called true clusters, if only because both involve a governing relation. On the other hand, we need a third structure which behaves as if it contained a visible empty nucleus even if the surrounding consonants could contract an interonset relation, a false cluster. This structure is excluded in (50b) on the basis of the forms like *mgła / mgieł* (49), but it is also shown in (51a) to be necessary. It appears, then, that *mgła / mgieł* could have lured us into making wrong proposals, namely, that onsets flanking an alternating vowel could contract a governing relation. We will return to the behaviour of branching onsets and Interonset Government, as opposed to false clusters in section 6, and argue that next to false clusters only one structure of true clusters is necessary.

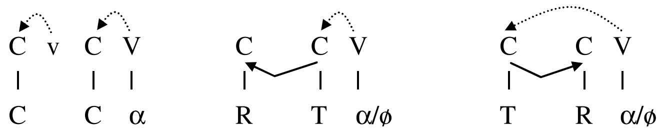
In the following subsection, we look in more detail at the distinction between true and false clusters in relation to the problem of initial consonant clusters in English and Polish.

5.6. True or False? English and Polish initial clusters

There are a few theoretical points concerning the distinction between true and false clusters we introduced earlier, which require clarification. One question is whether the model predicts any implicational relationship between the two types of consonant sequences. Another question concerns diagnostic contexts and effects which tell us which structure we are dealing with. Finally, the obvious question is if this theoretical distinction corresponds to real empirical aspects of phonological systems.

Judging by the conditions on government in (42), which underlie true clusters (*R←T* and *T→R*), as well as those on false clusters (*CøC*), it must be said that theoretically speaking there can be no implicational relationship between the two structures. Melodic and adjacency issues aside, the crucial conditions on true and false clusters boil down to two different aspects of one mechanism: licensing. While, in the case of true clusters it is the ability of nuclei to government license (52b-c), false clusters require that the intervening empty nucleus can license its onset (52a).

(52) a. *false* b. *true RT* c. *true TR*



Note that in a false cluster both onsets have their own licensers. It is clear that for a false cluster to be viewed as grammatical, an empty word-medial nucleus must be able to license its onset (ø is a Licenser). Additionally, this empty nucleus cannot be followed by another empty one.[60] On the other hand, true clusters require government licensing (Ns License to Govern) and this property can be possessed by both filled and empty nuclei, as we saw in earlier sections, depending on language specific choices.[61] The two parameters provide us with the following typology of possible systems with respect to the occurrence of consonant sequences, of which only one combination yields structural ambiguity between true and false clusters.

(53)

	A	**B**	**C**	**D**
ø is a Licenser	–	–	+	+
Ns License to Govern	–	+	–	+

The above typology shows clearly that the two parameters, which are independently manipulated, allow for no implicational relationship between true and false clusters. System A is one in which no surface consonant

[60] In other words, sequences of two empty nuclei are ungrammatical (*ø–ø).
[61] Recall from section 4 that decisions as to which types of nuclei government license, and at which level of syllabic complexity, are language specific.

sequences can be found, as they are eliminated by the negative settings of both parameters. System B contains only true clusters, that is governing relations. Whether both *RT* and *TR* clusters will be used depends on the language particular setting of the licensing strength. By contrast, system C will only have false clusters. It is a system in which empty nuclei may license simplex onsets, while no government licensing is possible for any type of nuclei. Finally, system D is the most complex. It has both true and false clusters. It is in this type of system that we need to ask about the diagnostic contexts which would identify the type of structure at hand. We will briefly comment on two.

The right edge of words appears to be one of the most reliable diagnostic contexts in this model. Recall that an empty nucleus inside a false cluster cannot be followed by another empty nucleus (52a). Thus, only true clusters, that is, governing relations can survive at the right edge of morphologically simplex words.

Word-initial and medial contexts are more ambiguous in that here a given sequence is pre-vocalic and it is not immediately obvious whether that vowel licenses a governing relation or simply does not disallow a false cluster. In these contexts the lack of melodic restrictions on the consonant sequences can be diagnostic. This brings us to the distinction between Polish and English initial clusters.

In English, word-initial clusters are highly restricted. Two consonant clusters are limited to branching onsets, that is rightward governing relations (*T*→*R*), e.g. *try*, and the 'magic' sC, e.g. *stop*. The latter sequence is in fact a coda-onset relation (*R*←*T*), but because of its special status we will continue to refer to it as sC. There are stringent melodic restrictions on the structure of the branching onsets in this language, which have traditionally been captured in terms of sonority distance and constraints on homorganicity. These disallow initial clusters like *[pn, kn, tf] and *[pw, tl, dl] respectively. On the other hand, sC sequences are virtually unrestricted except for the sequence *[sr]. Clusters of three consonants in English are a combination sC and *TR*, in that they all must take the pattern *sTR*, e.g. *string*.

Given that both sC and *TR* are instances of true clusters, that is, governing relations, we may rightly conclude that English does not allow false clusters on the left edge of words. Technically, this decision may be expressed by a parameter on the licensing potential of empty nuclei in this context – since they are not granted licensing abilities, false clusters are out. It must be stressed that the ban on false clusters in English concerns only the left edge. English does have post-vocalic, that is word-medial false clusters, for example, *bottling* [bɔtlɪŋ] < /bɔtøIɪŋø/.[62] Thus, we are dealing here with another example pointing to the fact that licensing properties of nuclei must be established separately for different positions within the word.[63] At this stage we have identified three such positions: word-final (right edge of words), word-initial (left edge) and word-medial.

Polish, on the other hand, seems to make the most of the possibility of having false clusters initially. Consider the following forms involving only two consonants and the phonological structures proposed for them.

(54) **#C_1C_2**

a. T→R *krowa* [krova] 'cow'
b. s←C *staw* [staf] 'pond'
c. CøC *lnu* [lnu] 'flax, gen.sg.', cf. *len* [len] 'ibid., nom.sg.'
kto [kto] 'who'
lwa [lva] 'lion, gen.sg.', cf. *lew* [lef] 'ibid., nom.sg.'

Note that Polish uses the same possibilities as English, that is, sC and *TR* (54a-b), with a third option, that is, a false cluster *CøC* (54c), where no melodic restrictions seem to hold. Thus, a claim that Polish exhibits no phonotactic restrictions word-initially is only partly true. It utilizes the same structures as English with an addition of false clusters (54c) which exhibit all possible melodic patterns, that is, obstruent + obstruent, sonorant + sonorant, sonorant + obstruent.[64] Note that the related forms *len* and *lew*, in which the empty nucleus is realized phonetically, provide additional support for claiming that [ln, kt, lv] cannot be branching onsets. They must be false clusters in which the empty nucleus is granted licensing potential, that is, they license their onset. Thus, vowel – zero alternation is another diagnostic phenomenon for the presence of the empty nucleus inside a cluster.

It appears that this empty nucleus in Polish is able to license more than just a simplex onset, which is not surprising. Theoretically speaking, any

[62] The sequence [tl] must be viewed as a false cluster for two reasons. Firstly, it cannot be a branching onset, for homorganicity reasons, and it cannot be a coda-onset governing relation, for sonority / complexity reasons.
[63] See Scheer (2004) for a completely different interpretation of the absence of false clusters on the left edge, which refers to the presence of an empty CV site at the beginning of English words.
[64] As we saw in the previous subsection, false clusters in Polish may also take the rising sonority pattern obstruent + sonorant. This problem is taken up again in the following section.

nucleus should be able to license any level of formal complexity (*CV – RTV – TRV*) in any position within the word. Consider the following structures proposed for three-consonant clusters in Polish.

(55) **# $C_1C_2C_3$**

a.	s←T→R	*strawa* [strava] 'food, nom.sg.'
b.	CøT→R	*tkliwy* [tklivɨ] 'tender'
c.	T→RøC	*krwi* [krf´i] 'blood, gen.sg.' cf. *krew* [kref] 'ibid., nom.sg.'
d.	Cøs←C	*bzdura* [bzdura] 'nonsense'[65]
e.	s←CøC	*szkło* [ʃkwo] 'glass, nom.sg.' cf. *szkieł* [ʃk´ew] 'ibid., gen.sg.'

The structures of ternary initial clusters in Polish appear to utilize the same configurations as English, that is, *sTR*, which is the only possible structure of a ternary true cluster, as well as the combinations of sC and *TR* with a single consonant separated by an empty nucleus. This way, we get five predicted structural patterns, all of which find instantiations in real data. (55b-c) are combinations of a branching onset and a single onset. Note that in *krwi* [krf´i] < /k→røvi/ 'blood, gen.sg.', the empty nucleus must be able to license the governing relation which is at level III of syllabic complexity. Additionally, this nucleus alternates with a vowel pointing directly to the fact that there must be a vocalic site inside the cluster, and precisely in the place where we predict it to be. A similar situation can be observed in (55e), where the nucleus following the sC cluster also alternates with a vowel.

The employment of false clusters word-initially in Polish, and the way in which it is done, as observed in (54) and (55) – simply by allowing for one empty nucleus and various shapes of the surrounding consonantal material – leads us to suspect that there is potential for clusters of four and even more consonants in Polish.[66] Although, one can theoretically imagine structures of five consonants which would follow the same patterns, such as /*sTRøTR*.../ or /*TRøsTR*.../, Polish has four consonants at most initially, and does not seem to use all logical possibilities. This is not surprising,

[65] In Polish, the 'magic' sC seems to include a range of clusters: [sC], e.g. *staw* 'pond', [zC], e.g. *zdobyć* 'conquer', [ɕC], e.g. *ściana* 'wall', [ʑC], e.g. *ździebko* 'little', [ʃC], e.g. *szczeniak* 'puppy', [ʒC] *żbik* 'wild cat'.

[66] Note that this interpretation in fact re-expresses an old assumption of Kuryłowicz (1952) that the complex initial clusters in Polish might be sequences of two well-formed onsets. Kuryłowicz, however, did not use empty nuclei in his analysis (cf. Gussmann 1992).

given that structure costs. Consider the following patterns of four consonant clusters which exist in Polish.

(56) **# $C_1C_2C_3C_4$**

a. Cøs←T→R *pstry* [pstrɨ] 'gaudy'
b. T→RøT→R *drgnąć* [drgnoɲt͡ɕ] 'to budge'[67]
c. s←CøT→R *źdźbło* [ʑd͡ʑbwo] 'blade of grass'[68]

It should be stressed that, while the structure in (56a) may be exemplified with a handful of existing forms, (56b) and (56c) are isolated examples.

At any rate, it is clear, that armed with the theoretical distinction between true and false clusters, we may reduce the striking differences between Polish and English initial clusters to one parameter – allowing empty nuclei to license onsets at the left edge of Polish words.[69] It must be emphasized that the ability of empty nuclei to license all possible structural configurations of the preceding consonantal material is fully predicted by the theory. In Polish, empty nuclei seem to license all predicted formal complexity, both word-finally and in initial bogus clusters. Recall that in English, word-final empty nuclei license up to level II, that is, *RT* clusters. Word-medially, empty nuclei may also license level II, for example, *antler* [æntlə] < /æn←tølə. Initially, however, no licensing potential is given to empty nuclei in this language.

In the following subsection, the problem of conflicting principles in GP is discussed and further simplification of the model is proposed.

[67] We assume here that in Polish [gn] can be a branching onset, but this sequence may also form an interonset relation locking an empty nucleus (/d→røgø̲nõt͡ɕø/), parallel to *tknąć* (48b). Since, branching onsets and interonset relations have so far been shown to behave identically, the question as to the actual choice of structure is irrelevant. In section 6 it will be proposed that only one of these structures is used in Polish phonology.

[68] More discussion of this form can be found in chapter 3.

[69] What is missing in the structural combinations discussed here is the governing relation *RT* which would be different from sC. This issue is given more space in chapter 3.

5.7. Principles and parameters in conflict – towards a solution[70]

The analysis of Polish forms like *tknąć* [tknoɲt͡ɕ] 'touch' in (48b) showed that two licensing mechanisms, that is, Proper Government and Interonset Government may come into conflict, in which case some sort of solution must be sought in the form of granting precedence or higher status to one of them. It must be said that potentially, almost all the licensing mechanisms enumerated in table (41), which are meant to deal with empty nuclei, may conflict with parameter settings on the ability of these nuclei to license their onsets. The only exception is that of Interonset Government, a fact which will be explained shortly. However, while some conflicts may be resolved by giving precedence to one mechanism or the other, in most cases granting special status, that is ranking, solves nothing. The proposal to be made in this section attempts to cover both situations and eliminate the problem of conflicts altogether.

Charette (1990, 1992) offers the first discussion of the problem of principles in conflict in GP. She observes that the schwa vowel, which in French has the property of alternating with zero, and hence should be represented phonologically as an empty nucleus, does not 'delete' after consonant clusters even though there is a proper governor in the following syllable. This concerns both TR and RT clusters, for example, *encom[brə]ment* 'congestion' and *fo[rtə]ment* 'strongly'. Charette proposes that the reason why the empty nucleus is realized as schwa in these contexts is because a melodically empty nucleus would not be able to license the governing relations. Thus, the conflict between Proper Government and the principle of Government Licensing is resolved in favour of the latter in French.[71]

This conflict depends strictly on the settings of the properties of empty nuclei as licensers in a given system. In Polish, for example, the issue does not arise because empty nuclei may license both types of clusters, that is, T→R and R←T relations, as we may observe in such forms as *krwi* [krf´i] <

[70] The term principle refers to principles of phonological organization. In this respect, Proper Government, Interonset Government and Government Licensing may be viewed as principles. Some parameters were mentioned earlier in this chapter and eliminated, that is, those on branching syllabic constituents. The two relevant parameters here are the domain-final parameter and the so called 'magic licensing' parameter.

[71] For an analysis in which interaction between three mechanisms is discussed, that it, between Proper Government, Interonset Government and Government Licensing in Irish, see Cyran (1996a).

/k→røvi/ 'blood, gen.sg.' and *marchwi* [marxf´i] < /mar←xøvi/ 'carrot, gen.sg.' respectively. In the nominative, the empty nucleus is vocalized in both words, that is, *krew* [kref] < /k→røvø/ and *marchew* [marxef] < /mar←xøvø/, however, this is not effected by Government Licensing, but rather by the fact that there is a sequence of two empty nuclei of which, as a rule, the first one must be vocalized.

It will be recalled that what we are referring to as Government Licensing is in fact the mechanism responsible for sanctioning levels II and III of syllabic complexity. It is therefore an aspect of phonological organization which we have found independent evidence for in the form of the syllabic complexity scale posing varying licensing demands on the following nucleus. Thus we predict that the vocalization of an empty nucleus may occur not only after *RT* and *TR* clusters, but also after simplex onsets if an empty nucleus is unable to license it. We also predict that the complexity levels will act as cut-off points across languages, or in dialectal variation with respect to the appearance of schwa where an empty nucleus is expected.

Interestingly, the dialect of French spoken in Saint-Etienne (e.g. Morin 1978), also quoted in Charette (1992), differs from standard French in that the schwa is pronounced after *TR* clusters, that is, level III of syllabic complexity, but not after *RT* clusters which are at level II. Thus, we have a difference between *encom[brə]ment* 'congestion' and *fo[rtm]ent* 'strongly' in this dialect. Note that the complexity scale advocated in this work fully anticipates this state of affairs, and also predicts that the reverse situation should not occur. That is, a system in which the schwa would appear after *RT*, e.g. *fo[rtəm]ent* and not after *TR*, e.g. **encom[brm]ent* should not exist.[72] The complexity scale, which defines the licensing demand on the nuclei, predicts the situations in both dialects and excludes the impossible one. The model of complexity scales and licensing also allows us to treat the distribution of schwa in French in a static way. Namely, we do not need to refer to deletable and non-deletable schwas or even vocalization of empty nuclei in this context. The cut-off points express the static distribution of onset + nucleus patterns without a derivational bias.

As for the licensing of the lowest level of syllabic complexity, that is simplex onsets, we must assume that even at this level, some systems will not allow their empty nuclei to license such structures, and a schwa-like vowel will appear. An example illustrating this prediction can be found in

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[72] While Charette is able to capture the Saint-Etienne dialect by assuming that empty nuclei are direct, but not indirect government licensers, the independence of the two parameters does not allow for an easy exclusion of the impossible dialect.

Malayalam (Mohanan 1986, Cyran 2001), where only some consonants can be followed by an empty nucleus, e.g. *awa[n]* 'he', while others enforce schwa epenthesis word-finally, e.g. *kaa[tə]* 'ear'. This phenomenon is most interesting, as the schwa appears after consonants of particular internal complexity, thus reflecting the substantive complexity scale discussed in the first chapter. Another crucial fact about this phenomenon is that it occurs word-finally. Thus, we are dealing here with a conflict between the licensing properties of nuclei, and the domain-final parameter of standard GP, which is supposed to license the empty nucleus. As mentioned above, such conflicts are unavoidable in a model which strives to license its empty nuclei whenever they appear in the representation, and at the same time affords them with varying ability to license the preceding onsets.

Note that given the present shape of the model, in order to sanction a word-final consonant or cluster, two seemingly disparate statements must be referred to. Firstly, the domain-final parameter must be set in the ON position. Secondly, the empty nucleus must be able to license the preceding consonant or cluster. It is impossible to predict what particular system would be defined if the two disparate parameters were not activated or deactivated in conjunction. In other words, if the domain-final parameter is switched OFF, there is no question of the licensing properties of empty nuclei, and likewise, if the empty nucleus cannot license its onset, there is nothing that the domain-final parameter could change. It must be concluded that one of the parameters is spurious and should be eliminated from the grammar.

Since the licensing properties scale defined by syllabic complexity is able to handle the requirements on the type of nucleus that can follow particular structures, as we saw in French, Dutch, Polish, and Malayalam, let us propose that empty nuclei, which are a predicted and logical structural possibility in phonological theory, can be employed in any system if only they can be afforded some licensing properties. The properties may differ across languages, across dialects of one language, or across registers. More importantly, given that empty nuclei have some licensing properties, they need not be licensed themselves to remain silent. Therefore, we banish the domain-final parameter from the grammar.

This proposal may in fact be extended to other contexts within the word which were listed in table (41), including situations where empty nuclei were supposed to be licensed by Proper Government. In other words, we may eliminate Proper Government from the model just as we eliminated the domain-final parameter. The immediate advantage of this move is that we rid the grammar of the conflicts in which Proper Government seemed to be involved, such as the one with Interonset Government in Polish *tknąć* (48b), and with Government Licensing in French *fo[rtəm]ent* and *encom[brəm]ent*.[73]

One condition on this simplification of the model, which was mentioned earlier, is that some mechanism must take over the responsibility for the vocalization of empty nuclei. It seems that this aspect can be taken care of by the interaction between the licensing properties of nuclei and the complexity of the structure that demands licensing from them. For example, if empty nuclei in a given system can license levels I and II of syllabic complexity but not level III, we expect vocalization of empty nuclei after *TR* clusters only, as in Saint-Etienne French, or the absence of such clusters. Since we are dealing with a scale of complexity, the cut-off point may be placed anywhere along levels I–II–III. Additionally, within particular levels of complexity, a form of micro-variation is expected due to the fact that certain clusters are easier and others are more difficult to license, as we saw in Dutch (4.2).

Before we see how this new model can handle the consonantal clusters in Polish which were discussed earlier, we must mention one more mechanism responsible for the vocalization of empty nuclei. This is connected with the ban on sequences of such objects, that is *ø–ø. Recall that the vocalization of the first nucleus in such a sequence was thought to be the result of the absence of Proper Government. This option is now unavailable. For the time being let us assume that there is a universal constraint on this structure. Rowicka (1999: 54), for example, refers to this constraint as NO LAPSE, thus attempting to ground it in the universal rhythmic organization of speech, whereby sequences of unstressed syllables are avoided. This structure is always resolved as a strong – weak sequence, reminding us of the trochaic foot organization.[74] This second mechanism is crucial to account for such alternations in Polish as *cukier / cukru* [t͡suk´er ~ t͡sukru] 'sugar/gen.sg.'. Recall that the nominative form has a sequence of two empty nuclei, that is, /t͡sukørø/. Referring solely to the licensing properties of empty nuclei would not be sufficient, as they can license not only simplex

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[73] The 'magic licensing' parameter should also be eliminated for consistency's sake. This point will be discussed in chapter 3.

[74] In fact, Rowicka (1999) retains Proper Government in her model but she reverses the direction and views it as a trochaic relation. Thus, the first nucleus is realized and forms the stronger part of the foot, which means it can properly govern the second empty nucleus. It seems, however, that this intuitively correct approach can be maintained without recourse to Proper Government.

but also complex onsets, for example, *wiatr* [v´atr] < /v´at→rø/ 'wind'. Thus, if there were no constraint on sequences of empty nuclei we would wrongly predict the existence of forms like, e.g. */t͡sukørøføtø/.

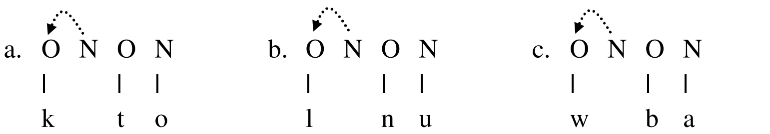
5.8. Licensing of clusters without licensing of empty positions

One of the foremost aims of early GP was to seek a system for licensing empty nuclei. This can only be viewed as resulting from a sense of phonological guilt that empty positions were introduced into phonological theory on such a grand scale. This tendency led to situations where analyses striving to determine the licensing of complex clusters in fact dealt with the licensing of empty nuclei, thus complicating the machinery required for that purpose. Below, it will be shown that the consonantal clusters and vowel – zero alternations in Polish may be best understood without recourse to Proper Government, or any licensing mechanism other than Interonset Government.

The modified model will use two mechanisms to derive vocalization of empty nuclei, that is, reference to the licensing properties of nuclei, and the constraint *(ø–ø). The contexts and sources for the occurrences of empty nuclei listed in (41) remain the same, for the time being. The general assumption is that empty nuclei may be employed in languages not because there are mechanisms at hand to license them, but because they are a logical possibility in any language. The primary role of nuclei in the representation is to license the onset and if the language affords its empty nuclei such a property, it is reason enough for their presence.

Let us begin with an earlier observation that empty nuclei in Polish may license all types of syllabic complexity in both word-final and internal contexts. This may be illustrated by the forms of the type *wiatr* [v´atr] < /v´at→rø/ 'wind' and *krwi* [krf´i] < /k→røvi/ 'blood, gen.sg.' in which the empty nuclei license level III of syllabic complexity. If this is the case, then empty nuclei in Polish will not vocalize due to the licensing demand posed by their onsets like in French *fo[rtəm]ent* and *encom[brəm]ent*. The constraint *(ø–ø) should be the only cause for their vocalization. In other words, any instance of a single empty nucleus is grammatical. Let us consider some initial clusters involving two onsets which were mentioned earlier; the representations are somewhat simplified.

(57)

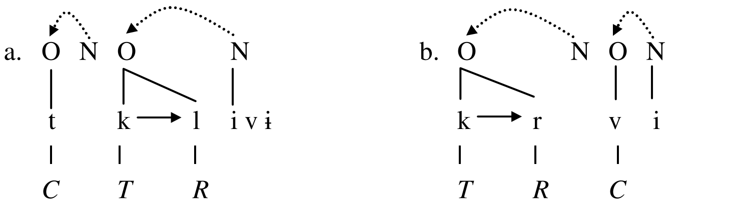


kto ‘who’ *lnu* ‘flax,gen.sg.’ *łba* ‘head, gen.sg.’

The forms in (57) contain consonants which cannot form branching onsets due to the incorrect complexity / sonority slopes. Since the empty nucleus is not followed by another empty category, and it is able to license the preceding onset, it may remain silent. This is all that needs to be said about these forms. Note that while *kto* is never inflected by means of changing the shape of the final nucleus, the nominative forms of *lnu* and *łba* end with an empty nucleus, thus leading to vocalization of the first nucleus (*len* [len] < /lønø/, *łeb* [wep] < /wøbø/).

The three-consonantal clusters involving only one empty nucleus will have the same interpretation.

(58)



[tkvlivɨ] *tkliwy* ‘tender’ [krf´i] *krwi* ‘blood, gen.sg.’

In (58a), the empty nucleus licenses only a simplex onset. On the other hand, in (58b) the onset is complex, but the empty nucleus is able to license it and may, therefore, remain silent.[75] The vocalization of this nucleus occurs in the nominative (*krew* [kref] < /k→røvø/), due to the same constraint *(ø–ø) which was responsible for the appearance of the vowel in *len* and *łeb* above. Crucially, this analysis shifts the focus from the licensing of empty positions to the licensing of onset configurations, where empty nuclei may be utilized as licensers.

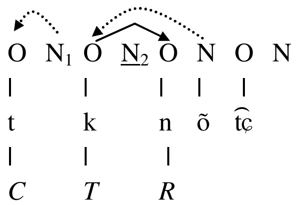
It will be recalled that the fundamental difference between Polish and English phonotactics lies precisely in the fact that English does not allow empty nuclei at the left edge to license any material. This single distinction

[75] The shape this word takes in the various Slavic languages is interesting. In Russian, the word is pronounced [krov´i]. It may be assumed that an empty nucleus was insufficient to license the cluster *kr*. See chapter 3 for more detail.

eliminates such forms as *kto* /kφto/ (56a), *tkliwy* /tφk→livɨ/ (58a) and *krwi* /k→rφvi/ (58b) from English, and leaves it with simplex and branching onsets only. In this respect, English is stricter than French in which simplex onsets may be licensed by empty nuclei at left edge, for example, *semaine* [smɛn] < /sφmɛnφ/ 'week' (Charette 1990: 239).

Let us now briefly consider the three-consonantal clusters involving two empty nuclei. Potentially, these forms are problematic precisely due to the presence of two empty nuclei in a row (N_1–N_2).

(59)



[tknoɲt͡ɕ] *tknąć* 'touch'

Given that the interonset relation 'locks' the empty nucleus N_2, this nucleus is invisible to other nuclei and thereby to the constraint *φ–φ. This way, the nucleus N_1 may remain empty, and the structure is grammatical. In the same way, we may also able to handle forms like *drgnąć* [drgnoɲt͡ɕ] 'budge' which involve four consonants. The phonological representation of this word may be viewed as containing a branching onset licensed by an empty nucleus, followed by an interonset relation licensed by a full vowel (/d→rφg<u>φ</u>nõt͡ɕφ/).[76] Recall that this word may also be analysed as a sequence of two branching onsets, an issue to be settled in the following section.

5.9. Conclusion

In this section, we first discussed the status of empty nuclei in GP. It appears that arguments justifying the existence of this phonological object come from different quarters. There is a historical and synchronic justification, as well as a purely theoretical one. 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.

[76] The underlined empty nucleus means that the surrounding onsets are in a governing relation.

The main source of empty nuclei in representation is connected with governing relations. They may appear also due to grammatical settings of parameters and as a result of purely lexical distribution – like any other vowel. We looked at three contexts in which empty nuclei occur and considered the licensing mechanisms which are used in standard GP to silence them.

Since in the model of Complexity Scales and Licensing (CSL), which we are trying to develop in this book, the primary job of nuclei is to license the preceding onset and the formal configurations in which this onset might be involved, we assumed that an empty nucleus can be used in a given system only if it is afforded some licensing properties. Thus, we shift the focus from licensing of empty nuclei to licensing properties of the nuclei in question. This allows us to simplify the model by eliminating a number of mechanisms known from standard GP, which were responsible for licensing empty nuclei, namely, the magic licensing parameter, the domain final parameter and Proper Government. Recall that earlier we eliminated parameters on branching constituents, which were replaced by the complexity scale of formal configurations interacting with the licensing properties of nuclei. The only mechanism which is left from standard GP and may be viewed as a licensing instrument is Interonset Government (IO) which, however, does not license empty nuclei in the traditional sense. First of all, IO is a governing relation that is not motivated by a need to license the intervening empty nucleus. It just is. It is an automatic relation that must be contracted if all the conditions are fulfilled. The fact that, IO 'locks' the intervening empty nucleus and makes it invisible to other nuclei and to the constraint on sequences of empty nuclei (*ø–ø) should rather be viewed as a side-effect.

The CSL model predicts that some onsets may be licensed by empty nuclei, not only word-finally but also word-medially and initially. Depending on the licensing properties of such empty nuclei, we naturally predict the existence of complex clusters such as those in Polish and their absence in languages like English. The two systems differ not only in terms of what their empty nuclei can license, leading to the distinctions in the word-final context, but also with respect to the particular positions within the word. The absence of empty nuclei at the left edge in English effectively eliminates strings like *#kt…, *#tkl…, or *#krf…, which are found in Polish *kto, tkliwy* and *krwi* and leaves only those structures which are simplex onsets or true clusters, that is, *C (tap)*, *sC (stop), TR (trap)*, and *sTR (strap)*.

In the following section, we will take things a step further and show that the model of complexity scales and licensing strength should be redefined as a model in which the syllable structure is assumed to be a sequence of Cs and Vs (Lowenstamm 1996, Scheer 1996, 1998b, 2004). One of the immediate advantages of this move will be elimination of branching onsets, that is, the structure that behaves identically to interonset relations. Consequently, the status of branching rhymes and nuclei will also have to be reconsidered.

6. Polish as a CV language?

6.1. Introduction

In this section an attempt is made to demonstrate that the model of complexity scales and licensing strength (CSL) is fully compatible with the radical hypothesis that syllable structure is in fact a sequence of consonantal and vocalic positions, that is, simplex onsets and nuclei (Larsen 1994, Lowenstamm 1996, Scheer 1996, 1998b, 2004, Rowicka 1999).[77] It is also better suited for handling a number of questions concerning Polish phonotactics. The purpose of this exercise, however, is not limited to the mere redefinition of a model with maximally binary syllabic constituents, which is already fairly constrained, as a more abstract model in which every consonant is structurally followed by a nucleus. There are a few reasons why this step seems to be necessary.

One of the reasons why the strict CV assumption appears to be more attractive than branching constituents is connected with the internal logic of the complexity scales and licensing model. Note that in the modified view of phonological organization in which word structure is an effect of a tug of war between formal complexity and the licensing strength of nuclei, the entire syllable typology as well as language specific settings are now dealt with by referring to the formal configurations of the onsets, and their licensing relation with the following nucleus. Thus, in effect, we have already been dealing with a pattern of onsets and nuclei. Since the onset configurations beyond level I of syllabic complexity, that is CV, involve

[77] Rowicka (1999) is the first study employing the strict CV assumption in the analysis of Polish clustering. It is also an attempt to eliminate parameters from standard GP. However, her model replaces parameters with violable universal constraints, thus attempting to connect the GP way of viewing phonological representation with the Optimality Theory of constraint interaction. A similar attempt within GP is found in Polgárdi (1998).

governing relations between two consonants, whether they are strictly adjacent or adjacent in the sense that no vocalic melody separates them does not make much difference and may be a matter of general assumption, or a question of which of the two options is more suited to explain particular phonological phenomena.[78]

More importantly, the CSL model relies heavily on formal distinctions between structures. Recall that the distinction between true *R←T* and *T→R* clusters lies in the distance between the licenser and the head of the governing relation (Direct vs. Indirect Government Licensing). It appears then, that the introduction of an empty nucleus inside similar, though, interonset relations should have consequences on the understanding of the syllabic space introduced in section 4.4. In each case, whether it is leftward or rightward interonset, we would be dealing with greater distances. This should lead to a clear difference between skeletally adjacent governing relations and those of interonset type, which would be reflected in empirical facts. Thus, from the point of view of CSL it would be best to be dealing with one type of government, either interonset or one involving skeletal adjacency.

The second reason for considering the CV assumption is that most of the problematic cases in Polish phonotactics already receive a CV analysis. This concerns not only the sequences of two consonants, as in *mchu* /møxu/ 'moss, gen.sg', and *kto* /køto/ 'who', which have been shown to contain an empty nucleus, but also three-consonant sequences, for example, *tknąć* /tøk<u>ø</u>nõt͡ɕø/ 'touch', etc., in which two empty nuclei must be postulated on theory internal grounds, and the entire word is formed of sequences of simplex onsets and nuclei.

Additionally, the forms which already reflect a CV pattern occur alongside ones with assumed branching constituents, thus producing a variety of formal configurations which seem to cover similar if not the same empirical ground. For example, the purpose of introducing the structural overlap between branching onsets and interonset relations in the analysis of *tknąć* [tknoɲt͡ɕ] < /tøk<u>ø</u>nõt͡ɕø/ 'touch' and *tkliwy* [tklivɨ] < /tøk→livɨ/ 'tender' (48) was precisely to be able to analyse *tknąć* on a par with *tkliwy*, in which [kl] is a branching onset.

It will be demonstrated below, that branching onsets and rightward interonset relations do not exhibit disparate behaviour and one of these structures is spurious. For that purpose, we will consider a few standard tests for

[78] Note that the introduction of Interonset Government in standard GP has in fact precipitated this move.

detection of branching onsets to see if this structure has any function that would distinguish it from Interonset Government.

6.2. Branching onsets in Polish?

At the outset of this discussion of clusters with rising sonority it must be emphasized that we are trying to discover a distinction between the following formal configurations on the basis of their phonological behaviour. Only if the two structures turn out to be functionally independent can they be accepted as necessary. Likewise, if they behave identically, one of them will have to be eliminated from the model.

(60) a. b.

Both structures involve rightward governing relations. While (60a) is the representation we assume for any *TR* cluster conforming to the conditions for well-formed branching onsets, the structure in (60b) has been argued for on the basis of Polish initial sequences.[79] To test the phonological behaviour of (60a) and (60b) we will look at what may happen in the contexts immediately preceding and following these structures, as well as what can happen to the structures themselves in particular contexts. It will be shown that the representations in (60) behave identically in Polish. If there are any distinctions in the phonological behaviour of surface *TR* clusters, they turn out to involve an opposition between branching onsets and rightward interonset relations on the one hand, and a /*TØR*/ sequence, that is, a false cluster on the other. The latter will be shown not to involve a governing relation.

We will look at five potential theory internal tests which were first formulated within standard GP. They refer to notions which are non-existent in the present model. Nonetheless, these arguments are still valid in many ways. Alternative views, based on the modified version of GP will be also presented. In short, we will look at the application of Proper Government, the effects connected with the principle of Government Licensing, prefixation, the word-final distribution of *TR*, and the melodic conditions on branching onsets and interonset relations.

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[79] For a discussion of the conditions on well-formed branching onsets in English see e.g. Harris (1990, 1994), Kaye, Lowenstamm and Vergnaud (1990).

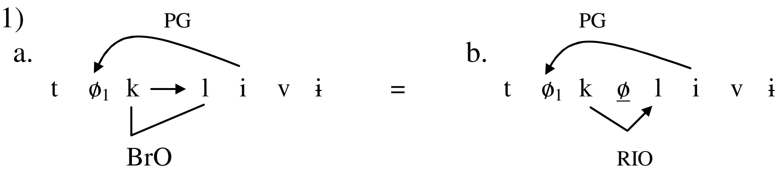
6.2.1. *Proper Government across branching onsets*

One of the typical characteristics of the structure of branching onsets (BrO) is that they should block the application of Proper Government (PG) in the context /...øk→lV.../. This blocking effect was discovered in Charette (1990: 237) and concerned French forms like *secret* [səkrɛ] 'secret'. Since schwas are assumed to be realized empty nuclei in French, Charette concludes that in the presence of a proper governor (the vowel [ɛ]), the failure of PG to operate in such forms, and hence, the interpretation of the empty nucleus, must be due to the fact that branching onsets block internuclear relations. If this was also true about Polish, then what we would expect in strings of the type /...øk→lV.../ in Polish is vocalization of the empty nucleus ([...EklV...]), where [E] stands for a realized empty nucleus.

It seems, however, that in Polish no such effects are observed. Recall words like *tkliwy* 'tender' which were discussed in the previous sections. In accordance with the syllabification procedures used in standard GP, the second and the third consonants of the initial cluster form a branching onset /k→l/ because that cluster is never broken up by a vowel. Thus, *tkliwy* has only one empty nucleus which separates *t* from *kl*, that is, /tøk→livɨ/. Under the standard assumptions, this nucleus must be properly governed and it can only be licensed by the vowel which follows the branching onset (Gussmann and Kaye 1993). The fact that the nucleus remains silent means that PG is not blocked.

As such, this fact does not constitute any evidence against branching onsets (BrO) in Polish. It will suffice to say that the condition on PG blocking is not operative in this language, due to some parameter settings, for example. What is important, however, is that it is equally possible to derive *tkliwy* as a sequence of three separate onsets. An analysis of such a structure has been mentioned earlier in connection with *tknąć* (48b). Thus, there is no functional distinction between BrO and rightward Interonset Government (RIO) in this particular context, as illustrated in (61) below.

(61)



This test is interpreted differently in our model, in which PG relations do not exist. What is important for our purposes is that both representations in

(61) contain only one 'unlocked' empty nucleus $\emptyset_1$. If this empty nucleus can license its onset, and is not followed by another 'unlocked' empty nucleus, the form is grammatical.

We conclude that in this context, Polish phonology does not recognize any difference between a branching onset (BrO) and a rightward interonset relation (RIO).

6.2.2. Government Licensing

Another context where branching onsets may exhibit special effects refers to the familiar notion of Government Licensing (GL)[80]. While in the previous test the site in which we expected the effects was in the context preceding the branching onset, here they concern the empty nucleus which directly follows a branching onset. For example, in French, as discussed in section 5.7 above, the empty nucleus in a string /...T→RøCV…/ has to be realized phonetically in order to be able to provide government licensing to the preceding governing relation, e.g. *li[brə]ment* 'freely'. This happens despite the fact that the empty nucleus can be properly governed by the following vowel.

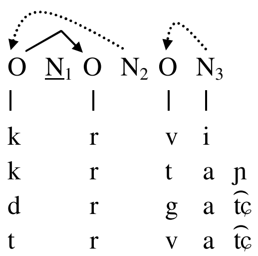
Again, this test finds no use in Polish because there is no vocalization of empty nuclei in the relevant position. Charette (1992) attributes this fact to the licensing properties of Polish empty nuclei. In this respect we may fully agree with her interpretation. In Polish, empty nuclei are indeed government licensers and their vocalization is connected with the occurrence of universally ungrammatical sequences of empty nuclei (*ø–ø), rather than stemming from GL requirements. This fact is best illustrated by the alternation *krew / krwi* (/k→r$\emptyset_1$vø/ ~ /k→r$\emptyset_1$vi/) 'blood/gen.'. Under standard GP assumptions, the empty nucleus $\emptyset_1$ in *krwi* is properly governed, and at the same time functions as a government licenser for the preceding BrO. In *krew*, this nucleus must be vocalized because it is followed by another empty nucleus.

Returning to the comparison between RIO and BrO, it seems that a very similar interpretation of *krew / krwi* [kref ~ krf´i] 'blood, nom.sg. /gen.sg.' would hold if the empty nucleus $\emptyset_1$ was preceded by an interonset relation, in which case it would have to license this relation as illustrated below in (62a). In fact, a number of initial three-consonant clusters would receive

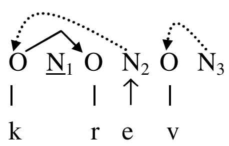
[80] See Charette (1990, 1991, 1992) for the operation of Government Licensing in French, Tangale and Polish, Cyran (1996a) for Irish, and Scheer (1996) for a criticism of this mechanism.

the same interpretation under the CV assumption, for example, *krtań* [krtaɲ] < /k$\underline{\emptyset}_1$r$\emptyset_2$taɲ$\emptyset$/ 'larynx', *drgać* [drgat͡ɕ] < /d$\underline{\emptyset}_1$r$\emptyset_2$gat͡ɕ$\emptyset$/ 'shudder', and *trwać* [trfat͡ɕ] < /t$\underline{\emptyset}_1$r$\emptyset_2$vat͡ɕ$\emptyset$/ 'persist'. Note that the relevant empty nucleus is now $\emptyset_2$, although it is still the first visible nucleus. The underlined $\underline{\emptyset}_1$ is locked by the interonset relation and invisible to the constraint on sequences of empty nuclei *$\emptyset$–$\emptyset$.

(62) a.



b.



The empty nucleus $\underline{\emptyset}_1$ in (62a) is locked by RIO and $\emptyset_2$ is the only empty nucleus in this word which is called upon to do any licensing. This nucleus licenses the same structure in (62a) and (62b), that is, a governing relation between two consonants. Recall that in *krew* [kref] < /k$\underline{\emptyset}_1$r$\emptyset_2$v$\emptyset_3$/ (62b), $\emptyset_2$ must be vocalized, not because it cannot license the preceding structure, but because it is followed by another empty nucleus $\emptyset_3$.

So far we have seen two contexts where the distinction BrO vs. RIO does not seem to matter much phonologically. The reason for this is that these tests detect governing relations rather than the architecture of a constituent, and we are dealing with a governing relation in both cases. In what follows we will look at two other tests for BrO. These will rely on the crucial structural distinction between true and false clusters, that is, BrO vs. ONO.

6.2.3. BrO vs. ONO and verbal prefixation in Polish

There are certain facts concerning the vocalization of jers in Polish prefixes which seem to crucially rely on the distinction BrO versus ONO.[81] Jer vocalization, mainly known in the literature as the Lower rule (Gussmann

[81] Jers arose in Slavic languages mainly as a result of weakening of short *u/i*. They were subsequently lost in certain positions. Since some of the sites of historical jers exhibit vowel – zero alternations in modern Slavic languages, the term is used in synchronic descriptions to refer to the alternating vowel.

1980, Rubach 1984, Szpyra 1989), occurs with some exceptions in prefixes attached to verbal stems also containing a jer. Specifically, if a prefixed verb begins with a sequence which may be morphologically broken up by a vowel, then the jer of the prefix shows up as [e]. For example, the verb *brać* [brat͡ɕ] 'take', alternates with *bierze* [b´eʒe] '(s)he takes', in which the cluster [br] is broken up by a vowel. When the prefix *roz-* is added to the former, a vowel appears between the prefix and the stem in the infinitive, that is, *rozebrać* [rozebrat͡ɕ] 'undress'. However, in *rozbierze* [rozb´eʒe] '(s)he will undress', no vocalization of the jer occurs. Similarly, there is no vocalization of the jer in the prefix if the cluster of the stem does not show any alternation. For example, *bryzgać* [brɨzgat͡ɕ] 'splash', when prefixed, does not show the vocalization of the jer in the prefix, e.g. *rozbryzgać* [rozbrɨzgat͡ɕ] 'splash out'.

Applying a standard GP analysis to these facts, we may say that the clusters which contain an alternating vowel may be represented as /*T∅R*/, e.g. /b∅rat͡ɕ∅/. It is a sequence of two onsets separated by an empty nucleus. The onsets are not in a governing relation. It is a false cluster. This structure is opposed to that of a branching onset /*T→R*/, e.g. /b→rɨzgat͡ɕ/. When the prefix *roz-* (/roz∅/) is attached to the stem containing a false cluster, a sequence of two empty nuclei arises /roz$\emptyset_1$b$\emptyset_2$rat͡ɕ∅/, which must be resolved by vocalization of the first empty nucleus. Hence the phonetic form [rozebrat͡ɕ]. This analysis is possible under the assumption that the prefix *roz-* attaches synthetically, that is, it does not form a domain of its own. In this respect, the application of Lower viewed in terms of interaction between empty nuclei, is not different from word-internal cases like *gier / gra* [g´er ~ gra] < /g∅r∅/~/g∅ra/ 'game, gen.pl. /nom.sg.', and the jer may be functionally identified with an empty nucleus in modern Polish.

On the other hand, sequences which look like branching onsets and never get broken up by morphological processes, do not cause vocalization in the prefix. This is because the jer of the prefix is not followed by another jer in the stem, e.g. *rozbryzgać* [rozbrɨzgat͡ɕ] < /roz$\emptyset_1$b→rɨzgat͡ɕ∅/ 'splash out'. It is striking that the relevant portion of the representation of /roz$\emptyset_1$b→rɨzgat͡ɕ∅/, that is, /…z$\emptyset_1$b→rɨ…/ resembles that of three consonant clusters in such forms as *tkliwy* [tklivɨ] < /t$\emptyset_1$k→livɨ/ 'tender' (48a).

Consider a few examples illustrating the distinction between stems containing a nuclear site (63a) and those which begin with a branching onset. The rightmost column provides tentative structural representations of the stem-initial cluster.

(63)

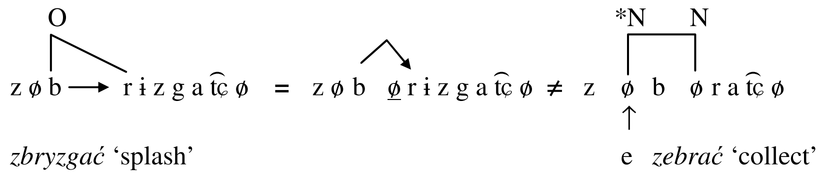
	Infinitive	*Prefixed verb*	*Prefixed Derived Imperfective (DI)*	*Repr. of the stem*
a.	brać 'take'	zE+brać	z+bierać	/bør…/
	drzeć 'tear'	rozE+drzeć	roz+dzierać	/døʒ.../
	przeć 'push'	odE+przeć	od+pierać	/pøʒ…/
b.	bryzgać 'splash'	roz+bryzgać	roz+bryzgiwać	/b→r…/
	drapać 'scratch'	roz+drapać	roz+drapywać	/d→r…/
	pracować 'work'	od+pracować	od+pracowywać	/p→r…/

Even though the alternations within the stems in (63a) are morphological, their effect on the shape of the prefix is assumed to be phonological (e.g. Laskowski 1975, Nykiel-Herbert 1985, Szpyra 1989, Rowicka 1999). Consequently, the presence of the empty nucleus / jer in the stem enforces the phonetic realization of the jer in the prefix *zebrać*, due to the constraint *ø–ø, while the presence of a vowel in the stem results in the absence of such vocalization, e.g. *zbierać*. True clusters, that is, branching onsets in (63b) never cause the vocalization. Additionally, these stems do not form the DI by breaking up the initial cluster but by affixation (*-i/ywać*), hence, there is no need to postulate an empty nucleus inside the first cluster.

It is clear, that the relevant structural distinction in the initial clusters in (63a) and (63b) is that between a branching onset, that is, a true cluster, and a sequence ONO which does not involve any governing relation – a false cluster. Therefore, we predict that interonset relations (RIO) should behave exactly like BrO because, by virtue of involving a governing relation, they are also true clusters, even if structurally, RIO is also a sequence of two onsets separated by an empty nucleus. Recall that, the interpretation of *rozbryzgać* [rozbrɨzgat͡ɕ] < /rozø$_1$b→rɨzgat͡ɕø/ in (63b) is identical to that of *tkliwy* [tklivɨ] < /tø$_1$k→livɨ/ 'tender' (48a). The latter, on the other hand may receive an alternative interpretation involving RIO as in *tknąć* [tknoɲt͡ɕ] < /tø$_1$kø̲$_2$nõt͡ɕø/ 'to touch' (48b), in which ø$_1$ can remain silent because ø̲$_2$ is locked by RIO and the constraint *ø–ø does not apply.

This means that special reference to branching onsets is not necessary to account for prefix vocalization, because the crucial distinction is one between true clusters, that is, those involving a governing relation (64a = 64b), as opposed to the false cluster which is a mere sequence ONO with no governing relation (64a-b ≠ 64c). The relationship between the three structures is illustrated below.

(64) a. ***BrO*** b. ***RIO*** c. ***ONO***



zbryzgać 'splash' *zebrać* 'collect'

Since RIO brings out exactly the same effect as BrO, the forms in (63b) could just as well be analyzed without referring to branching onsets. However, there seems to be one problem with the replacement of BrO by RIO – the nature of government. If RIO is contracted in *bryzgać*, there is no reason why it should not be present also in *brać*.

Recall that government must be contracted if all conditions are fulfilled. Namely, if two consonants are adjacent at a relevant level, they form a sonority / complexity slope, and they are licensed by the following nucleus. It seems that the last two conditions must be viewed as fulfilled in *brać*. Specifically, the sequence [br] is melodically identical in *bryzgać* and *brać*, thus, the complexity slope should equally favour government in both instances. Also, in both cases the sequence [br] is followed by a full vowel which is a perfect licenser.[82] The only condition which may distinguish between *brać* and *bryzgać* is that of adjacency.

In fact, adjacency is an equally pressing problem for standard GP analysis and for the model we are trying to develop here. It will be recalled, that once interonset is admitted in standard GP – this was argued for on the basis of forms like *tknąć* (48b) – adjacency at the level of skeleton is no longer valid, and the intervening empty nucleus is no longer a blocker to government.[83] Thus, before a systemic elimination of BrO and replacing it with RIO we need to be able to distinguish between RIO and ONO in forms like *bryzgać* and *brać*, respectively. Since in both cases the onsets are separated by an empty nucleus, the nucleus cannot be a blocker to government in one string and not in the other, unless the empty nuclei are not of the same kind. The question is, then, what blocks RIO in (64c)? An attempt to answer this question will be made in the following section. In

[82] Note that the governing relation in [br] can be licensed also by an empty nucleus, as in, e.g. *brnąć* [brnoɲt͡ɕ] 'wade', regardless of whether the governing relation is viewed as the branching onset (/b→r∅nõt͡ɕ∅/), or interonset type /b∅̱r∅nõt͡ɕ∅/.
[83] The problem was discussed in section 5.5 and illustrated in (50).

what follows, however, we will consider an alternative way of approaching the distinction between the stems in (63).

It has been proposed in the literature that the difference between the data sets in (63a) and (63b) may lie in the way prefixed verbs are bracketed (Booij and Rubach 1984, Szpyra 1989, Rowicka 1999). Without going into too much detail, it is assumed, based on evidence from other phenomena involved in prefixation such as palatalization spreading, that only prefixes attached to a selected number of stems form with them one phonological word (synthetic affixation), a domain within which phenomena like jer vocalization may occur. The stems which require such affixation exhibit the morphologically conditioned vowel-zero alternations of the type *brać / bierze* 'take / (s)he takes', *prać / pierze* 'wash / (s)he washes', and so on (63a). On the other hand, prefixes attached to other stems, that is, to those lacking a jer, are said to form a separate (analytic) domain. Thus, according to this proposal, *zbryzgać* must be bracketed as /[zø][brɨzgat͡ɕø]/,[84] while *zebrać* has a one domain structure /[zøbørat͡ɕø]/.

From the point of view of standard GP, this leads to a peculiar situation in Polish in that *zbryzgać*, which could be easily derived in the same way as the independently motivated case of *tkliwy* (48a), that is, as a single phonological domain (65a), is offered an additional mechanism securing the absence of prefix vocalization by means of analytic bracketing (65b).[85]

(65) a. O (branching onset over b r)
[z $\emptyset_1$ b→r ɨ z g a t͡ɕ ø]

b. O (branching onset over b r)
[z ø] [b→r ɨ z g a t͡ɕ ø]

cf. [t $\emptyset_1$ k→l i v ɨ] BrO (48a)
[t $\emptyset_1$ k ø̲ n õ t͡ɕ ø] RIO (48b)

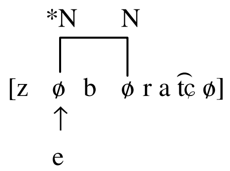
Both approaches to the structure of the initial cluster [br], that is, the standard GP analysis with a branching onset (BrO) and the one proposing an interonset relation (RIO), are perfectly capable of handling the *zbryzgać* as a synthetic domain. The nucleus $\emptyset_1$ is not required to vocalize, and does not need to be separated by a domain as in (65b).

[84] The exact bracketing is irrelevant. See Booij and Rubach (1984), Szpyra (1989) and Rowicka (1999) for proposals in this respect. The distinction can be broadly made by referring to analytic versus non-analytic (synthetic) morphology.

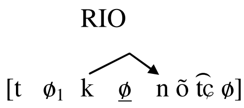
[85] The same argument holds even if [br] were viewed as a RIO /bø̲r/ locking the intervening empty nucleus, as shown in the analysis of *tknąć* /tøkø̲nõt͡ɕø/ (48b).

On the other hand, ironically, *zebrać*, which is assumed to form one phonological domain, defies the established interpretation of three-onset sequences shown in (65a). The first nucleus is vocalized. In this respect, *zebrać* is as surprising as **megła* and **teknąć* would be. The analysis of *zebrać* as opposed to *tknąć* involves one crucial difference, that is, an interonset governing relation is absent in the former case, and present in the latter.

(66) a.



b.



The absence of RIO in (66a) creates a sequence of two unlocked empty nuclei which must be resolved by vocalization due to the constraint *ø–ø, whereas in (66b) there is only one visible empty nucleus $ø_1$. Thus we return to our initial question of what conditions the fact that RIO is contracted or not, which in fact is a question pertaining to the difference between what we can call a true cluster and a false one.

6.2.4. Three types of nuclei in Polish

So far, we have seen that in all the diagnostic contexts which allow us to detect the structure of the branching onset in Polish, the competing structure of rightward Interonset Government (RIO) is able to replace it, because it is predicted to behave in exactly the same way. If there is any functional difference between phonetically identical strings of rising sonority in Polish, it is always the case that BrO and RIO pattern together in opposition to the so called false clusters ONO, in which no governing relation is found. The ultimate elimination of BrO from the phonology of Polish requires, however, that a solution be found to the question why some sequences of the /TØR/ type, do not contract a governing relation, e.g. *brać* /børatɕ͡ø/, even though all the necessary conditions seem to be fulfilled.

The answer must be sought in the representation. More precisely, there must be something in the representation of *brać* that blocks RIO. Since government is obligatory, it appears that its absence in *brać* is due to the fact that one of the conditions on government is contravened. Recall that melodically speaking, the sequence [br] in *brać* and *bryzgać* is identical.

Therefore it is not the complexity / sonority slope requirement that prevents government in the former. Additionally, in both forms [br] is followed by a full vowel, hence, government licensing is also above suspicion. The only condition on government that remains is adjacency. Normally, empty nuclei should not block government. It appears, however, that some of them do, and they are typically the nuclei which sometimes appear as vowels.

Following Scheer (2004) we assume that there are two types of empty nuclei. Representationally they differ in one respect. A truly empty nucleus (∅) is just a nuclear position in phonological representation (67c), while the empty nucleus which alternates with vowels contains unassociated / floating melody ($\emptyset_e$).[86] Let us compare these representations with regular vowels.

(67)	a. ***full vowel***	b. ***alternating vowel***	c. ***empty nucleus***
	N	N	N
	|		
	α	α	

The three structures of nuclei in (67) in fact represent all the logically possible configurations which follow from the three-dimensional model of representation.[87] Polish appears to utilize all three structures. Full vowels (67a) are complete representations with melody associated to the nuclear position. These vowels do not alternate with zero. They also block interaction between the surrounding onsets. Alternating vowels (67b), which structurally constitute a halfway house between full vowels and empty nuclei, contain unassociated melody, which may or may not be linked to the nucleus depending on the shape of the following nucleus. The empty nucleus (67c), on the other hand, is deprived of any melody, and does not block Interonset Government.

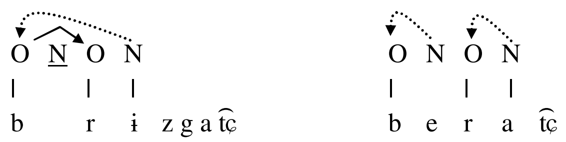
The dual function of the alternating vowel is such that, as a licenser, it patterns with the empty nucleus. If the melody is linked, then, quite logically, it behaves like a full vowel. On the other hand, even if the melody remains unassociated, the alternating vowel behaves like a full vowel in that it blocks government between the flanking onsets. This assumption

[86] The floating melody in Polish is typically [e], hence the symbol $\emptyset_e$. There are also alternations with [o], e.g. *kozioł / kozła* [koʑow ~ kozwa] 'male goat, nom.sg. /gen.sg.' in which case we are dealing with $\emptyset_o$.
[87] The level of skeletal positions is conflated with the level of Ns for simplicity. All three structures may be represented with an x-slot.

clarifies the dilemma at which level onsets see each other in interonset government. Recall that once interonset is introduced into phonological theory, adjacency defined at skeletal level is no longer valid. The two options we mentioned in the previous sections were either the level of onset projection, or the melodic level. The effect of blocking RIO by the floating melody unequivocally points to the latter level. The presence of vocalic melody, whether associated or not, blocks this interaction. Given that governing relations between consonants are strictly related with their melodic make-up it stands to reason that the interaction must take place at the melodic level.

We are now ready to eliminated BrO completely from Polish phonology and illustrate the representational difference between *brać* and *bryzgać* as that between RIO and ONO, that is, a true and a false cluster.

(68) a. ***RIO*** b. ***ONO***



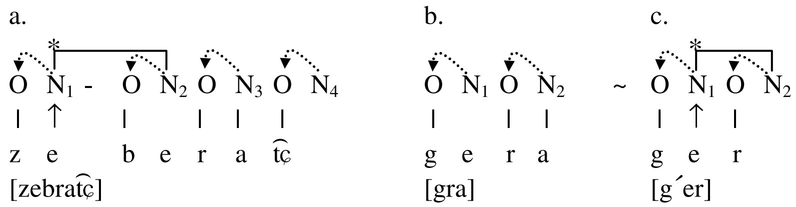
bryzgać 'splash' — *brać* 'take'

A true cluster is one which involves government between the consonants (68a). Government may to some extent be viewed as a binding mechanism which extends the domain of licensing. In other words, government, though ontologically different from licensing, is *de facto* forming structures bigger than one segment, whose individual players exist due to a single source of licensing – the nucleus that directly follows the second consonant. Thus true clusters may be compared to compounds in morphology.

A few words are in order concerning the 'locked' empty nucleus. At this stage we assume that it is invisible to phonological processes, in that it may not vocalize if followed by another empty nucleus, and may not cause vocalization of the preceding empty nucleus. Additionally, as transpires from the representation in (68a), it does not license its onset. All these functions become available to the empty nucleus only once it is, or becomes unlocked.

The false cluster in (68b) contains an unlocked empty nucleus. Consequently, it must be a licenser to its onset, and it is visible to all phonological phenomena connected with nuclei. For example, it causes vocalization of the jer in prefixes, e.g. *zebrać* [zebrat͡ɕ] 'collect' (69a), and is itself subject to vocalization if followed by another visible empty nucleus, as in *gra / gier* [gra ~ g´er] ‘game, nom.sg. /gen.pl.’ (69c).

(69)



Note that N_1 in (69a) is also proposed to possess a floating melody now. The melody is linked due to the universal (unviolable) constraint *ø–ø. The melody under the nucleus N_2 is proposed on the basis of the morphological alternations, e.g. *bierze* ‘(s)he takes’, *rozbierać* ‘undress’. N_3 is the only lexical full vowel in that form. On the other hand, N_4 is a regular empty nucleus.[88] Such empty nuclei may remain unlocked not only word-finally. Note that in words like *kto* ‘who’ < /køto/, the empty nucleus is unlocked because the string [kt] could not contract a governing relations for melodic reasons. Since this empty nucleus never alternates with a vowel, it would be totally arbitrary to suggest that it contains a floating melody.

In (69b), the nucleus N_1 is not followed by an empty nucleus and the melody remains unassociated. The opposite obtains in (69c), in which the word ends with an empty nucleus. Thus, the presence of the floating melody in representation correlates with vowel – zero alternations, which are either morphological in nature, e.g. *brać / bierze* ‘to take / (s)he takes’, or phonological, e.g. *zebrać / zbiera* ‘collect / (s)he collects’, or *gra / gier* ‘game, nom.sg. /gen.pl.’.

To conclude, the introduction of the third representation, that is, the alternating vowel with floating melody, we may retain the strict principle that any /*TØR*/ sequence must contract a governing relation which locks the empty nucleus /*TØ̲R*/. Government is obligatory if all conditions are fulfilled. However, it is blocked by vocalic melody of full vowels /*TVR*/ and alternating ones /*TØ*$_e$*R*/. We are also able to rid the grammar of the structure of the branching onset, which duplicated the functions that RIO could effectively handle.

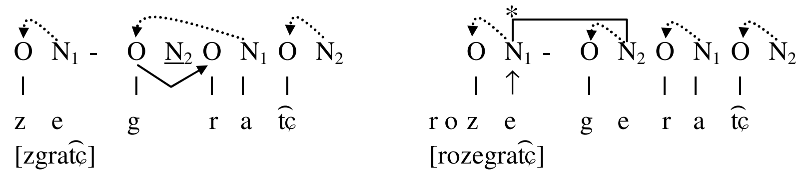
Synchronically speaking, we may suggest that all *TR* sequences should involve RIO by default, while those deprived of RIO must be learnt and

[88] For arguments against proposing a floating melody in final empty nuclei see Scheer (2004: 91).

they are always connected with morphologically or phonologically determined vowel – zero alternations. The employment of two types of empty nuclei may and does lead to cases of ambiguity in some forms. These are, however, always disambiguated in alternations. In other words, the structure with a floating melody is always postulated only on positive evidence, such as alternation.

However, the very fact that such ambiguities exist may lead to various changes and lexicalizations where the shifts always involve the two options, that is RIO vs. ONO, that is, a locked or unlocked intervening empty nucleus. For example, the word *grać* 'play', which in the nominal paradigm exhibits the purely phonological alternation *gra / gier* 'game/gen.pl.', behaves ambiguously with respect to prefixes, as mentioned earlier. To account for the outcomes in, e.g. *zgrać* [zgrat͡ɕ] 'synchronize' vs. *rozegrać* [rozegrat͡ɕ] 'play out', we must assume that the respective stems are lexically different. One of them contains RIO (70a) and the other ONO (70b).

(70) a. b.



Assuming the non-analytic nature of prefixation in the above forms, the difference between the stems in (70) lies in the status of the first nucleus, which is marked as N_2. The interpretation of N_1 is strictly dependent on N_2.

Returning briefly to the question of bracketing in forms like *zgrać*, it must be admitted that although here there is sufficient representational distinction between stems which vocalize the preceding prefixes and those that do not, the problem of bracketing is far from settled and may need to be reconsidered. It would probably be wrong to assume that bracketing can be dispensed with completely. It seems that some forms must involve analytic suffixation, for example, *roztkliwić* [roztkliv´it͡ɕ] 'become tender', which must be /[[rozø$_e$] [tøkø̲liv´it͡ɕø]]/, otherwise, we should expect that the word be pronounced *[rozetkliv´it͡ɕ] < /[rozø$_e$tøkø̲liv´it͡ɕø]/.

Below we consider a final diagnostic context for the presence of BrO, which refers to the behaviour of *TR* sequences at the right edge of the word. Predictably, it will be shown that in this context RIO replaces BrO as well.

6.2.5. RIO in word-final context

In standard GP, the occurrence of a cluster of rising sonority in word-final position was viewed as a strong argument that we are dealing with the structure of a branching onset. The argument is straightforward and follows from general principles of phonological organization. Only true clusters, that is governing relations are allowed word-finally because the absence of a governing relation automatically yields a structure with an intervening empty nucleus (*…TøRø#*) which is ungrammatical. Thus, any surface string conforming to the well-formedness conditions on branching onsets must be given this structure word-finally (*…T→Rø#*). The sequence with two empty nuclei (*…TøRø#*) must be resolved by vocalization of the first empty nucleus (*…TeRø#*).

One can immediately think of forms in Polish which illustrate these predictions. For example, the string [tr] in *wiatr* [v´atr] 'wind' presents a steep sonority / complexity profile. It is a 'good-looking' branching onset. On the other hand, [pɲ] in *stopień / stopnia* [stop´eɲ ~ stopɲa] 'step, nom.sg. /gen.sg.', or [kn] in *okno / okien* [okno ~ ok´en] 'window, nom.sg. /gen.pl.' cannot form a true *TR* cluster and must be broken up by a vowel.

As in other contexts, we assume that the true clusters word-finally are not BrO but RIO, that is, interonset relations licensed by the final empty nucleus. The crucial distinction between integral clusters of rising sonority word-finally and those which must alternate with a vowel is again that of true clusters which involve government and lock the intervening empty nucleus (*…T*<u>*ø*</u>*Rø#*), as opposed to false ones, which eschew government and are therefore subject to vowel – zero alternation. It is interesting that the sequences [pɲ, kn] form false clusters for a different reason than the one observed in *brać* vs. *bryzgać*. Here, the strings are separated by an empty nucleus due to the fact that they have an inappropriate sonority / complexity profile, and government locking the first empty nucleus is simply impossible.[89]

There are, however, false clusters at the right edge which melodically represent good candidates for RIO. They must possess the floating melody in the representation in order to exhibit vowel – zero alternations. The data in (71) illustrate some of the melodically identical true and the false clusters of rising sonority at the right edge of words.

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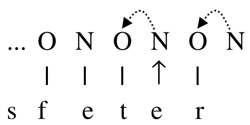
[89] However, given the fact that this nucleus alternates with [e] it should probably represented as possessing a floating melody in modern Polish.

(71)

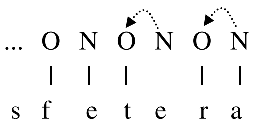
a. **RIO:**	***…TøRa#***	***…TøRø#***	
	wia[tr]u	wia[tr]	‘wind, gen.sg./nom.sg.’
	ka[dr]u	ka[tr]	‘frame, gen.sg./nom.sg.’
	bo[br]a	bó[pr]	‘beaver, gen.sg./nom.sg.’
	Cy[pr]u	Cy[pr]	‘Cyprus, gen.sg./nom.sg.’
	a[kr]y	a[kr]	‘acre, nom.pl./nom.sg.’
	cy[kl]e	cy[kl]	‘cycle, nom.pl./nom.sg.’
b. **ONO:**	***....Tø$_e$Ra***	***...TeRø#***	
	swe[tr]a	swe[ter]	‘jumper, gen.sg./nom.sg.’
	wia[dr]o	wia[der]	‘pail, nom.sg./gen.pl.’
	że[br]o	że[ber]	‘rib, nom.sg./gen.pl.’
	ko[pr]u	ko[per]	‘dill, gen.sg./nom.sg.’
	is[kr]a	is[k´er]	‘sparkle, nom.sg./gen.pl.’
	pu[kl]a	pu[k´el]	‘lock, gen.sg./nom.sg.’

The sequences [tr, dr, pr, br, kr, kl] are potentially good RIO relations, as demonstrated in (71a). Therefore, we must postulate that these sequences are separated by the floating melody of alternating vowels in (71b). In other words, the alternation *sweter / swetra* must be viewed as marked, in the sense that something prevents the expected interonset governing relation (72a). On the other hand, the form *wiatr* must be viewed as a regular phonological situation, that is, RIO across an empty nucleus (72c).

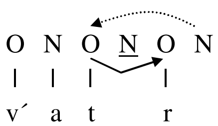
(72) a. ***sweter*** **[sfeter]**



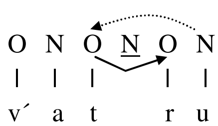
b. ***swetra*** **[sfetra]**



c. ***wiatr*** **[v´atr]**



d. ***wiatru*** **[v´atru]**



It is interesting that the forms *swetra* (72b) and *wiatru* (72d) are structurally ambiguous: both yield the surface string [tr], however, one is a false cluster and the other a true one. This ambiguity leads to curious instances of fluctuations. For example, while in uneducated Polish the licit *TR* clusters are broken up in, e.g. $^{?}$*liter*, $^{?}$*wiater* (instead of *litr* 'litre' and *wiatr* 'wind'), we also frequently encounter equally uneducated instances whereby alternating sequences are turned into true clusters, for example, $^{?}$*swetr* instead of *sweter*. Both situations seem to arise due to the ambiguity between the marked situation, that is the alternating forms like *swetra / sweter*, which are however very common in Polish, and the less common but phonologically more regular cases of RIO. Thus, what the uneducated speakers seem to do in such cases is the following. In $^{?}$*swetr*, the speakers apply regular phonology to this form on the basis of the parallel form *wiatr*. They do not postulate the floating melody between the last two consonants, and the consonants form a governing relation. On the other hand, in $^{?}$*liter*, and $^{?}$*wiater*, the speakers postulate a floating melody parallel to the majority of the forms in the lexicon, which are alternating. If this interpretation is correct, then we should not expect one speaker to perform both types of misanalysis. That is, a speaker who uses the form $^{?}$*swetr* should not use $^{?}$*liter*, and $^{?}$*wiater*.[90]

6.2.6. Substantive restrictions on final RIO

It appears that a CV version of phonological representation, that is, one which uses interonset relations, e.g. RIO rather than branching constituents, e.g. BrO is well suited to account for such ambiguities as the one between *swetra / sweter* and *wiatru / wiatr*, which sometimes lead to incorrect forms like $^{?}$*swetr* and $^{?}$*wiater*, respectively. The representations in (72) show that the structural differences are very small and depend on one decision: whether a speaker postulates the marked type of empty nucleus, that is, one with a floating melody, or not. The problem boils down to placing the floating melody in the right forms.

However, an interesting paradox follows from the above analysis. Namely, we are forced to say that the consonants sequences which exhibit vowel – zero alternation (71b) are marked – because we have to postulate the floating melody, while the forms in which the *TR* cluster shows integrity at the right edge of words illustrate the operation of regular phonology. The problem with this interpretation is that the marked, alternating forms, seem to be more common in Polish lexicon than the integral *TR* clusters. What is more, the RIO relations at the right edge of words in Polish exhibit severe restrictions.

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[90] This prediction has yet to be verified.

Let us look in more detail at the melodic patterns involving clusters of rising sonority in word-final position. What should be said at the outset is that melodic restrictions in word-final position are fully expected. Note that we are dealing with a RIO, that is, level III of structural complexity, licensed by an empty nucleus. We begin with *obstruent* + *r*.

(73) a.

wia[**tr**]	'wind'
ka[**tr**]	'frame'
musz[**tr**]	'drill, gen.pl.'
jesio[**tr**]	'sturgeon'
siós[**tr**]	'sister, gen.pl.'
hałas[**tr**]	'mob, gen.pl.'
bó[**pr**]	'beaver'

b.

tea[**tr**]	'theatre'
parame[**tr**]	'parameter'
li[**tr**] (li**ter**)	'litre'
fil[**tr**] (fil**ter**)	'filter'
Cy[**pr**]	'Cyprus'
a[**kr**]	'acre'
maka[p**r**]	'macabre, gen.pl.'
szy[**fr**]	'cipher'

The reader will have noticed that the data in (73b) are of foreign origin and do not even require glosses. If we ignore possible multiplications produced by compounding, for example, *milimetr, centymetr* and so on, the forms in (73) pretty much exhaust the number of word-final *obstruent* + *r* clusters which may be regarded as RIO. Note that the native forms in (73a) are almost exclusively restricted to [tr].[91]

The situation with another typical complement of a RIO relation, that is *l*, does not look any better.

(74) a.

cy[**kl**]	'cycle'
mono[**kl**]	'monocle'
pejo[**tl**]	'peyotl'
nota[**pl**]	'notable'
spekta[**kl**]	'spectacle'

b. ***imperative***

pie[**kl**]	'fuss'
ocie[**pl**]	'warm up'
rozświe[**tl**]	'brighten up'
mó[**tl**]	'pray'
pona[**kl**]	'rush'

Again, the non-alternating sequences *obstruent* + *l* in (74a) are strongly felt to be synchronically foreign (Laskowski 1975: 38). Note also that *tl*, which is possible in these forms, is universally excluded as a possible onset in standard GP (Kaye, Lowenstamm and Vergnaud 1990). The forms in

[91] There are also individual forms like *Mamr* 'name of lake, gen.pl.' *Niemr* 'German woman, gen.pl.', *żanr* 'genre' where a nasal may be followed by *r*.

(74b), on the other hand, belong to a strictly defined grammatical category, that is, the imperative construction. Here too, *tl* is found in two cases.

There are three other sets of data with final *obstruent* + *sonorant* clusters which may be considered. They also exhibit some effects connected with the conditions on what can be licensed finally.

(75) a.

	preterite	
biegać 'run'	bie[**kw**]	> bie[**k**]
pleść 'waffle'	pló[**tw**]	> pló[**t**]
wieść 'lead'	wió[**tw**]	> wió[**t**]
nieść 'carry'	nió[**sw**]	> nió[**s**]
moknąć 'get wet'	mó[**kw**]	> mó[**k**]

b.

		derivative
modli[**tf**] 'prayer, gen.pl.'	–	modli[**tev**]ny 'used for prayer'
pańs[**tf**] 'country, gen.pl.'	–	pańs[**tef**]ko 'country, dim.'
wars[**tf**] 'layer, gen.pl.'	–	wars[**tef**]ka 'layer, dim.'
mar[**tf**] 'worry, imp.'		
posels[**tf**] 'envoy, gen.pl.'		
zabójs[**tf**] 'killing, gen.pl.'		
płe[**tf**] 'fin, gen.pl.'		

c.

pa[**tʃ**] 'look, imp.'
wywie[**tʃ**] 'air, imp.'
spię[**tʃ**] 'pile up, imp.'
rozis[**kʃ**] 'incite, imp.'
wi[**xʃ**] 'stir up, imp.'
wie[**pʃ**] 'pig'
pie[**pʃ**] 'peper'

It appears that the preterite forms in (75a) once again constitute a well-defined group. It is interesting to note that these hyper-correct sequences are regularly simplified in rapid speech by deleting the final [w]. Clusters of the type *consonant* + *w* are not favoured before an empty nucleus in Polish not only word-finally but also medially, where such clusters are also simplified, either regularly, e.g. *jabłko / jabłek* [japko ~ jabwek] 'apple, nom.sg. /gen.pl.', or as a result of articulatory difficulties, e.g. *płci / płeć* [pwt͡ɕi > ˀpt͡ɕi ~ pwet͡ɕ] 'gender, gen.sg./nom.sg.'.

However, the most intriguing regular sequences in word-final position are those in (75b) and (75c). As for the sequence *obstruent + f*, Gussmann (1981, 1998) argues that the [f/v] found in words like *twarz* [tfaʃ] 'face', *dwa* [dva] 'two' and *modlitw* [modlitf] 'prayer, gen.pl.' should be treated as a sonorant /w/, with voicing being fully predictable from the context. What we are dealing with in (75b) is a set of forms parallel in many ways to the final [tr] in (73a), in that the cluster in question is basically restricted to [tf].[92] Word-initially, the variety of forms is greater in that, excluding [pf] and [bv], we have *chwytać* [xfɨtat͡ɕ] 'catch', *kwas* [kfas] 'acid', *gwizdać* [gv´izdat͡ɕ] 'whistle', *twarz* [tfaʃ] 'face', and *dwoje* [dvoje] 'two'. This fact is not surprising given that in this context such sequences are licensed by a full vowel rather than an empty nucleus.

A similar interpretation may be offered for the clusters in (75c). Some of these forms have alternants which betray a sonorant-like source for the final [ʃ], for example, *patrz* 'look, imp.' > *pdpa**tr**ywać* 'peep', *wywietrz* 'air, imp.' > *wia**tr*** 'wind', *spiętrz* 'pile up, imp.' > *pię**tr**o* 'storey', *roziskrz* 'incite, imp.' > *is**kr**a* 'spark', *wichrz* 'stir up, imp.' > *wi**chr**y* 'strong wind, pl.', etc. Note also that the clusters typically involve a strong obstruent and [ʃ]. Thus, just like in the case of [f/v], [ʃ/ʒ] may be have two identities: a sonorant-like one, and an obstruent-like one, where the complement of RIO in, for example, *drzewo* [dʒevo] 'tree', *trzy* [tʃɨ] 'three' and *patrz* [patʃ] 'look, imp.' is in some way related to [r].

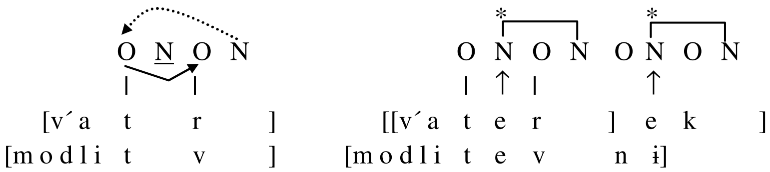
The restricted character of word-final *obstruent + f* clusters, where [f] is sonorant-like, follows from a few factors. Firstly, *t* seems to be the strongest governor in Polish, hence, [tf] is like [tr]. Secondly, labial obstruents are excluded for reasons connected with homorganicity. This leaves us with [tf] as the best candidate, and [kf] as a possible one, but not as good. Note that the latter does appear in a limited group of words in Polish, such as, *sakw* [sakf] 'bag, gen.pl.', and *tykw* [tɨkf] 'bottle-gourd, gen.pl.'. In the case of word-final clusters with the sonorant-like [ʃ], a homorganicity constraint does not seem to apply, as none of the stops is homorganic with [ʃ]. For this reason, not only [tʃ], but also [kʃ, pʃ, xʃ] occur finally.

As for the vowel – zero alternation within the final [tf] cluster, for example, *modlitf / modlitewny* 'prayer, gen.pl./Adj.', let us observe that the same phenomenon occurs in final [tr] in *wiatr / wiaterek* 'wind/dim.'. In our terms, *wiaterek* and *modlitewny* are based on different lexical represen-

[92] There are also a few words with final [kf] in Polish, e.g. *sakw* 'sack, gen.pl.'.

tations than *wiatr* and *modlitw*, respectively. They must be assumed to contain a lexically present floating melody, that is, /[v´at$\underline{ø}$rø]/ as opposed to /[[v´atø$_e$rø]ø$_e$kø]/ and /[mod$\underline{ø}$lit$\underline{ø}$vø]/ as opposed to /[mod$\underline{ø}$litø$_e$vøniɨ]/. The relevant aspects of these representations are presented below.

(76) a. b.



The analysis of the two word forms is parallel to that of *zgrać* 'synchronize' and *rozegrać* 'play out' in (70) and depends on the assumption that the representations of the respective stems are different. Thus in *wiaterek* (76b), which is viewed as a case of analytic suffixation, the first cycle contains a representation which is the same as that of *sweter* (72a), that is, it is marked for the presence of a floating melody and consequently for the absence of RIO. Similarly, in *modlitewny* (76b), although there is no need to postulate analytic suffixation, the form contains a floating melody.[93]

The question that still remains is what governs the distribution of floating melodies in Polish. Whether it is completely arbitrary, or whether some explanation can be provided for their occurrence. Recall that this question is strictly connected with the paradox defined earlier, consisting in the fact that marked structures – containing the floating melody – are more common in Polish lexicon than the phonologically regular though highly restricted RIO relations at the right edge of words. An attempt to answer this dilemma will be made in the following section, in which leftward interonset relations are also considered. However, some historical explanation concerning the distribution of alternating vowels should be mentioned at this point.

Most of the synchronically observed vowel – zero alternations, whether conditioned phonologically or morphologically, as in the Derived Imperfective (DI), e.g. *ze-brać* 'collect' vs. *z-bierać* 'collect, DI', occur in sites where the historical jers first developed from, for example, the high short vowels *i/u* and were later lost in contexts in which they were not followed

[93] In fact an alternative analysis is also possible. Since a separate representation must be postulated for *wiatr* and *wiaterek* anyway, it is possible to assume that *wiaterek* in fact contains a full vowel [e] rather than a floating melody.

by another jer.[94] This situation concerns not only most of the alternating stems in (71b) above, but also the cases at the left edge of the word in Polish, which have been discussed in connection with the presence of an unlocked empty nucleus. This nucleus may synchronically alternate with a melody or not. For example, the alternations *mech / mchu* 'moss, nom.sg. /gen.sg.' can be traced back to the Old Church Slavonic (OCS) form *mъxъ*. The unlocked empty nuclei in *kto* /køto/ 'who', *ptak* /pøtak/ 'bird' and *mgła* /møgø̲wa/ 'mist' also go back to a lost jer, as the respective OCS forms *kъto, pъtica* and *mьgla* demonstrate. This pattern can of course be extended to the verbs which have been discussed above in connection with prefixation. For example, *zebrać* /zø$_e$bø$_e$rat͡ɕø/ 'collect' goes back to OCS *sъbьrati* (Shevelov 1964: 435ff).

Thus, forms like *bьrati* 'take' used to have a phonologically different structure than initial *br* clusters by virtue of containing a reduced jer vowel. Then, at the time when jers in weak positions began to be dropped, prefixed forms like *sъbьrati* still had to be distinguished from forms with initial *br* which did not cause vocalization in the prefix. It appears that the different behaviour of the new phonetic *br* clusters had to be marked somehow. It may be claimed that the marking with a floating melody petrified the earlier regular phonological interpretation of a sequence of jers by ensuring that the *br* sequence did not form a governing relation of the type that already existed in the system, and which did not cause vocalization in the prefix. Thus, the purpose of marking is to preserve the regularity, which used to be phonological, and which would otherwise have to be eliminated due to a different development of the phonological system. The phonological regularity which imposes a governing relation on all TØR sequences is thwarted. In a sense, this marking is a case of lexical conservatism (e.g. Steriade 1999). We will see in the following that this interpretation of the distributional paradox is not far from being accurate.

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[94] The situation is in fact a little more complicated. Jers developed from other sources than *i/u* as well, for example, due to simplification of some endings or from the so called syllabic liquids. There are also the so called non-etymological jers, in that we observe vowel – zero alternation in sites which did not contain a historical jer. A good example of this is OCS *mьgla* 'mist', which did not have a jer inside the [gl] sequence, but this is an alternation site in modern Polish *mgła / mgieł* (see section 5.5). Jers are discussed in more detail in chapter 3.

6.2.7. Conclusion

We have looked at four different contexts in which branching onsets typically show particular behaviour to see if the existence of branching onsets (BrO) in Polish is substantiated by other factors than the mere presence of surface non-alternating strings like [kl, tr, pr], and so on. The conclusion is that functionally, branching onsets behave in the same way as rightward interonset relations RIO in all possible contexts. The relevant structural distinction that constitutes the basis of disparate phonological behaviour is that between false clusters ONO, on the one hand, and true clusters on the other, where a true cluster is defined as one involving government, that is, RIO and BrO.

False clusters, contain an unlocked / visible empty nucleus which may contain a floating melody or not. To be more precise, there is no floating melody in the false clusters in forms like *kto* [kto] < /køto/ 'who'. There are two reasons for that. Firstly, the intervening empty nucleus never shows up in vowel – zero alternations. Secondly, the two obstruents could not contract a governing relation for melodic reasons anyway. Thus, we have a reason to postulate the empty nucleus, and no reason whatsoever to postulate a floating melody in such forms. On the other hand, in forms like *brać* [brat͡ɕ] < /bø$_e$rat͡ɕø/ 'take' and *swetra* [sfetra] < /sfetø$_e$ra/ 'jumper, gen.sg.', the floating melody must be postulated because the RIO relation in [br] and [tr] would otherwise have to be contracted. Forms like *rozebrać* [rozebrat͡ɕ] < /rozø$_e$-bø$_e$rat͡ɕø/ 'undress' and *sweter* [sfeter] < /sfetø$_e$rø/ 'jumper, nom.sg.' show that this relation must not take effect. The first empty nucleus with floating melody has to vocalize in both *rozebrać* and *sweter*, so they must be followed by another empty nucleus. This is simple and straightforward in the case of *sweter* because the word must lexically end in such an empty nucleus. However, in *rozebrać*, the effect of vocalization in the prefix is possible only if we postulate an empty nucleus inside the phonetic sequence [br] in the stem, i.e. /bø$_e$rat͡ɕø/. Recall that this empty nucleus also has a floating melody for two reasons. Firstly, the floating melody blocks the expected RIO in such melodic strings. And secondly, this nucleus is vocalized itself, although for morphological reasons, in forms like *bierze* [b´eʒe] 'he/she takes'.

The replacement of BrO with RIO, and hence, assuming the CV structure of phonological representation, is not just doable. It seems necessary from the point of view of language economy. The ultimate argument for maintaining two disparate formal structures for identical phonetic strings is their disparate phonological behaviour. They must show functional distinction. No such distinction can be found between RIO and BrO because they are both true clusters, i.e. involving government between consonants. However, they are both different from the structure of false clusters ONO, which do not exhibit government. Thus, the choice we are confronted with is between having two syllabic structure types which show no functional distinction and having more empty nuclei, which are independently motivated in the system anyway. Thus, what is increased in the CV assumption is the number of locked empty nuclei, which is without consequence for the system as long as they remain locked within governing relations.

The introduction of floating melodies coupled with the CV assumption provides simpler interpretations of such phenomena as language errors, e.g. ?*liter*, ?*wiater* vs. ?*swetr*. These forms may be viewed as cases of misanalysis due to the similarity of structures between RIO and ONO. The two structures differ in one variable: the presence or absence of a floating melody. Note that it is very much a substantive, i.e. melodic difference, rather than a formal one. Though, admittedly, this melodic difference has formal consequences – presence or absence of government. The confusion is due to a paradoxical distribution of floating melodies in Polish lexicon, whereby the phonologically marked forms (with the floating melodies), e.g. *sweter* /sfet$ø_e$rø/ are more common than the unmarked structures, in which the empty nucleus is locked by a governing relation, e.g. *wiatr* /v´at$\underline{ø}$rø/.[95] We will try to solve this paradox in the following section, in which we consider leftward interonset relations (LIO) in word-final *RT* clusters. We begin with a peculiar systematic gap in Polish root level phonology. Namely, the vowel – zero alternations which we observed in the rising sonority consonant sequences are strangely missing in *RT* sequences.

6.3. Branching rhymes lost

In the preceding section it was demonstrated that rightward interonset relations (RIO) may be identified with what was traditionally assumed to be a branching onset. The change from a binary theorem to a strict CV model

[95] Admittedly, the term ‘marked’ is used here in a particular sense. The postulation of the lexical presence of a floating melody must be based on phonological evidence, such as vowel – zero alternation. Forms containing floating melodies are marked in the sense that they disallow phonologically regular and expected interonset government between phonetically adjacent consonants. However, it is not clear at this stage whether false clusters are in general more marked than true clusters (see the discussion in section 5.6).

was shown not to be a mere formal ploy, but an attempt to further simplify the model, whereby simplicity stems from the principles of phonological organization, and not from impressionistic views that some structure may look simpler than another, because, for example, it does not contain an empty category. In the absence of functional reasons to maintain two disparate phonological constructs that deal with identical empirical facts, the structure of the branching onset was abandoned. The direct consequence of this move for the model of Complexity Scales and Licensing (CSL) is that level III of syllabic complexity is now viewed as a case of a rightward interonset relation.

Quite naturally, we must now ask the question concerning the status of level II of syllabic complexity, that is, *R←T*, and see if the leftward governing relation may also be redefined as a leftward interonset relation (LIO). This would be a welcome situation from the point of view of the uniformity of the model.[96]

6.3.1. The 'missing' structure

A cursory look at the behaviour of consonant sequences of falling sonority at the right edge of the word in Polish might give the impression that the situation is similar to that concerning *TR*s. That is, we have consonant sequences which may exhibit vowel – zero alternation (77a), or not (77b). This situation is comparable to the respective distinction *swetra / sweter* 'jumper, gen.sg./nom.' vs. *wiatru / wiatr* 'wind, gen.s.g./nom.' in the *TR* context.

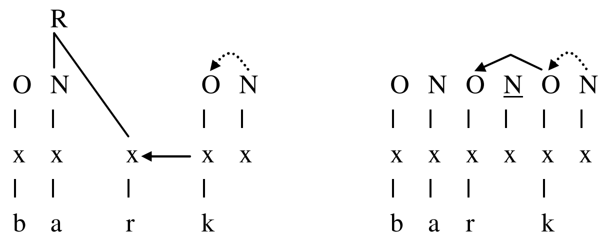
(77)	a.	barku / barek	[barku ~ barek]	'bar, dim.gen.sg./nom.sg.'
		półka / półek	[puwka ~ puwek]	'shelf, nom.sg./gen.pl.'
	b.	barku / bark	[barku ~ bark]	'shoulder, gen.sg./nom.sg.'
		pułku / pułk	[puwku ~ puwk]	'regiment, gen.sg./nom.sg.'

The analysis of the integral *RT* clusters word-finally is straightforward: they must constitute governing relations. In standard GP, this means that words like *bark* 'shoulder' and *pułk* 'regiment' end in a coda-onset cluster, where the coda consonant is part of the branching rhyme (BrR). Under the CV interpretation, these are also true clusters – involving government – with

[96] In chapter 3, we will consider the consequences of this proposal in more detail.

the exception that the leftward relation is contracted between two onsets (LIO). For the purpose of comparison, the skeletal level is included.

(78) a. ***Branching Rhyme*** b. ***Leftward IO***



Let us look more closely at the alternating forms now. It appears that fairly regular vowel – zero alternation in *RT* sequences occurs only in a specific context, namely, in cases of morphological derivation involving the suffix *–ek* (79a), which has been mentioned earlier, and the nominalizing suffix *–ec* [et͡s] (79b). We assume that both types of suffixation in (79) may have the same status, that is analytic.[97]

(79) a. **/...] $\emptyset_e$ k $\emptyset$]/**

bu[wk]a	~	bu[wek]	'bun, nom.sg./gen.pl.'
wo[rk]a	~	wo[rek]	'sack, dim.gen.sg./nom.sg.'
ba[jk]a	~	ba[jek]	'fable, nom.sg./gen.pl.'
la[lk]a	~	la[lek]	'doll, nom.sg./gen.pl.'
sy[nk]a	~	sy[nek]	'son, dim.gen.sg./nom.sg.'
blu[sk]a	~	blu[zek]	'blouse, dim.nom.sg./gen.pl.'

b. **/...] $\emptyset_e$ t͡s $\emptyset$]/**

ma[lt͡s]a	~	ma[let͡s]	'little boy, gen.sg./nom.sg.'
ko[lt͡s]e	~	ko[let͡s]	'thorn, nom.pl./nom.sg.'
Nie[mt͡s]y	~	Nie[m´et͡s]	'German, nom.pl./nom.sg.'
ko[ɲts]e	~	ko[ɲets]	'end, nom.pl./nom.sg.'

[97] Compare the items in (79) with some related forms *buła* 'bun', *wór* 'sack', *bajać* 'tell stories', *lala* 'doll', *syn* 'son', *bluza* 'blouse', *mały* 'small', *niemy* 'dumb', *koniuszek* 'end'.

It is often overlooked or simply ignored that vowel-zero alternations within clusters of falling sonority typically involve such morphologically complex forms rather than root-internal phonology.

Admittedly, it is not always obvious whether we are dealing with a suffixed form in the cases of *–ek/–ka* or *–ec/–ca* alternations. First of all, *–ek* does not always bring out the diminutive meaning, e.g. *bajka / bajek* 'fable/gen.pl.'. And secondly, it is not always clear what base the suffix is added to. For example, while in *lasek* 'grove', we can distinguish the base *las* 'forest', this is not so easy in the case of *–ek* in, e.g. *laska / lasek* 'stick, nom.sg. /gen.pl.', or *–ec* in *korce / korzec* 'bushel, nom.pl. /nom.sg.'. It may be assumed that the *–ek/–ka* or *–ec/–ca* alternations in the morphologically simplex forms simply follow the general pattern involving these melodic strings in derivation, which does not mean that they must have the same structure, that is, analytic domains. In general, however, vowel – zero alternation in sequences of falling sonority is connected with morphological complexity.

In morphologically simplex forms, on the other hand, the predominant pattern is that *RT*s are true clusters and must remain integral. The data below, which illustrate this point, take into account the phonetic shape of the clusters, which allows us to include devoiced obstruents, for example, *mord* [mort] 'killing', as well as nasal vowels which form a nasal consonant in front of stops, for example, *kąt* [kont] 'corner'. The forms marked with a superscript '^{M}' have derivatives showing an intervening vowel, for example, *hańb* 'infamy, gen.pl.' vs. *haniebny* 'infamous'. These require a separate explanation which would take into account derivational morphology. Recall that CSL analyzes such forms as separate lexical items which contain a nucleus with a floating melody as in *wiatr / wiaterek* (76).[98]

(80) ***sonorant + obstruent (RT)***

wt	*gwałt* 'rape', *kształt* 'shape'	*...wet /...wtu
lt	*palt*^{M} 'coat, gen.pl.', *dekolt* 'décolletage'	*...let /...lta[99]
rt	*czart* 'devil', *mord* 'killing'	*...ret /...rta
nt	*kąt* 'corner', *patent* 'patent'	*...net /...nta

[98] Given that they are separate lexical items, they could just as well possess a full vowel in that position.

[99] The list of the derivatives includes respectively: *paletko* 'coat, dim.', *haniebny* 'infamous', *Kielecki* 'of Kielce', *serdeczny* 'warm-hearted', *słoneczny* 'sunny', *waleczny* 'brave'.

wp	*małp* 'monkey, gen.pl.', *chełp* 'brag, imp.'	*...wep /...wpa[100]
lp	*skalp* 'scalp', *Alp* 'Alps, gen.pl.'	*...lep /...lpu
rp	*sierp* 'sickle', *karp* 'carp'	*...rep /...rpa
mp	*pomp* 'pump, gen.pl.', *dąb* 'oak'	*...mep /...mpa
ɲp	*hańb*ᴹ 'infamy, gen.pl.'	*...ɲep /...ɲba
wk	*czołg* 'tank', *pułk* 'regiment'	*...wek /...wgu
lk	*wilk* 'wolf', *obelg* 'impudence, gen.pl.'	*...lek /...lka
rk	*targ* 'market', *bark* 'shoulder'	*...rek /...rgu
ŋk	*bank* 'bank', *pąk* 'bud'	*...nek /...ŋku
lt͡s	*walc* 'walz', *Kielc*ᴹ 'name of city, gen.'	*...let͡s /...lt͡se
rt͡s	*serc*ᴹ 'heart, gen.pl.', *sztorc* 'upright'	*...ret͡s /...rt͡se
ɲt͡s	*słońc*ᴹ 'sun, gen.pl.'	*...ɲet͡s /... ɲt͡se
wt͡ɕ	*kształć* 'educate, imp.', *żółć* 'bile'	*...wet͡ɕ /...wt͡ɕi
rt͡ɕ	*zaparć* 'constipation, gen.pl.', *barć* 'beehive'	*...ret͡ɕ /...rt͡ɕe
wt͡ʃ	*Wałcz* 'name of city', *miałcz* 'moan, imp.'	*...wet͡ʃ /...wt͡ʃa
lt͡ʃ	*walcz*ᴹ 'fight, imp.', *milcz* 'quiet, imp.'	*...let͡ʃ /...lt͡ʃy
rt͡ʃ	*tarcz* 'shield, gen.pl.', *skurcz* 'cramp'	*...ret͡ʃ /...rt͡ʃa
nt͡ʃ	*lincz* 'lynch', *poncz* 'punch'	*...net͡ʃ /...nt͡ʃu
ɲt͡ʃ	*kończ* 'finish, imp.', *pomarańcz* 'orange'	*...ɲet͡ʃ /...ɲt͡ʃy
lx	*olch* 'alder, gen.pl.'	*...lex /...lxa
rx	*parch* 'scab', *wierch* 'top'	*...rex /...rxy
mx	*czeremch* 'bird cherry, gen.pl.'	*...mex /...mxy
wf	*żółw* 'turtle'	*...wef /...wv´a

The list contains a mixture of native and borrowed vocabulary items, which does not diminish in any way the import of the observation that word-final *RT* clusters in Polish seem to be doing remarkably well. This stands in sharp contrast to our observations concerning *TR* clusters in that position. Recall, that the situation with *TR*s was the opposite: there were numerous instances of vowel – zero alternations in that context and only a restricted set of true *TR* clusters. Note also that the disparate patterns observed in *TR* and *RT* clusters cannot be viewed as trivially following from the Sonority Sequencing Generalization. The distribution of floating melo-

[100] Forms like *łeb / łba* 'head, nom.sg./gen.sg.' and *mech / mchy* 'moss, nom.sg. /nom.pl.' below do not qualify as counterexamples here because they are monosyllabic and subject to other conditions on word structure, such as the requirement of possessing a phonetically overt head of domain. Note that the alternation here is word-final, medial and initial at the same time.

dies in TRs is lexically driven, and hence, arbitrary. For this reason, one should expect a hefty set of alternating forms in RTs as well.

Exceptions to the regularity shown in the above list exist and can be divided into a few well-defined groups. Firstly, there are the morphologically complex forms with *–ek* and *–ec* endings (79) with regular vowel – zero alternation. This group is supplemented by a number of analogical forms, in which morphology does not seem to be involved, e.g. *laska / lasek* ‘stick, nom.sg. /gen.pl.’, or *korce / korzec* ‘bushel, nom.pl. /nom.sg.’. Secondly, a vowel seems to break up the RT clusters in a well-defined group of derivatives, for example, *palt* ‘coat, gen.pl.’ vs. *paletko* ‘coat, dim.’, *hańb* ‘infamy, gen.pl.’ vs. *haniebny* ‘infamous’. However, it is difficult to speak of a phonologically based vowel – zero alternation here. Rather, the derivatives should be treated as separate lexical items, which possess a floating melody which gets linked to its nucleus due to the NO LAPSE constraint *ø–ø ([haɲebnɨ] < /haɲø$_e$bønɨ/, or even as already containing an underlying full vowel (/haɲebønɨ/).

There is also a third set of forms which seems to group true exceptions to the overall regularity that there is no vowel – zero alternations in monomorphemic words ending in RT.[101] Such exceptions are not difficult to find because they are in common use, but they constitute a small group. For example, while final [rp] is a good RT cluster in Polish (*karp* ‘carp’), there is an alternating form *torba / toreb* ‘bag, nom.sg. /gen.pl.’. Likewise, next to the integral [rf] in *barwa / barw* ‘colour, nom.sg. /gen.pl.’, there is *Narew / Narwi* ‘name of river, nom.sg. /gen.sg.’ and *kurwa / kurew* ‘prostitute, nom.sg. /gen.pl.’.

Even if the group of true exceptions is extended to include *laska / lasek* ‘stick, nom.sg. /gen.pl.’, *korce / korzec* ‘bushel, nom.pl. /nom.sg.’, *marca / marzec* ‘March, gen.sg. /nom.sg.’, which were viewed as analogical to the morphologically complex forms, or *oset /ostu* ‘thistle, nom.sg. /gen.sg.’, and *sto / setny* ‘hundred / hundredth’, one cannot fail to notice that the situation with respect to vowel – zero alternations in RT is the exact opposite to what we found in TR sequences word-finally. Namely, the integral RT clusters form a majority, and the alternating forms (*…ReT / …RøTa*) are in retreat. This suggests that the distribution of alternating vocalic sites in modern Polish is not entirely arbitrary – it is to a great extent governed by phonotactics, but this is visible only when we compare TRs and RTs.

[101] For the moment we consider only the RT clusters with steep sonority / complexity slope, which are traditionally considered ‘good contacts’ (e.g. Vennemann 1988).

Summarizing the observations made above, it may be said that the following patterns seem to hold in Polish. Either the sequence *RT* is integral, regardless of what type of licenser follows, as in (81a), or the sequence of *R* and *T* is separated by a lexically filled nucleus (81b). The pattern illustrated in (81c), however, is strangely missing.

(81)	a.	***karta* / *kart***	< /kar$\underline{ø}$ta ~ kar$\underline{ø}$tø/	CSL
		‘page, nom.sg./gen.pl.’	< /kar←ta ~ kar←tø/	standard GP
	b.	***kareta* / *karet***	< /kareta ~ karetø/	CSL = standard GP
		‘carriage, nom.sg./gen.pl.’		
	c.	****karta* / *karet***	< */kar$ø_e$ta ~ kar$ø_e$tø/	CSL
			< */karøta ~ karøtø/	standard GP

This structural gap equally concerns CSL and standard GP, and boils down to the absence of false *RT* clusters word-finally. The difference between the two models lies in the definition of false clusters. In CSL, we are dealing with the absence of empty nuclei with a floating melody (alternating vowels) in this context (82a). In standard GP, a false cluster simply contains an empty nucleus (82b), and the integrity of root-internal *RT* clusters always suggests that a coda-onset governing relation is contracted in such sequences (78a).[102]

(82)

a. ***the ‘missing’ structure in CSL***

```
     O N O N
     | | | |
 ... x x x x #
     |   |
     R e T
```

b. ***the ‘missing’ structure in standard GP***

```
     O N O N
     | | | |
 ... x x x x #
     |   |
     R   T
```

Recall, however, that in standard GP the status of the empty nucleus is unclear due to the fact that this model allows for interonset relations across

[102] Unless there is obvious evidence that we are dealing with analytic morphology and the sequence is spurious. This could be the case with English forms like *tenths* (/[[[tenø]θø]sø]/).

empty nuclei.[103] This means that we could as well be dealing with LIO in all the non-alternating cases and not with a branching rhyme and a coda-onset relation. In other words, it may well be the case that it is the branching rhyme that is missing in Polish, and (82b) should be supplemented with the leftward interonset relation (LIO), which would license / lock the first empty nucleus, thus rendering vowel – zero alternations in this context impossible.

This is what CSL must assume as a matter of course. Here, the strangely missing structure is that of (82a), while (82b) represents the 'regular' non-alternating clusters. However, even if we adopt the CSL structure of false clusters, the following problem remains: if the distribution of floating melodies seems to be lexically determined and by nature arbitrary, why are they missing in the so called good *RT*s? An attempt to answer this question will be made below. We begin by looking at *RT* clusters with flat sonority / complexity slope.

6.3.2. The distribution of floating melodies in Polish

There are generally two mutually exclusive approaches to the phenomenon of vowel – zero alternation in Polish. One of them assumes that the vowel [e] is epenthetic, that is, it is inserted if particular conditions to do with phonotactics are fulfilled.[104] It is enough to look at the disparate behaviour of phonetically identical sequences in *swetra* and *wiatru*, discussed under (72), to realize the inadequacy of such a view. Namely, the sequences which are broken up by the so called 'epenthetic vowel' may be phonetically identical to those that remain integral and show that there is nothing wrong with phonotactics here.

The other approach to the alternations stipulates that the fleeting vowel is somehow present in the phonological or lexical representation of some forms and the role of phonology is merely to determine whether it will surface as [e] or remain phonetically null. This 'ghost vowel view', as we may call it, represents a range of proposals: the jer analysis (Lightner 1972, Gussmann 1980), the empty v-slot analysis (Spencer 1986), the floating vocalic matrices analysis (Rubach 1986), and the empty root node analysis (Szpyra 1992), to name the main ones in generative phonology, as well as

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[103] See the analysis of *tknąć* (48b) and the discussion of its consequences for standard GP in section 5.5.

[104] The 'epenthetic view' is represented by, e.g. Czaykowska-Higgins (1988) and Piotrowski (1992).

the empty nucleus analysis (Gussmann and Kaye 1993) couched in standard GP.

One serious problem, however, that the 'ghost vowel' approach faces is connected with the tacit assumption that the distribution of the floating vowels in the lexicon is random, that is, totally arbitrary. Looking at the forms *swetra* and *wiatru* (72) one finds support for this view. The presence of the floating vowel is indeed a lexical property of the former and not of the latter. The situation changes dramatically when we look at the distribution of 'ghosts' in *RT* sequences, where floating melodies are restricted to morphologically complex forms (79), a handful of exceptions discussed under (80), and a very interesting group of sequences of flat sonority profile. The data in (83) below show a situation which to some extent resembles the ambiguity observed in steep, that is, good *TR* sequences (71).

(83) ***Flat RT sequences***

	integral	***alternating***
rɲ	*darń* 'sod'	
	cierń 'prick'	*dureń / durnia* 'fool, nom.sg./gen.sg.'
rn	*urn* 'urn, gen.pl.'	*żarn* or *żaren* 'quern, gen.pl.'
		ziarno / ziaren 'grain, nom.sg./gen.sg.'
ʃm	*piżm* 'musk, gen.pl.'	*ciżm* or *ciżem* 'foot-ware, gen.pl.'
sn	*blizn* 'scar, gen.pl.'	*wiosna / wiosen* 'spring, nom.sg./gen.pl.'
sw	*pomysł* 'idea'	*poseł / posła* 'MP, nom.sg./gen.sg.'
ɕɲ	*pieśń* 'song'	
	baśń 'fable'	
	bojaźń 'fear'	*mięsień / mięśnia* 'muscle, nom.sg./gen.sg.'

Unlike with steep *RT* clusters (80), there is a degree of ambiguity concerning the distribution of floating melodies in flat *RT*s. Next to integral clusters of this type, e.g. *darń* 'sod', there are regular vowel – zero alternations, e.g. *dureń / durnia* 'fool, nom.sg. / gen.pl.', and double forms – with, or without a vowel, e.g. *żarn* and *żaren* 'quern, gen.pl.'. Recall that such ambiguity is not found in steep *RT*s, where integral clusters are predominant, and alternations are found in well-defined situations.

The facts concerning the integral and ambiguous *RT*s leave no place for doubt that the distribution of alternating vowels in the Polish lexicon is far from arbitrary. If it were, we would expect equal or near equal incidence of vowel – zero alternations in both *RT* and *TR* contexts. Arbitrariness does occur, but it seems to be limited to steep *TR*s (good branching onsets) and, strangely enough, flat *RT*s (bad coda-onset contacts).

The full picture of the distribution of vowel – zero alternations in morphologically simplex forms in Polish seems to be as follows (Cyran 2005).

(84) ***The distribution of vowel – zero alternations***

a. flat TR v – ∅ obligatory
e.g. *ogień / ognia* 'fire, nom.sg. / gen.sg.'
okien / okno 'window, gen.pl. / nom.sg.'

b. steep TR v – ∅ common, ambiguity present (71)
e.g. *sweter / swetra* 'jumper, nom..sg. / gen.sg.'
wiatr / wiatru 'wind, nom.sg. / gen.sg.'

c. flat RT v – ∅ common, ambiguity present (83)
e.g. *darń* 'sod', *cierń* 'thorn'
dureń / durnia 'fool, nom.sg. / gen.sg.'

d. steep RT v – ∅ excluded (80)[105]
e.g. *gwałt* 'rape', *czart* 'devil'

It is rather obvious why flat *TR*s must alternate. Such sequences are always bogus clusters because one of the conditions on government cannot be fulfilled – the sonority / complexity slope. In other words, there are purely phonological reasons, and not necessarily lexical, for the presence of the floating melody in (84a). Steep *TR*s in (84b) are ambiguous in the sense that the distribution of the floating melody is arbitrary. The same must be said about flat *RT*s in (84c). Both steep *TR*s and flat *RT*s could potentially form integral clusters word-finally, but, for lexical reasons, they sometimes do not. In this respect, steep *RT*s in (84d) behave quite differently – the random, lexical distribution of the floating melody is mysteriously blocked here.

The paradox consists in the fact that on the one hand phonotactic principles seem to have nothing to do with the distribution of the floating melody, and hence, vowel – zero alternation. The pairs of forms like *sweter / swetra* 'jumper, nom.sg./ gen.sg.' versus *wiatr / wiatru* 'wind, nom.sg./ gen.sg.' clearly demonstrate that the same melodic string [tr] may or may

105 Recall some of the exceptions, e.g. *Narew* / *Narwi* 'river name, nom.sg. / gen.sg.', *kurew* / *kurwa* 'prostitute, gen.pl. / nom.sg.', or *toreb* / *torba* 'bag, gen.pl. / nom.sg.'.

not be broken up by a vowel due to a lexical distinction – presence vs. absence of a floating melody – rather than due to a phonotactically driven epenthesis or syncope. On the other hand, in steep *RT*s, the melodic shape of such sequences seems to play a crucial role in the distribution of empty nuclei with a floating melody. Thus, we seem to be dealing with a strange and very unclear role of phonotactics in Polish. The striking asymmetry with respect to cluster integrity and vowel – zero alternation between final *TR* and *RT* sequences must be explained somehow. In what follows, a simplified and hypothetical account of the lexical patterns shown in (84) above will be presented.

The distribution of alternating sites in Polish is due to a few factors: historical, lexical and purely phonological. First of all, most of the alternations correspond to the historical distribution of the so called jers, that is, weak vowels originating, among other sources, from the high lax *i* and *u*. The distribution of the high lax vowels was of course lexical and not phonologically conditioned. The subsequent loss of jers gave rise to vowel – zero alternations, but there are also modern cases of alternations in which no historical jer was present. For example, the Common Slavic form *ǫglь* 'coal', which did not contain an etymological jer inside the *gl* sequence, exhibits a vowel – zero alternation in modern Polish: *węgiel / węgla*, 'coal, nom.sg. / gen.sg.'. The explanation is simple. When the final jer was lost, that is, it became a final empty nucleus, that nucleus could no longer license the preceding *TR* cluster. Epenthesis repaired the situation. Thus, the alternation in *węgiel / węgla* has a phonological source, which could, to some extent be compared to the situation in (84a).

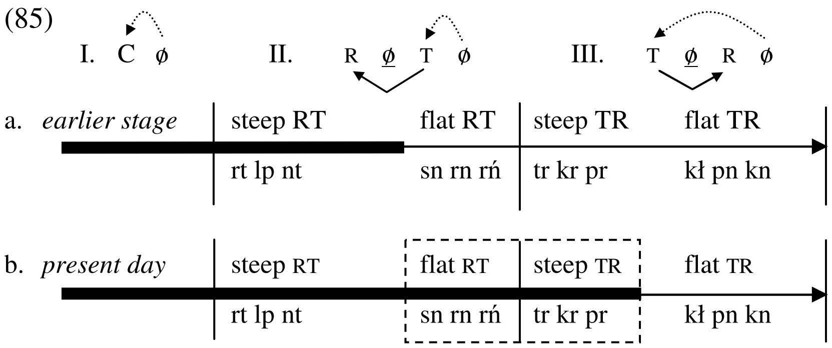
The question is what would happen if the jer was lost between consonants that could, and therefore had to contract a governing relation? For CSL the answer is simple. Such nuclei became locked inside governing relations and do not participate in vowel – zero alternations. In such context, we should not find, what we now call a floating vocalic melody. These forms cannot be ambiguous as none of them was allowed to remain bogus. This is clearly the case with steep *RT*s (84d).

The most interesting are the ambiguous sequences, that is, steep *TR*s and flat *RT*s (84b-c). The question is why they ended up using both possibilities, i.e. vowel – zero alternation and cluster integrity. This question can be answered if we assume that at some point in the history of Polish, the final empty nucleus, could license much less than today. In other words, we are dealing with a historical strengthening of the licensing power of word-final empty nuclei.

The thermometer-like scale in (85a) shows how much formal complexity could be licensed by final empty nuclei after the loss of final jers, and what types of sequences had to exhibit vowel – zero alternations.[106] At that stage, the licensing strength of final empty nuclei reached level II, that is *RT* clusters, but only the good *RT*s, with steep sonority / complexity profiles, could remain integral. On the other hand, flat *RT*s, that is, bad coda-onset contacts, and any *TR* sequences, which belong to level III, could not be licensed as clusters and had to exhibit vowel – zero alternations. Since there was no ambiguity as to the presence of the vowel – zero alternation in these sequences, the alternation sites did not have to be marked with the presence of a floating melody.[107]

The scale in (85b) illustrates the licensing strength of the final empty nucleus in modern Polish, which now not only covers the flat *RT*s, but also the steep *TR*s of the next level of syllabic complexity.

(85)



In present day Polish, no ambiguity is found in flat *TR*s (84a) and steep *RT*s (84d). In the former group, this is due to the fact that phonology still does not allow for rightward government between objects of flat sonority differential (flat *TR*s). Steep *RT*s, on the other hand, continue the old phonological regularity that such clusters contracted leftward governing relation and did not exhibit regular vowel – zero alternation.

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[106] Chapter 3 offers a more detailed discussion of the syllable related phenomena in the history of Slavic, including a reverse phenomenon, i.e. weakening of the licensing potential of nuclei.

[107] Modern Bulgarian seems to behave in the same way, in that it has vowel – zero alternations that do not involve floating melodies, thus allowing for interonset relations which depend only on the presence of a licenser (see chapter 3).

The representational ambiguity in modern Polish occurs exactly in the types of sequences which are boxed in (85b). These sequences used to alternate, but now they may form governing relations (84b-c). Note that flat *RT*s and steep *TR*s constitute a theoretical continuum in CSL in terms of ease of licensing. Flat *RT*s are more difficult than steep *RT*s, and steep *TR*s are more difficult than flat *RT*s, but easier than flat *TR*s. This continuum becomes real only if we assume the formal complexity scale of CSL (*C–RT–TR*), interacting with licensing strength of nuclei, and if we allow words to end in an empty nucleus, which is a general feature of GP. What makes CSL with its CV assumption more coherent than standard GP is the status of empty nuclei, which are not interonset government blockers if they do not contain a floating melody. In standard GP, the function of empty nuclei as government blockers was inconsistent.

Given the strengthening of the licensing potential of final empty nuclei, one may expect a number of ways in which the formal structure of words in Polish could have developed. Firstly, one might expect that the shift in the licensing properties of the empty nuclei should have led to a shift in the phonotactic patterns to the effect that now there should be no vowel – zero alternations in flat *RT*s and steep *TR*s. In other words, the alternating forms could have been reanalysed as non-alternating, because the phonology allowed for it.

If reanalysis were a phonological process, and not a lexical one, which is merely conditioned by phonology, this course of action would have be certain. It may be the case that some of the forms were indeed reanalysed. However, one must realize that the alternations in these contexts were a regular feature of the lexicon and the new phonological regularity did not go hand in hand with the lexical regularity. Thus, one could also expect a different course of action. When empty nuclei began to license more structure they encroached on the existing alternating forms. Instead of redefining the sequences as integral clusters, Polish petrified most of the alternating forms – a case of lexical conservatism – and marked them lexically as alternating by means of the floating melody. Recall that a floating melody prevents interonset government as it disrupts onset-to-onset visibility. Thus, the melodic patterns of consonant sequences belonging to the boxed area in (85b), correspond to the group of forms where ambiguities, doublets, and non-standard forms occur in modern Polish, and for a good reason.

The paradoxes at the right edge of words in Polish are only apparent, and are due to a mixture factors such as regular phonology, lexical marking, and historical shift in the licensing strength of final empty nuclei. The gap in the form of the absence of vowel – zero alternations in steep *RT*s is not entirely arbitrary if we assume this historical perspective where regular phonology at some stage in the history of the language is petrified in the lexicon when the phonology itself develops out of the pattern. Thus, in modern Polish, phonology does not govern the distribution of the alternating vowels in the lexicon but it is still responsible for the interpretation of these objects.

A word of comment is also in order concerning the status of exceptions such as *torba / toreb* 'bag, nom.sg. /gen.pl.', or *laska / lasek* 'stick, nom.sg. /gen.pl.'. Since the distribution of floating melodies is for the most part the domain of the lexicon in Polish, such exceptions, cannot and need not be totally excluded. They are simply marked by the presence of a floating melody, which can only be done on the basis of direct phonological evidence, that is, vowel – zero alternation.

In this section, an attempt was made to demonstrate that Polish may be analysed as a language exhibiting an overall CV pattern. The reasons given in favour of this proposal were based on language economy, system consistency, as well as on the major patterns of phonological organization in Polish. First, it was shown that there is no functional distinction between the structure of a branching onset and that of a rightward interonset relation. While there is independent motivation for the latter in Polish phonology, the former has been always assumed out of habit. Then the CV pattern was extended to *RT* clusters, that is, coda-onset contacts. In effect, what was at stake was the structure of branching rhymes, as traditionally, a coda is part of a branching rhyme. We conclude that neither branching onsets nor branching rhymes need to be postulated in Polish as separate structures from interonset relations with rightward and leftward directionality. This means that branching onsets and branching rhymes do not exist.

The fact that all governing relations in Polish are interonset relations, that is, taking place across an empty nucleus, does not influence the model of CSL in any substantial way. The system needs to be only slightly redefined.

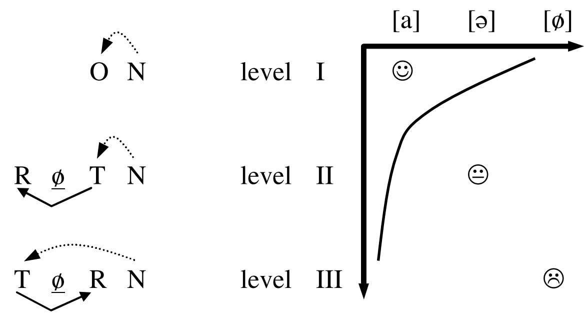
7. CSL – summary and conclusions

This chapter attempted to integrate the findings concerning substantive complexity into a higher level of phonological organization, in which segments composed of elements are grouped syntagmatically into prosodic patterns.

First, some basic concepts of syllabification were introduced, in which three aspects seem to be important: a) the supremacy of nuclei, b) the precedence of onsets, and c) the principles of phonotactics. In standard Government Phonology the first two aspects follow directly from the presence of the licensing relation between onsets and their nuclei. Phonotactic patterns, on the other hand, stem from governing relations contracted between consonants, where the governors are complex in terms of their elemental makeup, while the governees are simplex. Substantive complexity is thus incorporated directly into the workings of phonological systems and, as was also demonstrated in the previous chapter, may successfully replace the extraneous and often arbitrary scales of sonority or strength.

At the formal / syllabic level of phonological representation CSL replaces the standard Government Phonology parameters on branching constituents with two non-rerankable scales. The first one is the scale of formal complexity (I–II–III), which is defined by the presence and type of government between two consonants. This scale is responsible for the implicational relationship between simplex onsets (*CV*) on the one hand, and *RT* and *TR* clusters on the other, where *RT*s are formally less marked than *TR*s. The markedness is derived from the type of licensing that is required. Direct government licensing in *RT*s is 'easier' than the indirect government licensing, which takes place in *TR*s. The second scale is the scale of licenser types (a–ə–ø). It expresses the fact that there is an implicational relationship between different types of nuclei with respect to the amount of formal structure that they may license. The scheme in (86) repeats the 'syllabic space' that is defined by the interaction of the two scales, and points to the relative markedness of particular configurations.

(86)



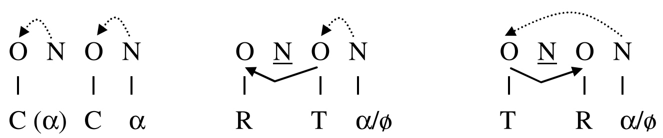
The syllabic space illustrated above is the central point of CSL. The application of the complexity scale model to various phenomena in different languages points to the supreme role of nuclei as licensers in phonology. The entire syllable typology, including markedness tendencies and the definition of individual systems, boils down to the licensing properties of nuclei. The strength of nuclei is an abstract property, and can be unambiguously read-off from the surface structures that they license.

It has been shown that the licensing properties of nuclei are manipulated in register switches in Dutch (4.1) and Malayalam (Mohanan 1986, Cyran 2001), as well as in dialectal variation in French (5.7). Thirdly, the properties may change over time, thus allowing us to capture historical shifts in syllable structure (85). This possibility throws new light on the shape of the right edge of the word in Polish, and more generally, on the history of Slavic, as will be shown in chapter 3.

The empty nucleus word-finally allows for a systematic incorporation of the right edge of the word into syllable typology. It turns out that the right edge of words differs little in structural terms from the word-internal context. Another prediction that follows from the employment of the empty nucleus as a licenser is that its distribution should not be limited to word-final context. CSL abandons the standard GP idea that empty nuclei must be licensed to remain empty. Instead, it is proposed that there are two conditions controlling the distribution of empty nuclei: a) their ability to license the preceding onset, and b) their inability to occur in the sequence (*ø–ø). Thus, in the analysis of Polish complex clusters the emphasis was shifted from the licensing of empty positions to the licensing of onset configurations, where word-internal empty nuclei were shown to be as much a part of the game in Polish as they are in word-final position. The exclusion of the standard GP mechanisms licensing of empty positions automatically eliminated the conflicts between them (5.7).

Another crucial aspect of CSL is the CV assumption. Phonological representation is a consecution of onset-nucleus pairs. This means that all governing relations between consonants are in fact interonset relations, and that all surface consonant clusters are phonologically separated by an empty nucleus. Clusters which involve government are true clusters. This concerns the *RT*s and *TR*s in (86). On the other hand, surface clusters which do not involve interonset government are called false. The distinction is repeated below for convenience.

(87) a. *false* b. *true RT* c. *true TR*



Both true and false clusters are conditioned. In the case of true clusters, the conditioning concerns the ability to contract government. A slightly revised set of the conditions on government are repeated below.

(88) ***Conditions on government***

a. *melodic complexity profiles* (in which the governor, symbolized as (*T*), is melodically more complex than the governee (*R*).

b. *adjacency* (the two consonants must not be separated by any melody, linked or floating).

c. *licensing* (governing relations, just as simplex segments, require licensing from the nucleus following such a segment or relation).

If any of the conditions in (88) is not fulfilled, government, and thereby a true cluster, is impossible. For example, an insufficient melodic complexity profile between two adjacent consonants (88a) may lead to a variety of outcomes, such as epenthesis, or cluster simplification. But the cluster may also remain as false, in which case it is subject to two conditions.

(89) ***Conditions on false clusters***

a. 'ø' is a licenser of the preceding structure

b. 'ø's do not occur in sequences (*ø–ø)

In (87a), the nucleus inside the false cluster is shown to have optional floating melody. It seems that Polish provides evidence for this optionality. The presence of a floating melody blocks interonset relation, but it is also a site of vowel – zero alternations. However, there are false clusters in Polish which do not exhibit vowel – zero alternation, for example, *kto* [kto] < /køto/ 'who'. The intervening empty nucleus need not have a floating melody in such cases. But it must license its onset.

The table below gathers the universal characteristics of different types of nuclei with respect to government blocking, licensing properties and distribution.

(90)

type	***properties***
N | α	- blocks interonset government - full licenser - distribution lexical / arbitrary and free
N α	- blocks interonset government (may not be locked by IO) - may be a licenser; licensing properites the same as for empty nucleus if melody unassociated; licensing properites the same as for full vowel if melody linked - distribution lexical / partly arbitrary, and conditioned (it must be a licenser, and it must not be followed by another empty nucleus (89b), or else the melody is linked)
N	- does not block interonset government (may be locked by IO) - may be a licenser - distribution / lexical / partly arbitrary / partly predicable, and conditioned (it must be a licenser, and it must not be followed by another empty nucleus)

It is clear that the floating vowel shares some properties with full vowels, while others with empty nuclei.

Finally, one might also consider the potential role of this model in language acquisition. The model is not only learnable, in that the acquisition of syllable structure consists in extending the two vectors away from the basic CV shape, thus increasing the 'syllabic space', but it also addresses two very important aspects. Firstly, phonological structure is induced on the basis of positive input, that is, each input tells the child what is possible, rather than what is not. And secondly, a minimal amount of input allows the child to induce the presence of other less complex structures. To exemplify the last two points let us assume for the sake of the argument that the child is genetically equipped with the model illustrated in (86). Generally, what the learner knows are two scales of implicational relationship. One of them relates to the formal complexities ($\mathrm{I} \subset \mathrm{II} \subset \mathrm{III}$), and says that *TR* clusters imply the presence of the less complex *RT* clusters, and that both clusters imply the presence of simplex onsets. The other scale relates to the licensers (a ⊂ ə ⊂ ∅), and says that if a structure is licensed by an empty nucleus it may also be licensed by schwa and a full vowel. In Polish there are no schwas. However, let us consider how much about the syllable structure of its language a child may induce on the basis of the single input *wiatr* [v´atr] 'wind', which has a word-final *TR* cluster, that is, it represents level III of syllabic complexity, licensed by the weakest licenser.

(91) **input**: [v´atr] *wiatr* 'wind'

level	*effects of induction*				
III	…TRa	because	TRø	⊃	TRa
II	…RTø	— // —	TRø	⊃	RTø
II	…RTa	— // —	RTø	⊃	RTa
I	…Cø	— // —	RTø	⊃	Cø
I	…Ca	— // —	Cø	⊃	Ca

In phonetic terms the induced structures form a vast set of structural configurations which are expected to be grammatical, for example, […tra, …rt, …rta, …t, …r, …ta, …ra]. Note that if the input word was *czart* [t͡ʃart] 'devil', the child would be able to induce only the less complex structures and would not discover final *TR*s by any implication. It is also interesting that each single input strengthens the least marked structures, that is CV. Thus, the gradation of the formal complexity corresponds also to the relative entrenchment of particular structures in a given system. To conclude, the required amount of input for a learner of a complicated syllabic system like Polish is really small, which agrees with general intuitions concerning viable models of language acquisition. Each positive input allows the child to create a vast number of potentially grammatical structures. In this sense, the model of Complexity Scales and Licensing seems to be superior to approaches in which grammar acquisition consists in ranking constraints on what is impossible rather than what is possible. Such models require much more input (e.g. Boersma and Hayes 2001, Tesar and Smolensky 1998). Of course there remains the question as to how the model of complexity scale itself is learned, an issue which we will leave for further research.