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Eugeniusz Cyran

COMPLEXITY SCALES AND LICENSING IN PHONOLOGY

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Preface

This book is an attempt to demonstrate that the basic principles of phonological organisation boil down to the interaction between the strength of nuclei as licensers of phonological structure and various non-rerankable scales of complexity occurring at different levels of phonological representation. The licensing relation between nuclei and the preceding onsets on the one hand, and governing relations between consonants, which are to a great extent determined by their internal melodic structure, allow us to view the phonological representation as a self-organizing system.

As a starting point of our discussion, we take the theory of Principles and Parameters in phonology, also referred to as (standard) Government Phonology (Charette 1991, Harris 1990, 1994, 1997, Kaye 1990, 1995, Kaye, Lowenstamm and Vergnaud 1985, 1990). The central underlying principle of the self-organization in phonology due to the interaction between complexity scales and licensing strength leads to a number of dramatic modifications of the standard model. Firstly, a lot of most cherished principles and parameters are eliminated or redefined as part of non-rerankable scales. Secondly, a change of philosophy is proposed concerning the employment of empty nuclei in representation: from striving to develop mechanisms of their licensing – muting mechanisms which allow empty nuclei to remain silent – to determining their own licensing properties. Their formal function is viewed as generally the same as that of other nuclei, while their special status stems from the fact that they are substantively empty. And thirdly, the phonological representation is viewed as a consecution of CVs (Lowenstamm 1996, Polgárdi 1998, Rowicka 1999, Scheer 2004), which is not just an assumption. Some arguments for the CVCV structure are also adduced.

Complexity itself is not a new concept in Government Phonology, but it has mostly been discussed in the context of the melodic make-up of segments (Harris 1990, 1994). In Chapter 1, various melodic complexity effects are discussed in Irish, Polish and Welsh. It is shown that such aspects of segmental phonology as sonority effects, relative markedness, segmental inventories and their susceptibility to phonological processes, as well as the interaction between consonants in syllabification may to a great extent be derived from the substantive complexity of segments defined as the number of elements they contain. Additionally, an extension to the Element Theory is proposed in the form of parameterizing the occurrence of some elements. Chapter 2 deals with formally defined complexity – at the syllabic level – and its interaction with the melodic level. The proposal transforms the original idea of Government Licensing (Charette 1990, 1992) into a non-rerankable scale of progressively more complex structures which demand progressively stronger licensers. The resulting model may account for both fairly basic and also quite complex issues connected with syllabification and word structure, such as phonotactics and clustering, syllabically driven phonological processes, syllable typology, markedness, and acquisition. This chapter contains a new analysis of Polish initial consonant clusters. Chapter 3, considers issues connected with phonologically conditioned aspects of word structure. Its first part deals with the interaction between foot structure and syllabic organisation in the context of the historical development in Slavic languages called liquid metathesis. It is shown that the model is fully compatible with the predictions made by the Licensing Inheritance theory (Harris 1997). The interaction between licensing and complexity may now be treated as an organising agent present at all levels of phonological representation which enables us to reinterpret the familiar notion of structural analogy found in Dependency Phonology (e.g. Anderson and Ewen 1987). Finally, the problem of word edges is returned to with a view to demonstrating that the new model predicts such anomalies of word structure as complex clusters at word edges in Polish, or Super Heavy Rhymes in English and Dutch. This allows us to adopt a different view on extra-syllabicity, that is, one in which such notions need no longer be necessary.

I wish to express my gratitude to the following friends and colleagues for their generous assistance and comments at various stages of writing the book. First and foremost, many thanks are due to Edmund Gussmann, who taught me phonology, and whose constant support and interest in my work greatly contributed to the feeling that my efforts may be worth pursuing. His numerous comments on the earlier version of this book were more than helpful. They also saved me form a number of blunders. Of course, I take full responsibility for the remaining ones. I did not take all of Ed's criticisms in to account, but I know I will be forgiven, as always. I am also extremely grateful to Jonathan Kaye and Tobias Scheer who were always more than willing to discuss my proposals and phonology in general, and who have greatly influenced my thinking. Thanks are also due to the friendly, vibrant, and ever-growing group of people working within the broadly understood model of Government Phonology. They provided a lot of inspiration for my research. In particular, I would like to thank Monik Charette, John

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Last but not least, I would like to thank Marta Cyran for her patience and support. This book is dedicated to her.

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Chapter 1
Substantive complexity

1. Introduction

The aim of this chapter is to demonstrate that one of the crucial organizing properties of phonological representation at the melodic level is subsegmental complexity, which is of a scalar character. *Substantive complexity*, as we will call it, will be shown to play a pivotal role in phonological systems, contributing to the understanding of certain static aspects of these systems, for example, segmental inventories, phonotactics, typology, markedness effects etc., as well as a number of dynamic characteristics such as phonological processing, in both its synchronic and historical dimension.

The chapter is organized in the following way. First, in section 2, the Element Theory is introduced and illustrated by focusing on both simple and more complex aspects of sub-segmental representation, and by showing that complexity may successfully replace such concepts as *sonority*, and *strength* in all the areas of phonological theory where they were used to account for phonological systems, including the syllabification of consonants (section 3). Then, in section 4, we look more deeply at the system of modern Irish with a view to illustrating how the model can be practically applied to a range of phenomena within one phonological system. First, we deal with vowel quality alternations and show the advantages of a privative model employing elements over an equipollent feature system in capturing the existing alternations, as well as capturing the peculiar pattern whereby the relative regularity of the phenomenon is strictly dependent on the height distinctions of the target vowels. The second aspect of the phonological system of Irish which is dealt with concerns the role of substantive complexity in determining grammatical coda-onset contacts. Here, a modification of the model will be proposed, which consists in allowing the utilization of a particular melodic prime to be subject to parameterization. This move will be shown to facilitate a better understanding of Irish phonotactics and to have additional, far-reaching consequences for the types of segments that this phonological system may theoretically employ. Some systemic distinctions leading to typological variation between consonantal systems will be proposed, of which the distinction involving internal complexity seems to be the most important. Finally, we focus our discussion on the phenomenon of initial consonant mutations in Welsh – another Celtic language – with a view to showing how this seemingly complex phenomenon can receive a fairly simple analysis within the Element Theory.

2. The Element Theory in Government Phonology

The smallest units of phonological representation in Government Phonology are called elements.[1] The term has been chosen not only to oppose this construct to the traditional features, but also to convey the similarity of their behaviour to physical elements, in that they can occur in isolation – simplex structures, or in compounds – complex structures. In a nutshell, the elements can be characterized as privative, cognitive units which enjoy a stand-alone phonetic interpretability. Privativeness, as opposed to equipollence, means that each relevant property of melodic representation is defined by the physical presence of a given prime, and phonological processes may refer only to actively present elements, rather than to their absence, or to a negative value for them. The term 'cognitive unit' is used to convey the fact that elements which encode lexical contrasts are neither articulatory nor auditory in nature.[2]

> ...continuing the essentially Jakobsonian line of thinking, we consider their phonetic implementation as involving in the first instance a mapping onto sound patterns in the acoustic signal. Viewed in these terms, articulation and perception are parasitic on this mapping relation. That is, elements are internally represented templates by reference to which listeners decode auditory input and speakers orchestrate and monitor their articulations.
>
> Harris and Lindsey (1995: 50)

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[1] This section draws heavily on Harris (1990, 1996) and Harris and Lindsey (1993, 1995). Early GP proposals on elements also include Kaye (1989), Kaye, Lowenstamm and Vergnaud (1985, 1990), Rennison (1987, 1990). Other contributions are Backley (1993, 1995), Backley and Takahashi (1998), Brockhaus (1995), Charette and Göksel (1996, 1998), Cobb (1993, 1997), Cyran (1996b, 1997), Denwood (1993), Harris (1997), Jensen (1994), Kaye (2001), Nasukawa (1998, 2005), Ploch (1999), Pöchtrager (2006), Ritter (1997), Rennison (1998), Rennison and Neubarth (2003), Scheer (1996, 2004), Szigetvári (1994).

[2] See, for example, Coleman (1998) for a review of various arguments concerning the nature of linguistic primes, in which he arrives at similar conclusions.

As far as autonomous interpretability is concerned, it is assumed that each element that is linked to a skeletal position can be directly realized as a speech sound, either alone, or in combination with other elements. The phonological representations remain privative and redundancy-free throughout the derivation. There is no place for any default fill-in procedures. For example, sonorants are non-specified for voice lexically, and they remain so at every stage of the derivation.[3] Thus, there is no need for a level of systematic phonetic representation (Harris and Lindsey 1993, 1995: 46).

The details of the Element Theory will transpire as we proceed. It will also become obvious that some assumptions which are fit for an introduction to the Element Theory must be verified and confronted with particular phonological systems. Let us first look at an exhaustive list of what we assume to be a standard set of elements in GP. The following table defines the elements in terms of their acoustic patterns and the necessary articulatory execution required in their production (adapted from Harris 1996: 314).

(1)

	Acoustic pattern	***Articulatory execution***
A	*Mass*: central spectral energy mass (convergence of F1 and F2)	Maximal expansion of oral tube; maximal constriction of pharyngeal tube
I	*Dip*: low F1 coupled with high spectral peak (convergence of F2 and F3)	Maximal constriction of oral tube; maximal expansion of pharyngeal tube
U	*Rump*: low spectral peak (convergence of F1 and F2)	Trade-off between expansion of oral and pharyngeal tubes
ʔ	*Edge*: abrupt and sustained drop in overall amplitude	Occlusion in oral cavity
h	*Noise*: aperiodic energy	Narrowed stricture producing turbulent airflow
N	*Nasal*: low frequency of first resonance	Lowered velum; air flow through the nasal passage
H	*High tone*: raised pitch on vowels; VOT lag (aspiration) in obstruents	Stiff vocal cords
L	*Low tone*: lowered pitch on vowels; VOT lead (full voicing) in obstruents	Slack vocal cords

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[3] The modal voicing of sonorants in the Element Theory may be said to follow from the fact that they are typically represented by the same primes as vowels, that is, resonance elements, to be introduced below. Most sonorants exhibit spectral patterns similar to vowels.

Before we continue the discussion, it must be emphasized that the rough universal cues inherent in the elements listed above become fully meaningful only when they are viewed as part of a particular sound system. As we will see presently, it may be the case that a given phonological representation will not correspond to identical phonetic interpretations across languages. Here we differ markedly from Kaye, Lowenstamm and Vergnaud (1990: 194) who assume that "the same physical object will receive uniform interpretation across phonological systems". Since they made their proposal it has been found that the same representation will not always yield identical phonetic effects or vice versa. That is, identical phonetic objects may have disparate phonological representations across systems.

2.1. Representing vowels

The first three elements (A), (I), and (U) in (1) define vocalic expressions and place of articulation in consonants. The discussion of vowel systems within the Element Theory will serve the purpose of a rather sketchy illustration of some of the points made above. However, in general, more emphasis will be placed on consonantal systems in this work.[4]

A basic three-vowel system, for example [a,i,u], reflects simplex representations involving only one element in each case (2a). These are the least marked vowels which utilize the phonetic vowel space most efficiently. We may define this space either in terms of articulation, using familiar properties like HIGH, LOW, BACK, FRONT, or in terms of acoustic dimensions.[5] At any rate, the simplex character of the three corner vowels reflects their universally unmarked status (Crothers 1978, Maddieson 1984). The schwa vowel represents the neutral state of articulators and, typically, evenly spaced-out formants. In Government Phonology this vowel may be viewed as a realization of a neutral element or nothing, a point which will be returned to when we discuss headedness.

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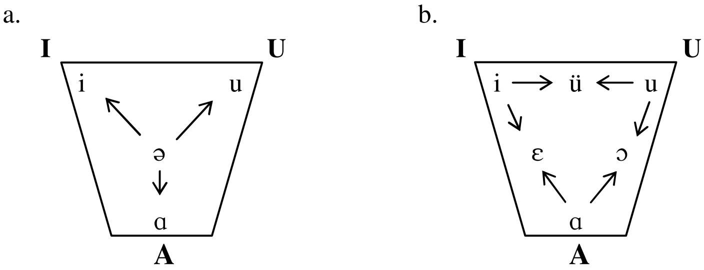
[4] For more extensive studies of how resonance elements function in phonological systems the reader is referred to Backley and Takahashi (1998), Bloch-Rozmej (1998), Charette and Göksel (1998), Cobb (1997), Cyran (1997), Polgárdi (1998), Rennison (1998), Scheer (1996).

[5] See, for example, Ladefoged (2001: 39ff) for a discussion of how, with a certain amount of theoretical gymnastics, the same phonetic space can be defined in terms of F1 and F2 values.

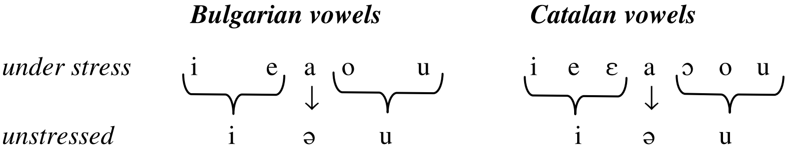
(2)



Other vowels are combinations of the elements (I), (A), (U), for example, (A-I) = [ɛ], (A-U) = [ɔ], (I-U) = [ü] (2b). It follows from the illustrations in (2) that the more complex and marked vowel systems have more complex representations in terms of combinations of elements. Thus, the relation between markedness and representational complexity is inherent to the model.

The relative markedness of mid vowels is reflected in the fact that they are the first vowels to be eliminated in prosodically weak positions. Let us look at some typically quoted instances of vowel reduction in unstressed positions (Harris and Lindsey 1995).

(3)



Note that in both languages the surviving melodies in unstressed positions are simplex. We do not wish to make any particular claims concerning the representation of schwa vowels in the two systems, that is, whether they still contain the element (A). However, one thing is clear, compound structures cannot be maintained in prosodically weak positions in some languages.

We must note two immediate advantages of the Element Theory in the description of vowel reduction. Firstly, the relative markedness is directly read-off from the representations rather than extrinsically encoded on the basis of observation. Here, mid vowels are marked because they are complex objects. Secondly, there is a direct and logical connection between vowel reduction and the context where it occurs. Prosodically weak positions simply eschew complex vocalic structures, therefore, the latter must be reduced in complexity.

So far, we have seen how to represent vowel systems possessing between three and six objects, and the obvious question is what happens in systems with more than six vowels, or in those in which there are two types of mid front and mid back vowels as shown in Catalan in (3). At this point, one more aspect of representations in the Element Theory must be introduced. This additional mechanism is called *headedness*.

When two elements combine to form a compound, for example, (A-I), it is assumed that the elements may enter into an asymmetrical relation in which one of the elements may dominate the other, thus yielding a different object than if the situation was reversed.[6] Roughly speaking, a compound structure (A-I) which is I-headed, that is (A.$\underline{\text{I}}$), may correspond to phonetic [e], while ($\underline{\text{A}}$.I) should give [æ]. In other words, due to the reversed head-operator relations, we are dealing with an essentially high front vowel which is lowered, and an essentially low vowel which is fronted and raised, respectively.[7]

The use of headedness has been extended to two other situations. One of them concerns simplex structures. Here we find two different representations, that is, a simplex structure which is headed, and a headless one. Thus, the contrast between a lax [ɪ] and a tense [i] may be expressed by referring to a headless (I._) vs. headed ($\underline{\text{I}}$), respectively. Similarly, a compound as a whole may also be headless, for example, (A.I._). This structure may correspond to the open front mid vowel [ɛ].

Thus, the introduction of headedness is meant to account, among other things, for tense/lax contrasts, introducing greater generative potential into the simple theoretical system which uses only three basic categories. Note that now we are able to define much richer systems, including such contrasts as the one between [e] and [ɛ], which we saw earlier in the system of Catalan. In fact, the introduction of headedness allows the model to define at most twenty independent vocalic objects, and attempts have been made to propose mechanisms or parameters which would restrict the generative power of the Element Theory with respect to individual systems (e.g. Charette and Göksel 1998, Backley 1995, 1998, Cobb 1993, 1997, Kaye 2001).[8]

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[6] This idea is familiar from such models as Dependency Phonology (e.g. Anderson and Ewen 1987). Headedness will be represented by underlining the relevant element.

[7] Throughout this work the elements will be used in parentheses and underlined when headed, unless headedness is irrelevant for the discussion. Compounds in which head specifications are deliberately omitted will be represented as e.g. (A-I).

[8] One must add that apart from the three resonance elements, (L), (H), and (N) may also be used in vowels. They represent tonal patterns – low and high pitch – and nasalization respectively.

As for schwa vowels, there are various options to consider. It is not impossible that some schwas do have an active resonance element in operator position, for example, (A._), (U._), (I._). In other words, the nuclei still contain elements, though they are headless. This would account for the various qualities of schwa vowels, not only across languages but also within one system, for example, English. Within the Element Theory, it has also been proposed that there is an additional, neutral element (@) which is present in all representations but only shows up, as it were, if the full-blooded elements are absent (Harris and Lindsey 1995). Other proposals boil down to the assumption that schwa may have no representation in terms of elements, that is, phonologically speaking it is a phonetically interpreted nuclear position which has no melodic content. Under this proposal, the difference between schwa and an empty nucleus proper lies only in the fact that the former is interpreted phonetically and the latter remains silent.[9] Let us see how these options may be applied to the well-known phenomenon of the rise and fall of jers in Slavic.

(4)

$$\begin{tikzcd}
\text{[u]} > \text{[ъ]} \arrow[dr] & \\
 & \text{[ø]} \\
\text{[i]} > \text{[ь]} \arrow[ur] &
\end{tikzcd}$$

Generally speaking the short high back and front vowels [u] and [i] were weakened to the so called jers [ъ] and [ь], which were later lost in particular positions.[10] Given the current assumptions of Element Theory, we may provide three descriptions of the events depending on our view on the structure of schwa and the status of the neutral element.

(5)

	[u/i]		**[ъ/ь]**		**[ø]**
a.	(U/I)	>	(@)	>	(_)
b.	($\underline{\text{U}}$/$\underline{\text{I}}$)	>	(U/I._)	>	(_)
c.	(U/I)	>	(_)	>	(_)

---

[9] More on empty nuclei can be found in the following chapters.

[10] The development of jers will be discussed at length in chapter 3.

All three options agree in their interpretation of the last stage in which there is no melody left in the nucleus. In (5a), the rise of jers is accompanied by the complete loss of the melodies (U) and (I). What remains in the representation is the neutral element. This analysis assumes that the opposition between back and front jers has been shifted onto the preceding consonant, in that now front jers occur after palatalized consonants, while back jers follow non-palatalized consonants. The interpretation in (5b) assumes that the jers are schwa-like but they still contain the resonance elements as operators, and only when these elements are lost is a phonetic zero possible. Under this view, only after the loss of jers should palatalization be represented on consonants. The last view, represented in (5c), is similar to (5a) in assuming that jers have no active resonance elements and that the opposition between palatalized and velarized or neutral should be represented on consonants. However, it assumes that schwas and schwa-like vowels may be representationally identical to empty nuclei. The difference lies in the context-based interpretation of such constructs.

In this work, we will follow the assumption that there is no such thing as a neutral element, which narrows down the options in (5) to two. However, the problem of the phonological structure of schwa, or of the jers, cannot be dismissed with one sweeping statement. More detailed discussion of these objects will be provided in the relevant contexts in the following chapters. An example of an element-based analysis of a vocalic system will be provided in section 3.1. Let us now turn to the representation of consonants in the Element Theory.

2.2. Representing consonants

In the previous section we saw how vowels are represented in the Element Theory and how a phonological representation may be affected in phonological processing. Vowel reduction, for example, is a phenomenon in which the internal structure of a vowel is decomplexified by means of deducing primes, e.g. (A-I) > (I), or reducing their status from head to operator, e.g. ($\underline{\text{A}}$) > (A._). Both cases are instances of weakening and their direct contextual connection with weak prosodic positions is a welcome effect. Besides *decomposition*, the Element Theory also predicts *composition* as another possible type of phonological event. This process involves element addition, as in vowel harmony or the strengthening of consonants. In both instances a condition must be satisfied whereby the added element is locally present.[11] Let us now look in more detail at the representation of consonants in the Element Theory.

2.2.1. Place

The resonance elements discussed above define primary and secondary places of articulation in consonants.[12]

(6) (I) = *palatal*, e.g. [j, ç, c]
palatalized, e.g. [pʲ, kʲ]
(U) = *labial*, e.g. [p, b, v, f, w]
labialized, e.g. [kʷ, gʷ]
(A) = *coronal*, e.g. [r, t, s]
retracted (uvular, pharyngeal), e.g. [ʀ, q, ɢ, ʕ]
(_) = *velar*, e.g. [k, g, x]
velarized, e.g. dark [ɫ] in English

The categories given in (6) must be taken as rough indications rather than exact representations. It will transpire presently that the best way to talk about the Element Theory is within the context of a particular system. The parsimony of the model must be striking for anyone familiar with the IPA chart. However, it is also true that no language uses all the place, or indeed manner distinctions found in the world's languages. Thus, it must be borne

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[11] This is probably too general a statement. Some historical processes of consonant strengthening, for example, [w] > [v] in the history of Slavic languages, require a more complicated, and less idealized analysis (Cyran and Nilsson 1998). In a nutshell, since the weakening processes involve either element deduction or demotion, it is logical that strengthening may involve element addition or promotion to headed status. Cyran and Nilsson claim that in Slavic strengthening in which there is no source for the added elements, two stages are necessary: first element promotion, e.g. (U)>($\underline{U}$), yielding [w~v] alternations, and then phonological reanalysis of ($\underline{U}$) as (U,h,L), yielding systems with [v~f] alternations. Mixtures of the two systems are also possible, e.g. in Slovak (Rubach 1993: 244).

[12] There is no agreement as to the use of resonance elements in defining place of articulation. For example, the old dilemma whether coronal or velar consonants should be unmarked for place remains unsolved. See e.g. Backley (1993) and Scheer (1996, 2004). In this work, we assume that velarity has no place element, while coronality is represented by the element (A), or its combination with (I), that is (A-I), as will soon become apparent.

in mind that the actual representations of consonants in a given system must follow an in-depth analysis and should not be assumed a priori.

Before we consider the manner and source elements, let us briefly look at an illustration of how primary and secondary articulations as defined by resonance elements may interact in the description of certain historical shifts in consonantal place of articulation.

In Celtic languages there was regular labialization of Indo-European $*g^w$ to [b] as in, for example, IE *$*g^w$ou-*, 'cow, ox' > Old Irish *bó*, Welsh *bu*, or IE *$*g^w$enā*, 'woman' > Old Irish *ben*, Welsh *benyw*. A similar phenomenon affected the proto-Celtic voiceless labialized velar $*k^w$, but only in the Brittonic subgroup, thus leading to the linguistic division into the so called P– and Q–Celtic groups.[13]

(7)			***$*k^w$etu̯ores***	***$*k^w$eis***	***$*mak^wk^w$o-***
	↗ *p*	(Brittonic)	***p**edwar*	***p**wy*	*ma**b***
$*k^w$					
	↘ *k*	(Goidelic)	***c**ethar*	***c**ía*	*ma**cc***
			'four'	'who'	'son'

Given that the representation of velars has no active element, the secondary labialization is best represented as the presence of the (U) element in operator position. The shift from [g^w] to [b] in Celtic in general, or [k^w] to [p/b] in Brittonic, is thus directly captured as a switch in the status of the resonance element from operator to head.[14] For the moment we ignore the other elements making up the velar plosive and concentrate on place only.

(8)	***velar***		***labialized velar***		***labial***
	[g]	vs.	[g^w]	vs.	[b]
	(_)		(U._)		$(\underline{U})$

The distinction between the three types of segments can be described as a scale of (U) presence. While it is completely absent in plain velars, it affects the labialized consonants as an operator – adds the labial colouring as it were, or, in the case of the labial, it assumes the head position. Thus, one

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[13] This shift also occurred in other IE languages, e.g. Italic (Oscan and Umbrian $*k^w > p$), and to some extent in Greek.

[14] The [p/b] variation in Welsh is due to lenition which is discussed in some detail in section 4 below.

way to distinguish between primary and secondary articulation of consonants is by referring to the status of the resonance element.[15]

A similar description can be offered for parallel shifts in Slavic. This time the property that affects a velar consonant is the element (I), responsible for palatalization. Typically, three different types of velar palatalization are mentioned in the literature on Polish. These are: *surface velar* palatalization in which, the velar plosives [k, g] and the fricative [x] are palatalized to [kʲ, gʲ, xʲ] before front vowels, as in *bok – boki* 'side, nom.sg. /nom.pl.', *noga – nogi* 'leg, nom.sg. /nom.pl.', *historia* 'history'; the so called *1st velar* palatalization (e.g. Gussmann 1978, 1980, Rubach 1981) in which [k, g, x] alternate with palatal [t͡ʃ, ʒ, ʃ], as in *bok – boczek* 'side nom.sg. /dim.', *noga – nóżka* 'leg, nom.sg. /dim.', *ucho – uszko* 'ear, nom.sg. /dim.'; and the *2nd velar* palatalization, occurring in the dative and locative singular and producing alternations between [k, g, x] and [t͡s, d͡z, ʃ] respectively, as in *rzeka – rzece* 'river, nom.sg. /loc.sg.', *noga – nodze* 'leg, nom.sg. /loc.sg.', *mucha – musze* 'fly, nom.sg. /loc.sg.'.[16] Ignoring the 2nd velar palatalization in which the corresponding sounds have very little in common, let us look closer at a possible representational contrasts between ordinary velars, and those affected by surface and 1st velar palatalization respectively. These contrasts may be given a similar interpretation to the one involving the different degrees of labialization of velars in Celtic.

(9)	***velar***	vs.	***palatalized velar***	vs.	***palato-alveolar***
	[k]		[kʲ]		[tʃ]
	(_)		(I._)		(I̲)
	lok 'hair lock'		*loki* 'pl.'		*loczek* 'dim.'
	[lok]		[lokʲi]		[lot͡ʃek]

The plain velar is devoid of any secondary articulation. The palatalized velar – through surface palatalization – contains the element (I) in operator

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[15] Another possibility that may be considered for the purpose of capturing secondary articulation is connected with structural distinctions, for example, the use of contour structures.

[16] See Gussmann (1978) for arguments that the so called 2nd velar palatalization has no synchronic reality as a phonological regularity, and Gussmann (1997b) for saying the same about the 1st velar palatalization.

position. On the other hand the element (I) as the head produces a palato-alveolar consonant which concomitantly undergoes affrication.[17]

Let us now turn to the remaining elements defining other dimensions in the representations of consonants.

2.2.2. Manner

The manner dimension in consonants is defined by five elements of which only two (ʔ, h) can be called truly consonantal, in that they are not used in vowels. This has been one of the reasons why the status of these elements is shaky.[18] As mentioned above, nasality, as well as high and low tones are also used in vowel systems. The latter two will be discussed in more detail in the following sub-section.

(10)

(ʔ) = *occluded*, e.g. [p, t, k]
(h) = *'noisy'*, e.g. [s, ʃ, x]
(N) = *nasal*, e.g. [n, m, ŋ]
(H) = *voiceless aspirated* [p^h, t^h]
(L) = *fully voiced* [b, d, g]

Each of the elements above deserves comment. The occlusion element is assumed to be present in plosives but some researchers also place it in nasal consonants and laterals (Kaye, Lowenstamm and Vergnaud 1985, Harris 1990). The noise element is assumed to be present in all released stops.[19] The status of nasality as an independent prime has been challenged in the work of Nasukawa (1998, 2005) and Ploch (1999). Both researchers attempt to merge nasality with low tone (L) in some way.

Leaving aside the laryngeal elements for the moment, let us observe how some basic consonants may be represented by means of the manner elements

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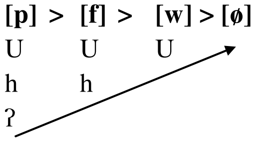
[17] Some phonological reasons for this affrication, couched in terms of the Element Theory, are provided in Cyran (1997: 214), Harris (1990: 270), Rennison (1998).

[18] For discussion related to 'stopness' and 'noise' see e.g. Cyran (1996b), Golston and van der Hulst (2000), Jensen (1994), Pöchtrager (2006), Ritter (1997).

[19] This view is challenged in Cyran (1996b) who proposes that the noise element may in some systems be completely missing even in released stops. We will return to this idea shortly in the discussion of Irish clustering and Welsh consonant mutations.

just mentioned. The representations below only serve the purpose of illustrating how the Element Theory captures such phenomena as lenition.[20]

(11) ***lenition trajectory of the opening type***



Since each element on its own and each possible combination of elements can be independently interpreted in production and perception, each of the stages along the trajectory can be described as the effect of losing one phonological prime, that is, decomposition. Thus there is a logical connection between the fact that lenition is a weakening process and the idea that decomposition leads to progressively less complex structures. Recall that vowel reduction in unstressed position consists in precisely the same procedures though, admittedly, the contexts for consonantal lenition are different from those for vowel reduction. Nevertheless, we can describe both contexts uniformly as prosodically weak (Harris 1997).

It is obvious now that sonority in Element Theory is the inverse of subsegmental complexity.[21] The question is if complexity can successfully replace sonority in all those aspects of phonology where the latter played a central role. For one thing, it seems that the complexity scale captures the lenition trajectory better than sonority. As noted by Harris (1996), if the sonority hierarchy is anything to go by then we should expect nasals to appear along the lenition trajectories of obstruents as they are more sonorous than, say, [p] or [f]. Secondly, it seems that complexity is able to solve two apparent paradoxes connected with the weakening of consonants and vowels. The first one concerns the fact that in terms of sonority the weak-

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[20] This discussion of lenition draws heavily on the work of Harris (1990, 1996, 1997) and Harris and Lindsey (1993, 1995). Note that so far we limit ourselves to a discussion of the effects produced on a given segment, and little reference is made to the link between lenition phenomena and the contexts in which they occur. The typical sites for lenition or neutralization can be roughly defined as the intervocalic and coda positions. The latter context is understood in a dramatically different way in Government Phonology than in other current frameworks (see e.g. Kaye 1990, Harris and Gussmann 1998).

[21] See e.g. Rice (1992) for the reversed relationship between sonority and complexity of structure.

ening of vowels, such as the rise and fall of jers in Slavic discussed above ([u/i] > [ъ/ь] > [ø]), results in less and less sonorous objects, in contradistinction to the weakening of consonants which results in more and more sonorous ones. It is interesting that the sonorization of consonants ends with a stage where the object is the least sonorous one, that is silence ([p] > [f] > [w] > [ø]).[22] In terms of complexity, both phenomena receive a uniform interpretation. Simply, all stages of vowel weakening and consonant lenition are of the same nature: depletion of melodic complexity.

The element-based analysis of lenition also bypasses the pertinent problem of major class feature changes.[23] In this model, what remains as the outcome of any decomposition process is as interpretable as the previous stage, as shown in (11) above.

There are two more points to be made here. Firstly, in the model of representations introduced in this section the range of possible processes that a given segment may undergo is logically limited by its phonological structure. For example, a stop may either lose its release (h), be spirantized by losing (ʔ), debuccalized by losing the resonance element defining place, voiced or devoiced. All these will be exemplified in section 5, when we discuss consonant mutations in Welsh. Secondly, the pre-deletion stages typically involve a simplex segment, for example, [h]=(h), [ʔ]=(ʔ), as well as [w]=[U], [j]=(I), and [ɾ]=(A), while their sonority values differ markedly (Harris 1994: 122). Thus, elemental complexity offers a uniform account of such phenomena in contradistinction to sonority scales.

In general, it appears that complexity can quite successfully replace sonority in lenition. On the other hand, complexity may replace another term used with relation to lenition, and indeed syllabification, namely, *strength*.[24] In Element Theory, the plosive seems to be the most complex and at the same time the strongest consonant. This direct relation between complexity

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[22] I was made aware by Péter Szigetvári (p.c.) that the last point may be erroneous, in that that net result of the last stage in the lenition trajectory is the most sonorous stage, because what is left is the vocalic context flanking the consonantal position. Though essentially true, this point does not diminish the merits of the complexity-based treatment of lenition in any way.

[23] For a critical evaluation of various proposals to deal with this issue see Harris (1990, 1996).

[24] The concept of strength has a long history in phonological theory. It typically refers to inherent properties of segments which determine their behaviour in lenition processes as well as phonotactics (e.g. Sievers 1901, Vennemann 1972, Hooper 1976, Foley 1977, Murray 1988).

and strength follows from the internal representation rather than being assumed in an arbitrary fashion on the basis of observation. In the following sections and chapters it will be shown how strength defined as complexity is exploited in syllabification. In the meantime, let us deal with the last two elements, which define the laryngeal distinctions.

2.2.3. Source

The Element Theory uses only two elements to express all the possible phonation types: (L) which is found in fully voiced obstruents, and (H) which is found in voiceless fortis obstruents.[25] It is assumed that laryngeal specification is typically asymmetrical. For example, in a system like English, which exhibits voiceless aspirated stops as opposed to weakly voiced ones, the opposition is expressed by marking the fortis series with the high tone element (H), while the so called lenis series bears no laryngeal element. In other words, the lenis obstruents are neutral. On the other hand, languages like Polish in which the opposition among the obstruents is that of fully voiced as opposed to voiceless, it is assumed that the voiced series is the marked one and contains the low tone element (L), while the voiceless series is unspecified.[26] It follows then that from the phonological point of view, the same phonological representation of, for example, neutral stops, yields quite different phonetic results in Polish and in English. However, we must remember that the respective interpretations belong to two distinct systems in which the neutral stop is perceived and produced with sufficient phonetic difference from the series to which it is opposed in the system. If the marked series is fully voiced, as in Polish, then the neutral series tends towards the voiceless reflex, and conversely, if the opposite series is voiceless then the neutral series tilts towards the voiced one.[27] A simple acoustic analysis of English and Polish plosives reveals that the

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[25] This description is deliberately simplified. The system of H/L tone elements is also able to express more rare laryngeal articulations, e.g. Sahakyan (2006) demonstrates that it is the ejectives in South-East Armenian and not the aspirated voiceless stops that contain the high tone element.

[26] For a discussion of the relationship between tone and voice see Matisoff (1973).

[27] The term *phonetic polarization* may be used to describe this effect. This is reminiscent of the Dispersion Theory (Liljencrants and Lindblom 1972), which has recently been harnessed into Optimality Theory in the form of SPACE constraints (e.g. Flemming 1995, Ní Chiosáin and Padgett 2001).

supposedly distinct neutral series are very similar, thus supporting our views on how the opposition should be represented.

One of the ways to define laryngeal distinctions in phonetics is by means of Voice Onset Time, that is, VOT (Lisker and Abramson 1964). This is the interval between the release of a stop and the start of a following vowel. In general, the neutral obstruents in English have a short VOT and a little voicing occurring before the release, to which we may refer as VOT *lead*. The fortis series has a long VOT, also called VOT *lag* (e.g. Harris 1994, Ladefoged 2001). On the other hand, the neutral series in Polish and Spanish have a short VOT in the voiceless series, as opposed to distinct voicing during closure, that is, a long VOT lead in the voiced series. Generally, the Element Theory assigns elemental representations to the long VOT lead (L), and the long VOT lag (H), but no element defines the short VOT type. The typology of phonation types in obstruents supports the view that the short VOT class is the unmarked one. For example, if a system has only one series of stops it is typically voiceless unaspirated, that is, having short VOT, or, in terms of elements, no laryngeal specification.[28] The majority of languages exhibit the two-way distinction of the two main types: fully voiced vs. plain voiceless, and voiceless aspirated vs. voiced. Let us look at a simple typology of laryngeal distinctions and see how the Element Theory can capture the VOT distinctions. The typology is based on Harris (1994), Ladefoged (2001) and Maddieson (1984). The unmarked series of stops, with short VOT, and their elemental representation is represented as '_', that is nothing.

(12)	***VOT opposition***			***representation***	***examples***
Malakmalak		_		(_)	p
Spanish, Polish	lead	_		(L) , (_)	b, p
English, Irish		_	lag	(_) , (H)	b, p^{h}
Thai	lead	_	lag	(L), (_), (H)	b, p, p^{h}
Hindi	lead	_	lag, lead/lag	(L), (_), (H), (LH)	b, p, p^{h}, $\text{b}^{\text{ɦ}}$

It seems that both the VOT and the element system share the ability to capture one important aspect of the above typology, namely, that with the increase of the number of contrasts, the number of VOT combinations and

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[28] In fact 98% of such systems in the UPSID data base show this tendency (Maddieson 1984: 28).

the complexity of representations in terms of elements also increase.[29] Thus, once again the relative markedness of particular systems goes hand in hand with the relative complexity of representations. Both the acoustic and elemental models of description have a neutral series in each system of oppositions, and they seem to be able to directly express laryngeal neutralizations in a straightforward fashion: as the simplification of laryngeal activity, giving rise to the unmarked variant. This advantage of privative models over equipollent ones is well-established in phonological theory (e.g. Lombardi 1995, Brockhaus 1995).

Let us look at how the phenomenon of obstruent devoicing is captured in this model. As mentioned above, in Polish the voiced series of obstruents is marked and bears the element (L), while the voiceless obstruents have no specification.

(13) ***voice contrasts in Polish stops*** ***devoicing***

[b]	**[p]**	**[d]**	**[t]**	**[g]**	**[k]**	**[b]**	**>**	**[p]**
U	U	A	A	_	_	U		U
h	h	h	h	h	h	h		h
ʔ	ʔ	ʔ	ʔ	ʔ	ʔ	ʔ		ʔ
L		L		L		L		

In an asymmetrical system of privative specification of voice, devoicing is understood as delinking of the property responsible for voice due to licensing failure in prosodically weak positions. Again, there is a direct relation between the structural description of the phenomenon and the fact that we are dealing with neutralization, or weakening. We do not attempt a full analysis of devoicing in Polish here, suffice it to say that predominantly it is due to the weak licensing that the obstruent receives in a particular context, for example, word-finally.[30]

It appears then that Polish and English have quite different complexity asymmetries in the representation of their obstruents. In the following section we will look at one possible indication in the phonotactics of the two languages which might directly fall out from the different laryngeal speci-

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[29] For a more advanced discussion of the relation between the Element Theory and VOT types see Harris (1994: 133).

[30] An exhaustive and satisfactory analysis of all the voice phenomena in Polish within the Element Theory has not been proposed yet. For surveys of all the relevant issues and recent feature-based analyses see Bethin (1992), Gussmann (1992) and Rubach (1996).

fications employed in the two systems. More intricate complexity effects will be described in the ensuing sections.

2.3. Complexity and syllabification

In the above discussion we saw how the concept of complexity is able to capture a number of segmental phenomena, successfully replacing such notions as sonority or strength. The advantage of complexity over the other two concepts is that the scales of relative complexity fall out from the internal composition of segments and, therefore, are directly incorporated into phonological processing, rather than being arbitrarily postulated as look-up scales. Syllabification and phonotactic restrictions is another area of phonology in which sonority and strength play an important role. The aim of this and the following section is to demonstrate that complexity may replace these constructs also here, and also provide some new insights into the nature of syllabification.

In definitions of well-formed branching onsets or good syllable contacts, that is, coda-onset clusters, the sonority profile plays an important role (e.g. Selkirk 1982, 1984, Yip 1991, Itô 1986). A good coda-onset contact is one in which the coda is more, or at least no less sonorous than the following onset (e.g. Harris 1994). In models operating with strength of segments (e.g. Vennemann 1972, 1988, Murray 1988), the preferred contacts are similarly defined as those in which the strength differential between the coda and the following onset is greater, in favour of the latter. The strength scale, however, is the inverse of sonority, therefore, the onset will be stronger, or higher on the scale of strength, and the preceding coda will be weaker.[31] This is no place to introduce the syllabification principles of Government Phonology. Suffice it to say that in terms of phonotactics it is no different from sonority- or strength-based models, in that the best contacts are those with the greatest complexity differential. For ease of comparison with the other models, the most complex segments in the Element Theory are obstruents, that is, they are the least sonorous in the former theory and the strongest in the latter.

Much stricter conditions constrain well-formed branching onsets. Here, the condition of sufficient sonority distance is usually referred to in order to account for the fact that onsets of the type [pl, kl], [pj, kj], or [tr, kr] are better than [ks, pf, kn]. In fact, most of the latter group are normally viewed

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[31] This understanding of strength will be returned to in more detail in the following chapter where we take up the problem of syllabification in Government Phonology.

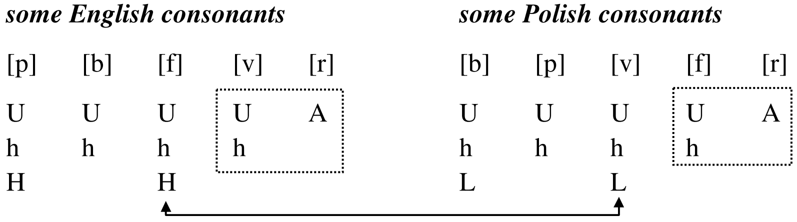
as impossible onsets, at least in English. Thus, the best branching onsets are those which involve an obstruent as the first element and a glide or liquid as the second. What is required then is sufficient distance in terms of sonority, strength, or complexity between the two consonants.

Below, we compare a fragment of the phonotactics in English and Polish, in which the preferences seem to be contradictory. While in the sonority and strength systems this problem cannot be solved without arbitrary reshuffling of the scales, in the complexity-based model the facts fall out directly from what we know about the representation of obstruents in the two languages. Specifically, the differences will depend on the way the laryngeal contrasts are specified.

Both English and Polish have branching onsets of the type [pr, br]. However, once we move down the scale of complexity of the other labial obstruents in the two languages, we encounter restrictions to the effect that while [vr] is a well-formed onset in Polish, for example, *wrota* 'gate', *wróg* 'enemy', *wrona* 'crow', in English this option is not utilized in native vocabulary, except for the onomatopoeic *vroom*, or some obsolete forms and French borrowings. On the other hand, while [fr] is a perfect branching onset in English, for example, *free, front, freak*, etc., in Polish, words beginning with this cluster are mostly borrowings, for example, *fryzura* 'hairstyle, *frytki* 'fries', *frykatywa* 'fricative', *frustracja* 'frustration'. Admittedly, [fr] in Polish fares much better than [vr] in English, as most of the borrowings are fully integrated into the language and one might even find some forms which sound native, for example, *fruwać* 'to fly', which appears to be of onomatopoeic origin, like the English *vroom*.[32]

It seems that complexity as understood in the Element Theory may provide some rationale for these asymmetries between English and Polish. The representations below are limited to the relevant labial obstruents and [r], which is the second element of the branching onset.

(14)



some English consonants

[p]	[b]	[f]	[v]	[r]
U	U	U	U	A
h	h	h	h	
H		H		

some Polish consonants

[b]	[p]	[v]	[f]	[r]
U	U	U	U	A
h	h	h	h	
L		L		

---

[32] The gap in native Polish vocabulary may be due to the fact that most of the modern instances of [f] are either borrowings or due to the devoicing of [v].

Recall, that the specification of the laryngeal contrasts in English involves the presence of high tone in the voiceless obstruents, while in Polish the voiceless series is unmarked. It transpires from the representations above that [fr] in English is parallel to [vr] in Polish in terms of complexity differential, an effect which in sonority-based accounts must result from arbitrary manipulation of the scale. In both languages preference is given to the clusters with the greater complexity differential. Theoretically, neither English [vr], nor Polish [fr] are completely illegal because there is some complexity slope, but their 'toned' counterparts are understandably preferred.[33] In the following chapter the role of complexity in syllabification will be defined in more detail. It is hoped that we will be able to provide an answer to the question why clusters with identical complexity slopes (English [vr] and Polish [fr]) still show a different degree of acceptability. This will be connected with conditions on syllable structure which are of more importance than substantive constraints on well-formed onsets.

The following section discusses some complexity effects in modern Irish in which we try to demonstrate the connection between phonotactics, syllable structure, and phonological processes on the one hand, and subsegmental representations on the other.

3. Substantive complexity effects in Irish

In this section, we bring together a few aspects of the phonological system of Irish in order to demonstrate how the element-based model is employed in concrete analyses of linguistic facts, and how various aspects of one phonological system converge on the internal representation of its consonants and vowels. Since the discussion is limited to substantive complexity effects, some aspects of the data reviewed in this section will receive a fuller interpretation once other principles of phonological organization are introduced in the following chapters.

3.1. Features vs. elements in vocalic alternations

From the presentation of the Element Theory it follows that an element may be equal to a segment, for example, (I) defines the vowel [i] on its own, while some segments contain combinations of elements. In this respect, elements

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[33] One might wish to extend this analysis to another asymmetry in English, namely, [θr] vs. *[ðr], or [ʃr] vs. *[ʒr].

are bigger units than features of the SPE type (Chomsky and Halle 1968). Note that in order to get the same vowel in any feature-based model, we need at least two features, for example [+HIGH] and [–BACK], neither of which means anything in isolation, because the former defines all high, while the latter refers to all non-back vowels. On the face of it, it seems that feature systems are able to provide more precise and subtle descriptions of phonological objects. The question however is if analyses in terms of elements fail to cover the empirical facts, and, more importantly, if they can account for the same phenomena better or worse than feature-based systems. Let us briefly look at a comparison of two analyses of vowel quality alternations in Irish, one couched in the equipollent version of feature specification (Ní Chiosáin 1994), and the other within the Element Theory.

In all dialects of Modern Irish consonants are grouped into two quality series: palatalized and velarized.[34] These consonants affect the preceding phonologically short vowels by spreading their secondary articulation property.[35] In the data below (C) refers to Connemara and (M) to Munster Irish.

(15)

a.	(u ~ i)	[muk] ~ [mik´]	muc / muic 'pig / dat.'	(C,M)
b.	(o ~ e)	[sop] ~ [sep´]	sop / soip 'wisp / gen.sg.'	(C)
c.	(o ~ i)	[sop] ~ [sip´]	sop / soip 'wisp / gen.sg.'	(M)
		[kodə] ~ [kid´]	coda / cuid 'portion, gen.sg./nom.'	(C,M)
d.	(a ~ i)	[f´ar] ~ [f´ir´]	fear / fir 'man / gen.sg.'	(M)
		[f´æːr] ~ [f´ir´]	fear / fir 'man / gen.sg.'	(C)
e.	(a ~ e)	[d´as] ~ [d´eʃə]	deas / deise 'nice / gen.sg.'	(M)
		[d´æːs] ~ [d´eʃə]	deas / deise 'nice / gen.sg.'	(C)

Although the preceding onset is not unimportant, for the sake of simplicity we will limit the discussion to the context VC, in which the quality of the consonant affects the nucleus to its left.

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[34] The distinction palatalized vs. velarized is typically represented as C´ vs. C. The consonant inventory of Irish, with a degree of simplification, is as follows: *Labial* (p, p´, b, b´, f, f´, v, v´, m, m´), *Coronal* (t, t´, d, d´, s, ʃ, n, n´, l, l´, r, r´), *Velar* (k, k´, g, g´, x, x´, ɣ, ɣ´, ŋ, ŋ´), *Glottal* (h, h´).

[35] Consonants also affect the following vowels although on a smaller scale. This effect may to some extent be called phonetic. See Ní Chiosáin (1991) and Bloch-Rozmej (1998) for thorough analyses of these effects in Connemara Irish, and Cyran (1995, 1997) for the Munster dialect.

The alternation [u~i] is the most regular across all dialects, and the effects are identical in Munster and Connemara. The alternation [o~e] is rather limited to Connemara Irish, and the corresponding alternation in Munster is that of [o~i].[36] Nevertheless the [o~i] alternation is also found in the descriptions of western dialects, for example, in Connemara (de Bhaldraithe 1945). As for (15d), the alternation may be said to be identical in both dialects, despite the difference in the pronunciation of the stressed [a] which comes out as [æ:] in Connemara. Similarly, the alternation [a~e] seems to be analogous in the two dialects. However, this alternation is highly conditioned. To obtain [e], the nucleus must be flanked by palatalized consonants on both sides, and, additionally be followed by a schwa vowel in the following nucleus.

In Ní Chiosáin (1994), the alternations illustrated above are due to spreading of the feature [±BACK] from the consonants into the nucleus. [−BACK] and [+BACK] define the palatalized and the velarized consonants respectively. Short nuclei, which are the targets of the spreading, are underspecified for backness. Ní Chiosáin proposes that the inventory of short vowels involves only three objects: two underspecified ones, that is, [I] and [E] which correspond to high and mid vowels, and a low [ɑ] which has a phonetic variant [a/æ:] after a palatalized onset (C´a/æ:). Thus, Ní Chiosáin predicts that only high and mid vowels are targets of backness spreading, while the alternations in (15d) and (15e), which involve manipulation of height, are not part of the rule *Spread [BACK]*. This move is, of course, logical. It is difficult to expect that spreading of [±BACK] should cause changes in height. However, the effects involving the low vowels occur in exactly the same phonological contexts as the high and mid vowel alternations, that is, when the quality of the following consonant changes from [+BACK] to [−BACK]. Thus, to capture this fact one would need to refer to backness to account for height shifts, despite the lack of formal connection between the two phonological dimensions. Another prediction that the feature-based analysis makes is that the vocalic alternations take place in a symmetrical fashion along the same height. This idea is repre-

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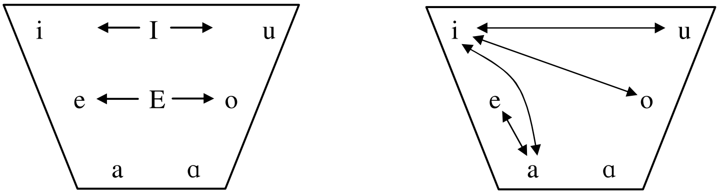
[36] It must be added that both dialects exhibit opaque vowels which are not affected by the property of the following consonant. For example, *scoil* [skol´] 'school', *cois* [koʃ] 'leg', rather than the expected *[skel´ / skil´] or *[keʃ/ kiʃ] (e.g. Ó Cuív 1975, de Bhaldraithe 1945). Similar behaviour concerns the back low vowel [ɑ]. For example, *bainne* 'milk' is pronounced as [bɑn´ə] in Munster and [bɑ:N´ə] in Connemara ([N] stands for a tense coronal nasal). The lengthening in Connemara is phonetic.

sented graphically below in (16a). On the other hand, (16b) shows the directions of changes which transpire from the data in (15) above. Admittedly, they concern Munster Irish to a greater extent, but they occur in both dialects. This suggests that, some small differences notwithstanding, the two dialects should be offered a uniform analysis, in which we would be able to incorporate height as well as backness.

(16) a. ***Spread [±BACK]*** b. ***Munster Irish***



The illustrations above clearly suggest that the analysis based on spreading [±BACK] idealizes the facts slightly even in the case of Connemara Irish – as shifts of the type [a~i], [a~e] and [o~i] do occur in this dialect (15c-e). The system with [I] and [E], coupled with spreading backness, predicts symmetry in behaviour, and it is completely unable to subsume the Munster facts which involve height distinctions on a regular basis. These would have to be dealt with by means of additional patch-up rules.

What seems to be required is an analysis which would be able to cover all the facts and the dialectal variation in a simple and elegant fashion. It should also be able to explain how and why vowels of any height tend to alternate with [i] in Munster, and occasionally in Connemara. In other words, there seems to be an asymmetry in the effects of backness spreading which are difficult to express in an equipollent feature system in which [+BACK] should be no different from [−BACK].[37] One would also like to have some explanation of the interesting correlation between the height of the target vowels and the corresponding complexity of the facts. Note that the [u~i] alternation is almost exceptionless in both dialects. The [o~e] alternations are almost regular in Connemara, and almost non-existent in Munster, in which [o~i] is the norm. The latter type is only marginal in Connemara, though, much better established than [o~e] in Munster. This asymmetry in the behaviour of high and mid targets of spreading has no

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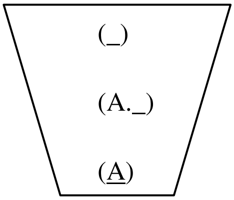
[37] There is no denying that one may always resort to feature co-occurrence restrictions to derive these effects. The point is, however, that there is nothing inherent in the two values of the feature [BACK] that would directly express such asymmetries.

expression in the I/E distinction in (16a). Thus, the lower we get in terms of the height of the targets, the more complicated the picture gets, and the targets are less and less susceptible to spreading, with the low vowel /ɑ/ being fully resistant, like long vowels. This also brings up the question of the representation of the short opaque vowels.[38]

Let us briefly compare the story of backness spreading with an element-based analysis. In Cyran (1997), palatalized consonants are defined by the presence of the element (I) which spreads to the preceding nucleus as the head ($\underline{\text{I}}$). The velarized series of consonants contains the (U) element, which spreads as an operator. The asymmetry in the status of the spread element is responsible for the fact that (I)-ness dominates the vocalic system of Munster Irish, as we saw above. The so called opaque nuclei are headed, e.g. ($\underline{\text{A}}$), while the targets of spreading are headless. The short vowel system of Irish may be viewed as a vertical system, very much in the spirit of Ní Chiosáin (1994), but with some crucial differences.

(17) ***Short vowels in Irish***



Two comments are in order here. Firstly, we should immediately say that the headed ($\underline{\text{A}}$) is realized as back after velarized consonants (Cɑ), and as front after palatalized ones (C´a). In the latter context palatalization spreading from the right hand context may affect such nuclei leading to [a~i] and [a~e] alternations under the specific contextual conditions discussed in Cyran (1997: 56). Secondly, the reason why (I) and (U) are banished from the lexical representations of alterable short vowels is because these properties are always available from the consonants. However, the headless targets should not be viewed as underspecified vowels which will receive phonetic interpretation only once filled with (I) and (U). In a system in which

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[38] It is conceivable that they may be lexically specified with the feature [±Back], similarly to long vowels, which do not participate in the alternations.

there would be no element spreading to such nuclei, they would still be interpretable in some way.[39]

Finally, a word of comment is in order concerning the concept of spreading, which is fundamentally a derivational notion. In non-derivational parlance, we may say that the domain of phonetic interpretation of the secondary articulation of consonants in Irish is wider than one skeletal position. In this respect, the phonetic interpretation of alterable short vowels in Irish may be said to involve two overlapping domains, that is, the melody lodged in the nucleus and the superimposed melody of the secondary articulation of the following consonant. In what follows the term spreading should be understood in the non-derivational sense. We will also use the term superimposition of properties in overlapping domains.[40]

The alternation [u~i] is derived by means of the superimposition of (I̲) or (U) from the following consonant on a nucleus which otherwise has no melodic content. Since consonants in Irish are always either palatalized or velarized, this structure will always be interpreted as either [i] or [u]. Note that the height of these vowels needs no further specification because this property is inherent in the two elements. In addition to that, because in this instance (I̲) and (U) meet no other element in the nucleus, this type of alternation is the most regular, as it does not involve any interaction between the lexically present elements and the spread ones.

The situation is different in the case of lexical (A._), responsible for the [o~e] and [o~i] alternations. Here the dialectal differences between Connemara and Munster are most clear, but only when we talk about palatalization contexts. Note that the spreading of (U) into the nucleus represented as (A._) yields (A.U._), that is [o] in both dialects. The problem lies in the way (A) and (I̲) combine in the two dialects. It appears that in Connemara the incoming (I̲) may assume the head position to produce (A.I̲), hence the regular alternation [o~e].[41] In Munster Irish, [e] is an extremely restricted

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[39] Languages with vertical vowel systems of this type do exist. For example, Kabardian has only two short vowels [ɨ, ɛ], but it has a full set of five long ones [i:, u:, e:, o:, a:] (Maddieson 1984: 417).

[40] The scope of the superimposition of secondary articulation in Irish is a complex issue. There are generally two blockers restricting overlapping domains: a) the so called 'opaque vowels', b) the specification of the preceding non-adjacent consonant, which marks the beginning of a new domain (Cyran 1997: 50).

[41] It is also possible that in Connemara the element (I) spreads as an operator just as (U) does. This could explain why the effects of spreading into a nucleus specified as (A._) are symmetrical, that is, (A.U._) and (A.I._).

vowel. On the basis of other phenomena involving the interaction between (A) and (I), Cyran (1997: 101) proposes that the well-formed (A-I) compound in this dialect is (A)-headed, that is, (A.I).[42] Thus, in the case of vowel-consonant interaction, the incoming (I) element cannot form a grammatically licit compound with (A._) and it suppresses the (A) element, or, to put it differently, the element (A) cannot be licensed in the nucleus headed by (I). The same type of (A)-suppression is observed in the [a~i] alternation, for example *fear / fir* [f´ar ~ f´ir´] 'man / gen.sg.', while in [a~e] the phonetic mid vowel survives, but it must receive additional support from the following nucleus, for example, *deas / deise* [d´as ~ d´eʃə] 'nice / gen.sg.'.

Thus, the complexity of the effects concerning the mid vowels in Irish follows directly from the melodic design of such vowels. Here, in contrast to high vowels, the nucleus already has one property which is lexically present in the nucleus. The effects of I/U-spreading are therefore dependent on the combinatorial possibilities between (A) and the incoming (I) and (U). It appears then, that we in fact predict exactly where dialectal variation is more likely to occur: it is when the targets already have a lexical property which will interact with the incoming elements.

The low vowels behave in the most irregular fashion because they are represented by a headed element (A) which interacts with (I)-ness only under strict conditions, if at all. This is parallel to the long vowel system. Thus, it seems that the vertical system presented above is able to capture not only the reflexes of spreading and their different outcomes by referring to dialect-specific constraints on element combinability, but also straightforwardly captures the correlation between the height of the targets and the relative regularity of the observed alternations. This analysis fully incorporates the properties of backness and height which eluded a uniform analysis in a feature-based model. All the necessary asymmetries can be derived from the general nature and workings of representations. Finally, it is worth noting that the short vowel system in Irish resemble the scales of (U) and (I) presence in the place of articulation of consonants illustrated in (8) and (9) respectively. Here, we are dealing with a similar ternary scale of (A) presence, in that, it may be a) absent (regular [u~i] alternation across dialects), b) present as operator (leading to dialectal distinction: [o~e] in Connemara vs. [o~i] in Munster), and c) present as head (general immunity to element spreading). The scale (_)-(A._)-(A), with all the accompanying

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[42] For a recent exposition of the so called Licensing Constraints defining element combinability in GP see e.g. Kaye (2001).

phonological contrasts and behaviour, also suggests a solution for the opacity of some mid vowels. For example, the [o] in *cois* [koʃ] 'leg' and *scoil* [skolʹ] 'school' is opaque because it is lexically represented as (U.A̲), that is, a headed vowel.

We will now return to consonants and discuss some aspects of Irish phonotactics in which the melodic complexity seems to play a role.

3.2. Substantive conditions on Irish epenthesis

The idea that complexity may replace sonority or strength scales is attractive for the simple reason that it is now a derivative of the internal representation of consonants rather than a separately proposed look-up scale whose role in the phonological system is arbitrary and unclear.[43] Ideally, once the representations of consonants are established for a given system they should display consistent behaviour for all possible phonological phenomena where complexity, sonority, or strength are assumed to play a role. We should expect a convergence of unrelated aspects of a given phonological system in the internal structure of its segments.

In this section, we look at two such aspects of the phonological system of Irish. The first is phonotactics, or more specifically, the interaction between consonants in clustering. The second aspect concerns the segmental inventory of Irish and some effects connected with it. The third area which calls for an analysis in terms of elements are the initial consonant mutations, which is attested in other Celtic languages as well. This phenomenon will be only mentioned in passing here. It will be dealt with more fully in the following section in relation to Welsh which will be assumed, quite uncontroversially, to share some properties of its consonantal system with Irish. Let us first concentrate on the phenomenon concerning the syllable structure of Irish, which is common to all dialects, and which appears to be conditioned by the segmental structure of consonants.

Irish displays a consistent phonotactic pattern in which certain coda-onset contacts are disallowed. To be more precise, only a subset of potentially possible clusters of falling sonority is found in this language. The instances of sequences which are not grammatical are normally assumed to be broken up by epenthesis, which has received a lot of attention in the literature. Descriptions of the facts can be found in, for example, Ó Cuív

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[43] To be fair, phonological theory has witnessed quite a few attempts to encode sonority effects in the internal representation of segments (e.g. Steriade 1982, Clements 1990, Dogil and Luschützky 1990, Rice 1992, Zec 1995)

(1975), de Bhaldraithe (1945), Ó Dochartaigh (1987), Ó Sé (2000), Ó Siadhail (1989), Sjoestedt (1931), Sjoestedt-Jonval (1938), Wagner (1959). Formal accounts include, among others, Cyran (1996a), de Búrca (1981), Green (1997, 2003), Ní Chiosáin (1991, 1999), Ó Baoill (1980). Let us consider some examples below, in which the epenthetic vowel is given in superscript.

(18)

a.	[ˈf´er´əg´ə]	feirge ‘anger, gen.sg.’
	[ˈg´er´əb´ə]	geirbe ‘scab, gen.sg.’
	[ˈl´er´əg´ə]	leirge ‘slope, gen.sg.’
	[ˈboləgəm]	bolgam ‘mouthful’
	[ˈʃer´əv´iːʃ]	seirbhís ‘sevice’
	[ˈar´əg´əd]	airgead ‘money’
b.	[ˈd´arəfə]	dearfa ‘proved’
	[ˈkonəfə]	confadh ‘anger’
	[ˈfurəxə]	forcha ‘beetle’
	[ˈdorəxə]	dorcha ‘darkness’
	[ˈforəmədu:l´]	formadúil ‘envious’
	[f´er´əˈm´o:r´]	feirmeoir ‘farmer’
	[ˈan´əm´]	ainm ‘name’

For the sake of the argument, the data include only those forms in which the cluster is followed by a vowel rather than word-final, so that we can uncontroversially speak of the impossibility of establishing coda-onset contacts. The same pattern, however, is attested for these clusters also in the word-final context, for example, *fearg* [f´ar^{ə}g] ‘anger’, *gearb* [g´ar^{ə}b] ‘scab’, *learg* [l´ar^{ə}g] ‘slope’, *bolg* [bol^{ə}g] ‘belly’, *balbh* [bɑl^{ə}v] ‘dumb’. In the following chapter, an attempt will be made to unify these two seemingly disjoint contexts.

There is some agreement among linguists concerning the synchronic status of this type of epenthesis. The main argument for this view is based on the way secondary articulation affects clusters in Irish and Scots Gaelic (Clements 1986, Cyran 1996a, Ní Chiosáin 1999).[44] Specifically, lexical clusters always agree in terms of palatalization or velarization. For example, in Irish *cearc* [k´ark] ‘hen’, the cluster is velarized, while in *circe*

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[44] In fact, the discussion in Clements (1986) concerns similar instances of epenthesis in Barra Gaelic, e.g. those described in Borgstrøm (1937).

[k´ir´k´ə] ‘hen, gen.sg.’ it is palatalized. The same condition holds for the assumed epenthetic sequences, for example, *fearg* [ˈf´arᵊg] ‘anger’ vs. *feirge* [ˈf´er´ᵊg´ə] ‘anger, gen.sg.’, but not those sequences in which the intervening schwa is unambiguously lexical rather than epenthetic, for example, *capall* [kɑpəl] ‘horse’ vs. *capaill* [kɑpəl´] ‘horse, pl.’, and not *[kɑp´əl´]. On this basis, we may claim that the epenthesized sequences of consonants are lexically adjacent.

It seems that one of the reasons for the impossibility of establishing coda-onset contacts is strictly connected with the sub-segmental structure of the second consonant. The structural description of the process of epenthesis varies depending on which data are assumed to be part of the phenomenon. For example, de Búrca (1981) defines it as vowel insertion “between a sonorant and a non-homorganic voiced obstruent when the cluster is preceded by a short vowel”. However, as the examples in (18b) clearly demonstrate, the second consonant need not be voiced, e.g. *dearfa* [ˈd´arᵊfə] ‘proved’, and it need not be an obstruent, e.g. *ainm* [an´ᵊm´] ‘name’. A more precise definition of the context for epenthesis is given in Ó Siadhail (1989), where it is described as occurring within a coda-onset cluster if the vowel preceding the cluster is short, and the sonorant is followed by a non-homorganic consonant other than a voiceless stop. This formulation is in fact an accurate description of the contacts which are possible in Irish. In other words, the surviving contacts are those which involve homorganicity, or those in which the second consonant has a particular value for sonority (Ní Chiosáin 1999). The question is, however, if there is any way of capturing where and why the phenomenon of epenthesis actually occurs.[45]

Let us look at some data illustrating the good contacts in Irish, which involve a sonorant followed by an obstruent.[46] Again, we limit ourselves to the word-medial context, which differs slightly from the final one. However, these clusters also occur finally, for example, *beirt* [b´er´t´] ‘two people’, *olc* [olk] ‘bad’, *corp* [korp] ‘body’.

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[45] There are three crucial aspects of the context: a) the preceding short vowel, b) the sonorant, c) the non-homorganic consonant other than a voiceless stop (Cyran 1996a). Ní Chiosáin (1999) adds data in which the prosodic structure also seems to play a role.

[46] Irish also has clusters of falling sonority with [s, ʃ, x] followed by an obstruent. Here too, certain restrictions hold. For example, [x] can be followed by [t], but not [p] or [k].

(19)

a.	[ˈʃk´ulpə]	*sciolpa* ‘splinter’
	[kɪr´ˈp´ax]	*coirpeach* ‘criminal’
	[il´k´əs]	*oilceas* ‘evil’
	[ˈk´ir´k´ə]	*circe* ‘hen, gen.sg.’
	[pərˈtɑx]	*portach* ‘bog’
	[ˈbɑl´t´ə]	*bailte* ‘home, pl.’
b.	[ˈt´i:m´p´əl]	*timpeall* ‘round’
	[ˈmi:n´t´ɪr´]	*muintir* ‘people’
	[ˈri:ŋ´k´ə]	*rince* ‘dance’
	[ˈbaundə]	*banda* ‘band’
	[ˈfrauŋkəx]	*Francach* ‘French’
	[ˈm´i:l´ʃə]	*milse* ‘sweet, pl.’
	[ˈtɪrʃə]	*tuirse* ‘tiredness’

The above data do not include all the possible types of sonorant – obstruent word-internal clusters, but they illustrate the main tendencies. (19a) shows that clusters in which a sonorant is followed by a voiceless stop are not broken up by epenthesis. On the other hand, (19b) illustrates an additional interesting phenomenon which is optional in Connemara but fairly regular in Munster: the homorganic clusters are often preceded by a long nucleus. Some of these are cases of lengthening before the homorganic sonorant – obstruent clusters, for example, *milse* [ˈm´i:l´ʃə] ‘sweet, pl.’, others are much more complicated.[47] However, the main point is that for cluster integrity to be maintained, the second member should be either homorganic (*milse, banda*), or a voiceless stop (*circe, sciolpa*). We will not pursue the question of how homorganicity contributes to cluster integrity, though this is not an uncommon situation in languages in general (e.g. Hayes 1986). We are interested in seeing how sub-segmental representation in terms of elements can enable us to understand the fact that, apart from cases of homorganicity, only the voiceless stops make good contacts for the preceding sonorants.

In models operating with sonority the obvious solution to the above question would be that the voiceless stops are the least sonorous, and therefore, together with the preceding sonorant, they provide the biggest sonority slope. Likewise, in models using consonantal strength in the definition

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[47] For a formal analysis of the difference between *milse* [m´i:l´ʃə] ‘sweet, pl.’ and *tuirse* [tɪrʃə] ‘tiredness’ see e.g. Cyran (1996a).

of preferred contacts, the voiceless stops are considered to be the strongest. The Element Theory deals with sonority sequencing in a similar way. Namely, the best syllable contacts, as well as the most preferred branching onsets, are those displaying the greatest differential in complexity, which corresponds to sonority slope. Note however, that the complexity-based description has already been shown to be more advantageous than sonority and strength scales. As we saw in the case of branching onsets in English and Polish in (14), sometimes the preferred sequence involves a voiced rather than a voiceless obstruent. Thus, the preference for /vr/ over /fr/ in Polish is inexpressible in terms of sonority distance, because then, the preference should be the reverse of what it is.

When sonority scales are fine-tuned to include distinctions among a group of stops or fricatives, the voiceless congeners are at the bottom of sonority, not the voiced ones. On the other hand, in strength systems, we may put voiced obstruents at the top of the strength scale, but only as a result of an arbitrary decision. The Element Theory, on the other hand, may deem voiced stops or fricatives stronger (more complex) than their voiceless congeners by representing the former as containing the low tone element and representing the voiceless ones as neutral. This decision, however, must follow from a thorough analysis of the behaviour of the obstruents in a given system and should never be taken contingently, just to account for one effect.

Given that Irish voiceless obstruents are marked and contain the high tone element as argued in e.g. Cyran (1997), the Element Theory correctly identifies the voiceless stops in Irish as the class with the highest complexity, in which case the interpretation of the preferred contacts would go along the same lines as in sonority and strength models.[48]

Below, in (20), a first approximation of the representation of Irish obstruents is attempted. The representations clearly demonstrate that stops are the most complex of obstruents as they have the additional element (ʔ). Among the stops, however, the voiceless ones are still more complex than the voiced ones because they possess the high tone element. Thus, it seems that we are able to point to a precise place on the complexity scale pertaining to the Irish obstruents where voiceless stops begin to pattern on their own, in contradistinction to the remaining obstruents.

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[48] In the following chapter complexity is integrated into a model of consonant interaction, based on governing relations in which the concept of complexity slopes will become more meaningful.

(20) ***Irish obstruents***[49]

[p]	[b]	[t]	[d]	[k]	[g]	[f]	[v]	[s]	[ʃ]	[x]	[ɣ]
U	U	A	A	_	_	U	U	A	I	_	_
h	h	h	h	h	h	h	h	h	h	h	h
ʔ	ʔ	ʔ	ʔ	ʔ	ʔ						
H		H		H		H		H	H	H	

Note, however, that voiced stops have exactly the same complexity as the voiceless fricatives, that is, three elements. Thus, we may predict that if the cut-off point was made one element lower on the complexity scale, then voiceless stops would pattern with voiced stops and voiceless fricatives. However, in Irish, the cut-off point sets the voiceless stops aside from the remaining obstruents.

At this point, the question arises as to how we should treat the place-defining elements with respect to complexity slopes. If they count, then Irish [k] should pattern with voiced stops, and we should expect it to feature in the data illustrating epenthesis, which is not the case. This leaves us with two alternatives. Either velarity must be represented by a real element, for example, by means of the neutral element, or resonance elements must be claimed not to contribute to the inherent complexity of segments. Below, we assume that the latter option is correct, that is, generally resonance elements do not contribute to the complexity slopes.[50] However, they play an important role in the aforementioned homorganicity condition.

Let us look at the representation of a) good (e.g. *coirpeach* [kɪr´ˈp´ax] ‘criminal’), b) acceptable (e.g. *banda* [ˈbaundə] ‘band’) and c) illegal syllable contacts (e.g. *geirbe* [ˈg´er´ᵊb´ə] ‘scab, gen.sg.’) with respect to their complexity slopes.

The structures in (21) represent a scale of preferences which can be interpreted in the following way. Irish clusters with a complexity differential of three elements display integrity (21a) and are never broken up by an epenthetic vowel. The same complexity slope is found in the case of other

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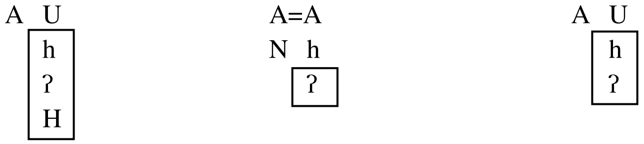
[49] The list ignores the contrast between palatalized and velarized consonants. It also does not include the glottal fricative /h/ whose status is unclear.

[50] For the opposite conclusion see e.g. Scheer (2004: 59), who restricts complexity to counting only the resonance elements, with sonority being derived by three parameters: a) the status of the aperture element (A), b) syllabic position (nucleus or onset), and c) presence or absence of manner elements (h) and (ʔ).

voiceless stops, e.g. *oilceas* [il´k´əs] ‘evil’, *portach* [pər'tɑx] ‘bog’, because they all contain noise, stopness and the high tone. On the other hand, clusters in which the differential is two elements or less must be broken up by epenthesis (21c). This ‘class’ of segments includes voiced stops and voiceless fricatives, as in e.g. *feirge* ['f´er^{ə}g´ə] ‘anger, gen.sg.’, *dearfa* ['d´ar^{ə}fə] ‘proved’, *forcha* ['fur^{ə}xə] ‘beetle’. However, excluded from epenthesis are those obstruents which share the same place elements (21b), as in partial geminates, e.g. *banda* ['baundə] ‘band’.

(21) a. /kɪ **r´** **p´** ax/ b. /bau**n** **d** ə/ c. /g´e **r´** **b´** ə/



The representations in (21) show that complexity, coupled with additional conditions such as the one on homorganicity, can account for Irish phonotactics. It should be stressed that the distinction between voiceless and voiced stops which in this model follows directly from the specification of the laryngeal dimension is not always obvious in models based on strength or sonority.[51]

One question which remains unanswered is why such stringent conditions on clustering should hold in Irish.[52] Harris (1990), in his first discussion of element complexity and syllable contacts claims that sometimes the accepted coda-onset clusters may have even equal complexity. Why is an obstruent which is more complex from the preceding sonorant by two elements not a good contact? The answer to this question is two-fold. Substantive complexity merely provides a non-arbitrary scale with cut-off points. However, where exactly the grammar of a particular language chooses to place the divisions is an arbitrary property of that grammatical system.[53]

Thus, so far, the Element Theory may be said to cover similar empirical ground as sonority and strength-based models. It also has the potential of

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[51] For example, Clements (1990) proposes a universal sonority scale in which no distinction is made between stops and fricatives, not to mention one between voiced and voiceless stops, a distinction which seems to be called for in Irish.

[52] In the following chapter, we will see that in Dutch the conditions on cluster integrity are slightly different.

[53] In chapters 2 and 3 we will look at other conditions on cluster integrity, e.g. the shape of the following vowel.

doing a little better when it comes to phonotactics without losing any of its restrictiveness. This can be achieved if two assumptions are made. Firstly, there is a small universal set of privative primes called elements (A, I, U, h, ʔ, L, H). Secondly, there is no such thing as a universal uniformity of segmental representations. The latter assumption is necessary to avoid such theoretical pitfalls as providing melodic representations for all the contrasts found in the IPA chart – a tendency which besets most distinctive feature theories and some element-based ones. Rather, the small set of elements must be utilized in representations on the basis of an in-depth system analysis.

Despite the paucity of the model, there are a few variables which allow for a fairly accurate description of any system. One of these parameters involves the status of the resonance elements (headedness), which was most visible in the discussion of the vowel system of Irish. In consonants, the status of resonance elements is inherently connected with primary and secondary place. Another variable is connected with the language-specific utilization of the source elements, which leads to particular subtle distinctions between the marked and the neutral obstruents.

Ideally, the proposed representations should find support in other areas of a given phonological system. Convergence of disparate effects is one of the symptoms of correctly established representations. Below, we consider yet another variable, this time involving the utilization of the noise element (h) across languages. This will allow us to see better how various aspects of the system of Irish consonants converge.

3.3. The h-parameter

It seems that we may further refine our understanding of the Irish consonantal phonology by making a particular systemic claim.

The claim concerns the systematic absence of the noise element (h) in the Irish language, and possibly also Welsh, as will be shown in the following section. This proposal was first made in Cyran (1996b) and argued for on the basis of a number of phonological phenomena in Irish.[54] Let us first see how the scale of preferred clusters looks after this innovation, before we

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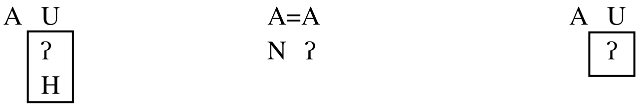
[54] There is a general tendency in GP to eliminate the manner elements (h, ʔ) completely (e.g. Jensen 1994, Kaye 2001, Ploch 1999, Pöchtrager 2006, Ritter 1997). In this work, it is assumed that both of them are necessary, while noise can be absent in systems as a parametric choice, just as some languages may choose not to utilize any of the tone elements, and have just one series of obstruents, e.g. Malakmalak (12).

offer some additional support for the claim, which is based on the analysis of the segmental inventory of Irish.

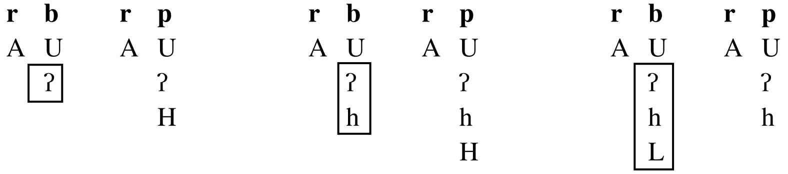
(22) a. /kɪ **r´** **p´** ax/ b. /bau**n** **d** ə/ c. /g´e **r´** **b´** ə/



Notice that the systematic absence of the noise element makes all the obstruents less complex. However, the relevant distinctions which were discussed under (21) still hold. The voiceless stops continue to be the most complex. What needs to be said in the case of the new representations in (22) is that the cut-off point between good contacts and bad ones is below two manner elements. If the obstruent has two such elements, it may form a good contact. If the obstruent is less complex, the cluster will have to be broken-up by epenthesis. As mentioned earlier, contacts such as those in (22b) survive due to homorganicity, not complexity.

It will be recalled that substantive complexity merely provides a non-arbitrary scale with cut-off points, whose choice is then an arbitrary property of particular grammars. However, given the general principle that good contacts are those with steep complexity slope, we may venture a comparison between Irish and other languages, in which the consonantal system is not deprived of the noise element and the complexity slopes are thereby steeper. It may be the case that the internal representation of Irish obstruents has some influence on the fact that the clustering in this system is so stringently conditioned, and why seemingly the same cluster, say [rb], is better off in a system like English or Polish.[55]

(23) a. ***Irish*** b. ***English*** c. ***Polish***



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[55] Let us assume that we are dealing with a rhotic variety of English, that is one in which [r] is pronounced in the coda.

In fact, the best [rb] contact is found in Polish in which voiced obstruents have an additional element (L). Note that even in contexts for devoicing, that is, (L)-delinking, the Polish cluster [rp] will still exhibit the same complexity slope as English [rb] (23b) or Irish [rp] (23a). Thus, Irish [rp] patterns with Polish and English in terms of its complexity differential as well as in showing no epenthesis. Note that the Irish [rb] sequence exhibits some degree of complexity steepness but is still disallowed, in contradistinction to Harris' position that coda-onset sequences may be even equal in terms of complexity. This question will be taken up in the following chapters. It seems that some additional factor is at play, which makes such contacts possible in, for example, English, but totally illicit in Irish.

In what follows we will take a closer look at elemental representations of Irish consonants in the light of this new assumption concerning the noise element, and see how the segmental inventory and certain phonological processes can now be understood better.

3.4. Segmental inventories and complexity

There are two aspects of the consonant system of Irish which attract one's attention immediately. The first one concerns the quality distinction between the palatalized and velarized series, which was briefly mentioned earlier in the discussion of vocalic alternations. The second characteristic feature is the presence of word-initial consonant mutations which occur in particular morpho-syntactic contexts.[56] In the list of consonants below, palatalization is marked by the diacritic '´', while velarization is not represented by any diacritic.

(24) ***Irish consonants***

Labial	p, p´, b, b´, f, f´, v, v´, m, m´
Coronal	t, t´, d, d´, s, ʃ, n, n´, l, l´, r, r´[57]
Velar	k, k´, g, g´, x, x´, ɣ, ɣ´, ŋ, ŋ´
Glottal	h

A few comments are in order here concerning the status of the consonants listed above. In word-initial position [x, x´, v, v´, ɣ, ɣ´] occur only in leni-

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[56] An analysis of initial mutations in a related language, that is, Welsh is offered in the following section.

[57] The palatalized version of [s], that is, [ʃ] is in fact palatal.

tion contexts, that is, they are derived, as it were, from [k, k´, ʃ, b, m, f, b´, m´, f´, g, d, g´, d´]. Of these restricted fricatives, [x] has the widest distribution as it also occurs intervocalically, in clusters, and word-finally. [v] tends to freely alternate with [w] word-initially. Both [v] and [v´] are found finally, but they tend to be elided in intervocalic position, as will be shown later. On the other hand, [f] is restricted in word-final position to two items which may be native and a handful of borrowings (see Doyle and Gussmann 1996: 135). The pair [ɣ, ɣ´] is not found outside the initial mutation context, while [h] not only does not have a palatalized congener (Ó Cuív1975: 11), but it is restricted to initial position of lexical items which are mostly borrowings. For this reason, [h] will be kept out of the discussion of the Irish consonant system below.[58]

In general, what is striking about the system of consonants in Irish is the restricted distribution of fricatives, of which [f, s, ʃ, x] seem to fair best, and a very low profile which is kept by the voiced fricatives, a point which calls for a principled account.

In order to see the peculiarities of the Irish system better it will be compared with that of Polish, and Malakmalak.[59] The palatalized / velarized distinction in Irish is disregarded in what follows.

(25)	***plosives***	***affricates***	***fricatives***
Polish	p t k	t͡s t͡ɕ t͡ʃ	f s ɕ ʃ x
	b d g	d͡z d͡ʑ d͡ʒ	v z ʑ ʒ –
Irish[60]	p t k	– – –	f s – ʃ x/h
	b d g	– – –	v$^?$ – – – ɣ$^?$
Malakmalak	p t tʲ k	– – –	– – – – –
	– – – –	– – –	– – – – –

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[58] Some examples are: *haircín* 'hurricane', *hata* 'hat', *hidrigin* 'hydrogen', *histéire* 'hysyeria', *héileacaptar* 'helicopter'.

[59] Malakmalak is an Australian language whose consonantal system involves the following objects (Maddieson 1984: 327): *Stops*: p, t, tʲ, k; *Nasals*: m, n, nʲ, ŋ; *Liquids*: r, ɹ, l, lʲ, j, w. The superscripted 'ʲ' denotes palato-alveolars, contrasting with alveolars.

[60] Marginally, one comes across instances of [d͡ʒ] and [z] in Irish. However, they can hardly be treated as part of the phonological system.

Let us first identify the similarities and differences between Polish and Irish obstruents. In broad phonemic terms, the two languages seem to have analogous systems of stops. Practically, this is where the surface similarities end. Polish has a group of affricates while Irish has none.[61] And finally, while Polish has a fairly symmetrical system among the fricatives in terms of voicing which is also reflected in its affricates and stops, Irish has a defective system in which the voiced fricatives are highly restricted, or virtually non-existent. One might ask a number of questions concerning the defective Irish system, for example, why there are voice contrasts among the stops but not among the fricatives? Why the systems of stops appear to be similar in Irish and Polish while everything else is so different? Could we expect the reverse situation? What is the nature of the gap concerning the affricates? Could we predict a system in which there are no fricatives, but there are voiceless affricates? Is there any formal connection between the absence / presence of voice contrasts among fricatives and the absence / presence of affricates? How Malakmalak fits the picture?

It turns out that most of the above questions can be answered by referring to a single representational aspect which makes all the difference between Polish and Irish. The answer involves the aforementioned hypothesis that Irish does not make use of the noise element (h). Metaphorically, we may say that Polish is a 'noisy' language, while Irish is 'noiseless'. Let us compare the representations of obstruents in Polish and Irish beginning with the stops.

(26) ***Polish stops***

[b]	[p]	[d]	[t]	[g]	[k]
U	U	A	A	_	_
h	h	h	h	h	h
ʔ	ʔ	ʔ	ʔ	ʔ	ʔ
L		L		L	

Irish stops

[p]	[b]	[t]	[d]	[k]	[g]
U	U	A	A	_	_
ʔ	ʔ	ʔ	ʔ	ʔ	ʔ
H		H		H	

The above representations show how identically looking segmental inventories of stops are dramatically different phonologically. They show that making lists of segments or phonemic inventories is both futile and misleading if a thorough analysis of the internal structure does not go with it.

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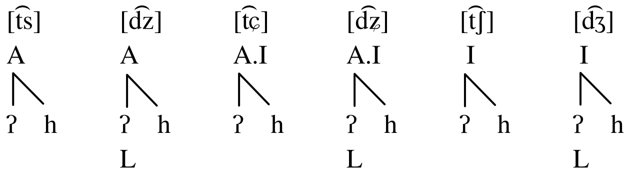
[61] In Donegal Irish palatalized dentals are pronounced with affrication (Ó Dochartaigh 1987). However, this need not be viewed as the presence of affricates in the system.

Firstly, the voice specification is different in that Polish uses (L) versus nothing, whereas Irish has (H) versus nothing. Secondly, the noise element (h) features with a vengeance in Polish, but is completely missing in Irish. It is only to be expected that the two systems will also behave differently. In Polish we have devoicing of obstruents, while in Irish the more complex character of the voiceless stops plays an important role in clustering, as we saw in the previous sub-section. What is worth noting is the representation of [g] in Irish which is as different from its Polish counterpart as can be. In Polish, this consonant is made up of three elements while in Irish it contains only one, the stopness itself. How is this single element interpreted as a voiced velar plosive? Firstly, it is a plosive because it has the stopness element. It is velar because it has no place specification, and it is voiced because the system interprets unmarked obstruents as voiced. If Polish was a ‘noiseless’ language like Irish, but continued to have the same specification of voicing (L vs. nothing), then the representation of the stopness element alone would give a phonetic [k].

As we will see shortly, the simplex representation of [g] in Irish allows us to understand why this is the only stop which is deleted intervocalically. To conclude our discussion of Polish and Irish stops, we must emphasize the fact that, despite the impoverished representations, all the existing contrasts in Irish are captured in our system.

The problem of the absence of affricates in Irish may follow from the absence of (h) as well. Harris (1990) proposes that the representation of affricates involves a contour structure whereby the relation between stopness (ʔ) and noise (h) is broken up. Below we give tentative representations of Polish affricates, with headedness deliberately unspecified.

(27) ***Polish affricates***



Whether affricates are indeed contour structures, or the mere presence of ‘noise’ brings out the effect of affrication, one thing is clear. A system without ‘noise’ should not have affricates, and Irish is such a system.[62] On the other hand, a language with ‘noise’ may have affricates and Polish is an example.

Let us now turn to the difference between Polish and Irish fricatives. This class of segments is the most interesting with respect to the proposal that ‘noise’ is missing in Irish, because this category is normally responsible for aperiodic energy in the acoustic signal, that is, friction. As shown in the representations of Polish fricatives in (28), the noise element is the inherent property of this class of obstruents just as stopness was the defining property of plosives. Irish has to do without the noise category, and it does. The question is, how?

It has been proposed within Government Phonology that the headedness of resonance elements, which produces tenseness in vowels, may also bring about the stronger articulation in non-vocalic positions, whereby, the representation of fricatives without noise becomes possible (Cyran 1996b, Ritter 1997). Thus, it is possible to say that a labial fricative is a phonetic interpretation of a headed ($\underline{U}$) element, which, when headless, represents the labial-velar glide [w]. Then, the fluctuations of the type [v~w] and indeed [r~ɾ] in Irish can be viewed as head switches ($\underline{U}$)~(U) and ($\underline{A}$)~(A) respectively.[63]

(28)

Polish fricatives									***Irish fricatives***				
[v]	[f]	[z]	[s]	[ʑ]	[ɕ]	[ʒ]	[ʃ]	[x]	[f]	[v]	[s]	[ʃ]	[x]
U	U	A	A	A.I	A.I	I	I	_	$\underline{U}$	$\underline{U}$	$\underline{A}$	$\underline{I}$	_
h	h	h	h	h	h	h	h	h	H		H	H	H
L		L		L		L							

Concentrating now on the remaining Irish fricatives, it will be noted that this way of representing the Irish fricatives suggests that the voiceless series contrasts directly with glides and liquids, phonologically speaking, and

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[62] See Rubach (1994) for a proposal that Polish affricates are strident stops from the point of view of phonology, and also Rennison (1998) who considers other formal devices to replace contour structure. Rennison’s proposal still relies on a physical presence of particular primes, in this case the ‘noise’ element.

[63] See Cyran and Nilsson (1998) for a discussion of the Slavic shift [w] > [v] which involves two different alternations: [w~v], that is (U)~($\underline{U}$), and [v~f], that is (U,h,L)~(U,h). See also Golston and van der Hulst (2000) who derive stricture from structure rather than from a separate melodic prime.

not with voiced fricatives. A true phonological voiced fricative in Irish is possible only if ‘noise’ is part of the system. Thus, Irish [f] contrasts directly with an object which is sonorant-like in character, as it is represented only by one resonance element.[64] Note that [s] directly contrasts with (A̲), which stands for the phonetic trill [r]. This ‘noiseless’ system has therefore a direct influence on the absence of [z] in Irish.[65] Furthermore, Irish [ʃ] directly contrasts with [j], hence there is no [ʒ]. In fact, the palatal glide in Irish also has a near-fricative realization, that is, [ʝ], which is the result of the headed status of the element (I̲). It seems that we can also account for the most restricted Irish fricative, that is [ɣ], which occurs only as a result of lenition word-initially. Depending on the way we represent velarity – it will be recalled that velarity may also be represented by means of the so called neutral element – this segment may be the realization of a neutral element, or, as suggested by the above representations, it is the phonetic interpretation of an empty onset.[66]

Finally, a word of comment is in order concerning the fricative [x]. It is a headless object because it has no place element. On the other hand, it contains the high tone element which is also responsible for voicelessness and aspiration. Quite possibly we are dealing here with a third source of phonetic friction in the Element Theory. Namely, next to the noise element, which is absent in Irish, and headedness of the resonant element, which appears to be utilized to the full in this system, also the high tone

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[64] The voiced labial fricative is notorious for displaying sonorant-like characteristics cross-linguistically. This is true of, for example, Russian (Andersen 1969), Polish (Gussmann 1981, 2002), Slovak (Rubach 1993), Hungarian (Siptár 1996, Szigetvári 1998).

[65] Irish seems to be the type of system that, provided it had a process of H-deletion, would exhibit the rhotacism of [s] > [r] instead of the voicing of [s] > [z] in a process like Verner’s Law which generally voices fricatives (Cyran 1997: 192).

[66] Empty onsets in Irish may license velarization or palatalization (Cyran 1997), hence, [ɣ] and [ɣ´] could indeed be treated as empty onsets with secondary articulation, a situation comparable to the [u~i] alternations discussed in 4.1., where nuclei had no specification and were interpreted as [u] or [i] depending on what secondary specification was lodged on the following consonant. Note that [ɣ´] is in fact [ʝ], that is, a palatal fricative, and as we remember, the (I) element of palatalization affects objects as the head, hence the friction is expected in each such case. For this reason Irish does not exhibit the alternation [ʝ]~[j], that is a (I̲)~(I) fluctuation (Ó Cuív 1975: 42).

may be responsible for the phonetic effect of friction.[67] This richness of the potential sources of one phonetic effect shows manifestly that any *ad hoc* representation of phonetic facts by means of elements is likely to be wrong, as phonetic effects of different theoretical categories may overlap. This, however, is not a drawback of the element system but rather its inbuilt positive potential to cover, for example, such phenomena as phonologization, reanalysis, and other phenomena leading to language change.[68]

In general, the existing phonetic voiced fricatives in Irish are not fully-fledged phonological objects, which is a result of the missing noise element and the fact that voiced friction is derived by other, less stable means, that is headedness. Thus, it seems that the systematic absence of (h) almost single-handedly accounts for the main distinctions between Polish and Irish obstruent systems. What initially appeared to be a defective and asymmetrical system, turns out to be perfectly symmetrical, given the resources it has at its disposal. Its defective nature follows from the fact that not all universally recognized primes are utilized. Specifically, Irish makes no use of the ‘noise’ category. On the other hand, we see that Polish must have this category to be able to express the additional contrasts, that is, affrication and voice among the fricatives. Hence, we propose that the utilization of the noise element is subject to parameterization.[69]

It should be borne in mind that almost every obstruent in Irish differs markedly from the phonetically corresponding object in Polish. This also refers to the seemingly identical systems of plosives (25). What these results demonstrate is that it is impossible and hence erroneous to determine the phonological composition of segments on phonetic grounds, or on the basis of a superficial analysis. Phonetic contrasts in voicing do not directly correspond to particular laryngeal elements. Likewise, some phonetic contrasts in manner of articulation need not directly correspond to particular elements. This is evident in the case of friction.[70]

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[67] In fact, the effects formerly ascribed to the noise element (h) are now often attributed to the dual behaviour of the high tone (H). See e.g. Kaye (2001).

[68] For an example of phonologization and language change in the Element Theory see Cyran and Nilsson (1998), which concerns the Slavic shift from [w] to [v].

[69] It seems now, that any attempt to eliminate the noise element in the Element Theory should be able to offer a new interpretation of noisy and noiseless languages like Polish and Irish, respectively.

[70] We make no particular claims concerning stopness (ʔ) and nasality (N). See however Jensen (1994), Nasukawa (2005), Pöchtrager (2006), Ploch (1999).

Let us briefly return to the comparison in (25) and in particular to the system of Malakmalak consonants. For fear of contradicting the above conclusions we may tentatively suggest what parameters should be checked to account for what this language has. It seems that it can be characterized first of all as ‘toneless’, that is, neither (H) nor (L) is used. For this reason, there is only one series of stops, that is the voiceless unaspirated one. Malakmalak also appears to be ‘noiseless’. The absence of (h) excludes affricates and fully-fledged fricatives. Potentially, such a system could have voiced fricatives if its resonance elements could be headed. Since there are only glides and liquids, we may suspect that this language does not utilize headedness either. Recall, that fricatives have three representational sources: a) the noise element (h), b) headedness of resonance elements, and c) high tone, as in the case of Irish [x]. Since no analysis of Malalkmalak is provided here, the above definition of its consonantal system must, of course, be viewed as a sheer speculation.

Returning, again, to the Irish consonants we must emphasize that the impoverished (h-less) system allows us to understand better quite a number of seemingly unrelated issues. Firstly, we saw that the less complex nature of Irish obstruents sets it clearly apart from ‘noisy’ languages such as English and Polish in terms of phonotactic restrictions, or more specifically, clustering (23).[71] The uniform absence of ‘noise’ also accounts for some crucial aspects of the segmental inventory of Irish consonants, in particular, the absence of voice oppositions among the fricatives and the complete absence of affricates.[72] It seems that we also gain an insight into a few other phenomena concerning Irish consonants. For example, in lenition contexts, [m] and [b] lenite to [v]. If the fricative were a typical obstruent containing (h), we would be able to understand [b] > [v], but not [m] > [v], in which case the phenomenon would have to involve the loss of nasality and the addition of noise.[73] Under the ‘no-noise’ assumption this problem is non-existent, as the shift [m] > [v] is simply ($\underline{\text{U}}$,N) > ($\underline{\text{U}}$).

Earlier, in our discussion of Irish stops, we mentioned that [g] is now a simplex object (ʔ._). On the other hand, in models operating with sonority or strength scales the position of this segment in Irish should be relatively

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[71] Note that the representations in (23) show distinctions which are hardly calculable in sonority-based systems.

[72] One should bear in mind that the presence of (h) does not guarantee the presence of affricates. What is meant here is that the absence of (h) in a system means that it will not have such objects.

[73] The following section deals with Celtic mutations in much more detail.

analogous to that of [g] in English or Polish. For these models, deletion of [g] in intervocalic position, or in Welsh mutations (see section 4), is a complete accident. In a model operating with sub-segmental complexity in terms of elements, this is fully predicted, given the correctness of the ‘no-noise’ hypothesis.

To conclude this section, let us consider the following phenomenon. Two segments, [g] and [v], tend to be deleted in intervocalic position in Munster Irish. As a result, a long vowel is created. The velar plosive is lost in the verbal system when the first person ending *–im* is added to a stem ending in this consonant (29a). That the personal ending contains a lexical vowel is shown by such forms as *las / lasaim* [lɑs / lɑsɪm´] ‘light / I light’. The labial fricative, on the other hand, is lost in the nominal system when a vocalic ending is added (29b). In this case, we are dealing with the same kind of genitive formation as in *cearc / circe* [k´ark / k´ir´k´ə] ‘hen / gen.sg.’, that is, by addition of the ending *–e*, which palatalizes the preceding consonant.

(29)	***Imperative***		***Ist person sg. ([-im´])***		
a.	[n´ig´]	*nigh*	[n´i:m´]	*ním*	‘wash’
	[sig´]	*suigh*	[si:m´]	*suím*	‘sit’

b.	[uv]	~	[i:][74]	*ubh / uibhe*	‘egg/gen.sg.’
	[n´iv´]	~	[n´i:]	*nimh / nimhe*	‘poison/gen.sg.’

The question is what [g] and [v] have in common to be deleted intervocalically, or what makes them different from other consonants? A quick look at the representation of these objects in terms of elements tells us that the two consonants are mono-elemental. Note that in the lenition trajectories discussed in, for example, Lass (1984), or Harris (1990, 1996) the pre-deletion stages usually involve simplex objects like glottal stops [ʔ], or glottal fricatives [h], which in the Element Theory are simplex objects. What the pre-deletion stages of Irish [g] and [v] have in common with other known types of deletable objects is precisely the same complexity, that is, being represented by only one element. This connection does not follow from any scale of sonority or strength unless the scales are seriously manipulated, or arbitrarily set on the basis of observation. In our model, such facts follow directly from the internal representation of consonants in a given system,

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[74] This form is pronounced as [iv´ə] in Connemara and Donegal Irish.

which must be first arrived at through analysis. Note that the representation of Irish obstruents has been shown to converge on a few disconnected aspects of the phonological system. These areas are phonotactics, segmental inventories, and phonological processes.

In the following section the complexity-based model is tested against the well-known phenomenon of consonant mutations. This will be done on the basis of data from Welsh, which, like Irish, is a Celtic language, and is also h-less.[75]

4. Initial consonant mutations in Welsh

4.1. Introduction

Alternations of initial consonants, called mutations, are among the most distinctive traits of Celtic languages.[76] As a result of these mutations, a few different surface forms of a given lexical item can be observed depending on the grammatical context. For example, the Welsh word *cath* [ka:θ] ‘cat’ begins with a voiceless velar plosive in the phrase *eu cath* [i ka:θ] ‘their cat’, but there is a corresponding voiced plosive in the phrase *ei gath* [i ga:θ] ‘his cat’, a voiceless velar fricative in *ei chath* [i xa:θ] ‘her cat’, and a voiceless velar nasal as in *fy nghath* [və ŋ̊a:θ] ‘my cat’. Similar effects are observed in Irish as well. For example, the same word *cat* [kɑt] ‘cat’ appears as [ə xɑt] ‘his cat’, [ə gɑt] ‘their cat’, and [ə kɑt] ‘her cat’.

The above examples serve to illustrate two points. Firstly, they show the phonetic correspondences between the various reflexes of the initial consonant [k] in Welsh and Irish, which are clearly phonologically related and do not form arbitrary sets of forms, even though, analogous grammatical

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[75] For a thorough analysis of the Irish initial mutations within the Element Theory can be found in Jaskuła (2006). In what follows some comparison will be made between Irish and Welsh to show that the switch of language in our presentation is warranted.

[76] The study of initial consonant mutations in Celtic languages is a well-ploughed area. There are numerous accounts of the phenomenon within a number of theoretical frameworks. The list of authors which follows is only partial and includes works on Welsh, Irish and Scottish Gaelic: Awbery (1973), Ball and Müller (1992), Ewen (1982), Green (2003), Grijzenhout (1995), Gussmann (1983, 1986), Hamp (1951), Morgan (1952), Ní Chiosáin (1991), Oftedal (1962), Ó Cuív (1986), Ó Siadhail (1989), Pilch (1975), Pyatt (1997), Stewart (2004), Thurneysen (1949).

contexts lead to different effects in the two languages. Thus, some phonological description of the mutations is necessary and warranted. Secondly, the above data illustrate the fact that phonetically identical contexts (postvocalic) trigger disparate effects on the initial consonant. In other words, the different types of mutations, which are complementary in the respective grammatical contexts, are the only exponents of the different meanings. The relationship between the phonological context and the effect is broken.

Thus, at the outset of this discussion we must realize that we are not going to discuss a real phonological process that is taking place synchronically (Gussmann 1983, Green 2003, Jaskuła 2006). Rather, we will concentrate on the representational relationship between the alternating forms with a view to demonstrating that the Element Theory and the concept of melodic complexity offer a good tool to understanding these relationships. The following analysis will not be that of a live phonological process, but it will nevertheless attempt to provide some answers concerning the scope of different mutations, the nature of exceptions, as well as shed some light on the problem of the learnability of such complex phenomena in language acquisition. Phenomena such as reradicalization consisting in mistaken uses of mutation patterns to derive wrong basic forms (Ball and Müller 1992, Chudak, in prep.) suggest that learners do attempt to construct the phonological regularity of mutations despite the fact that they are no longer truly phonological.

It is generally assumed among historians of the Celtic languages that originally (4th – 5th century AD.) the mutations were purely phonological phenomena. We may refer to them as sandhi effects, triggered by clearly defined phonological contexts which arose in close syntactic configurations such as *preverb* + *verb*, *article* + *noun*, or *noun* + *adjective*. What is interesting is that the external sandhi phenomena mirrored similar effects within the word, which can be illustrated by such Welsh borrowings from Latin as *a**p**ostlus* > *a**b**ostol* [abostol], *pe**cc**ā**t**um* > *pe**ch**o**d*** [pexod], or *A**d**am* >*A**dd**af* [a:ðav]. The effect of lenition illustrated by the above forms may be given a structural description as occurring in intervocalic position within the word. There is some historical evidence which allows us to assume that the sandhi contexts created similar environments to those in which consonants were lenited word-medially. The identification of the two contexts can be schematically illustrated in the following fashion.

(30) ...V**C**V... = ...V#**C**V...

The sound shifts within the word were lexicalized, giving ***pechod*** [pexod] and *Addaf* [a:ðav] in modern Welsh, while the sandhi alternations later became grammaticalized (6th century) due to the fact that, for the most part, the phonological triggers disappeared together with the loss of final syllables. Thus, the mutations themselves continued to act as the exponents of gender, number, or case, and *de facto* became part of morpho-syntax rather than phonology proper.

Before we look at possible triggers for the various mutations let us first get a more general view of what can happen to consonants when they are mutated. In order to facilitate the comparison between Irish and Welsh a somewhat simplified picture is presented where the secondary articulation distinctions on Irish consonants are ignored.

(31) ***Effects of mutations on a consonant in Irish and Welsh***

Irish

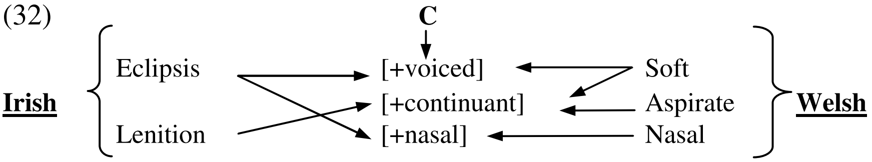
Basic	k	g	t	d	p	b	s	f	m
Lenition	x	ɣ	h	ɣ	f	v	h	ø	v/w
Eclipsis	g	ŋ	d	n	b	m	-	v	-

Welsh

Basic	k	g	t	d	p	b	s	f	m	ɬ	r̥
Soft M.	g	ø	d	ð	b	v	-	-	v	l	r
Aspirate M.	x	-	θ	-	f	-	-	-	-	-	-
Nasal M.	ŋ̊	ŋ	n̥	n	m̥	m	-	-	-	-	-

It has been noted that, if we disregard other minor changes and adjustments in individual cases, the mutations of initial consonants can be captured in terms of manipulating only three features (e.g. Awbery 1973, Ball and Müller 1992, Fife 1993). This idea is represented below graphically.

(32)



The consonants affected by initial mutations can either become voiced, spirantized, nasalized, or be deleted. Individual modern Celtic languages, however, differ with respect to the actual implementation of the shifts. Thus, in Irish, the process of eclipsis, which historical descriptions refer to as nasalization (e.g. Thurneysen 1946), results in the voicing of some obstruents and the turning of others into nasal consonants. Lenition in this language turns stops into fricatives, weakens [s] to [h], deletes [f], and also turns [m] into [v/w], as the list in (31) demonstrates.

In Welsh, on the other hand, lenition, which we will call soft mutation, either voices or spirantizes stops, but it also deletes [g], turns [m] into [v], and voices [ɬ, r̥] to [l, r]. With respect to the spirantization of stops, soft mutation coincides in its effects with aspirate mutation in that both processes involve turning stops into spirants. However, aspirate mutation only affects the voiceless stops, which in soft mutation are voiced rather than spirantized. Finally, unlike eclipsis in Irish, the nasal mutation in Welsh turns all its targets into nasal sounds, whether voiced or voiceless.

Before we consider some data illustrating the mutations in Welsh, let us briefly look at the putative phonological triggers of the mutations, which we can reconstruct to some extent. In general the three main contexts for the consonant changes may be represented in the following fashion.

(33) ...V#CV... > lenition
...s#CV... > spirantization or no effect
...n#CV... > nasalization

Lenition required that the initial consonant found itself in an intervocalic environment. If the first element of a close syntactic unit ended with an [s], this resulted either in spirantization of the following initial, or in no change at all. On the other hand, a nasal consonant in that position brought about nasalization of the following initial. Some examples concerning Welsh and Irish follow below. The capital letter following the forms denotes the type of mutation they caused on the initial consonant of the following attributive adjective. ^{S} = Spirantization / Aspirate mutation, ^{L} = Lenition / Soft Mutation, ^{N} = Nasalization / Nasal Mutation / Eclipsis.

(34) ***A reconstructed Brittonic o-stem declension*** (Russell 1995: 123)

Singular

Nom.	*mapos	>	**mab (+^{S} in Breton)
Acc.	*mapon	>	**mab^{N}
Gen.	*mapī	>	**meib^{L}
Dat.	*mapū	>	**meib^{L}

Plural

Nom.	*mapī	>	**meib^{L}
Acc.	*mapūs	>	**meib^{S}
Gen.	*mapon	>	**mab^{N}
Dat.	*mapobi/os	>	**mabof$^{L/S}$

Although in modern Welsh most of the case endings are lost, the former, reconstructed forms for *mab* [ma:b] ‘son’ allow us to identify the connection between the shape of its final syllable and the type of mutation the noun used to impose on the following syntactically close material. A vocalic context led to lenition, a nasal one to nasalization, and the presence of [s] either led to spirantization or to nothing. It must be emphasized, however, that the absence of mutation refers to the basic form, sometimes called the ‘radical’ form, which continued to play a role in the alternations and later in the exposition of the particular meanings, just as much as mutated forms did.

The following development in the history of Irish illustrates similar effects, with the additional comparison between masculine and feminine declensions showing the origin of the intricate complementarity of mutation effects which pervades the grammatical systems of Celtic languages even today.

(35) ***Development of the Old Irish declension*** (Russell 1995:41)

	io-stem (masc.)					ā-stem (fem.)	
	Proto-Celtic	*Proto-Irish*	*Old Irish*		*Proto-Celtic*	*Proto-Irish*	*Old Irish*
Nom.	**donii̯os**	**dunei̯ah**	**duine**	cf.	**tōtā**	**tōta**	**túath**^{L}
Voc.	donii̯e	donii̯e	duini^{L}				
Acc.	donii̯on	donii̯e	duine^{N}				
Gen.	**donii̯ī**	**dunii̯i**	**duini**^{L}	cf.	**tōtii̯ās**	**tōtei̯ah**	**túaithe**
Dat.	donii̯ū	dunii̯u	duiniu^{L}				

What is interesting in the data above is that the historical mutation effects are retained in modern Irish regardless of the fact that the contexts were opaque as early as the Old Irish period. Note that the nominative form of the masculine noun *duine* ‘man’ did not mutate the following attributive adjective even though the context was vocalic. Likewise, the feminine noun *túath* ‘tribe, people’, did cause lenition although it ended with a consonant. However, if we go back far enough in the reconstruction of these forms (to Proto-Celtic), we may identify the right contexts and gain some inkling as to when the mutations were full blooded phonological phenomena, and when they became mere exponents of grammatical information such as gender, case, etc.

After this brief and rather general introduction let us examine the effects in more detail.

4.2. Soft Mutation (SM)

Soft mutation, or lenition, is the most pervasive of the initial consonant alternations in that it involves the greatest number of targets and triggers. It is also the most complex mutation in terms of the number of processes involved (Awbery 1973, 1986, Thomas 1992, Ball and Müller 1992, Buczek 1995). To some extent, SM may also be claimed to be a fairly productive phenomenon. Watkins (1993: 306) gives an example of the English borrowing *chips* which begins with a consonant which is not even part of the phonological inventory of Welsh but still gets regularly lenited in colloquial speech producing [dʒɪps] as in *a bag of chips* [bag o dʒɪps]. All of the targets, with a sample group of triggers, are represented below.[77]

(36) ***Soft Mutation***

Target	*Example and Trigger*
p > b	*pen* [pen] 'top, head' > *ar ben* [ar ben] 'on top' (nouns after prepositions)
t > d	*tad* [ta:d] 'father' > *Duw Dad* [diu da:d] 'God the Father' (a noun in apposition)
k > g	*dŵr* [du:r] 'water', *ci* [ki:] 'dog' > *dwrgi* [ˈdurgi] 'otter' (compound)
b > v	*bach* [ba:x] 'little', *merch* [merx] 'girl' > *merch fach* [merx va:x] 'little girl' (adjective following a feminine noun)
d > ð	*daeth* [da:iθ] 'he came' > *yr un a ddaeth* [ər i:n a ða:iθ] 'the one who came' (after the relative particle *a*)
g > ∅	*gardd* [garð] 'garden' > *yr ardd* [ər arð] 'the garden' (feminine singular noun after definite article)
ɬ > l	*llanw* [ɬanu] 'filling, VN.' > *wrth lanw* [urθ lanu] 'by filling' (verbal noun after preposition)
r̥ > r	*rhaff* [r̥a:f] 'rope' > *ei raff* [i ra:f] 'his rope' (noun after masculine singular possessive pronoun)
m > v	*merch* [merx] 'girl' > *un ferch* [i:n verx] 'one girl' (a feminine noun following *un* 'one')

Although, as mentioned earlier, all the initial mutations in Celtic languages can be captured by using the three major features mentioned earlier, that is

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[77] For more exhaustive surveys of the triggers of all types of mutations in Welsh see, for example, Williams (1980), Ball and Müller (1992).

[+voice], [+continuant] and [+nasal], a quick glance at only one type of mutation in Welsh shows that the situation is rather more complex. In pretheoretical terms we may describe soft mutation as involving five processes. The voiceless stops [p, t, k] become voiced [b, d, g], the voiced anterior stops [b, d] become the corresponding voiced fricatives [v, ð], the voiced velar plosive [g] is deleted, the voiceless liquids [ɬ] and [r̥] are voiced, that is, they become modal liquids, and the bilabial nasal [m] becomes the labiodental [v].

Ball and Müller (1992), among others, working within a feature-based derivational model, show that these five processes can be collapsed into three if certain assumptions are made. Thus, we may talk about one major voicing process which turns [p, t, k, ɬ, r̥] into their voiced congeners [b, d, g, l, r]. The second process would involve the spirantizing of voiced stops including [g]. For this description to be upheld, we must assume that at some stage of the derivation a voiced velar fricative *[ɣ] is produced which is later deleted by other rules. And finally, the process turning [m] into [v] may be included in the second group, that is spirantization, under the proviso that, here too, the derivation is allowed to involve an abstract stage with a nonexistent nasalized voiced labio-dental fricative *[ṽ], that is *m* > **ṽ* > *v*. Here, parallel to the derivation of *g* > **ɣ* > *ø*, the simplification is effected at the cost of introducing abstract stages and having to posit further adjustment rules to arrive at the correct result.

As for the voicing process, one has to express some reservations concerning the theoretical validity of this generalization. The problem concerns not so much the formulation of the rule as the representation of the targets and products of the rules. It is normally assumed, at least in privative feature models, that voicing of sonorants is a default property which need not be specified phonologically, while it must be specified in obstruents (e.g. Lombardi 1995). The treatment of plosives and liquids as a natural class for the purpose of unifying the process of SM, in total disregard of the asymmetry in their universal voice specification, seems to be rather dubious.

The spirantizing rule, on the other hand, raises the question of the abstractness of phonological derivations, while leaving us with no way of getting round the problem of the need for a number of phonetic adjustment rules, for example, one turning bilabial place into labio-dental in *m* > *v*. Though we can posit a late rule of **ɣ*-deletion or **ṽ*-denasalization, this does not explain why it is the former that is deleted altogether and not the latter. The *m* > *v* change also involves a change of major class features.

The above reservations are not real objections as they only describe the necessary additional mechanisms which allow for a full derivation of soft mutation within a particular model. The problem, rather, is that the reduction of SM rules to three major ones and a host of minor ones does not convince us that we have simplified anything or indeed understood more than if we reverted to an analysis with five processes. The criterion for a successful analysis of the mutations should probably be one of a better understanding of the phenomenon rather than one of a more general description. As Ball and Müller (1992: 92) themselves rightly note, the complexity of SM may be only apparent and may simply stem from the complicated theoretical mechanisms, invoked to explain it.

The aim of this section is to demonstrate that the key to understanding the mutations better lies not in the reduction of the types of rules in the derivation but in the internal structure of the targets. Thus, we will first try to arrive at some approximation of what the targets of SM are made up of, hoping that the internal structure will not only be reflected in SM – we can always make assumptions concerning the representation which will yield the right results – but will also connect with other areas of Welsh phonology, such as consonant inventory, distribution, phonotactics, or indeed other, seemingly unrelated phonological phenomena. Once we have arrived at the correct representations within the Element Theory, the formulation of rules or constraints will hopefully be dramatically simplified. First, however, let us look at the remaining types of mutation in Welsh.

4.3. Aspirate Mutation (AM)

The term 'aspirate' is used here in line with other major works on Welsh phonology, and there is no linguistic reason why the more apt term 'spirant' should not be used in this context, other than to avoid terminological confusion with SM discussed earlier.

The process of spirantization affects only three radicals, that is, [p, t, k]. It has more triggering environments than nasal mutation, discussed below, but fewer than soft mutation. All the triggers are of a lexical type, for example, *ei* 'her', *gyda* 'along with', *chwe* 'six', or *tua* 'towards'. Some examples are given below.

(37) ***Aspirate Mutation***

p	>	f	*pen* [pen] 'head'	> *ei phen* [i fen] 'her head'
t	>	θ	*ty* [ti:] 'house'	> *ei thŷ* [i θi:] 'her house'
k	>	x	*ci* [ki:] 'dog'	> *ei chi* [i xi:] 'her dog'

This process can be given a straightforward description in terms of the feature [+continuant], as all the voiceless plosives more or less become the corresponding voiceless spirants.[78] The question, however, which one would like to answer is why only this set of consonants is targeted by AM. Does this fact follow from something, or is it totally accidental? In our analysis we will try to show that there may be a phonological reason why voiceless plosives participate in mutations on a larger scale than any other types of consonants. This reason has something to do with the internal complexity of segments. Let us now look at the last major mutation type in Welsh.

4.4. Nasal Mutation (NM)

This process affects all six stops by nasalizing them regardless of whether they are voiced or voiceless. This results in a series of three corresponding nasal consonants for the voiced stops [b, d, g], which become [m, n, ŋ], and in a series of voiceless nasals corresponding in place to the voiceless targets [p, t, k], which become [m̥, n̥, ŋ̊].[79] NM has the smallest number of triggering environments, and it is the only initial mutation type which seems to have retained its original phonological context in the triggers. That is, with some exceptions, almost all triggers of NM contain a nasal themselves.[80] Below we use examples adapted from Buczek (1995: 203). The nasalization is in some sense reciprocal as the nasal of the preposition assimilates to the place of articulation of the following consonant.

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[78] We ignore such details as the adjustment of place in the lenition of [p] to [f] from labial to labio-dental, parallel to the earlier discussed shifts [b]>[v] or [m]>[v], or the fact that [x] in *ei chi* [i xi:] ‘her dog’ tends to be pronounced as uvular [χ]. These phonetic adjustments have no consequences on the representations and do not bear crucially on the analysis.

[79] The nature of the voiceless nasals is debatable. Some realizations are clearly voiceless nasals, while others sound like aspirated voiceless nasals.

[80] An interesting case in point is the possessive pronoun *fy* ‘my’ which causes nasalization in the following noun, for example, *fy mhen* < *pen* ‘my head’. The standard pronunciation of this pronoun is [və], however, in colloquial speech it is pronounced as [ən] and behaves like the preposition *yn* ‘in’ (38) in that the nasal of the possessive pronoun assimilates to the place of the affected consonant. Thus, *fy mhen* ‘my head’ is pronounced as [əm m̥en].

(38) ***Nasal Mutation***

b > m *Bangor* > *yn Mangor* [əm maŋgor] ‘in Bangor’
d > n *Dyfed* > *yn Nyfed* [ən nəved] ‘in Dyfed’
g > ŋ *Goginan* > *yn Ngoginan* [əŋ ˈŋoginan] ‘in Goginan’
p > m̥ *Powys* > *yn Mhowys* [əm m̥owis] ‘in Powys’
t > n̥ *Tresaith* > *yn Nhresaith* [ən n̥reˈsaiθ] ‘in Tresaith’
k > ŋ̊ *Caerdydd* > *yn Nghaerdydd* [əŋ ŋ̊airˈdi:ð] ‘in Caerdydd’

One should also note that NM once again raises the question of changes in major class features. Although intuitively this is a simple process of [–nasal] > [+nasal] in the relevant context, the change of [obstruent] to [sonorant] is not as negligible an adjustment as that of bilabial to labio-dental place in for example *b* > *v* in SM. The point is that this would not normally be regarded as a minor adjustment, or at least, the criteria for minor and major adjustments are not entirely clear.

4.5. Hard Mutation (HM)

Finally, we must mention one more type of consonantal change which resembles the mutations discussed so far, except that it occurs less regularly and in a different context. Hard mutation, sometimes referred to as ‘provection’, represents effects which seem to be the reverse of soft mutation (Ball and Müller 1992: 286) in that the voiced stops [b, d, g] and, less regularly, the voiced fricatives [v, ð] are turned into their voiceless congeners [p, t, k, f, θ]. The changes occur in morpheme-final context and are triggered mainly by the phonological environment, that is, by the following element of a compound or certain derivational endings, for example, verb formation suffixes, which may be characterized as beginning with either [h] or a voiceless obstruent.

(39) ***Hard Mutation***

b > p *bwyd+ha* > *bwyta* [ˈbuɪta] ‘to eat’
d > t *abad+ty* > *abaty* [aˈbati:] ‘abbey’
g > k *gwag+ha+u* > *gwacau* [gwaˈkai] ‘to empty’

In the following sections we will try to understand the various consonantal mutations by first proposing a representation for the relevant consonants. This will lead to a more precise formulation of the changes in phonological terms. It must be remembered that this phonological characterization merely aims at understanding the phenomenon of initial mutations in terms of the necessary modifications that the segments undergo. Since most of the time the changes are divorced from any traceable phonological triggers, except for nasal and hard mutations, we must content ourselves with simply accounting for the effects.

4.6. Representing Welsh consonants

In existing accounts of the mutations in Welsh we note intuitively that there seems to be a distinction between statements which achieve the status of true generalizations and those which are mere descriptions. The former kind includes statements which manipulate the features [continuant], [voice] and [nasal], while the latter type supply redundant properties, such as place adjustment, or even a change of major class, as in the shifts *m* > *v*, or *b* > *m*. Thus, there seems to be a set of primes which are pertinent to a particular phenomenon – they tend to coincide with the features surviving in the underlying representations in underspecification frameworks – and properties which consistently turn out to be redundant. The latter form an arbitrary set, and the battery of redundancy rules which is needed to deal with them provides no insight into the phenomenon in question.

Let us briefly remind ourselves of the basic tenets of the melodic representation in Government Phonology, and apply the model to the Welsh system. The Element Theory in Government Phonology attempts to rid representations of redundancy altogether. It replaces features with primes that enjoy stand-alone interpretability. Each such prime individually or in combination with others is directly mappable onto articulation and auditory perception. Phonological representation in this model is therefore simultaneously redundancy-free and fully interpretable, that is, ready for phonetic implementation with no further specification required (Harris 1996).

The advantage of this model with respect to the problem of redundancy lies in the fact that phonological statements, be they rules or output constraints, refer only to lexically pertinent primes and there is no need to distinguish between true generalizations and other, less important statements. All statements are, in a sense, true generalizations. This model also restricts the nature of rules or constraints. For example, they may refer to combinability of primes (Charette and Göksel 1998, Cobb 1997, Kaye 2001), or their ability to occur in particular prosodic positions (Harris 1997).

Returning to the representation of Welsh consonants, we will tentatively assume the following representations of place. The labels are not meant to be precise phonetic definitions of place but rather act as rough functional distinctions. Since place of articulation does not play any crucial role in mutations the proposed representations will not be argued for.[81]

(40)

U	labials	b, p, m, v, w
A-I	dentals	t, d, θ, ð, n
A	alveolars	r, l, r̥, ɬ
I	palatals	ʃ
_	velars	k, g, ŋ, x

The manner dimension is more complex and a few comments concerning this aspect of the representation of consonants are needed before we consider the Welsh consonants. Let us again consider the list of manner elements below, based on the work of Harris (1990), Harris and Lindsey (1995).

(41)

ʔ	occlusion	b, p, t, d, k, g, l^{ʔ}, ɬ^{ʔ}, nasals^{ʔ}
N	nasality	nasals
H	high tone	aspirated voiceless obstruents
L	low tone	fully voiced obstruents (not in Welsh)
h	noise	fricatives, affricates, released stops

The presence of the occlusion element in plosives is rather uncontroversial. On the other hand, it is not clear why it should be part of the representation of Welsh laterals and nasals, hence the question mark. It is true, that the acoustic definition of (ʔ) is ‘a drop in overall amplitude of the signal’, which may mean complete silence as in stops, or attenuation of energy, as in nasals and laterals. Thus, in theory, there is no reason why occlusion should not be allowed in these consonants. However, there is also no reason why it must be present. Other sonorants, for example, glides, also exhibit attenuation in the signal as compared to vowels, but it would be inappropriate to claim that this is the result of the presence of occlusion. In this

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[81] The compound A-I is a shorthand notation which avoids resolving the question as to which of the two elements is the head and which one is the operator. It must be added that the representation of dentality in Welsh does not constitute a universal assumption concerning this place, although the same compound is used to define dentality in Irish and Polish in Cyran (1997: 222).

work we will retain this element in laterals. As for nasals, the situation is not straightforward.[82]

It is an inherent property of the Element Theory that to obtain a nasal consonant it should be sufficient to have a nasal element and some place specification, underlying or acquired through assimilation. The role of occlusion in this class of consonants requires further research, especially in the light of common assimilations to stops. We will assume that it is absent in nasals unless there are reasons for its presence, in which case we will still get a nasal consonant, albeit a more complex one. In other words, either (U,N) or (U,N,?) will yield [m], and it is phonology that will tell us which construct we are dealing with. This ambiguity, which is inbuilt in the Element Theory, has its advantages as we will shortly discover.[83]

Returning to nasality for a moment, the general introduction to Celtic mutations at the beginning of this section showed that there seems to be some affinity between nasalization and voicing. For example, the historical process of nasalization in Old Irish diverged into two phenomena, that is, nasalization and voicing. There has been a lot of research into the nature of post-nasal voicing in phonological theory (e.g. Herbert 1986, Itô and Mester 1986, Pater 1995). There are also proposals within the Element Theory which merge the elements (N) and (L) into one, for example, Nasukawa (1998, 2005), and Ploch (1999). In this work we would like to at least bear in mind the possibility that voicing and nasality might be two sides of the same coin. We will represent this option by supplying both elements in relevant contexts, that is (N/L).

The use of the tone elements in the definition of voicing has been described in detail at the beginning of this chapter. Let us only repeat that in systems which have a two-way laryngeal distinction only one of the elements is employed – in the marked series, while the neutral series remains undefined. In Welsh, just as in Irish and English, the marked series is the voiceless or aspirated one, containing the high tone element (H). In the previous section we saw how this asymmetry plays out in the phonotactics of modern Irish. Similar effects can be traced in Welsh. For example, clusters of the type *rg, lg* are absent word-finally and morpheme internally, and

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[82] There are facts from other languages which point to the presence of stopness in laterals and nasals. See the analysis of Icelandic pre-aspiration in Gussmann (2000).

[83] Ambiguous representations yielding identical phonetic effects but at the same time displaying disparate phonological behaviour have been called ‘double agents’ in the Government Phonology literature (Gussmann 2001, 2002).

the best nasal+stop clusters word finally are those with the voiceless stop and only one voiced, that is, *nd*.[84]

However, the most significant innovation that we would like to propose with respect to Welsh concerns the noise element (h), or rather its absence from the Welsh consonantal system. We put forward this proposal on the basis of our findings in Irish, discussed in the previous sections. The Welsh system shows all the relevant diagnostic aspects for such a move. First of all, as mentioned above, lenis obstruents in cluster formation are generally weaker. Secondly, systemically acceptable affricates are missing from the system of consonants. And finally, there are no real voice distinctions among the fricatives. The voiceless fricatives, specified as possessing (H), contrast directly with sonorants or sonorant-like fricatives. These diagnostic criteria seem to point heavily to the fact that Welsh, like Irish, is an h–less language. The tables below compare two approaches to Welsh consonants and their consequences for the analysis of mutations. One is Buczek (1995) in which the noise element (h) is very much part of the system and has a very important function to play, and the other is that advocated in this work, in which (h) is absent altogether from the Welsh system. First we look at Buczek's proposal.[85]

(42) ***Welsh consonants*** (adapted from Buczek 1995)

[p]	[b]	[t]	[d]	[k]	[g]	[l]	[r]	[m]	[n]	[ŋ]
U	U	A-I	A-I	_	_	A	A	U	A-I	_
ʔ	ʔ	ʔ	ʔ	ʔ	ʔ	ʔ			ʔ	ʔ
h	h	h	h	h	h			N	N	N
H		H		H						

[f]	[v]	[θ]	[ð]	[x]		[ɬ]	[r̥]	[m̥]	[n̥]	[ŋ̊]
U	U	A-I	A-I	_		A	A	U	A-I	_
h		h	h	h		ʔ	h	ʔ	ʔ	ʔ
H		H		H		h		N	N	N
								h	h	h

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[84] For a recent discussion of similar restrictions on word-final nasal+voiced stop clusters in the dialects of modern English see Gussmann (1998), and Tóth (2002).

[85] In Buczek (1995), coronality is represented by the element (R) which has since been eliminated from GP. We replace this element with (A) and (A-I).

Since there is no crucial difference in the use of place elements and the tone specification of voiceless obstruents between the above table and our proposal below, these aspects will be ignored in the discussion.

The noise element (h) is used in all stops in Buczek (1995), in accordance with the assumption of the early Element Theory that this element is present in released stops (e.g. Harris 1990). By definition, this element is also present in fricatives, but not in all of them. It is missing in the voiced labio-dental fricative, which is represented only by means of (U). This move is dictated by the fact that in soft mutation [m] becomes [v]. A description of this process would have to involve not only the loss of nasality, but also the addition of noise to obtain a fricative, a rather complicated procedure. It is also interesting to note that (ʔ) is missing in [m] as opposed to other nasals, clearly to avoid delinking two elements at a time in the shift *m* > *v*. However, given the representations of [v] and [b], Buczek cannot avoid delinking two elements in the SM shift *b* > *v* (U,ʔ,h) > (U), unless we assume that there are two types of [v] – one with noise and another without it. These small inconsistencies aside, Buczek also makes an important claim that the noise element is used to represent voicelessness and aspiration in [ɬ, r̥, m̥, n̥, ŋ̊].

The table below illustrates the option in which the relevant Welsh consonants are devoid of the noise element.

(43) ***An h-less representation of Welsh consonants***

[p]	[b]	[t]	[d]	[k]	[g]	[ɬ]	[r̥]	[m]	[n]	[ŋ]
U	U	A-I	A-I	_	_	A	A	U	A-I	_
ʔ	ʔ	ʔ	ʔ	ʔ	ʔ	ʔ	H	N/L	N/L	N/L
H		H		H		H				
[f]	[v]	[θ]	[ð]	[x]		[l]	[r]	[m̥]	[n̥]	[ŋ̊]
U	U	A-I	A-I	_		A	A	U	A-I	_
H		H		H		ʔ		N/L	N/L	N/L
								H	H	H

Note that the stops are still stops because they possess the occlusion element (ʔ), which together with place defining elements and the laryngeal distinction: high tone vs. nothing, fully suffices to define the system. What is interesting is that Welsh stops are generally less complex than in other languages, for example Polish, and that the voiced series is still weaker, with the voiced velar plosive having only one element, the occlusion itself. The same situation was earlier shown to hold also in Irish.[86]

It will be recalled that the phonetic realization of (ʔ) as [g] cannot be treated as universal. In Welsh, just as in Irish, it follows from two conditions; the systemic absence of (h), and the fact that obstruents use (H) in their laryngeal specification. This means that in another h–less system in which (L) is used in obstruents, the sole presence of (ʔ) may produce [k] because [g] in that system would have the low tone. The phonetic implementation of a given element in Government Phonology depends not only on its overall acoustic signature but also its place in a particular phonological system. This is one of the reasons why it is erroneous to try and provide element based representations for all the sounds represented in, for example, the IPA chart. The representations should always be system based.

To return to the discussion of the above table, the simplex representation of [v] is now a systemic effect rather than an *ad hoc* solution. Note that we bypass the problem of how many elements will be lost in the shift *m* > *v*, or *b* > *v*. In each case, only one element needs to be lost: either nasality or occlusion respectively.

The absence of (h) in the system requires that a different proposal be made concerning fricatives, sounds in which this element was traditionally indispensable. We assume, following Cyran (1996b, 1997) and Ritter (1997), that the headedness of the resonance element may be responsible for the effect of friction.[87] This is true of Welsh [v] = ($\underline{\text{U}}$), and [ð] = ($\underline{\text{A}}$-I). Such fricatives are sonorant-like in terms of their behaviour.[88] It is interesting to note that the two fricatives tend to be lost in word-final context in Welsh (Thomas 1992). For example, *gof* 'blacksmith' is pronounced as [go:] in the North and [go:v] in the South. Similar effects are found in words like *barf* [bar(v)] 'beard' and *gardd* [gar(ð)] 'garden'. The absence of the noise

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[86] Although the representation of [g] in Irish and Welsh is identical, the effects of lenition of that object are different. In Irish, [g] becomes [ɣ], while in Welsh its [g] is simply deleted. Historically, Welsh was like Irish. The difference may lie in the way the two modern languages interpret the empty onset that remains after the deletion of the stopness element.

[87] Recall that in the case of the velar fricative [x] friction results from (H), as there is no place element to be headed.

[88] Recall that [v] is notorious for acting as a 'double agent' not only in Welsh but also in Polish (Gussmann 1981), Irish (Cyran 1997), Russian (Andersen 1969), Hungarian (Szigetvári 1998), Slovak (Rubach 1993) and in the history of a number of Slavic languages (Cyran and Nilsson 1998).

element (h) also enforces a different representation for voiceless liquids and nasals, that is, one in which the high tone (H) is responsible for the voiceless effect. In this way, this group of consonants can be more easily related to the fortis plosives and fricatives.

Let us now look at how the two different approaches to the representation of Welsh consonants affect the analysis of the consonant mutations.

4.7. A new analysis of Welsh mutations

The table below is a comparison of the two different approaches to representations within the Element Theory, which were described above. One of them attempts to ascribe particular representations to Welsh consonants rather automatically introducing some modifications only contingently.[89] This is compared with the ‘h-less’ approach, which attempts to understand the system in terms of general parameters on element availability.

The Element Theory allows for only two types of processes: *decomposition*, that is, the deduction of elements, and *composition*, which is the addition of elements.[90] These correspond to lenition and fortition phenomena and are represented in the table as (–) and (+) respectively. The dotted line separates those classes of sounds which require a different analysis in terms of element deduction or addition. Ideally, the groups of consonants which are intuitively perceived as natural classes should receive identical interpretation.

One immediate observation that can be made on the basis of the table below is that there are certain aspects which the two analyses share. Some of the effects in Soft Mutation (SM), the entire Aspirate Mutation (AM) and Hard Mutation (HM) receive an identical interpretation, but this is where the similarities between the two approaches end.

The first set of targets in SM, that is [p,t,k] are uniformly turned into voiced stops by means of suppressing the high tone element. Since the high tone may to some extent be equated with the feature [–voice] in derivational frameworks, this fragment of the analysis is not only identical to Buczek (1995) but also to Awbery (1973) and Ball and Müller (1992).

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[89] Recall the discussion of the representations in (42).

[90] One of the conditions on composition in GP is that the element that is added must have a local source, that is, be present in the representation of the trigger, if this process is to be viewed as phonological.

(44) ***A comparison between a h-full and h-less analyses***

Soft M.	Buczek 1995	h-less analysis
p > b t > d k > g	–H	–H
b > v	–ʔ, –h$^?$	–ʔ
d > ð	–ʔ	
g > ø	–ʔ, –h	
ɬ > l r̥ > r	–h	–H
m > v	–N	–N/L
Aspirate m.		
p > f t > θ k > χ	–ʔ	–ʔ
Nasal. M.		
p > m̥h t > n̥h k > ŋ̊h	+N, –H	+N/L
b > m d > n g > ŋ	+N, –h	
Hard M.		
b > p d > t g > k v > f ð > θ	+H	+H

As for the voiced targets, that is [b,d,g], the h–less analysis needs only to deduct the occlusion element. Recall that the generative accounts of SM also strove to see the shift [b,d,g] > [v,ð,ø] as one process. However, the unification resulted in a special treatment of the shift [g] > [ø] which involved a postulation of abstract intermediate stages such as *g*>**ɣ*>*ø*. This representation-based analysis bypasses this problem and shows that there is no need for a derivational approach to the seemingly disparate behaviour of [g]. Once we arrive at the correct representations, the formulation of the process is quite simple. Since Welsh [g] is represented only by one element

(ʔ), its deletion results in nothing.[91] Note that in Buczek (1995) the situation gets a little complicated here. The shift [b] > [v] must involve either deletion of two elements (U,ʔ,h) > (U), or alternatively, we must assume that there are two representations of [v] in Welsh, (U) and (U,h). Similarly, two elements must be lost in the deletion of [g]. While, theoretically speaking, there is perhaps nothing wrong with losing two elements in some processes, it is not clear how we decide which segments will lose two and which ones only one element in Buczek's approach. In the h-less analysis this dilemma is non-existent: it is always only one element which is lost.

The interpretation of the voicing of the voiceless liquids naturally depends on what prime is made responsible for the effect of voicelessness. In this respect, the two analyses appear to be equally appealing in that only one prime is lost. The advantage of one over the other may only be assessed on the basis of the overall system. One argument which we can wheel out in favour of the h–less analysis is that the voicing of liquids may indeed be grouped with the voicing of fortis plosives, an observation which was also made in generative accounts. Here we are dealing with the uniform deletion of the high tone element.[92] No such unification is possible under Buczek (1995) in which the prime which is lost in liquids is (h), while the plosives lose the tone element (H).

The final shift in SM, that is (*m* > *v*), clearly involves deletion of nasality. It must be recalled however, that in Buczek (1995) this elegant interpretation is achieved at the cost of two assumptions. Firstly, [m] is the only nasal sound with no occlusion element, and secondly, [v] is the only fricative with no noise element. Both facts may however fall out directly from

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[91] An empty position in Government phonology, be it onset or nucleus, may also have a phonetic interpretation (Kaye, Lowenstamm and Vergnaud 1990, Charette 1991). We may tentatively assume that what is referred to as the historical reflex *[ɣ] may have been the interpretation of the empty intervocalic onset which resulted from the loss of occlusion, just as it is in modern Irish. Likewise, word-initial empty onsets in vowel initial words may be realized as glottal stops. Such effects need not be treated as the realization of separate elements, but as mere language-specific realizations of empty positions which for one reason or another cannot remain totally empty, for example, due to some language specific constraints on such structures.

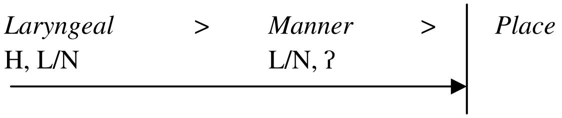
[92] Note that we also bypass the problem of specifying liquids as [+voice] as in the generative formulations. The marked case is represented by the voiceless liquids, which have an additional element, and the voicing of the liquids has no particular exponent in the form of a feature or element. They simply become modal liquids, which are voiced.

more general assumptions concerning the way elements are harnessed in the definition of sound systems. It should be mentioned that in this analysis the problem of major class features does not arise. The loss of (N/L) from (N/L, U) leaves us with only the labiality element, which has the interpretation of a voiced labio-dental fricative in Welsh. In this respect our account seems to be more adequate than the generative accounts also, which have to adjust major class features as well as the place of articulation in the *m* > *v* shift.

To conclude the discussion of soft mutation let us attempt to formulate the process in terms of what transpires as a result of the shifts discussed above. First of all, in the Element Theory we may provide a formulation of SM which will only involve the manipulation of one prime at a time. Given the nature of this model, no further adjustments are necessary – the deletion of an element creates a structure which is also independently interpretable, unless what remains is nothing, when we do get phonetic nothing, as in *g* > *Ø*. Secondly, we lose none of the generalizations made in generative studies which tried to reduce SM to three processes. It seems, in fact, that we can achieve the same generalizations in a more compact fashion because we avoid a lot of the additional adjustments that those frameworks required. What is more, given the possibility of conflation of nasality (N) and Low tone (L) elements, we are able to reduce SM to only two processes, that is, tone deletion, and if the tone is missing in the target consonant – as in the neutral series [b, d, g] – then occlusion is deleted. Note that given the representations of Welsh consonants, there is nothing else left to be deleted except for the place defining elements. But these do not seem to be targets of lenition in Welsh. Thus, our representations also restrict possible types of processes, in that what we observe is everything that could occur.[93]

It goes without saying that our analysis simplifies the most complex of the initial mutations in a considerable way. The overall principle of SM may be formulated as first targeting tone elements, and if they are missing, then other manner elements. Place elements seem to remain unscathed.

(45) ***A scale of mutation targets in Welsh***



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[93] Note that in an ‘h-full’ analysis this additional element creates an additional operation that could occur. It is difficult to imagine what deletion of (h) could bring about in Welsh.

The above scheme does not resolve the issue of conflation of nasality with the low tone (L/N), and how this new construct should be categorized. If it is part of the laryngeal node then the mutations may be more readily described as predominantly tonal phenomena, an option to which we will return below.[94]

As mentioned earlier, SM is the most common type of mutation and one with the greatest number of targets and triggers.[95] It seems to be the dominant type of mutation, especially when compared with aspirate mutation. In our earlier discussion of the latter we asked the question why AM affects only three targets, while the formulation of AM as delinking of occlusion allows us to cover all stops. We can understand this problem better under two conditions: if the dominant character of soft mutation is recognized, and if the formulation of SM given above is correct. Soft mutation, in a sense, uses up some of the options that aspirate mutation could have utilized.

It is not clear how the dominance should be formalized. It is not impossible that it may be best understood in terms of historical precedence, in which case no theory of the dominance of some types of mutations over others needs to be postulated. On the other hand, some formalization of the precedence of laryngeal elements as opposed to manner elements as targets of SM seems in place, if only to answer the question why the voiceless stops in SM are voiced, rather than spirantized on a par with the other plosives.[96]

Whether there is a universal hierarchy determining the propensity of particular elements to undergo deletion, and how this should be expressed in the Element Theory, is an issue for further research. At this stage we just state the fact that in Welsh laryngeal elements tend to be lost more readily than manner elements. Of course, the voiced stops in SM lose occlusion because there is no laryngeal element that could be lost. As for aspirate mutation, we must note that the voiceless plosives in Welsh are the only obstruents that have one remaining ‘deletable’ prime that has not been affected by SM. Hence, the occlusion in voiceless plosives is lost in AM. The voiced series of stops cannot be included in this type of mutation be-

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[94] The use of the term ‘laryngeal node’ may suggest that we are dealing with some melodic geometry within the Element Theory (Harris 1994: 127).

[95] Ball and Müller (1992) refer to it as the ‘default mutation’.

[96] The problem discussed here hinges on what Lass (1984) distinguishes as ‘sonorization’ versus ‘opening’ in lenition processes. Apparently, the former is less dramatic a change than the latter. However, Lass does not provide a rigorous linguistic argument in support of this impressionistic view.

cause this would lead to grammatical ambiguity – they have already lost their only deletable prime in SM. Thus, the special status of voiceless stops in Welsh is due to the fact that they are the most complex consonants (43).

Recall that voiceless stops are treated as the strongest and are placed at the beginning of the lenition trajectories discussed in Lass (1984: 178). The Element Theory, in which voiceless stops are the most complex only if specified by (H), also predicts that in systems in which it is the voiced series that is specified – with (L) – the voiceless stops are not the strongest. This allows the Element Theory to avoid the pitfalls of the universal marking of certain segment types as possessing particular characteristics (Foley 1977), and of treating such processes as devoicing in German or Polish as fortition (Lass 1984: 179), rather than the more intuitively correct lenition, or element deduction in prosodically weak positions as the Element Theory has it.

Let us return now to the remaining two mutation types and their analysis within the Element Theory. Nasal Mutation is the only initial consonant mutation which consists in element addition. Recall that most of the triggers contain the nasal property.[97] Here, the h-less analysis is simple again. The stops, whether voiceless or voiced, are affected by nasality. As a result, nasal or nasalized consonants appear as predicted by the Element Theory. Given the specification of the targets, where the voiceless series contains (H), the effects of NM seem to be straightforward, though not entirely unusual.[98] Nevertheless, assuming that nasality may combine with (H) in some way, we predict that the aspirated / voiceless stops will yield voiceless / aspirated nasals, and voiced stops will simply produce nasals with the same place of articulation.

Admittedly, the nasals which result from NM are representationally different from the nasals provided in table (43). The stops contain the occlusion element and therefore, this time, we must assume its presence in the nasalized forms. As mentioned earlier, the presence or absence of (ʔ) in nasal consonants changes nothing in terms of phonetic realization. Both (N/L,U) and (N/L,U,ʔ) will be realized as [m]. However, while in the case of the basic [m] we have evidence of the absence of occlusion, which is

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[97] On this basis it could be claimed that perhaps Nasal Mutation is still a phonological phenomenon.

[98] Voiceless or aspirated nasals are certainly a marked phenomenon, just as the voiceless liquids discussed earlier. Some dialects of Welsh, notably the South Glamorgan dialect (Thomas 1984) eschew such structures and of all the voiceless sonorants of Standard Welsh retain only [ɬ].

reflected in the effects of SM (*m* > *v*), in NM shifts *b* > *m* and *p* > *m̥* there is positive evidence of its presence, and hence we must accept this presence as a fact.

For Buczek (1995), nasal mutation is unduly complex, which is a direct consequence of the assumption that the noise element is responsible for the voicelessness of sonorants. Thus, to get the voiceless nasals, she needs to add nasality and delete the high tone, while for the voiced stops to become nasals, she must add nasality and delete the noise which is present in all stops and which would otherwise produce the voicelessness effect. Additionally, in Buczek's analysis a process which clearly consists in element addition must be also assumed to delete elements, where the choice of which element is to be deleted is quite arbitrary.

Finally, hard mutation, which is not an initial consonant mutation but rather a morpheme-final one, is also a composition process. It involves addition of the high tone element to the toneless series of stops and, less commonly, the toneless voiced fricatives. Here too, the phonological context is still retained and there are good reasons to assume that it may still be a phonological phenomenon.

To conclude the analysis of Welsh mutations we note that the h-less approach clearly shows that all the consonant mutations in Welsh can be fairly well understood as predominantly tonal phenomena. The picture is of course more convincing if nasality can indeed be conflated with the low tone into some sort of Janus-faced laryngeal element. Each process targets only one prime, which allows for a neat formulation of the mutations under any framework which decides to use element-based representations, be it a rule- or constraint-based model. This analysis works under certain assumptions concerning the internal structure of Welsh consonants, for example, the fact that the noise element is totally missing, and that radical nasal consonants do not contain stopness. These assumptions find some support within the Welsh system itself, as well as in other Celtic languages such as Irish.

In Welsh, we witness a convergence of effects in the mutations with a number of diagnostic criteria for the absence of (h). These include the absence of affricates, and no voice distinctions among the fricatives, whereby the existing voiced fricatives behave as sonorant-like and the voiceless fricatives contrast directly with liquids and glides by means of the (H) element. Just as in Irish, the weakest stop is the voiced velar one, and like in Irish, it is deleted in the relevant contexts. In Welsh, this happens in SM, while in Irish, [g] is deleted in the verbal system when intervocalic, for example, *suigh* ‘sit’ [sig´] loses the stop in *suím* ‘I sit’ [si:m´], when the first person singular ending *–im* is added.[99]

It must also be emphasized that this analysis throws new light on the apparent complexity of initial mutations in Welsh from the point of view of learnability and the interaction between morphology and phonology. As for the former issue, given that mutations are predominantly tonal phenomena, the difficulty they present for learners is roughly of the same kind as voice neutralization is in Polish or German. On the other hand, more needs to be said about the morpho-phonological nature of mutations. We turn to a brief discussion of this problem below.

4.8. The morpho-phonology of mutations

At the outset of our discussion of the initial consonant mutations in Welsh, we deemed these effects to be morpho-phonological due to the fact that they occur in morpho-syntactic rather than phonologically defined contexts. This is no place to deal exhaustively with the concept of morpho-phonology itself.[100] Our aim in this section is merely to set out some criteria for deciding whether we are dealing with pure phonological or morpho-phonological regularities. We will not attempt to define the nature of the interaction between phonology and morphology, though the element-based analysis opens some options which will be mentioned below.

The historical perspective on the initial mutations in Celtic languages and the analysis of the modern Welsh phenomena point to the fact that phonological and morpho-phonological regularities may look very similar. The reason for this state of affairs is simple and follows from the fact that, at least in the case of the mutations, we are dealing with grammaticalization of phonological regularities. In this respect, the morpho-phonological effects may be easily confused with phonology proper, because they reflect former rather than current phonological patterns, and, as we saw above, they may look very regular. We will assume that morpho-phonology is a term which covers cases of petrification of phonological regularities when the phonological system itself develops in such a way that the pattern can no longer be phonological. Thus, morpho-phonology is a case of systemic

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[99] Interestingly, also the fricative [v] is lost in the two languages, for example, Welsh *gof* [go:] ‘blacksmith’, and Irish *nimh / nimhe* [n´iv´] / [n´i:] ‘poison/gs.’.

[100] For some discussion of the place of morphophonology in linguistic theory see, for example, Dressler (1977, 1985), Gussmann (1985), Kowalik (1997), Laskowski (1975), Trubetzkoy (1931).

conservatism in that it petrifies former states of the phonological system.[101] How exactly is the relationship between the alternating consonants captured is another story.

At this stage we must mention some criteria on the basis of which something is deemed phonological or is relegated to morphophonology. The Element Theory provides us with some useful tools in this respect, for example, by restricting phonological operations at the melodic level to composition and decomposition. As for composition, the model requires that the added property be locally present. This, to some extent, obtains for the Welsh nasal and hard mutations. However, there is a purely grammatical reason why mutations in Celtic languages should not be viewed as automatic phonological effects. The mutations have taken on the grammatical functions of distinguishing gender, case or even tense, and are restricted to particular morpho-syntactic contexts. In other words, not every context where nasality is present will produce nasal assimilation. This last point significantly undermines the phonological status of the nasal mutation.

As for decomposition, that is, element loss, we may speak of the requirement of a phonologically determinable context triggering the loss. For example, we saw earlier that [g] and [v] are deleted intervocalically in modern Irish. However, the contexts in which the initial mutations in both Irish and Welsh originally arose are no longer present due to the historical loss of final syllables. It will be recalled that in present-day Welsh and Irish, the identical phonetic context triggers disparate types of mutations. The facts are repeated below for convenience.

(46) **Irish** *cat* [kɑt] 'cat'

a chat [ə xɑt] 'his cat'
a cat [ə kɑt] 'her cat'
a gat [ə gɑt] 'their cat'

Welsh *cath* [ka:θ] 'cat'

ei gath [i ga: θ] 'his cat'
ei chath [i xa: θ] 'her cat'
eu cath [i ka: θ] 'their cat'

Thus, to determine whether a regularity is phonological or morphophonological, we may use phonological criteria such as the requirement that

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[101] See for example Árnason (1985: 22) for similar views.

added primes be locally present and that this phenomenon is obligatory every time the appropriate context is created, or the requirement that the suppression of particular primes occurs in specific phonologically definable contexts. On the basis of such criteria we may quite definitely claim that, in Welsh, soft and aspirate mutations belong to morpho-phonology, while hard mutation can be viewed as phonological according to the criteria we have laid down. In fact, this phenomenon resembles regressive voice assimilation in, for example, the Polish phrase *nasz dom* 'our home', which is pronounced as [naʒ dom] rather than *[naʃ dom]. As for nasal mutation, some criteria, like the local presence of nasality, point to one solution, while others, such as the lexicalization of the contexts, point to the other.

We will not take a firm position concerning NM and simply accept that morpho-phonological effects may overlap with phonological ones. The full picture of the mutations in Welsh that transpires from our analysis grades the individual effects on the basis of the criteria we have suggested.

(47)

morphophonology	***???*** ◄────────────►	***phonology***
Soft Mutation Aspirate Mutation	Nasal Mutation	Hard Mutation

It is interesting to note that the uncertain status of nasal mutation finds some reflection in the way it is intuitively perceived by Welsh speakers. Recall that there is one particle in standard Welsh, that is, *fy* [və] 'my', which causes NM while it does not possess nasality itself. In spoken colloquial Welsh, however, this particle is pronounced as [ən], thus perhaps reflecting the intuitions of the speakers that nasal mutation has its source in the preceding nasal sound. In the following chapter, similar overlapping effects leading to ambiguous interpretations by speakers will be shown to take place also at the syllabic level.

We will refrain from making particular theoretical claims as to the status of morpho-phonological phenomena like initial mutations in grammar.[102] Proposals in this respect may oscillate between full lexicalization of all mutated forms, where the choice of a particular exponent resembles the selection of affixes (Green 2003), through segment replacement rules, whereby a separate module called morpho-phonology would implement rules

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[102] To put it bluntly, the term 'morpho-phonological' that transpires from this discussion is very much synonymous with 'non-phonological'

of segment exchange, to element manipulation, an option that this analysis of Welsh mutations reopens.[103]

Even if all the mutated forms are indeed lexicalized, it seems that the regularities may sometimes take a form of rules. This can be observed in the phenomenon called reradicalization (Ball and Müller 1992, Chudak, in prep.) whereby learners and speakers of Welsh or Irish mistake the mutated form for the radical and apply regular mutations to the new radical forming a new pattern for a given lexical item. This phenomenon, however, does not provide a conclusive argument as to the nature of morpho-phonology.

5. Summary and conclusions

In this chapter, an attempt was made to show that sub-segmental complexity, which may also be called substantive complexity, is an important factor in the organization of phonological representation. The basic tenets of the Element Theory were introduced and applied to a number of phonological and morpho-phonological phenomena. The main characteristics of the melodic primes in this model, that is their autonomous interpretability and privativity, allow us to view the phonological representation as redundancy-free and fully interpretable at any stage of derivation.

It has been shown that a number of phonological phenomena depend on the internal complexity of segments. The relative substantive complexity contributes to an understanding of both the static and dynamic aspects of phonological systems. By static aspects we understand typological and markedness effects as well as such system-specific areas as the segmental inventory and phonotactics. To the dynamic aspect belong historical as well as synchronic phonological processes such as the vocalic alternations of Irish, voice neutralization in Polish, or consonant mutations in Irish and Welsh. While the vocalic alternations of Irish are interpretations of morphologically manipulated phonological representations (composition), the devoicing in Polish consists in the interpretation of segments in which the laryngeal element is not licensed in prosodically weak positions (decomposition).

The melodic representations of speech sounds should always be determined on the basis of a particular system rather than on the basis of phonetics. The fact that representations in the Element Theory are always system dependent and are not uniform across languages, does not preclude

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[103] Recall that analyses based on distinctive features are unable to reduce the mutations to simple and non-derivational operations.

similarities such as those found between the Irish and Welsh consonantal systems, but the model eschews the automatic assignment of representations on phonetic basis alone.

Relatively complex objects behave like strong ones in cases where there is a syntagmatic relation with other segments, for example, in phonotactics. In this sense, complexity is able to replace both sonority and strength in phonological theory, while also being able to account for markedness effects.

Complexity defined in terms of the number of privative elements in a segment predicts the existence of asymmetries in phonological systems. The phenomena discussed in this chapter demonstrate that this is a welcome prediction. For example, the relative complexity of the target vowels in Irish vocalic alternations tallies with the relative regularity of the alternations. The asymmetrical representation of laryngeal contrasts, on the other hand, leads to asymmetries in neutralizations, and to particular phonotactic patterns concerning both complex onsets (English vs. Polish *fr/vr* in section 2.3) and coda-onset contacts (Irish ‘epenthesis’ in 3.2).

One of the more important features of the Element Theory is the possibility that not all universally recognized elements may be used in individual systems. Traditionally, this claim has been made about the use of the two laryngeal elements (H/L), in that systems with two-way laryngeal distinctions have been assumed to employ only one of the elements. In this chapter, we considered yet another case of the systemic absence of a prime, which concerned the ‘noise’ element (h). This single parameter accounts for the absence of affricates and voiced fricatives in Irish and Welsh, as well as for the phonological behaviour of consonants in the two languages.

If systems can be differentiated by systemic choices of not using particular primes of a universal set, we predict that there may be systems which develop additional primes which the Element Theory has not yet established. A whole area of research opens up here touching on such issues as typology, markedness and acquisition of categories. It should be the task for further research to determine the status of the currently used primes that can be dispensed with in individual systems, as well as the potential directions in which the model could expand, should the existing set of primes turn out to be insufficient.

Finally, the discussion of the consonant mutations in Welsh aimed at demonstrating how the Element Theory is able to simplify the analysis of this phenomenon if the consonantal system itself is first properly defined. Even though the mutations are not truly phonological processes, the description of the effects in terms of elements allows us to understand the logics of the phenomenon and gives us some inkling as to its nature when it was phonological. Given certain necessary representational assumptions, the mutations can be defined as primarily tonal effects, very similar in kind to obstruent devoicing and voicing. The simplification of the analysis is particularly beneficial in that it offers a simpler view of the interaction between phonology and morphology, if one assumes that morphophonological operations may manipulate the same categories as phonology proper.

As for the criteria for determining whether a given phenomenon is phonological or morpho-phonological, it is clear that they must primarily follow from the phonological theory. The theory must first be able answer the question of what is a possible phonological process. In the Element Theory, there are two main types of processes: composition and decomposition, both of which must occur in a phonologically definable context.

In the following chapter, the prosodic level of phonological representation is scrutinized. We will first develop a phonological model to deal with syllabification, which will be shown to be based on the interaction between substantive and formal complexity on the one hand, and licensing on the other.

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).

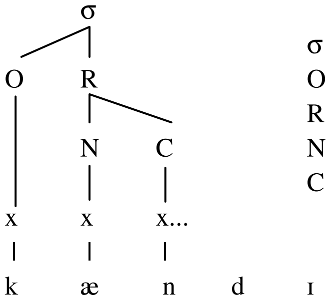
Descriptively, we will look at phenomena which are crucial for the understanding of syllabification, such as the distribution of clusters, vowel epenthesis, and vowel – zero alternations in Dutch, French and Polish. It will be shown that the modified model of Government Phonology is fully falsifiable, 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)



σ = *syllable*
O = *onset*
R = *rhyme*
N = *nucleus*
C = *coda*

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.**by*** 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.

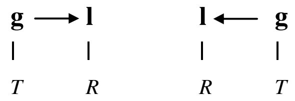
For example, the respective phonological constraints Onset, Nucleus, *Coda, *Complex Coda, and *Complex Onset express the observation that preferred syllables have onsets and nuclei and avoid having simplex or complex codas, and complex onsets. The unmarked syllable structure, that is CV, does not involve 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)



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

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

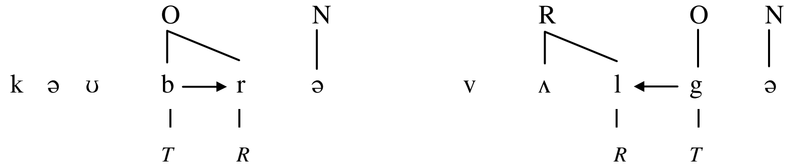
[4] In fact, the complexity of consonants which is defined in terms of the number of phonological elements present in their melodic make-up corresponds to a large extent to the strength scale proposed in Vennemann (1972). Since the complex consonants are governors, applying the term ‘strong’ to them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

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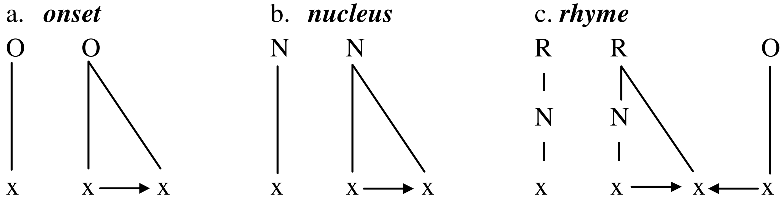
[5] Such labelling of consonants with a fixed function was attempted in the early Element Theory (Kaye, Lowenstamm and Vergnaud 1985). It is known as the Theory of Charm and was promptly abandoned in GP (see e.g. Harris 1990).

[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)



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

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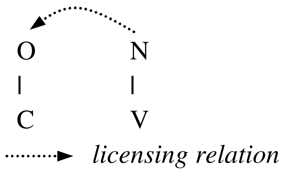
[7] Some cases of complex onsets and rhymes where binarity seems to be breached will be returned to. This problem concerns, for example, Polish initial consonant clusters and English super-heavy rhymes, in which the branching rhyme contains a branching nucleus.

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

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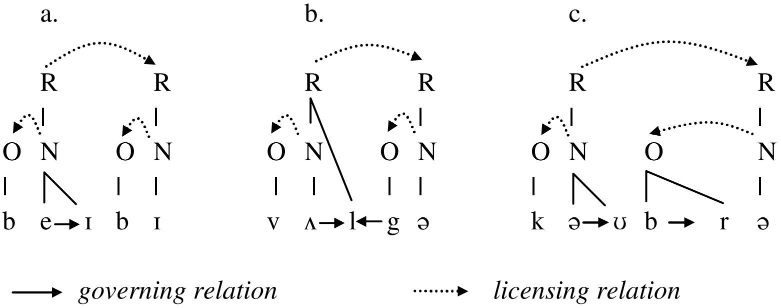
[8] In the ensuing discussion it will be shown that a branching Rhyme is not an independent constituent. More detailed discussion and a concrete proposal concerning this problem can be found in chapter 3. See also Lowenstamm (1996), Takahashi (1993) and Scheer (1996) for similar conclusions.

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.

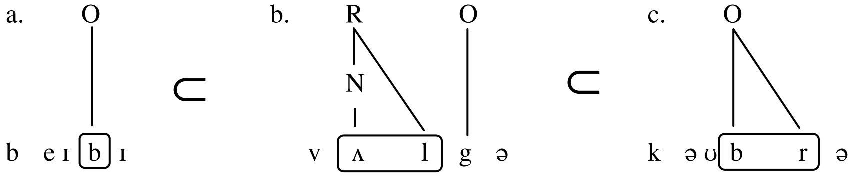
Recall that since segments in this model are composed of privative elements, the actual cost of licensing particular objects is calculated straightforwardly from the number of elements involved. It is to be expected that in prosodically weak contexts, the less complex segments should have a better chance 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.

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[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 $\supset$ 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]

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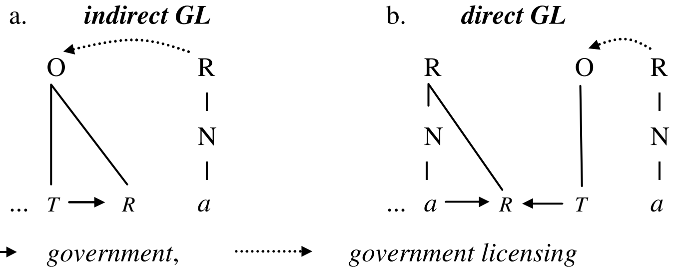
[12] In section 5.4 we deal with cases of structures seemingly exceeding binarity.

[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)



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	Japanese	???

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]

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[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

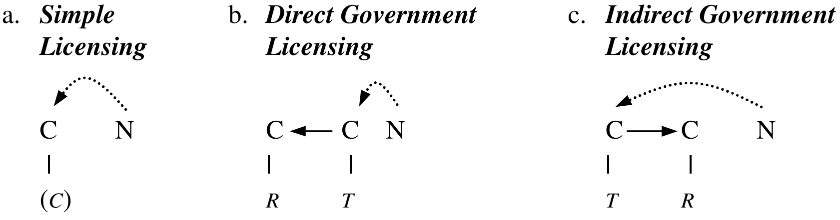
What (16) illustrates is that it is not clear what the possible conflicting settings of the two parameters would yield. They must be assumed, therefore, to be switched ON or OFF in conjunction to account for the observable facts, which suggests that either the two parameters require additional justification 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***

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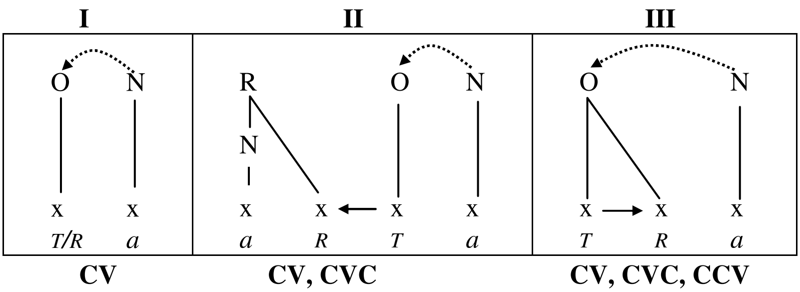
[17] Note that the elimination of parameters on branching constituents from the model does not affect such fundamental notions as, for example, the binary theorem. The maximally binary nature of constituents is guaranteed by the way governing relations are contracted and need not be doubly secured.

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***



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[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	Japanese ↓
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

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[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).

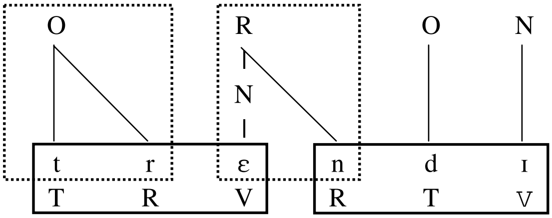
[22] Cases where government is not contracted between two consonants, as well as consonant sequences exceeding binarity will be discussed shortly.

[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 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.

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[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).

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 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

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[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.

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

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 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]

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[28] ‘a’ stands for a full vowel

(22) *TR# < $^{*/ok}$TRə < ^{ok}TRa

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.[29]

(24)	a.	[damp] *damp* ‘vapour’	b.	[χɛrt] *Gert* ‘name’
		[daŋk] *dank* ‘thanks’		[boelt] *bult* ‘hunch’
		[avənd] *avond* ‘evening’		[vɛrs] *vers* ‘fresh’

In the first set, the existence of partial geminates is accounted for by referring to the integrity of such structures.[30] 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

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[29] In addition, there are forms with non-homorganic clusteres such as *wreemd* ‘strange, *hemd* ‘shirt’ and *gems* ‘chamois’, *brems* ‘horse-fly’, which are characterised by the presence of a dental consonant in the second position (Trommelen 1984: 60).

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

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.[31] 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).[32]

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.[33] 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 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).

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[31] See section 3.2. in chapter 1.

[32] 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.

[33] 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.

(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.
	^{ok}TRa	>	$^{*/ok}$TRə	>	*TR#
		/		/	
	^{ok}R.Ta	>	$^{ok/ə\text{-}epen}$R.Tə	>	$^{ə\text{-}epen/ok}$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.[34] These effects are fully predicted in our model, as *TR* is formally more demanding. Thus, to use our terminology, a full vowel can license both *RT* and *TR* clusters (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-

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[34] 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.

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.[35] Note that the failure 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

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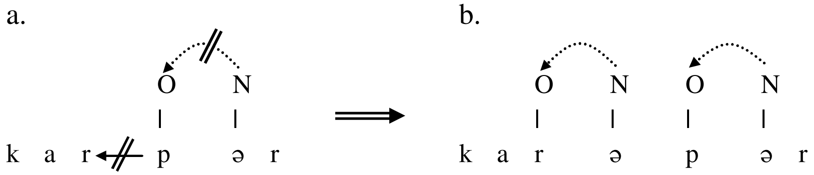
[35] We bypass the question of resyllabification as a result of epenthesis. Since all governing and licensing relations are contracted in the phonological representation, we may assume that the difference between epenthesized forms and those which retain the cluster ([karpər]) lies in the different representations. 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.

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).[36] 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.[37] 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

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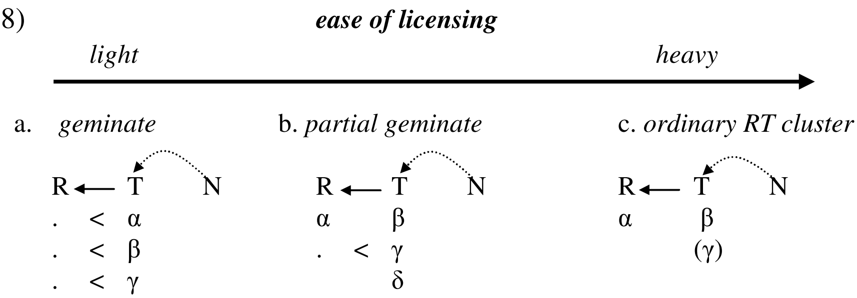
[36] Recently, a different strategy is also used in Dutch, namely, instead of epenthesis, the coda liquid is vocalised (van Oostendorp p.c.). In other words, instead of providing a stronger licenser for the coda consonant, the consonant itself is weakened. This situation is expected as one of strategies of resolving coda-onset clusters.

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

was briefly mentioned in the previous chapter when we discussed the differences 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´ᵊg´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.[38] 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.[39]

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.[40] 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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[38] Similar criticisms may be applied to sonority sequencing, and such concepts as sonority distance or degrees of sonority steepness.

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

[40] 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.[41] 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.[42] 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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[41] 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.

[42] 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	_∅

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.[43]

4.4. The syllabic space

Given the three levels of formal complexity (I–II–III) and the three-way scale of licensers (a–ə–∅), 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]		[∅]
I	C_	Ca	⊂	Cə	⊂	C∅
		∩		∩		∩
II	RT_	RTa	⊂	RTə	⊂	RT∅
		∩		∩		∩
III	TR_	TRa	⊂	TRə	⊂	TR∅

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[43] 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–∅). 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.[44]

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. *TR∅*, 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–∅).

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 *TR∅* 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.[45] 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

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[44] 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.

[45] 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* [vʲatr] < /vʲat→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).[46] 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.

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[46] 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).

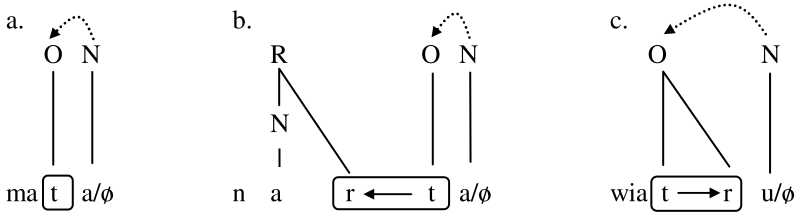
(34) ***Licensing properties of nuclei in Malayalam***

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

It is not always the case, however, that the full scale of licensers (a–ə–∅) is utilized by linguistic systems. Polish, for example, has no vowel reduction and uses only two types of licensers [a] and [∅]. 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.[47]

(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.[48]

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

	[a]	[∅]
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

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[47] 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.

[48] 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.[49] 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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[49] 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).[50] 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

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[50] 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–ø]), 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–ø), 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.

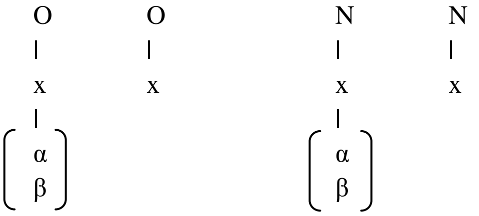
5. Sources of empty nuclei and licensing mechanisms in standard GP

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.

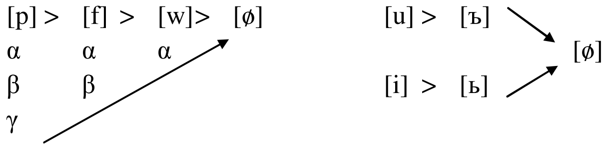
Empty positions play an important role in the theory of phonological government (Kaye 1990, Charette 1991, Gussmann and Kaye 1993, Harris and Gussmann 1998). Their presence is not only justified, but in fact, expected given the nature of phonological representation advocated not only in Government Phonology, 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*** b. ***Slavic rise and fall of jers***



Since the two phenomena have been discussed at length in chapter 1, they will not be given an airing here.[51] 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.[52]

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

[52] 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*).

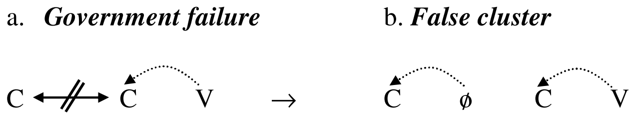
b. *adjacency* (the two consonants must be adjacent in the relevant sense).

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).

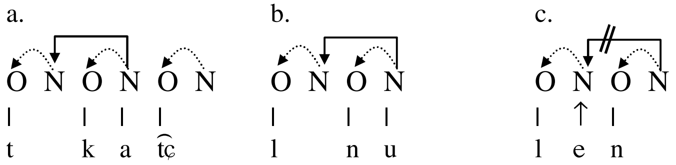
(43)



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)

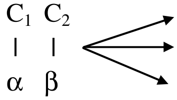


tkać [tkat͡ɕ] 'weave' *lnu* [lnu] 'flax, gen.sg.' *len* [len] 'flax, nom.sg.'

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)

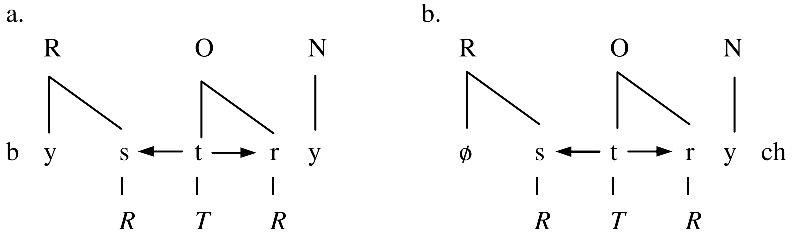


a. *R←T, T→R* true clusters (governing relations)
b. *CøC* false clusters
c. no cluster

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 *siόstr* [ɕustr] < /ɕus←t→rø/ 'sister, gen.pl.', which we discussed above in connection with the right edge of words.

(46)



[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.[53] 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.[54] 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).[55] 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.[56] 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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[53] Unless we redefine Proper Government as applying from left to right (Rowicka 1999).

[54] 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 /[]/.

[55] Gussmann (2002: 54) also suggests that phonological domains may be present lexically, independent of morphology.

[56] 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´ø$_1$sø$_2$kø$_3$]/ 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 (ø$_3$) is licensed by parameter, the second nucleus (ø$_2$) from the right would have to be realized, thus providing the licensing for the first nucleus (ø$_1$). 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´ø$_1$sø$_2$]ø$_1$kø$_2$]/. 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 (ø$_1$) is realized, yielding the correct phonetic form [p´esek]. The genitive form of this diminutive is *pieska* [p´eska] < /[[p´ø$_1$sø$_2$]ø$_1$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.[57] 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’[58]

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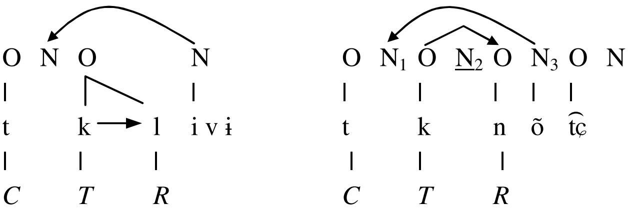
[57] For early discussion of Interonset Government see e.g. Kaye (1990) and Gussmann and Kaye (1993). See also Cyran (1996a, 1997), Cyran and Gussmann (1999), Rowicka (1998, 1999), Scheer (1996, 1998a), van der Hulst and Ritter (1998, 1999).

[58] 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 $\emptyset_2$, thus providing a licensing mechanism for this nucleus (48b).[59] Now, the melodically filled nucleus N_3 is free to properly govern the first empty nucleus $\emptyset_1$ 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.[60]

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-

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[59] 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.

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

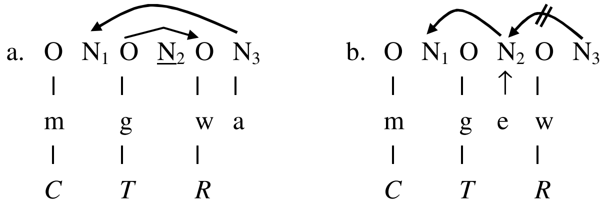
lated because, supposedly, [k] cannot govern [n]. On the other hand, once the empty nucleus is in place, this impossible relation becomes possible. What is more, the interonset relation seems to be required only to solve the problem created by the alleged inability of the two consonants to contract government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

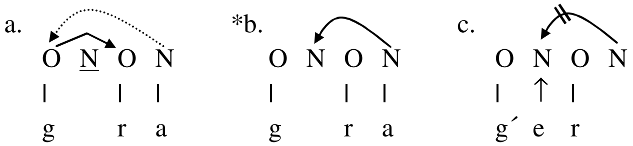


[mgwa] *mgła* 'mist' [mg´ew] *mgieł* 'mist, gen.pl.'

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 $C\emptyset_1T\emptyset_2RV$.[61] 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 /TØRV ~ TeRØ/, 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-

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[61] 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.'.

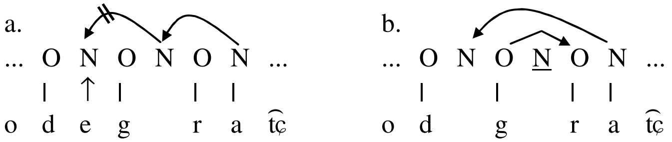
count of these forms only to say that its absence causes vocalization of the empty nucleus.

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)



[odegrat͡ɕ] *odegrać*

*[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-gø̲rat͡ɕø/), 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.

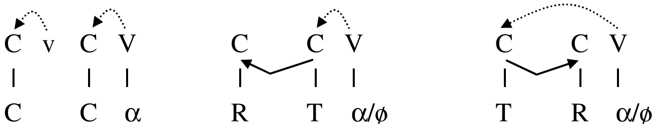
In the following subsection, we look in more detail at the distinction between true and false clusters in relation to the problem of initial consonant clusters in English and Polish.

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 (*C∅C*), 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 (∅ is a Licenser). Additionally, this empty nucleus cannot be followed by another empty one.[62] 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.[63] 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**
∅ 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

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[62] In other words, sequences of two empty nuclei are ungrammatical (*∅–∅).

[63] 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] < /bɔtølɪŋø/.[64] 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.[65] 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.[66] 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

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[64] 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.

[65] 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.

[66] 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’[67]
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.[68] 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,

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[67] 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. *źdźiebko* ‘little’, [ʃC], e.g. *szczeniak* ‘puppy’, [ʒC] *żbik* ‘wild cat’.

[68] 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’[69]
c. s←CøT→R *źdźbło* [ʑd͡ʑbwo] ‘blade of grass’[70]

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.[71] 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.

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[69] 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.

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

[71] 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[72]

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.[73]

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] <

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[72] 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.

[73] 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.[74] 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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[74] 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*.[75]

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.[76] 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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[75] The ‘magic licensing’ parameter should also be eliminated for consistency’s sake. This point will be discussed in chapter 3.

[76] 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/.

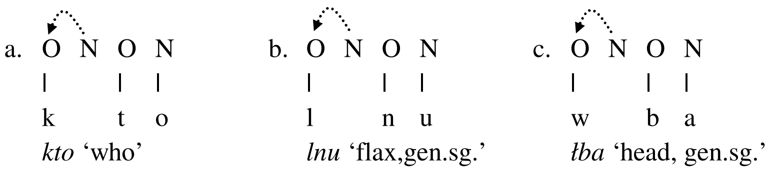
5.8. Licensing of clusters without licensing of empty positions

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.

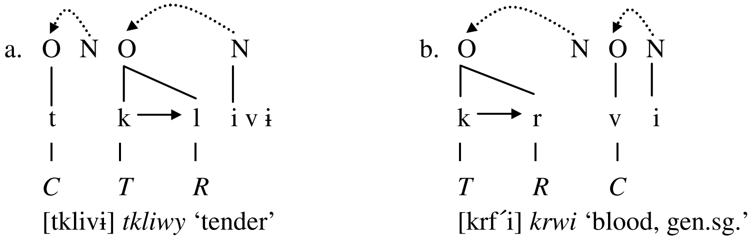
(57)



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)



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.[77] 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

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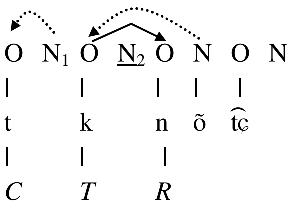
[77] The shape this word takes in the various Slavic languages is interesting. In Russian, the word is pronounced [krov´i]. It may be assumed that an empty nucleus was insufficient to license the cluster *kr*. See chapter 3 for more detail.

eliminates such forms as *kto* /køto/ (56a), *tkliwy* /tøk→livɨ/ (58a) and *krwi* /k→røvi/ (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] < /sømɛnø/ '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 *ø–ø. 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→røgø̲nõt͡ɕø/).[78] 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.

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[78] 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).[79] 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

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[79] 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.[80]

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* /tøkø̲nõt͡ɕø/ ‘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] < /tøkø̲nõt͡ɕø/ ‘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

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[80] 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)

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.[81] 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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[81] 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

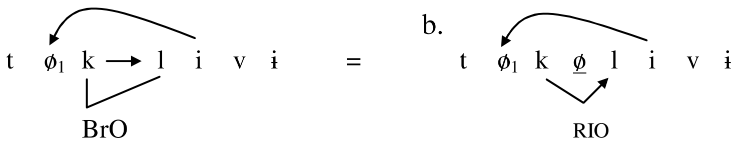
One of the typical characteristics of the structure of branching onsets (BrO) is that they should block the application of Proper Government (PG) in the context /...øk→lV.../. This blocking effect was discovered in Charette (1990: 237) and concerned French forms like *secret* [səkrɛ] 'secret'. Since 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)

a. b.



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 ø$_1$. 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)[82]. 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→rø$_1$vø/ ~ /k→rø$_1$vi/) ‘blood/gen.’. Under standard GP assumptions, the empty nucleus ø$_1$ 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 ~ krfʹi] ‘blood, nom.sg. /gen.sg.’ would hold if the empty nucleus ø$_1$ 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

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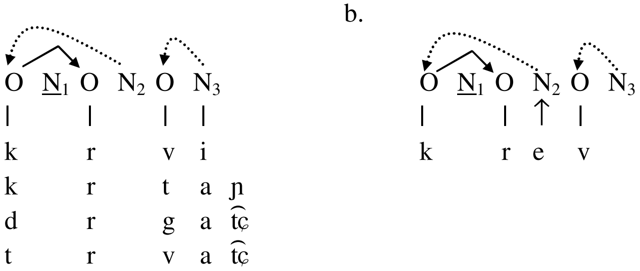
[82] See Charette (1990, 1991, 1992) for the operation of Government Licensing in French, Tangale and Polish, Cyran (1996a) for Irish, and Scheer (1996) for a criticism of this mechanism.

the same interpretation under the CV assumption, for example, *krtań* [krtaɲ] < /k$\underline{\varnothing}_1r\varnothing_2$taɲ$\varnothing$/ 'larynx', *drgać* [drgat͡ɕ] < /d$\underline{\varnothing}_1r\varnothing_2$gat͡ɕ$\varnothing$/ 'shudder', and *trwać* [trfat͡ɕ] < /t$\underline{\varnothing}_1r\varnothing_2$vat͡ɕ$\varnothing$/ 'persist'. Note that the relevant empty nucleus is now $\varnothing_2$, although it is still the first visible nucleus. The underlined $\underline{\varnothing}_1$ is locked by the interonset relation and invisible to the constraint on sequences of empty nuclei *$\varnothing$–$\varnothing$.

(62) a. b.



The empty nucleus $\underline{\varnothing}_1$ in (62a) is locked by RIO and $\varnothing_2$ 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$\underline{\varnothing}_1r\varnothing_2v\varnothing_3$/ (62b), $\varnothing_2$ must be vocalized, not because it cannot license the preceding structure, but because it is followed by another empty nucleus $\varnothing_3$.

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.[83] Jer vocalization, mainly known in the literature as the Lower rule (Gussmann

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[83] 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 /*TøR*/, e.g. /børat͡ɕø/. 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-* (/rozø/) is attached to the stem containing a false cluster, a sequence of two empty nuclei arises /roz$ø_1$b$ø_2$rat͡ɕø/, 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] < /gørø/~/gøra/ '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$ø_1$b→rɨzgat͡ɕø/ 'splash out'. It is striking that the relevant portion of the representation of /roz$ø_1$b→rɨzgat͡ɕø/, that is, /…z$ø_1$b→rɨ…/ resembles that of three consonant clusters in such forms as *tkliwy* [tklivɨ] < /t$ø_1$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.

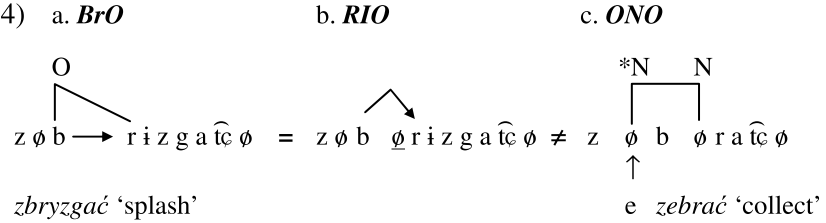
(63)	***Infinitive***	***Prefixed verb***	***Prefixed Derived Imperfective (DI)***	***Repr. of the stem***
a.	brać 'take'	zE+brać	z+bierać	/bϕr…/
	drzeć 'tear'	rozE+drzeć	roz+dzierać	/dϕʒ.../
	przeć 'push'	odE+przeć	od+pierać	/pϕʒ…/
b.	bryzgać 'splash'	roz+bryzgać	roz+bryzgiwać	/b→r…/
	drapać 'scratch'	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 *ϕ–ϕ, 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] < /rozϕ_1b→rɨzgat͡ɕϕ/ in (63b) is identical to that of *tkliwy* [tklivɨ] < /tϕ_1k→livɨ/ 'tender' (48a). The latter, on the other hand may receive an alternative interpretation involving RIO as in *tknąć* [tknoɲt͡ɕ] < /tϕ_1k$\underline{\phi}_2$nõt͡ɕϕ/ 'to touch' (48b), in which ϕ_1 can remain silent because $\underline{\phi}_2$ is locked by RIO and the constraint *ϕ–ϕ 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)



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.[84] 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.[85] 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

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[84] 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∅/.

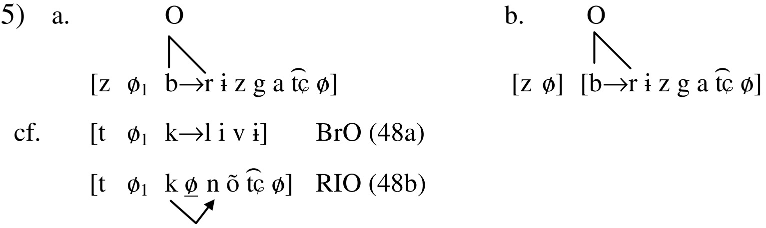
[85] The problem was discussed in section 5.5 and illustrated in (50).

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]/,[86] 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).[87]

(65)



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 $ø_1$ is not required to vocalize, and does not need to be separated by a domain as in (65b).

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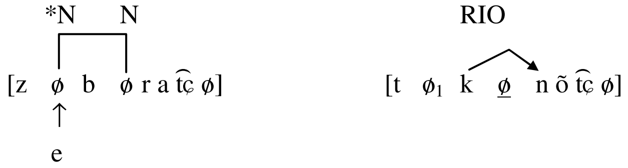
[86] The exact bracketing is irrelevant. See Booij and Rubach (1984), Szpyra (1989) and Rowicka (1999) for proposals in this respect. The distinction can be broadly made by referring to analytic versus non-analytic (synthetic) morphology.

[87] 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

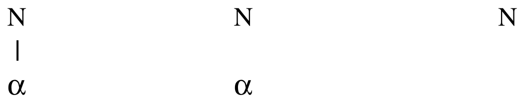
So far, we have seen that in all the diagnostic contexts which allow us to detect the structure of the branching onset in Polish, the competing structure of rightward Interonset Government (RIO) is able to replace it, because it is predicted to behave in exactly the same way. If there is any functional 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* /børa͡tɕø/, 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 ($\emptyset$) is just a nuclear position in phonological representation (67c), while the empty nucleus which alternates with vowels contains unassociated / floating melody ($\emptyset_e$).[88] Let us compare these representations with regular vowels.

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



The three structures of nuclei in (67) in fact represent all the logically possible configurations which follow from the three-dimensional model of representation.[89] 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

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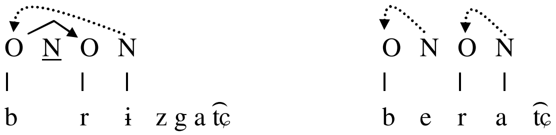
[88] The floating melody in Polish is typically [e], hence the symbol $\emptyset_e$. There are also alternations with [o], e.g. *kozioł / kozła* [koʑow ~ kozwa] ‘male goat, nom.sg. /gen.sg.’ in which case we are dealing with $\emptyset_o$.

[89] 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***



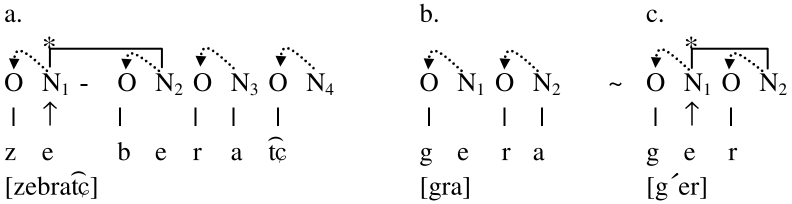
bryzgać ‘splash’ *brać* ‘take’

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.[90] 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 /*T*$Ø_e$*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

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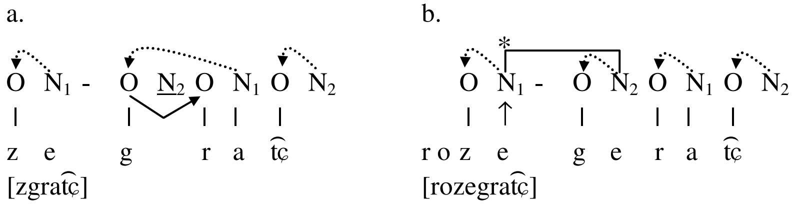
[90] For arguments against proposing a floating melody in final empty nuclei see Scheer (2004: 91).

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)



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 /[[roz∅$_{e}$] [t∅k∅̲liv´it͡ɕ∅]]/, otherwise, we should expect that the word be pronounced *[rozetkliv´it͡ɕ] < /[roz∅$_{e}$t∅k∅̲liv´it͡ɕ∅]/.

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*$\underline{ø}$*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.[91]

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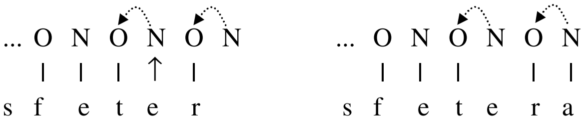
[91] However, given the fact that this nucleus alternates with [e] it should probably represented as possessing a floating melody in modern Polish.

(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*.[92]

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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[92] 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.		b.	
wia[**tr**]	‘wind’	tea[**tr**]	‘theatre’
ka[**tr**]	‘frame’	parame[**tr**]	‘parameter’
musz[**tr**]	‘drill, gen.pl.’	li[**tr**] (li**ter**)	‘litre’
jesio[**tr**]	‘sturgeon’	fil[**tr**] (fil**ter**)	‘filter’
siós[**tr**]	‘sister, gen.pl.’	Cy[**pr**]	‘Cyprus’
hałas[**tr**]	‘mob, gen.pl.’	a[**kr**]	‘acre’
bó[**pr**]	‘beaver’	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].[93]

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

(74)

a.		b. ***imperative***	
cy[**kl**]	‘cycle’	pie[**kl**]	‘fuss’
mono[**kl**]	‘monocle’	ocie[**pl**]	‘warm up’
pejo[**tl**]	‘peyotl’	rozświe[**tl**]	‘brighten up’
nota[**pl**]	‘notable’	mó[**tl**]	‘pray’
spekta[**kl**]	‘spectacle’	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

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[93] 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 > $^?$pt͡ɕi ~ 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].[94] 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-

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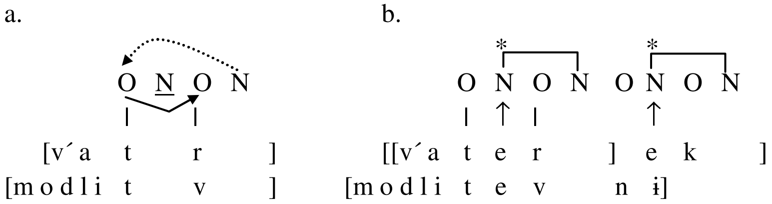
[94] There are also a few words with final [kf] in Polish, e.g. *sakw* ‘sack, gen.pl.’.

tations than *wiatr* and *modlitw*, respectively. They must be assumed to contain a lexically present floating melody, that is, /[v´atø̲rø]/ as opposed to /[[v´atø$_{e}$rø]ø$_{e}$kø]/ and /[modø̲litø̲vø]/ as opposed to /[modø̲litø$_{e}$vønɨ]/. The relevant aspects of these representations are presented below.

(76)



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.[95]

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

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[95] 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.[96] 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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[96] 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* /sfetø$_{e}$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/.[97] 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

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[97] 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.[98]

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

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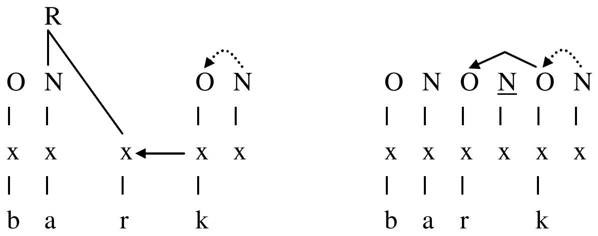
[98] In chapter 3, we will consider the consequences of this proposal in more detail.

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.[99]

(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.'

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[99] 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).[100]

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

wt	*gwałt* ‘rape’, *kształt* ‘shape’	*...wet /...wtu
lt	*palt*^{M} ‘coat, gen.pl.’, *dekolt* ‘décolletage’	*...let /...lta[101]
rt	*czart* ‘devil’, *mord* ‘killing’	*...ret /...rta
nt	*kąt* ‘corner’, *patent* ‘patent’	*...net /...nta

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

[101] 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[102]
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-

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[102] 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 *TR*s is lexically driven, and hence, arbitrary. For this reason, one should expect a hefty set of alternating forms in *RT*s 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*.[103] 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 *TR*s and *RT*s.

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[103] 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***		< /karøta ~ karøtø/	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).[104]

(82) a. ***the 'missing' structure in CSL*** b. ***the 'missing' structure in standard GP***

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

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[104] 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.[105] 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.[106] 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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[105] See the analysis of *tknąć* (48b) and the discussion of its consequences for standard GP in section 5.5.

[106] 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 RTs. 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 RTs, where integral clusters are predominant, and alternations are found in well-defined situations.

The facts concerning the integral and ambiguous RTs 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)[107]
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

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[107] 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).

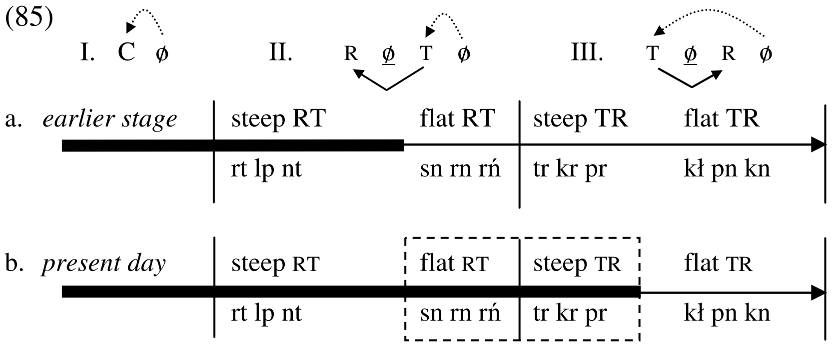
The question is what would happen if the jer was lost between consonants that could, and therefore had to contract a governing relation? For CSL the answer is simple. Such nuclei became locked inside governing relations and do not participate in vowel – zero alternations. In such context, we should not 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.[108] 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.[109]

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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[108] 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.

[109] 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.

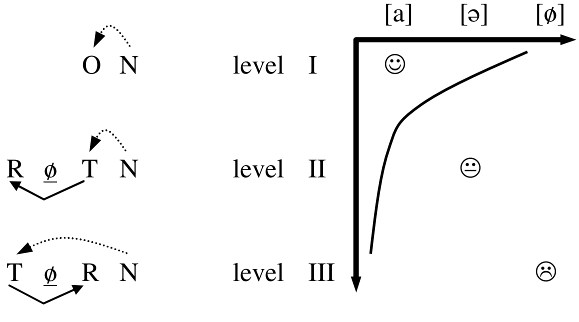
7. CSL – summary and conclusions

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)



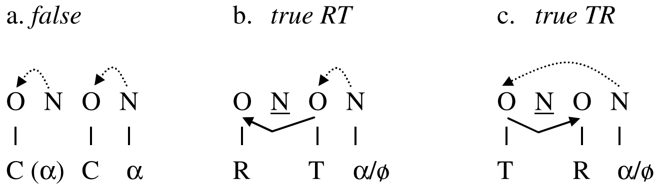
The syllabic space illustrated above is the central point of CSL. The application of the complexity scale model to various phenomena in different languages points to the supreme role of nuclei as licensers in phonology. The entire syllable typology, including markedness tendencies and the definition 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 (*ɸ–ɸ). 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 (I ⊂ II ⊂ 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	TR∅	⊃	TRa
II	…RT∅	— // —	TR∅	⊃	RT∅
II	…RTa	— // —	RT∅	⊃	RTa
I	…C∅	— // —	RT∅	⊃	C∅
I	…Ca	— // —	C∅	⊃	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 TRs 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.

Chapter 3
The phonological structure of words

1. Introduction

The aim of this chapter is to determine the phonological conditions underlying the structure of words. The facts discussed here are meant to extend the model of complexity scales and licensing strength in syllabification (CSL), by pointing to an intimate relation between the higher prosodic organization within the phonological word, that is, the foot structure, and certain tendencies at the level of the syllable. Since in our model syllabic types in individual linguistic systems are determined by the licensing strength of the nuclei, it is predicted that the licensing strength of these nuclei, due to their participation in the prosodic organization above the syllable level, should be subject to certain adjustments, especially in those cases where major prosodic reorganization takes place in a given system. Initially, in section 2, the discussion will be mainly based on the well-known phenomenon of liquid metathesis in the history of Slavic languages. However, facts from some modern Slavic languages, as well as from other modern languages, for example Irish, will be adduced in order to support those elements of the discussion which necessarily remain in the sphere of hypothesis. In section 3, we return to some aspects of syllabic organization which were signalled in the previous chapter, such as the problem of the traditional branching rhyme and *s+consonant* sequences, with a view to demonstrating that the model of complexity scales and licensing strength may account for a number of phonological processes and patterns, for example, the concentration of consonant clusters at the edges of words. Thus, we will see that most of the cases of extrasyllabicity need not be viewed as exceptional, but rather as the predicted outcome of utilizing the complexity scales to the full.

Looking at the history of Slavic languages, one is confronted with two major phenomena which attract immediate attention. They are puzzling because they produce, quite unexpectedly, opposing effects with respect to syllable structure. One of them is the so called *Law of Open Syllables*, or preference for syllables with rising sonority (e.g. Iljinskij 1916, Mareš

1965, Milewski 1932, Stieber 1979, Shevelov 1964, Vaillant 1950, Wilkoń 1999), which involves a number of processes such as the loss of final consonants, the simplification of clusters, the monophthongization of diphthongs, the rise of nasal vowels, and even the rise of prosthetic onsets word-initially. The last stage in this shift is represented by the way the so called liquid diphthongs *ar, er, al, el* developed in closed syllables (e.g. Bernštejn 1961, Ekblom 1927, Iljinskij 1916, Jakobson 1952, Lehr-Spławiński 1931, Shevelov 1964).[1] Metathesis took place in these sound sequences, which may be schematically represented as the (T)ART > (T)RAT shift.[2] After the process was complete, most syllables in Slavic were open, that is, they ended in a vowel and had almost no internal codas (CVCV).[3] The other major phenomenon, which has always bewildered linguists, is the loss of weak jers, which reintroduced closed syllables in all Slavic languages, thus putting an end to the tendency for rising sonority.

Initially, we will look more closely at the problem of liquid metathesis. However, this term covers only part of the facts with respect to Slavic, since metathesis did not take place everywhere in the relevant contexts, and where it did occur the effects varied. For this reason, we use the terms *elimination of liquid diphthongs*, and *elimination of RT clusters*, as these reflect the facts in Slavic in a more uniform fashion and cover the relevant phenomena in their entirety, while metathesis is only one of the strategies and part of a broader picture.

The primary reason why we look at the Slavic facts is that as a result of the law of open syllables, of which the resolution of liquid codas was an integral part, most Slavic languages had a syllable structure which appears to contradict the predictions made by our model of complexity scales and licensing strength, in which more complex structures imply the presence of less complex ones. Given that all syllables lost their codas, while the lan-

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[1] Most linguists agree that the process of liquid metathesis took place some time between the end of the 8th and the beginning of the 9th century.

[2] Throughout the discussion of Slavic, the abstract schemes of the relevant word structure will be expressed in capital letters and more concrete forms will be given in italics or phonetic transcription. In the general scheme, T stands for any consonant, A for any non-high vowel, and 'R' represents the liquids *l* and *r*. In later discussion, T will be understood as the governor and R as the governee in interconsonantal relations, just as in the rest of this work.

[3] While there were almost no codas, complex clusters of the branching onset type were present. In this respect, C in the scheme CVCV, stands for a consonant or consonant cluster of rising sonority, with the exception of S+C.

guages had branching onsets (*TR*), both ones inherited from the Indo-European and newly formed ones, we seem to be missing a structure which we assumed must be present in the syllabic inventory, that is, *RT* clusters. It is not our intention to give yet another analysis of the Common Slavic liquid diphthongs, and especially the very complicated dialectal variations.[4] Rather, we will concentrate on presenting a general account of the facts which is predicted by the model of complexity scales. The Slavic data provide an excellent testing ground for the model, and offer an interesting opportunity to extend it so as to include the interaction between syllabic organization based on the licensing strength of nuclei and the higher prosodic organization within the phonological word, that is, the distribution of licensing potential above the level of the syllable which was proposed in the theory of *Licensing Inheritance* by Harris (1997). Given that different types of licensers in our model are able to license different amounts of structural complexity, we predict that there is a strict relation between the stability of the prosodic system and the stability of syllable structure, and consequently, of consonantal clusters.

1.1. Theoretical assumptions

The theoretical model used here is a combination of the assumption that words are formed by sequences of CVs (Lowenstamm 1996, Rowicka 1999, Scheer 1998b, 2004, Szigetvári 1999) and the model of complexity and licensing strength presented in the previous chapter.[5] The main principles of syllabification, however, are those of standard Government Phonology (Kaye, Lowenstamm and Vergnaud 1990, Charette 1990, Harris 1990, 1994), where syllabification stems from governing and licensing relations. The CV assumption differs from the standard GP model, in that the governing relations between consonants are contracted across empty nuclei. In other words, all governing relations are in a sense interonset relations, which have been independently proposed in many GP analyses.[6] The melodically empty nuclei, which are locked within such relations, are not

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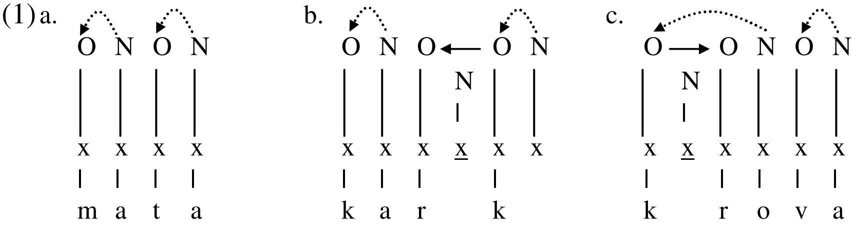
[4] For a recent account of the dialectal diversification of liquid coda elimination within a model of Optimality Theory, see Bethin (1998).

[5] Some reasons for the CV assumption were mentioned in the analysis of consonantal clusters in modern Polish presented in chapter 2. As will become evident below, the facts of liquid metathesis to be discussed are best expressed in this model.

[6] See e.g. Bloch-Rozmej (1994, 1998), Cyran (1996a, 1997), Cyran and Gussmann (1999), Kaye (1990), Rowicka (1999), and Scheer (1996, 1998b).

visible to phonological processes. They begin to play a role only when the interonset relation around them fails to be contracted for some reason, and the empty nucleus is called on to take over the role of the licenser of its onset. Below we illustrate the three main structures which require licensing from the following nucleus, on the basis of modern Polish examples. These structures are a direct translation of the ordinary constituent-based view of the syllable into CV. They also illustrate the three levels of syllabic complexity, as proposed in Kaye and Lowenstamm (1981).

(1)



a. *mata* ‘mat’ CV.CV
b. *kark* ‘neck’ CVC.CV
c. *krowa* ‘cow’ CCV.CV

Thus, (1a) illustrates level I of syllabic complexity where a full vowel licenses a simplex onset. In such cases, the melodic make-up of the onset does not matter. In (1b), the first nucleus licenses a simplex onset. The second nucleus is locked in the leftward governing relation (r←k) which is licensed by the final nucleus – this represents level II of syllabic complexity.[7] In such cases, the final nucleus licenses the entire cluster and the nucleus which is sandwiched between the consonants has no licensing function to play. Note that the final nucleus is empty and that in modern Polish it may license not only *RT* clusters, but also *TR* as in *wiatr* /v´atrø/ > [v´atr] ‘wind’. In standard, constituent-based terms, we may say that (1b) illustrates an internal coda. On the other hand, the initial governing relation in (1c) illustrates what we usually call a branching onset – this is level III of syllabic complexity. Here too, the governing relation contains a locked empty nucleus. We will see later in this chapter that this nucleus may in some contexts begin to function phonologically, thus further justifying its assumed presence.

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[7] For simplicity, the second level of syllabic complexity will be referred to as ‘*RT* clusters’. This situation corresponds to the internal coda-onset sequences in the traditional sense. R stands for a ‘governee’ and T for a ‘governor’. Likewise, *TR* clusters are traditional branching onsets.

The CV model sketched above is fully compatible with the model of licensing strength and complexity scales introduced in the previous chapter because, we will recall, syllabification is a reflection of the licensing relations between a nucleus and the preceding onset on the one hand, and on the other hand, the governing relations that this onset contracts either with the preceding or the following consonant. Additionally, the CV model, in which each consonant must be followed by a nucleus by assumption, is also compatible with our view that word-final consonants are always followed by a nucleus, even if sometimes it is empty melodically, as in *kark* (1b). It should become immediately obvious that in this model, the loss of final jers in Slavic languages did not reintroduce closed syllables but merely introduced another type of syllabic licenser, that is, nuclei without melodic content.

Generally speaking, the model of licensing strength and complexity recognizes three types of licensers: full vowels, schwas, that is, reduced vowels, and empty nuclei (a–ə–∅). They differ in terms of their inherent strength with respect to the other licensers, in that, within one phonological system, the weaker licensers are never allowed to license more than the stronger ones. Thus, the three types of nuclei form a non-rerankable scale (a 〉 ə 〉 ∅), just as the levels of syllabic complexity do (I 〉 II 〉 III). The two scales interact, in that the licensing strength of individual licensers is established with respect to the complexity scale. We assume that this is the source and the basis for variation in syllabic types across languages, and that this simple model is able to capture both the typology and the markedness of syllable structure. For example, the unmarked nature of CV, a syllable consisting of a single consonant and an unreduced vowel, follows from the fact that this is an example of the least complex structure licensed by the strongest type of licenser. No additional stipulations or constraints are needed to derive this simple fact. Below, hypothetical settings of the licensing properties of the three types of licensers are given. They happen to express an existing system, that is, Malayalam.[8]

(2)

	a	ə	∅
I (C_)	✓	✓	✓
II (RT_)	✓	✓	
III (TR_)	✓		

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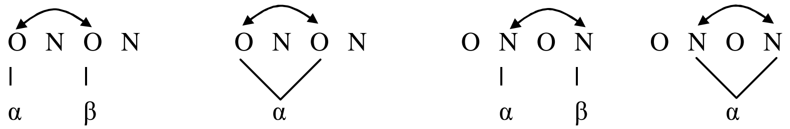
[8] For a full analysis of the settings in Malayalam see Cyran (2001). For comprehensive analyses of this language see Mohanan (1986) and Mohanan (1989).

In terms of existing syllabic configurations, the system illustrated in (2) has clusters of the branching onset type only when followed / licensed by a full vowel. The schwa is able to license simplex onsets and *RT* clusters, while word-finally, only simplex onsets are allowed. As mentioned earlier, each of the types of nuclei can utilize all the given options. However, each time, we assume that the stronger licenser must license the same amount of material or more. This follows from the nature of the scale of licensers.

To return briefly to the CV model, it assumes that not only consonantal clusters, including geminates, contain an empty nucleus within them, but also that long vowels and diphthongs contain an empty onset.

(3) a. ***consonant cluster*** b. ***geminate*** c. ***diphthong*** d. ***long vowel***



The direction of relations between the positions is deliberately not specified as it may vary across systems and even within a single system (Scheer 1998b, 2004).

Let us now turn to some basic data illustrating the developments that followed the elimination of liquid diphthongs in Late Common Slavic (LCS).

2. Lexicon optimization

2.1. Elimination of liquid diphthongs in Slavic

There are four different sets of data to consider with respect to the behaviour of liquids in Late Common Slavic. These can be schematically represented as ART, TART, TURT and TRUT. Due to the variety of effects evidenced, very often these sets are discussed separately and receive separate accounts. First, we discuss the main data which include the reflexes of the original ART and TART forms, that is, liquid diphthongs beginning with a non-high vowel. The discussion of the forms which involve high vowels and which are schematically represented as TURT and TRUT will be delayed till later. In the data below, the relevant contexts are typed in bold.

(4)	**ART >**	***rot / rat***	***rot / rat***	***rat***
Gloss	*Proto-Slavic*	*Polish*	*Russian*	*Serbo-Croatian*
‘elbow’	*â**lk**uti	**łok**ieć	**lok**ot’	**lâk**at
‘even’	*a**ru̯**inu	**rów**ny	**rov**nyj	**ráv**an
‘plough’	*á**rd**la	**rad**ło	**ral**o	**rȁl**o
‘to hunger’	*a**lk**ati	**łak**nąć	**lak**omyj	**lȁč**an

The least controversial set of data, in which the liquid coda was eliminated in an almost uniform way in the entire Slavic area, involves the shift ART > RAT (4). Slavic dialects divide here into two groups depending on the reflexes of the original root vowels. In northern dialects, including Polish and Russian, there were two resulting vowels: *o* and *a*. This distinction relates to the original intonation contours specifying the liquid diphthongs. Thus, under the *acute* (rising) intonation *art, alt* went to *rat, lat* e.g. Pl. *łania* ‘doe’, *radło* ‘plough’, while under the *circumflex* (falling) intonation the reflexes were *rot, lot* e.g. Pl. *łokieć* ‘elbow’, *robić* ‘work’. In southern dialects, regardless of intonation, all vowels became *a*. Historically, *o* evolved from a short *a*, and long *ā* gave *a*. Thus, apart from liquid metathesis, we are also dealing with changes in vowel quantity in (4). However, since metathesis took place regardless of whether the intonation-related lengthening occurred or not, we will bypass the quantity issue and indeed the intonation contrasts in our consideration of the elimination of liquids from the ‘coda’ position.[9] To all intents and purposes, the relevant fact is that the original ART forms were transformed into RAT, thus, eliminating *RT* clusters.

Details concerning the quality of vocalic reflexes with respect to dialectal variation have been instrumental in determining divisions between dialects and dialect groups in Late Common Slavic. Such details will be mostly disregarded in this discussion, as the focus of this analysis is primarily on syllable structure, and in particular on the loss of *RT* clusters. The only relevant distinction for our purposes is that of vowel height, because the liquids preceded or followed by high vowels, as opposed to those in

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[9] The influence of intonation on metathesis, especially in dialects where some forms were metathesized and some were not, cannot be excluded, and in fact it has been proposed that there is a connection between the two (Rozov 1932, Lehr-Spławiński 1931, Milewski 1933).

non-high vowel contexts, behave in an altogether different way with respect to syllable structure shifts.[10] Let us now look closer at the data in (5).

(5)	**TART >**	***trot/tret***	***trat/tret***	***torot/teret***	***tort/tret***
Gloss	*PS*	*Polish*	*Czech*	*Russian*	*Polabian*
‘cow’	*ká**ru̯**ā	**kr**owa	**kr**áva	k**oró**va	ko**rv**o
‘threshold’	*pá**rg**u	**pr**óg	**pr**áh	p**oró**g	po**rg**
‘frost’	*má**rz**u	**mr**óz	**mr**áz	m**oró**z	mo**rz**
‘fortification’	*gâ**rd**u	**gr**ód	**hr**ad	g**óro**d	go**rd**
‘shore’	*bê**rg**u	**brz**eg	**bř**eh	b**ére**g	**br**ig
‘milk’	*me**lk**á	**ml**eko	**ml**éko	m**olo**kó	**ml**ákă

In general, the forms in (5) demonstrate a similar phenomenon to what we observed in (4), that is, *RT* clusters are eliminated in most cases. Languages like Polish and Czech, have metathesized the TART forms into TRAT, which is the expected situation, as it is parallel to the effects witnessed in (4).[11] On the other hand, Russian is an example of a system in which the *RT* cluster was resolved in a different way. The liquid now appears with full vowels on both sides, a phenomenon which is called pleophony or polnoglasie. Thus, we may conclude that Russian, and the languages which belong to the same group (Byelorussian, Ukrainian), similarly to languages like Polish and Czech, eliminated liquid codas, though not in the same way. Instead of creating a new initial cluster, these dialects introduced an additional vowel, after the liquid (see e.g. Shevelov 1964: 410).[12]

Metathesis and pleophony were, clearly, two different means of achieving the same goal. However, the data from Polabian, a northern Lekhitic dialect, show that there was a third option to pursue as well. In this language some forms metathesized while others did not. The tendency here was to retain *tart* forms and to eliminate *tert*. A similar phenomenon, that is, the absence of metathesis in certain forms, has also been observed in

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[10] By high vowels we mean *i* and *u* which gave the so called jers ь and ъ respectively. These, in turn, disappeared at a later stage in some contexts, and were vocalized in others (e.g. Havlík 1889, Duma 1979).

[11] In the case of Polish, all TART forms yielded *trot* in this context regardless of the intonation contour, which was a crucial factor in the shift ART > *rot / rat*.

[12] Russian pleophony resembles the effects of epenthesis in Barra Gaelic (Borgstrøm 1937: 77, Clements 1986) in which the epenthetic vowel, which breaks up an *RT* cluster, is a melodic copy of the preceding vowel, e.g. *marbh* [marav] ‘dead’.

Kashubian and northern Polish – also belonging to the Lekhitic group – and eastern Bulgarian (Shevelov 1964: 405). We will return to the unmetathesized forms later in this section in connection with the development of liquids in the context of high-vowels. However, now we need to look closer at the difference between ART and TART

The context in TART is slightly different from ART in that the former already contains an onset at the beginning of the word. Quite probably, it is here that we should look for the reason why the effects of 'coda' elimination in (5) are so much more complex.

It is assumed that the metathesis ART > RAT took place earlier than TART > TRAT. Stieber (1979) and Bethin (1998) point to two arguments supporting this view. One of them refers to the relative uniformity with which ART > RAT occurred across all Slavic dialects. The other argument concerns the influence of the old intonation system (*acute* vs. *circumflex*) on the reflexes of the metathesized forms of RAT in northern dialects, and the absence of such an influence in TART.

Given that the primary cause for ART > RAT was identical to that in TART > TRAT, that is, the elimination of *RT* clusters, the chronological difference in the occurrence of the two shifts can be attributed to the absence of potential hindrances such as the above mentioned creation of new initial clusters in TART > TRAT. In fact, the metathesis in ART seemed to satisfy two separate tendencies with one move, that is, it eliminated the liquid codas and provided an onset for vowel-initial words. It must be mentioned that a tendency to fill onsets in vowel initial words at this particular stage in the history of Slavic languages existed independently. Some vowel-initial words developed prosthetic consonants, for example, Polish *jeść* 'eat' and *jagnie* 'lamb' (cf. Lithuanian *ésti* 'eat' and Latin *agnus* 'lamb', respectively). Thus, obtaining a consonant in vowel-initial words, either by prosthesis or by metathesis, seems to have been a welcome solution. Bethin (1998: 32), for example, has formalized this tendency by proposing that one of the crucial factors facilitating the ART > RAT shift was a highly ranked constraint **Onset*, which required that syllables had melodically filled onsets. This factor may indeed have facilitated the earlier completion of the shift in ART than in TART but, the primary, and uniform motivation for metathesis and indeed pleophony was not providing onsets but eliminating 'codas', that is *RT* clusters (Lehr-Spławiński 1931, Milewski 1933).

The obvious question that arises at this point is how the contextual difference between ART and TART influenced the different outcomes. It seems that the newly created clusters in the metathesized forms TRAT would have been well-formed. Firstly, all Slavic dialects had original branching onsets which were inherited from Indo-European, for example, PS **prositi* ‘to ask’, **pluti* ‘flesh’. Secondly, most of the potential new clusters in TART > TRAT would have been of the branching onset type, that is, with rising sonority.[13] Thus, it seems that the presence of a consonant at the beginning of TART should not inhibit the shift in any substantial way. However, there are certain facts, which are widely quoted in the literature (e.g. Łoś 1928, Lehr-Spławiński 1931, Stieber 1973), which seem to point to the fact that the newly created *TR* clusters in the metathesized forms were not automatically identified with the existing branching onsets. Stieber (1973: 21) provides some data from early Polish, repeated here in (6), which demonstrate that prepositions preceding the new clusters behaved as if the cluster contained a weak jer. That is, the jer in the preposition was vocalized. The phonological shape of the forms in (6) is hypothesized.[14]

(6)	*webłocie*	/vъbъ$^{?}$łocie/	‘in the mud’
	zebłota	/zъbъ$^{?}$łota/	‘out of the mud’
	węgłowę	/vъgъ$^{?}$łovę/	‘into the head’
	weproch	/vъpъ$^{?}$rox/	‘into dust’
	odemłodości	/odъmъ$^{?}$łodości/	‘from youth on’

The conclusion that can be drawn from these forms is that the TART > TRAT shift had an intermediate stage TъRAT, which subsequently lost the weak jer (Stieber 1973: 22).

Another argument, not necessarily for the existence of a weak jer inside the newly formed *TR* sequence, but at least for a different treatment of the newly formed sequences as opposed to original Common Slavic branching onsets, is provided in Lehr-Spławiński (1931: 121) and Stieber (1973: 22), and concerns the Lower Sorbian spirantization which affected the *r* sound in the original *kr*, *pr*, *tr*, e.g. **prositi* > *pšosyś* ‘beg’, **trawa* > *tšawa* ‘grass’, **kraji* > *kšaj* ‘edge’. The newly created clusters, however, remained unchanged, e.g. **porxu* > *prox* ‘dust’, **párgu* > *prog* ‘threshold’. Since, as Stieber suggests, the process of spirantization occurred after metathesis, we may assume that the original branching onsets and the newly created ones remained phonologically different in certain respects for some time. This difference in the phonological behaviour of otherwise identical phonetic

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[13] This statement is slightly undermined by forms such as Pl. ***mleko*** ‘milk’, or ***mróz*** ‘frost’ in which the resulting cluster would not be readily accepted by all linguists as a classic case of a branching onset.

[14] Recall the discussion of prefixation in modern Polish in chapter 2.

strings (*TR*s) could stem from two disparate formal structures. Recall from chapter 2 (section 6.2) that surface *TR* clusters can have two possible formal representations in CSL. One is a rightward interonset governing relation corresponding to the structure of a branching onset (1c), and the other is a false cluster, that is a sequence of onsets which are not in a governing relation. The latter form contains a visible empty nucleus, which could be blamed for the vocalization of years in the prefixes shown in (6) above.

In addition to the two arguments mentioned above, which point to the possibility that the newly created clusters were not automatically identified with existing clusters of the same melodic make-up, one should note that in some cases metathesis produced clusters which, from a theoretical point of view, do not look like well-formed branching onsets. Earlier, we mentioned the Polish forms *mleko* 'milk', and *mróz* 'frost', which are problematic as the sonority slope typically required for branching onsets is considerably relaxed here. To these two examples one might also add such forms as *sromota* 'shame', *środa* 'Wednesday', *młody* 'young', *słony* 'salty', *śledź* 'herring', *złoty* 'gold', and so on, all of which originated from TART.[15]

The arguments considered above are important for the following reason. If metathesis indeed produced TъRAT at some stage, or something to this effect, e.g. T^{ə}RAT, and not TRAT, then, regardless of the formal cause of the distinction between the original *TR* and the newly formed $T^{?}R$, we can uphold the argument that the difference in the chronology of ART > RAT and TART > TRAT lies in the fact that metathesis in TART involved the creation of a new construct word-initially, that is a *TR* sequence which was not a branching onset. The acceptance of this new construct by individual systems may have delayed the completion of liquid coda elimination in TART in contrast to ART > RAT in which, recall, additional tendencies – providing an onset for a vowel-initial word – facilitated the shift. We may also assume that the rejection of the new construct may have been responsible for pleophony in east Slavic. It is possible that these systems never allowed for TART > TъRAT, the result of metathesis advocated in, e.g. Lehr-Spławiński (1931) and Stieber (1973), while they still had to eliminate the liquid coda, like most Slavic systems at the time.[16]

In the above discussion we focused on the distinction between the original branching onsets and the newly created *TR*s, thus endorsing the

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[15] The word *śledź* is in fact of Scandinavian origin, cf. Icelandic *síld* 'herring' (Gussmann p.c.). Note that must have been borrowed before metathesis took place.

[16] A possible formal account of this restriction in east Slavic will be provided when we discuss a GP analysis of the elimination of liquid codas.

fact that branching onsets must have been a permitted structure.[17] Admittedly, this conclusion exposes a serious clash between the Slavic facts and the predictions of the model of complexity scales and licensing presented in the previous chapter. Specifically, it will be recalled that the CSL model stipulates that branching onsets, that is, true *TR* clusters are formally more complex than *RT* clusters in that it is more difficult for the following nucleus to license them (1). Therefore, we should expect that if a language in its historical development loses clusters it should tend to lose the more complex ones, that is *TR*s, rather than *RT*s. The facts from Common Slavic which we have seen so far seem to blatantly contradict this prediction. Both in the systems which had metathesis and in those which had pleophony, the original branching onsets – level III of syllabic markedness – were retained, while the *RT* clusters, which belong to level II, were eliminated.

Thus, we cannot escape the observation that the resulting syllable structure of most Slavic languages after the elimination of liquid codas was still TATA, TRATA and TATRA, that is, CV and CCV, but not *CVC.[18] In our model, this means that the nuclei lost the ability to license the easier, intermediate structures and retained the ability to license the more difficult ones. Theoretically, this situation makes no sense in the model of complexity scales and licensing strength.

Admittedly, any constituent-based model, referring to parameters on syllable structure, or parameters on the shape of individual constituents, can handle these facts without a problem, though it is not clear if such a model would be able to explain why such a system might arise. Our task will be to show that there is a clearly definable reason for this 'unfortunate' situation, and to demonstrate that the model of Government Phonology predicts such states in grammars, if we take into account the theory of

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[17] It will be recalled that the term 'branching onset' is used here as a short-cut to refer to those *TR* clusters in which a governing relation is established between the governor T and the governee R. Opposed to this structure is what we refer to as a '*TR* sequence', a false cluster in which no governing relation holds. Apart from the presence or absence of the governing relation both configurations involve the presence of an empty nucleus, but only in the false *TR*s is this nucleus visible to phonology, due to the fact that it is not locked by a governing relation between the flanking onsets.

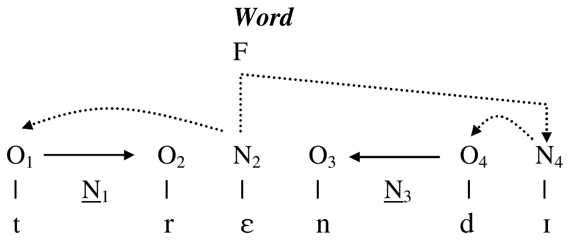
[18] This claim is valid for the systems which did eliminate the liquid codas only if we assume that the remaining word-internal s+consonant clusters were complex onsets rather than coda-onset structures, e.g. *nesti* 'carry'.

Licensing Inheritance proposed in Harris (1997), which defines the way in which licensing is distributed within the prosodic word.

2.2. Distribution of licensing in the phonological word

An interaction between the licensing properties of nuclei and the higher prosodic organization is part and parcel of the system presented in this work. Given that all syllabification is accomplished through the licensing of onsets by following nuclei, we would expect that these nuclei may differ with respect to their licensing potential depending on whether they find themselves in strong or recessive prosodic contexts. The general idea of Licensing Inheritance (Harris 1997) is illustrated below on the basis of a representation of the English word *trendy*, which is slightly modified to fit the CV model of phonological representation assumed in this work.

(7)



What we observe in (7) is a network of relations distributing prosodic licensing within the phonological word. For simplicity, the word used in (7) for illustration contains only one trochaic foot. The head of the domain (N_2) is the source of licensing for all the remaining positions. Depending on the distance from the source of licensing two types of recessive positions can be identified here. One involves consonants which are governees in relations contracted between onsets (O_2 and O_3).[19] The prosodic recessiveness of these objects is reflected in the depleted amount of material that they may contain – governees are always less complex than their governors. The other type of recessive position are nuclei which are subsumed under the weak branch of the foot. Here, it is N_4. Their recessiveness is reflected in numerous neutralizations of vocalic contrast, that is, vowel reductions. The present shape of the CSL model assumes that the nuclei N_2

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[19] Note that, technically speaking, these positions are adjacent to the head of the domain N_2.

and N_3 in (7) are locked by the respective interonset relations and do not participate in the distribution of licensing. Unless confronted with evidence to the contrary, we will maintain this assumption. This model also stipulates that of the two consonantal clusters in the word *trendy* the one which is licensed by the head of the domain should be better off than the one licensed by the nucleus which finds itself in the weak branch of the foot.

To conclude: Licensing Inheritance indicates that the licensing potential of the nucleus subsumed under the weak branch of the foot may be smaller than that of the nucleus which is in the head of the foot. Logically, then, the amount of licensing that it can bestow on the preceding onset may be smaller. Thus, this model predicts that the potential of nuclei, regardless of their phonetic make-up, may vary depending on the prosodic configuration in which they reside.

With this short reminder of the theory of licensing distribution, it seems reasonable to ask the question if it is theoretically sound to compare the licensing properties of nuclei in a given system unless we look at identical prosodic contexts. In the model presented in this work, syllabification is always a case of licensing from the nucleus to the preceding onset head, which in turn, may govern another onset in either direction if the complexity differential between the two consonants allows for it. Therefore, the licensing of an *RT* cluster which, in effect, allows for 'codas' in a given system, occurs in a word-non-initial context. In this respect, a comparison of the licensing abilities of the second nucleus of the word with those of the first one, in a hypothetical pair of words TRA_1TA_2 and TA_1RTA_2, is theoretically questionable, as it does not take into account the prosodic contexts in which the two nuclei find themselves.

Coming back to the Late Common Slavic situation, our model seems to explicitly point to the necessity of considering the phonological aspect of representations and of determining what problems need to be solved in a successful account of the fact that words of the form *TARTA suddenly became illicit. Firstly, we must find a reason why the second nucleus should have lost its licensing potential so drastically that it could no longer license *RT* clusters. Note that trochaic feet, like the one illustrated in (7) above, are present in many if not most languages (e.g. van de Vijver 1995, 1998), and yet, such dramatic shifts are not observed on a daily basis. Secondly, if we do find such an explanation, we must also be able to say what happened with the branching onsets in non-initial position, that is, in TA-

TRA.[20] Note that this is the only context in which we can compare the licensing of *RT* and *TR* in this model. We will first look at some facts concerning prosodic reorganization in Common Slavic in order to respond to the first problem, and then we will return to the second one. In the following discussion we draw heavily on the work of Bethin (1998).

2.3. Late Common Slavic prosody

There is one more, very clear, prediction which follows from the connection between the theory of Licensing Inheritance, dealing with the distribution of licensing within a phonological word, and the model of complexity scales and licensing strength defining the syllable structure of a given linguistic system. Namely, we may expect that a stable prosodic system will ensure stability for the syllable structure, and conversely, dramatic shifts in syllable structure will be connected with similar phenomena in foot and word prosody, because these two aspects of phonological representation are intimately related. At this stage we are not making any claims as to which affects which, though, logically, the more likely direction of influence is from foot and word prosody to the syllabic structure and not vice versa. The history of Slavic, however, seems to show that the influence was bidirectional, depending on the aspects of the respective levels which were involved.

To begin with, let us present a fairly general picture of the present day accentual systems of Slavic languages, in order to be able to see what aspects of prosodic organization must have been present in Common Slavic (CS), before the diversification began in Late Common Slavic (LCS). We will follow Bethin (1998) in assuming that despite the diversity of prosodic systems emerging in Late Common Slavic there was a new uniting element of prosodic organization. We will additionally claim that this uniting element may have been directly responsible for the so called law of open syllables. This will be a clear case of word prosody influencing the syllable structure. We will not discuss the details of prosodic changes in individual dialect of CS, nor will we attempt to provide an answer as to the cause of the prosodic upheaval in LCS, though we agree with Wilkoń (1999: 348) that the cause may have been primarily morphological in nature.

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[20] One can immediately think of a number of words in modern Polish which demonstrate that apparently nothing happened to non-initial branching onsets, e.g. *siostra* ‘sister’, *modry* ‘deep-blue’. In this respect, the Slavic facts do not cease to present a serious problem for our model.

Modern Slavic languages exhibit a complicated array of prosodic systems. For reasons which will become clear presently, we will look at three factors: stress, pitch, and quantity. The survey presented in the table below, based on Stieber (1979:64) and Bethin (1998), is only partial as it aims to show the diversity of the systems rather than provide a full typology.[21]

(8)

LANGUAGE	PITCH (INTONATION)	STRESS	QUANTITY DISTINCTIONS
Russian	–	free – dynamic	–
Bulgarian	–	free – dynamic	–
Polish	–	fixed (penultimate)	–
Czech	–	fixed (initial)	+
Macedonian	–	fixed (antepenultimate) dynamic	–
Serbian	+	+	+
Croatian	+	+	+
Slovene	+	+	+

The above table simplifies the facts somewhat, however, the general observation is that modern Slavic prosodic systems differ in terms of the three main aspects mentioned above, that is, pitch (tonal accent), type of stress, and the presence of quantity. Following Bethin (1998) we may generally divide the present day systems into stress and pitch accent languages. Among the stress languages, some have a fixed stress, like Polish and Czech, while others have a free stress, like Russian, Ukrainian and Byelorussian. An additional distinction that can be made here is whether the stress system is dynamic or not (Stieber 1979). Dynamic systems are characterized by changes in the quality of vowels depending on whether they are stressed or not. Thus, for example, Russian and Bulgarian are dynamic systems in this respect, as their unstressed vowels undergo reductions. Similarly, Macedonian can be said to have dynamic stress, even though the position of stress is fixed, unlike Polish, which has a fixed stress but is not dynamic. It may also be observed that languages with dynamic and fixed non-initial stress have lost quantity and tonal distinctions. Pitch accent is typically found among the south central Slavic languages, e.g. Serbian /

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[21] For a recent survey of the accentual systems of Slavic languages see e.g. Dalewska-Greń (1997).

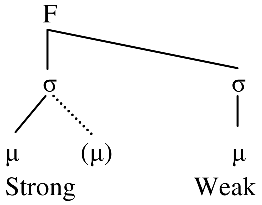
Croatian, Slovene. It is assumed that they have retained, with various modifications, all the major aspects of Common Slavic accentuation, especially the Čakavian dialects of Croatian which are assumed to have best preserved the Common Slavic relationships. Regardless of the current distribution of the prosodic elements of pitch, stress and quantity, it is assumed that all these aspects must have originated in Common Slavic. In other words, Common Slavic can be characterized as possessing pitch accent as opposed to stress, and quantity based prominence – it had both short and long nuclei.

The word stress in CS was free and mobile. This means that the accent could fall on any nucleus of the word and that within a given morphological paradigm the accent could fall on different nuclei. Stieber also points to the fact that CS accentuation was not dynamic, that is, whether the vowel was accented or not had no influence on its quality – there was no vowel reduction. In addition, there were two intonation patterns which we mentioned earlier in connection with the reflexes of metathesis in the group ART > *rot*, *rat*; the acute (rising pitch) and the circumflex (falling pitch).

With respect to the distinction between stress and intonation Bethin (1998) proposes that we differentiate between accented stems, which were marked lexically by the presence of a high tone on a given mora, and unaccented stems which were marked by default stress on the initial syllable. As for the collapse of the CS prosodic system which gave rise to various dialectal forms, Bethin connects the different developments to the syllable structure distinctions which were already present. In other words, the structure of the syllable had an effect on the prosodic diversification. Following her findings, we will claim that some aspects of prosodic reorganization influenced the shape of the syllable structure in all LCS systems. That is, the direction of influence was reversed. In our investigations, we will ignore the differences and focus on the elements which unite almost all Slavic languages from LCS to the day.

Late Common Slavic witnessed some dramatic changes with respect to prosody which led to a diversification of individual prosodic systems, but as a result of these changes, a new quality emerged which spanned the Slavic dialects with various degrees of intensity. A major innovation of LCS, noted in Bethin (1998) was the recognition of the bisyllabic trochaic foot as a prosodic organizer, that is, a strong–weak relationship within a bisyllabic domain. Bethin lists a number of phenomena which either contributed to this new metrical organization or merely reflect its influence on the shape of words.

(9)



One of the phenomena contributing to the emergence of the trochee was a general shortening of final long vowels, for example, **sĕstrā* (nom.sg.), **sĕstrȳ* (gen.sg.), **sĕstrǫ* (acc.sg.) gave Czech *sestra, sestry, sestru* 'sister' (Schenker 1993).[22] This shortening led to a situation in which the second nucleus became shorter, or 'weaker' than the first nucleus if originally the word had two long vowels (10a), or bisyllabic forms arose with two equal nuclei if the first nucleus was originally short (10b). This is schematically illustrated below.

(10)

a. VV–VV → VV–V

b. V–VV → V–V

There were other phenomena which reflect a similar tendency, for example, the retention of vowel length in pretonic position, e.g. **trau̯à* > Cz. *tráva*, and the neo-acute retraction from accented high lax vowels (jers) onto the preceding short or long vowel.[23] In addition to the above phenomena one should also bear in mind that the unaccented stems which had initial stress also display the same pattern, that is, trochaic rhythm. In this respect, the trochee is not a new invention but the concentration of the phenomena mentioned above could have contributed to its increasing importance in the phonology of LCS.

In (11) we illustrate the prosodic patterns of bisyllabic forms in LCS as provided in Bethin (1998: 124).

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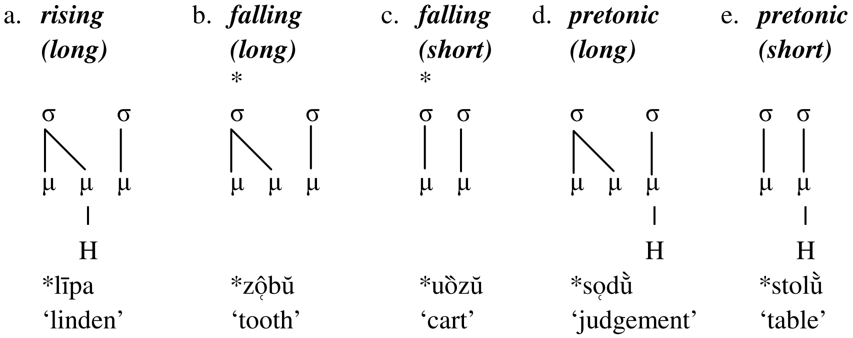
[22] Slovak Rhythmic Law could also serve here as an example of such a process (e.g. Kenstowicz and Rubach 1987).

[23] This phenomenon can be understood as retraction of tone in the dialects which retained the pitch accent (south central), and a retraction of stress in those dialects which lost tone (northern), see (11d) and (11e).

(11)



The form in (11a) illustrates a bisyllabic word with the first nucleus being long; it contains a high tone in the second element of the nucleus, thus yielding rising intonation (acute). In (11b), the stem is unaccented, therefore the first syllable is stressed which is represented by the use of (*) above the first syllable. This configuration produces falling intonation (circumflex). (11c) has two short vowels with no lexical accent, thus initial stress and falling intonation occur here too. (11d) and (11e) show bisyllabic forms before the neo-acute retraction, which we mentioned earlier. Regardless of whether this phenomenon took the shape of tone or stress retraction (Bethin 1998), the result was such that it contributed to the number of forms with the strong-weak pattern.[24]

Bethin observes that the generalized trochaic metrical rhythm is present in modern Slavic languages even if they have retained quantitative prominence and pitch distinctions, though of course this is more evident in languages with fixed stress. Thus, it looks like we are dealing with a phenomenon which next to the tendency for rising sonority and the development of jers had a general effect across the diverse systems which arose after the collapse of Common Slavic. In support of the observation that LCS developed a bisyllabic prosodic domain, Bethin also mentions other phenomena which point to the effectiveness of this metrical configuration. For example, the processes of Compensatory Lengthening of a vowel, if a jer was lost in the following syllable, and the strengthening of jers as a result of the loss of final jers could also be viewed as instantiations of the trochaic grouping.

We would like to connect this fact, that is, the rise of trochaic metrical organization with the developments which involved the liquid diphthongs.

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[24] Stieber (1979: 63) notes that retraction of accent also involved the vowel *a* in words ending with *–ša* < *–χja*.

In the analysis proposed below, we will focus not so much on the effect of trochaic feet on the shape of the word in a given system, as on the effects connected with the rise of trochaic feet in a system which apparently did not have or use this metrical organization in a meaningful way, and in which accentuation was not dynamic in the sense of Stieber (1979), that is, there were no reduced vowels.

2.4. Elimination of RT clusters – a foot-based analysis

In the analysis below we would like to demonstrate that the elimination of liquid diphthongs, which in some systems took the form of liquid metathesis and in others pleophony, can be viewed as a prosodically motivated redistribution of vocalic melodies. Recall that the prosodic network within the phonological word is built on nuclei, these nuclei in turn have licensing duties with respect to their onsets, and the onsets may be simplex or complex. Below we will use the following symbols:

T = potential governor, a complex consonant, typically an obstruent[25]
R = potential governee, a simplex consonant, typically a sonorant
a = a full unreduced vowel, strong licenser
ə = a reduced vowel, weak licenser, in the case of LCS: it can be a jer (ь/ъ) or any vowel found under the weak branch of the trochaic foot

The term ‘potential’ is used with reference to the two types of consonants for two reasons. Firstly, both types can occur as simplex onsets in which case their potential for fulfilling particular roles in governing relations is irrelevant. Secondly, whether a given consonant is a governor or a governee in a particular configuration of two consonants will depend on their segmental complexity differential. Thus, for example, /f/ will take on the role of a governee if it is followed by a more complex consonant, as in *hefty*, but the same complexity of /f/ will guarantee a governor function if it is followed by e.g. /r/, as in *Africa*.

Let us now consider how we could represent the initial situation in Slavic before the new prosodic organization began to have an effect on the licensing properties of nuclei. As mentioned earlier, we assume a CV analysis; the Slavic facts lend themselves fairly easily to such a structure.

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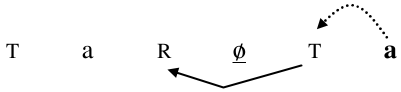
[25] Recall that *complex* in this model corresponds to *strong* in the sense of e.g. Vennemann (1983).

This model requires that the RT cluster contains an empty nucleus, whose locked status is marked by underlining, which lacks a licensing relation with its onset. In the representations below, all unnecessary details are avoided.

(12)



The representation in (12) illustrates a stage in which the nucleus which directly follows the RT cluster is still able to fulfil its licensing duties. It licenses the obstruent to govern a preceding liquid. In traditional terms, the liquid finds itself in the coda of the first syllable, while the obstruent is in the onset of the following one. At this stage in the development of Slavic languages, the licensing properties of nuclei were stable regardless of their position with respect to the accented nucleus.

Indeed, in terms of accent, we may be dealing here with three different configurations. In the first one, the first nucleus / rhyme contains a high tone and thus we have words with acute / rising intonation, e.g. Proto-Slavic **káru̯ā* 'cow' > Pl. *krowa*. Another possibility is one in which the stem is unaccented and has falling intonation (circumflex), e.g. PS **bêrgu* 'shore' > Pl. *brzeg*. And finally, the vowel which followed the cluster could be lexically accented as in PS **melká* 'milk' > Pl. *mleko*. Regardless of the different accentual patterns, we assume, following Stieber (1979) that all vowels in unaccented nuclei remained unreduced.

We believe that the crucial moment which precipitated the shifts of coda liquids was intimately related to the establishment of the trochaic metrical organization in LCS, due to which most of the nuclei which had originally followed the RT cluster found themselves in a prosodically weak position.[26] We illustrate this by representing the relevant nucleus as a schwa vowel with inverted commas ('ə'). This is to symbolize the weaker status of those nuclei as licensers with respect to what they used to be rather than to suggest that thes vowels were phonetic schwas. Note that a lot of these vowels were the original short *i/u* which became jers more or

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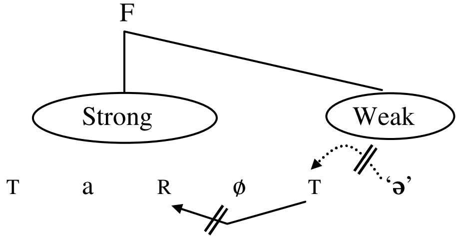
[26] It is not clear when in words such as PS **melká* the accent on the final nucleus was lost, cf. modern Polish *mleko* with stress on the first nucleus. In Russian, on the other hand, it was never lost as the modern forms like *molokó* show. Thus, for such cases we must assume that the elimination of the liquid diphthong could have been a case of analogy.

less at the time of the liquid shifts under discussion. These vowels are often assumed to have been reduced vowels (Stieber 1979: 29), or extra short, which basically amounts to the same thing.[27] Whether other vowels were indeed reduced or not is irrelevant for our discussion. The crucial point is that their prosodic position, which was determined by the new dominant trochaic metrical organization, was weakened, and that this directly affected the licensing ability of these nuclei. From the point of view of the syllabic organization this was a shock which had to be resolved at that level of representation. To use a political / economical metaphor, this situation resembles one in which the local government, which has particular duties and obligations to fulfil locally, suddenly experiences severe cuts in subsidies resulting from the different priorities of a new national government. As a result, some of the local obligations will not be satisfied. To return now to our analysis, this new situation, that is, when the status of the nucleus changed (a > ‘ə’), can be illustrated in the following way.

(13)



The new prevailing metrical pattern imposes a redistribution of prosodic licensing such that the licenser status of the final vowel in (13) is diminished. The nucleus is no longer able to license the *RT* cluster, that is the *R*←*T* governing relation, and something must be done to amend the situation. We predict that there are three main possible outcomes, which we present below with the view to demonstrating that we can describe all the facts connected with the development of liquid diphthongs in LCS. The dotted arrow shows a licensing relation between a nucleus and its onset.

The first effect that a reduction of the licensing strength of a nucleus maybring about is cluster simplification (14a). In a sense, it gets rid of the licensing problem as it leaves the weak nucleus with the easiest job to do, that is, the licensing of a simplex onset.

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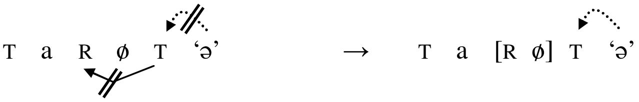
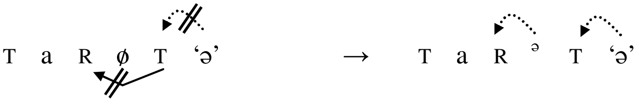
[27] Shevelov (1965: 436) claims that only jers in weak positions may be called reduced.

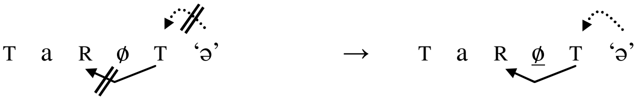
(14) a. ***cluster simplification***



b. ***epenthesis***



c. ***redefinition of the licensing potential of 'ə'***



One drawback of the repair strategy illustrated in (14a) is that it results in the loss of lexical information and in the creation of homophones with a CVCV structure. Nevertheless, this strategy was in fact utilized in the history of Slavic. For example, word-internal obstruent clusters, with the exception of *st, tv, sv, kv, gv, xv*, were simplified in this way, e.g. **živ-ti* > *ži-ti*, and **věd-si* > *vě-si* (Wilkoń 1999: 353). Another example of cluster simplification involves the development of the groups *om*, *on*, *em*, *en* before a consonant. It is assumed that in all LCS dialects these forms gave rise to the nasal vowels *ǫ*, *ę*, e.g. PS **mĕnsă* 'meat', **rănkā* 'hand' > LCS **męso*, **rǫka*. Thus, not all lexical information was lost in the development of nasal vowels, though the cluster NC was eliminated. We may assume that the change affected the formal aspect of representation, while leaving the melody intact. In later developments, nasal vowels were retained only in some languages, e.g. Polish *mięso*, *ręka*, and lost in others, e.g. Russian *mjáso*, *ruká*. Note that cluster simplification and the development of nasal vowels belong to the pool of phenomena subsumed under the tendency referred to as the law of open syllables, that is, the same tendency to which the elimination of liquid diphthongs belongs.

Epenthesis, illustrated in (14b), is another theoretically predicted way out of the problematic situation in (13). This strategy also appears to be preferable to cluster simplification because it entails no loss of lexical information. The epenthetic vowel, which in our model originates from an existing empty nucleus, takes on the role of the licenser for the first consonant of the original cluster RT.

This course of action was assumed to be the first step in the elimination of liquid diphthongs in LCS by a number of linguists (e.g. Ekblom 1927, Lehr-Spławiński 1931, Milewski 1933, Stieber 1979). In this analysis we accept that this was the crucial step, which led to polnoglasie and liquid metathesis. However, unlike other approaches, we claim that the cause of the phenomenon was not a tendency for rising sonority or constraints on syllable structure, but the reorganization of the prosodic structure beyond the syllable, which affected the licensing properties of nuclei which found themselves in a weak prosodic environment. Thus, whatever the source of the prosodic reorganization was, the loss of liquids in 'coda' position appears to be a phonologically motivated phenomenon.

Our main assumption is that the nucleus which found itself in the recessive position of the dominant trochaic foot lost the ability to license a governing relation *R←T* because it began to function on a par with reduced vowels. We represent these vowels as schwa to reflect their status, but do not claim that this reflects their actual melody. Recall that, according to Stieber (1979), Common Slavic – before the rise of jers – did not have reduced vowels, but at the time under discussion, there were jers and nonjers in recessive prosodic position, which as we assume, functioned in a similar way to schwas in modern languages.

To illustrate this new situation in LCS with examples from modern languages, we may remind ourselves of the distribution of *RT* clusters in modern Dutch, which we discussed in chapter 2. There is a clear difference in Dutch with respect to what can be licensed by a full vowel or a schwa.

(15)

a. ***ə-epenthesis optional*** (R.Tə → R(ə).Tə)

[kar(ə).pər] *karper* 'carp'
[kɛr(ə).kər] *kerker* 'dungeon'
[stal(ə).kər] *Stalker* 'Stalker'
[hɛl(ə).mər] *Helmer* 'first name'

b. ***ə-epenthesis excluded*** (R.Ta → R.Ta)

[har.pun] *harpoen* 'harpoon'
[kar.kas] *karkas* 'carcass'
[bal.kan] *Balkan* 'Balkan'
[hɛl.ma] *Helma* 'first name'

The data in (15) illustrate a system in which full vowels can license *RT* clusters but schwa finds it difficult to do so. As a result, the clusters followed by schwa are optionally epenthesized. Note that in the case of Dutch, this happens in a system with a fairly stable prosodic system, while in LCS we are dealing with a very similar distinction (a – ə), with the exception that the reduced / weak licensers are a relatively new arrival.

Before we discuss further hypothetical developments of the epenthesized forms in different Slavic languages, let us return to the third theoretically predicted outcome illustrated in (14c), that is, one in which nothing happens. This outcome corresponds to some Polabian, Kashubian and Pomeranian TART forms which do not show signs of liquid metathesis, for example, Polabian *porg* 'threshold', *korvo* 'cow', *gord* 'fortification', *morz* 'frost'. This option suggests that a given system assumed that its schwas could license level II of syllabic complexity, that is, *RT* clusters. This may have been concurrent with the rise of the new prosodic system, or it may have been a case of later reanalysis of the licensing potential of weak vowels. The latter possibility seems to be compatible with the assumptions of e.g. Lehr-Spławiński (1931) and Stieber (1973), who suggest that epenthesis occurred everywhere but that some systems may have reversed the process (TART > TAR^{ə}T > TART).[28] Alternatively, we may also pursue the possibility that the prosody of such a system developed in a different way. This option will be briefly discussed in later sections.[29]

Let us return to the discussion of hypothetical further steps in the development of TAR^{ə}T. The subsequent developments took various forms in different dialects. In eastern Slavic (16a), the liquid is flanked by two identical vowels, e.g. Russian *béreg* 'shore', a phenomenon called pleophony.[30]

(16)

a. TaR^{ə}Tə → TaRaTə

b. TaR^{ə}Tə → T^{ə}RaTə → TRaTə

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[28] Such re-evaluation of the licensing potential of nuclei cannot be excluded.

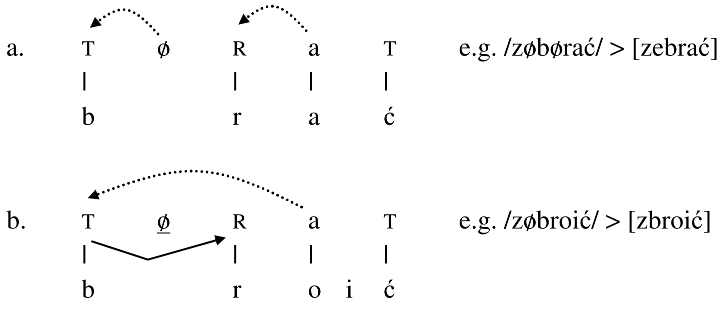
[29] In the case of Polabian, there have also been suggestions that the direct proximity of Germanic languages may have had some influence on the retention of *RT* clusters as well.

[30] As mentioned earlier, a similar result of epenthesis, which involves vowel copy, is observed in Barra Gaelic (Borgstrøm 1937, Clements 1986).

In other Slavic dialects, liquid metathesis took place (16b) which according to, for example, Ekblom (1927) and Lehr-Spławiński (1931) involved metathesis of quantity, that is, emphasis is put on the fact that it was the melodies of the vowels that switched positions rather than the liquid. The nature of this metathesis will be discussed below with reference to two languages which currently exhibit a similar phenomenon, that is, Bulgarian and modern Irish. In the latter language, epenthesis seems to go hand in hand with metathesis and stress shifts in the same way as in LCS.

It is assumed in Stieber (1979) that what we represent here as a raised schwa in (16b) was in fact a jer which later disappeared like other jers in weak positions. Recall that the initial clusters which resulted from epenthesis behaved in early Polish as if they contained a weak jer. As a result, the jer in the preceding preposition was vocalized in forms like *we błocie* 'in the mud', *we głowie* 'in the head' etc. Some phonological distinction between surface clusters of the *TR* type, which are true branching onsets, and those which vocalize the preceding jer is necessary not only for the analysis of the early Polish facts, but is also useful for an account of modern Polish, in which the identical phonetic sequences *br* in *broń* 'arms' and *brać* 'take' behave differently in *zbroić* 'to arm' and *zebrać* 'collect, perf.' which alternates with *zbierać* 'collect, imperf.'. Below we illustrate a possible way to represent this difference in the structure of the initial cluster.[31]

(17)



The representation in (17a) corresponds to early Polish *głowa* 'head' and modern Polish *brać* 'take'. The empty nucleus functions as a licenser of the first consonant and is visible to other nuclei. Thus, if the preceding preposition or prefix contains a jer, then the first of the two jers / empty nuclei

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[31] Some discussion of these phenomena was offered in chapter 2.

will have to be vocalized, in accordance with Havlík's law disallowing two consecutive jers / empty nuclei *(∅–∅).[32]

The structure in (17b) illustrates what is traditionally understood as a branching onset. The empty nucleus is locked in the rightward interonset governing relation and has no function to play as a licenser. It is also not visible to phonology, therefore the prefix in *zbroić* is not vocalized.

The representation of (17a) is important for other reasons too. Firstly, its creation in LCS was possible only if empty nuclei were to be afforded the status of a licenser. It is for this reason, perhaps, that the metathesis of ART and TART, which had the same origin both phonologically and chronologically, were not completed at the same time. Note that the metathesis of ART occurred every-where in the Slavic area and was most probably completed earlier. Additionally, there was a tendency to create onsets in vowel-initial words, and the shift ART > RAT was welcome in this respect. We may stipulate that because in the case of ART there was no question of creating the new structure *#TØR...* (17a), the discrepancies in the chronology and scope of metathesis occurred .

Thus, we may assume that the delay of metathesis in TART > TRAT with respect to ART > RAT may have been connected with the acceptance of a new construct in the LCS word-forms, that is, the sequence *TØR*, in which the empty nucleus licenses an onset. Note that at some point in the development of all Slavic languages, the empty nucleus which resulted from the disappearance of jers had to be assigned licensing properties. It is possible that some dialects of LCS could not afford licensing properties to empty nuclei for the simple reason that they were new to Slavic systems as functionally active licensers. It seems that eastern Slavic languages could be viewed as refusing to accept the new types of licensers. And perhaps this was the reason why they exhibit pleophony. In support of this claim we may mention a similar situation in east Slavic in which we can be sure that an etymologically present jer was vocalized even though it was in a weak position. To see this, we may compare the development of the words for *blood*, *spine* and *tear* in Polish and Russian. The vowel originating from a weak jer in Russian is underlined.

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[32] In standard Government Phonology (e.g. Charette 1991), sequences of empty nuclei are eliminated by the interaction between the Empty Category Principle, demanding that empty positions must be licensed, and the application of Proper Government, in which only melodically filled nuclei can license other empty nuclei. In chapter 2, we followed Rowicka (1999) in using the constraint NO LAPSE (*∅–∅) to account for systems avoiding a sequence of two empty nuclei.

(18)	***Proto-Slavic***	***Polish***	***Russian***	
	*kruu̯i	krew – krwi	krov’ – kro̲vi	‘blood/gen.sg.’
	*xribitu	grzbiet	xre̲bét	‘spine’
	*sliza	łza / łez	sle̲za / sl’oz	‘tear/gen.pl.’

In Polish, the jer which follows the original branching onset *kr* in *krwi* /krøvi/, was eventually assigned the licensing properties required to sanction this complex structure. The vowel-zero alternation in the pair *krew – krwi*, on the other hand, has nothing to do with the licensing properties of the empty nucleus in modern Polish, but is a reflection of Havlík’s law disallowing sequences of jers, or to use our terminology, which is more compatible with the present day situation, sequences of empty nuclei *ø–ø. As for Russian, we should probably assume that the vowel which originated from a jer is now lexical as it does not alternate with zero. This is one of the instances in the development of jers in Slavic in which a weak jer was treated as if it was strong due to the surrounding consonant clusters.[33]

Below we return to the problem of metathesis. By drawing on data from modern Irish and modern Bulgarian, that is a Celtic and a Slavic language, we are going to demonstrate that there is a close relationship between epenthesis on the one hand and metathesis and stress placement on the other.

2.5. Irish metathesis as a stress related phenomenon

The present day reflexes of the Common Slavic TART forms provide definite information with respect to only some of the hypothesized stages in the development which were mentioned in the previous section. Thus, we can be sure that metathesis did take place in the dialects which have TRAT instead of the original TART (e.g. **melká* > Pl. *mleko* ‘milk’). Based on the vocalic reflexes we may also assume that in the case of south central Slavic dialects metathesis was accompanied by vowel lengthening, though it is not certain if the lengthening occurred before, after, or concurrently with metathesis. What we cannot be sure of is whether there was an initial stage of vowel epenthesis TART > TAR^{ə}T (e.g. Ekblom 1927), or whether there was a stage with a reduced vowel after metathesis T^{ə}RAT. Apart from some evidence from early Polish and Lower Sorbian discussed above, there seems to be little proof of this stage. In this section, some evidence from

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[33] Another case of this type will be discussed later and refers to the weak jers in initial syllables in Polabian, e.g. *tå̲kăč* ‘weaver’, *så̲păt* ‘sleep’, *kå̲tü* ‘who’, as compared with modern Polish *tkać*, *spać*, *kto*.

modern languages will be adduced in support of the hypothesized stage of epenthesis and its relation to prosodic organization and metathesis.

Recall that the main thrust of our analysis of the elimination of *RT* clusters in LCS is that the major reorganization of prosody, in particular, the rise of the trochaic foot as the main metrical organizer, affected the licensing properties of the nucleus which directly followed the cluster. The nucleus was degraded to the status of schwa and could not fulfil its licensing duties with respect to the governing relation *R←T* which then had to be broken up: (TART > TAR^{ə}T). The subsequent development of this form depended on the individual systems. North western dialects, for example, Polish, preferred metathesis (TAR^{ə}T > T^{ə}RAT > TRAT), north eastern dialects, for example, Russian, opted for pleophony (TAR^{ə}T > TARAT), while the northernmost Lekhitic dialects, for example, Polabian, chose to retain the cluster in some forms, while metathesizing others (TAR^{ə}T > TART / TRAT).

The aim of this section is not to explain why a given system chooses one or another option. Rather, we would like to point to some data from modern languages which support a particular analysis of the initial stage of the elimination of *RT* clusters in LCS, one which is hypothetical and is not directly accessible from Slavic sources, but which is crucial in our analysis of the elimination of Slavic TART forms. We see a direct relation between the reorganization of prosody and epenthesis, which led to metathesis and polnoglasie in Slavic languages. In this respect, the stress system and epenthesis are indispensable for liquid metathesis, and the three phenomena are closely related.

First, we will look at cases of the metathesis of liquids in modern Irish, which are clearly stress related and which show exactly the opposite effects of the TART > TRAT shift in LCS. In the data below, taken from Munster Irish (Sjoestedt 1931, Ó Cuív 1975, Ó Siadhail 1989, Ó Sé 2000), the position of the liquid may change within the word. This is connected with the stress placement on the second syllable, which is marked by underlining the stressed vowel.[34]

(19)

a.	prɑ̱ʃig´	–	pərʃa̱χ	*praisigh / praiseach*	'porridge, dat./nom.'
	brɑ̱dig´	–	bərdɑ̱χ	*bradaigh / bradach*	'thieving, gen./nom.'

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[34] In Irish, the distinction between [a] and [ɑ] is phonetic and depends on the quality of the preceding consonant. A fronted reflex [a] is found after palatal and palatalized consonants.

b.	bərlɑ̲χ	*brollach*	‘breast’
	bərdɑ̲ː̲n	*bradán*	‘salmon’
	bərkɑ̲χ	*brocach*	‘grey’

The Irish data, just like the liquid shifts in modern Bulgarian to be discussed later in this chapter, are important in that they constitute verifiable facts from a living language, which provide us with an opportunity to extend the analysis of such phenomena to the hypothesized developments in the history of Slavic.

The data in (19) show an alternation which is effected by the shift of stress onto the suffix *–ach* (19a), which is a particular feature of Munster Irish, and forms with no alternation (19b), but likewise caused by the *–ach* sequence, or by regular stress attraction to a long vowel in a configuration V–VV, e.g. *bradán*.[35] What is interesting for us is that the effects of metathesis observed in (19) are exactly the opposite to the Slavic facts. That is, this time we are dealing with a peculiar preference for internal ‘codas’ at the expense of complex word-initial onsets (TRAT > TART). Let us compare the two developments, taking into account a broader context, that is, the prosodic organization influencing the status of the nuclei. The weak / unstressed vowel is represented as schwa and the strong nucleus is underlined.

(20) a. ***Late Common Slavic*** b. ***Modern Irish***

TA̲RTə → TRA̲Tə   TRəTA̲ → TəRTA̲

We see that there is a clear relationship between the placement of stress and the direction of the liquid shift. Thus, in Slavic where the trochaic organization regarded the second nucleus of the word as weak, the word-internal liquid moved to the left. In Irish, on the other hand, the liquid moves to the right. In both cases, however, the liquid, as part of a cluster, tends to appear to the left of the strong vowel. Note that phonological models which rely on the syllable as a linguistic unit, and its definition in terms of constituents, may to some extent capture the Slavic facts in (20a), because the stressed nucleus finds itself within the same syllabic domain as the liquid (TAR.Tə > TRA.Tə). However, the Irish data in (20b) are inexplicable within syllable based models, because the shift of the liquid occurs in the syllable preceding the stressed vowel (TRə.TA > TəR.TA), and the two domains should theoretically have nothing to do with each other.

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[35] See e.g. Gussmann (1997a) for an analysis of Munster Irish stress.

If, on the other hand, we view the liquid transitions as reflecting a tendency for consonant clusters to ‘glue’ to the following strong licenser, then the model of licensing presented in this work is not only able to capture the facts better, but in fact, it predicts that such phenomena should occur. This prediction is guaranteed by the combination of the Licensing Inheritance theory (Harris 1997) and the model of complexity scales and licensing strength described in this work. In this model, all syllabification is controlled by nuclei, such that every cluster, whether of rising or falling sonority (*TR* vs. *RT*), is ultimately licensed by the following nucleus. The nuclei, on the other hand, participate in the distribution of licensing strength at higher prosodic levels, such as the foot, and are therefore vulnerable to such phenomena as prominence shifts.

Thus, we have seen that there is an intimate relationship between stress placement, metathesis and epenthesis. By referring to the licensing strength of nuclei these three effects can be easily integrated; licensing strength also provides some indication as to the causal relationship. Let us see how we would account for the Irish and Slavic facts in more detail. First of all we must assume that there is something wrong with the schwa vowel with respect to licensing the preceding onset both in LCS and in Irish.[36] As for LCS, we said earlier that the establishment of the trochee led to the shift in the status of the second nucleus TARTA > TARTə and that schwa, being a ‘newcomer’ in the system, was unable to license the *RT* cluster (*...*RT*ə). This hypothesis finds some support in the Irish data. Similarly to the Slavic case, we assume that the shift of stress onto the second syllable in modern Irish creates a situation in which a schwa is left to license a complex onset, which is not allowed. Fortunately, we have evidence that in Munster Irish complex onsets must be followed by full vowels.[37] In this particular dialect of Irish, non-initial sequences of rising sonority are broken-up by an epenthetic schwa, e.g. [okərəs] *ocras* ‘hunger, [agələ] *eagla* ‘fear’, [mɑdərə] *madra* ‘dog’ (Sjoestedt 1931, Ó Siadhail 1989, Ní Chiosáin 1991). Thus, we are justified in claiming that the sequence **TR*ə is not favoured in Irish and must be broken up. This, it must be stressed, is a context for epenthesis,

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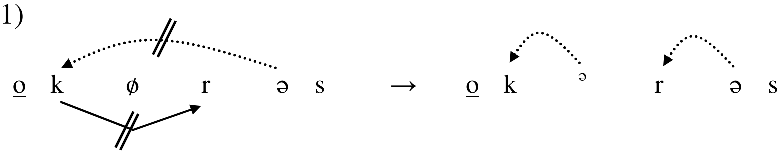
[36] It must be borne in mind that in the case of Slavic we cannot be certain if the weak nuclei were indeed schwas, even though instances of such nuclei with jers in that position can be viewed as such. Therefore, we assume that a weak nucleus is one that finds itself in the weak branch of the foot, an explanation which does not entail melodic reduction.

[37] Recall our discussion of Dutch in a previous chapter. This language also disallows **TR*ə. A similar situation is found in Malayalam (Mohanan 1989, Cyran 2001).

which is parallel, though not identical, to the first hypothesized step in the elimination of *RT* clusters in LCS.[38] The representation of the word for ‘hunger’ is illustrated in (21).

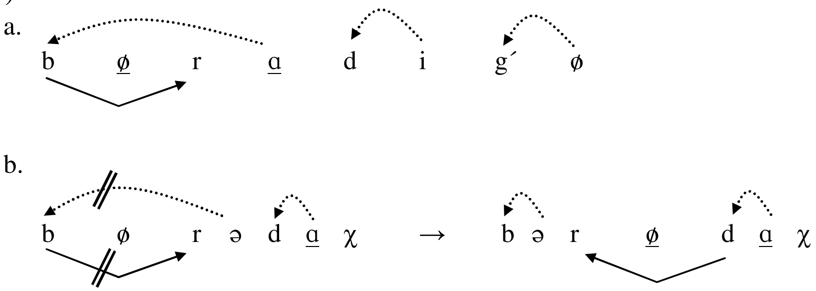
(21)



The above illustration should be understood in the following way. Since reduced vowels do not license complex onsets – level III of syllabic complexity – the internal nucleus must vocalize in order to provide licensing for its onset.

Coming back to the liquid shifts in Irish such as [brɑ̲dig´ – bərdɑ̲χ] *bradaigh / bradach* ‘thieving, gen./nom.’, we see that the situation is similar in that the shift of stress creates a disfavoured structure **TRə*, which tends to be epenthesized (22b). However, the creation of an additional vowel by epenthesis is prevented by shifting the liquid to the right, thus replacing TRəTA̲ with TəRTA̲. (22a) illustrates the genitive form [brɑ̲dig´].

(22)



Thus a phonological redistribution of vocalic melodies produces the surface effect of redistribution of consonant clusters. It looks as if we were dealing with a tendency to ‘glue’ consonants to a strong vowel. Of course, a few conditions must be fulfilled for such effects to take place. First of all, the context must involve an internal sonorant (T–R–T). Secondly, the potential clusters, either *TR* or *RT*, must be legal only if licensed by a full vowel.

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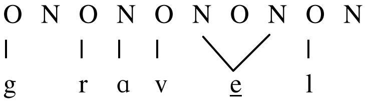
[38] In section 2.9, we will also discuss a type of epenthesis in LCS which will be much more similar to the one in Irish *ocras* and *eagla*.

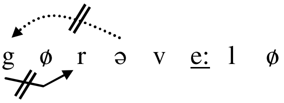
And finally, we must observe stress shifts which would undermine one or the other cluster by weakening their licenser, that is, by creating the illicit **TR*ə... or *...*RT*ə.[39] Additionally, this analysis requires that the metathesis of liquids must interact with epenthesis, whether the latter actually occurs or not. In other words, metathesis occurs in contexts in which changes in the licensing status of nuclei lead to a situation in which the integrity of the original cluster is undermined. This is exactly what we proposed in the analysis of Slavic TART > TRAT, except that the stress facts were the reverse and so was the direction of metathesis.

There is a lot to be said about the interaction between epenthesis and metathesis. Note that the former creates an additional vowel, while the latter is a strategy to avoid such newly created vowels by redistributing the cluster affiliation of the liquid to one that is secured by a strong licenser. But what if metathesis leads to the creation of an impossible cluster? Irish has a fairly restricted set of possible *RT* clusters, in that it disallows sonorants followed by voiced non-homorganic obstruents (e.g. de Búrca 1981, Ní Chiosáin 1991: 170, Cyran 1996a). Notice what happens with the word for *gravel*, a borrowing from English. The stressed vowel is underlined.

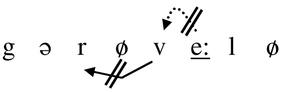
(23) a. ***assumed lexical form***



b. ***stress attraction to [e:] undermines the licenser for [gr]***



c. ***expected liquid shift (illicit)***



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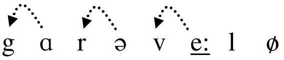
[39] To be precise, in Munster Irish, only the former is illicit, while *RT*ə is in fact allowed to some extent, e.g. [k´ir´k´ə] *circe* 'hen, gen.sg.'. There are quite different factors leading to breaking up some *RT* clusters in Irish and they are independent of the type of licensor (see e.g. de Búrca 1981, Cyran 1996a and chapter 1 for details).

d. ***actual form***



In [ˌgɑrəvʹˈe:l] *graibhéal* ‘gravel’, the long vowel attracts stress and the reduced vowel cannot license a complex onset. The initial cluster must be broken up by an additional vowel, just as in the case of *ocras* [okərəs] ‘hunger’. This is where we predict metathesis, shifting the liquid to the right to form an *RT* cluster followed by a strong licenser like in *bradán* [bərˈdɑ:n] ‘salmon’. However, regardless of the strength of the following nuclear licenser, Irish does not allow for *RT* clusters in which the obstruent is voiced and non-homorganic with the preceding sonorant. This thwarts metathesis and leaves us with the form in (23d).[40] Note that the first nucleus in (23d) develops secondary stress. This form demonstrates how complex the interaction between metathesis and epenthesis is and on how many factors it is dependent.

Coming back to the comparison between modern Irish and Late Common Slavic, it should be borne in mind that, with the exception of the position of the strong and weak nuclei, the analysis of Irish is reminiscent of the one proposed to account for the Slavic facts, which strengthens our earlier hypotheses. The same three elements seem to feature in both systems, that is, stress shifts causing epenthesis, this in turn leading to metathesis of liquids.

Irish also exhibits effects which are almost identical to those in the elimination of TART in LCS. Ó Siadhail (1989: 28) describes another stress-related phenomenon which is slightly different from the outcomes discussed so far, but almost identical to what happened in Late Common Slavic. Let us first briefly remind ourselves of the basic facts of accentuation in Irish. Irish stresses initial syllables if the word contains two or three short vowels, e.g. *ocras* ‘hunger’. Stress may be attracted to the second syllable only if it is long, e.g. *bradán* ‘salmon’, or, if a bisyllabic word with two short vowels ends with the suffix *–ach*, e.g. *bradach* ‘thieving’, though the latter is mainly a feature of Munster Irish. There are however very interesting stress shifts in words containing only short vowels, where normally no

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[40] With the exception of the original clustering in *graibhéal*, the outcome bears some resemblance to the east Slavic pleophonic forms, by showing the effects of epenthesis but not metathesis.

stress shifts should occur. This happens only if certain conditions are fulfilled. Below we provide a full quotation from Ó Siadhail (1989: 27).

> In this shift, the stress is transferred from the first syllable to the second, when both are short and separated by a nasal or liquid (i.e. /n/, /l/, /r/). The second syllable typically contains an epenthetic vowel. The third syllable will also be short... Pretonic elision operates after this shift.

The phenomenon described above typically takes place in Connacht Irish (Ó Siadhail 1989:28) though it is also reported in Munster (Ó Cuív 1975: 128). Schematically, this phenomenon can be illustrated as in (24). The stressed vowel is underlined, and the raised schwa is a result of epenthesis. The term *initial form* is used to cover two distinct situations in a comparison between Irish and LCS. In Irish, it means the underlying or phonological representation, whereas in Slavic it will refer to the original unmetathesized form.

(24)	a.		b.		c.		d.
	initial form		***epenthesis***		***stress shift***		***pretonic elision***
	T$\underline{\text{A}}$RTə	→	T$\underline{\text{A}}$R^{ə}Tə	→	T^{ə}R$\underline{\text{A}}$T ə	→	TR$\underline{\text{A}}$Tə

T = consonant, R = liquid, $\underline{\text{A}}$ = stressed vowel, ə = weak vowel, ^{ə} = epenthetic vowel.

Note that the form resulting from pretonic elision (24d) is in fact a metathesized form of (24a), and that the entire shift is an exact replica of the Slavic metathesis. It should also be borne in mind that the illustration in (24) is to a great extent the result of a particular analysis in which the initial form (24a) is the assumed underlying representation, (24b) is the attested epenthesized form, and (24d) is the alternative attested pronunciation of the epenthesized form. The stage represented by (24c) is hypothesized to fit the analysis relying on the rules of stress shift and pretonic elision postulated by Ó Siadhail (1989).[41]

Let us look at some actual examples from Irish which are strikingly similar to the word forms in LCS. Note that the result of the shift corresponds to the present day reflexes of the original TART in west Slavic, e.g. Polish, the initial form corresponds to the original Common Slavic situa-

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[41] For arguments supporting the initial form in (24) as the underlying form in Irish see e.g. Cyran (1996a).

tion, the form containing the epenthetic vowel directly matches the hypothesized state TARᵊT (Ekblom 1927), while the post-stress-shift form corresponds to TᵊRATə (Stieber 1979).

(25)

a.	***initial form***	***Munster Irish***	***Connacht Irish***	
	/boløgəm/	boləgəm	blogəm	*bolgam* 'mouthful'
	/furəsøtə/	furəstə / frustə	frustə	*furasta* 'easy'
	/t´ir´øməj/	t´ir´im / t´r´im	t´r´uməj	*tirim / tiormaigh* 'dry'/ 'to dry'
b.	****Proto-Slavic***	***hypothesized***	***modern Polish***	
	**káru̯ā*	?korᵊva > kᵊrova	krova	*krowa* 'cow'
	**melká*	?melᵊko > mᵊleko	mleko	*mleko* 'milk'
	**párgu*	?porᵊgu > pᵊrogu	pruk	*próg* 'threshold'
	**gâ̄rdu*	?gorᵊdu > gᵊrodu	grut	*gród* 'fortification'
	**bê̄rgu*	?berᵊgu > bᵊregu	bʒek	*brzeg* 'shore'

Note that the hypothesized forms in the development of TART > TRAT in Polish (25b), together with the present day reflexes, closely correspond to the present day variants in Irish.[42] It seems that we are dealing here with an identical situation with the only major difference lying in the fact that (25a) represents a synchronic situation, while (25b) reflects a diachronic change.

From looking at the various Irish cases of metathesis, and the data in (25a) in particular, we gain the following picture. Firstly, there is a close relationship between three phonological aspects, i.e. *stress shift* – affecting nuclear strength, *epenthesis* – due to the weakened nuclear strength a cluster cannot contract a governing relation and must be broken up, and *metathesis* – which appears to act as a repair strategy in the face of looming epenthesis. A point which must be stressed at this juncture is that in the case of the forms in (25a), it is the epenthesis, which is a regular process in Irish, that leads to stress shift and metathesis. Earlier, in forms like *brad-*

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[42] Ó Siadhail (1989: 23) assumes in fact that the derivation of [blogəm] from [boləgəm] does involve a stage like [bəlogəm]. This is due to the fact that in his analysis the derivation proceeds in stages, where first the stress shift occurs yielding [bəlogəm], and then the pretonic elision takes place.

ach [bərˈdɑχ] 'thieving', the order was slightly different in that the stress shift was the primary reason for the other two phenomena.

The peculiar nature of the facts in (25a), and indeed of the shifts in the history of Slavic, is that at the stage when epenthesis has occurred neither stress shift nor metathesis seems theoretically required to take place, because the resulting structure after epenthesis is CVCVCV, that is, it does not violate any syllabic conditions. The only structural change that epenthesis seems to bring about is that it adds a vowel to an otherwise bisyllabic word (a binary foot). Possibly, this is the ultimate reason for metathesis, both in Irish and in LCS in which, at the time when metathesis occurred, the resulting forms were also bisyllabic. If this is the case then we would be dealing with epenthesis and metathesis as side effects of one dominant tendency – binary foot construction. All the attendant consequences would result from this as well, such as the redefinition of the licensing strength of nuclei, which leads to epenthesis, and metathesis, which attempts to repair the initial damage.

The second observation that we can make now is that metathesis may in fact be viewed as the phonological redistribution of vocalic melodies, which only superficially looks like a redistribution of consonants or consonant clusters. Recall that Ekblom, Lehr-Spławiński and Milewski in fact use the term 'metathesis of quantity', which to some extent captures the same notion.

The third, and probably the most important observation, based on the modern Irish facts, is that metathesis may occur with or without visible effects of epenthesis, though the presence of a context for epenthesis seems to be an integral part of the whole complex of phenomena. The significance of the last point for the analysis of Slavic metathesis is that although we need to accept that the context for epenthesis caused by the shifts in prosody was present, whether the actual epenthesis did take place, producing a transitional stage TAR^{ə}T, or not, is not crucial. The overall analysis is not affected. In other words both courses of action are possible, just as we observe in modern Irish. We do not need to posit that all hypothetical stages took place (TART > TAR^{ə}T > T^{ə}RAT > TRAT), but at the same time we do not need to exclude them. In this respect, we may postulate that TART > TAR^{ə}T did take place in, for example, Russian, where the epenthetic vowel became, at some later point or simultaneously, a copy of the preceding nucleus.[43] On the other hand, given that all three conditions were fulfilled,

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[43] Also here, Celtic languages provide us with examples of identical effects in epenthetic contexts. For example, vowel copy occurs synchronically in Barra Gaelic, a dialect spoken on the isle of Barra (Borgstrøm 1937, Clements 1986).

we may also assume that the shift TART > TRAT was automatic, not so much as a phonological process, but as a reflection of the phonologically definable properties of word-structure.

We may also assume that both metathesized and unmetathesized forms co-existed, as they do across modern dialects of Irish. This also seems to be the position of e.g. Milewski (1933) and Shevelov (1964) with respect to Slavic. This analysis is also able to handle the early Polish and Lower Sorbian facts, which point to a stage at which *TR* was not a governing relation of the branching onset type, but contained a jer, a raised schwa or an empty unlocked nucleus. The three options seem to be synonymous in our analysis.

To add to the present picture of similarities between modern Irish metathesis and LCS we may point to some further data which involve words beginning with vowels (Ó Siadhail 1989: 23). The word for ‘tail’, *eireaball*, is pronounced [e̱r´əbəl] in Munster and *urball* [ru̱bəl] in Donegal. The pronunciation of *urchar* ‘shot’, takes the form [u̱rəχər] in Connacht and [ru̱χər] in Munster, while the word for ‘excess’, *iomarca*, is pronounced as [u̱mərkə] in Kerry and as [murkə] in Ring. Note that these examples remind us of the ART > RAT shift in Slavic. It is interesting to note in this context that Irish does not exhibit a tendency to fill onsets in word-initial position. We assume that the conditions for the above facts are exactly the same as for the other phenomena involving stress, epenthesis and metathesis.

To summarise the discussion so far and concentrate on the Slavic facts more, we claim that the analysis of the elimination of *RT* clusters in the history of Slavic has its source in the redistribution of metrical organization, which affected the status of nuclei as licensers. The nuclei in the weak branch of the foot could no longer license the *RT* clusters and they had to be broken up by epenthesis (cf. Blevins and Garrett 1998: 522). This is the stage at which the east Slavic languages stopped, treating the epenthetic vowel as a copy of the preceding one. Other dialects, in which the rise of an additional vowel was going strongly against the wish to retain the binary nature of the foot, redistributed the melodies of the nuclei in such a way that the foot structure was preserved, while the liquid switched its cluster affiliation, a phenomenon which we call metathesis of liquids.

A schematic and somewhat simplified picture of the developments in Slavic, viewed as a redistribution of vocalic melodies due to metrical reorganization, is presented below. Full vowels are represented symbolically as ‘a’, reduced or weak vowels, including the jers are symbolized as ‘ə’, while ‘ø’ stands for the empty nucleus. Recall that in the CVCV model advocated in this work, every onset is followed by a nucleus, albeit sometimes empty.

(26) a. ***Metathesis*** **TART > TRAT** b. ***Pleophony*** **TART > TARAT**

Within the huge diversity of various developments in LCS dialects, a number of uniform phenomena are captured in this analysis. These are: a) the generality of prosodic reorganization, with the increasing dominance of the trochaic foot b) the resolution of coda-onset *RT* clusters due to the shock of the shift (a>ə) under the weak branch of the trochaic foot, and c) the loss of weak jers, which is the last stage and part and parcel of the shift which we can symbolize as (a>ə>ø). Note that the loss of weak jers word-finally does not end the era of open syllables in Slavic languages, contrary to what is generally assumed. In our model, the word-final consonants are still onsets, only the nuclei which follow and license those onsets are devoid of phonetic melody. In this respect, the loss of final jers in the history of Slavic need not be viewed as a dramatic change from the formal point of view.

It will be recalled from chapter 2 that empty nuclei are also present inside all clusters which are in a governing relation. They are ‘locked’ buy such relations and begin to function as licensers only if the above mentioned governing relation ceases to hold for some reason. Such ‘unlocked’ empty nuclei may be employed in the phonological system only if they are able to discharge their licensing duties. In this respect, the jers (if viewed as reduced vowels) were lost once it was possible for empty nuclei to take over the licensing of onsets, or once the lost jer, now an empty nucleus, could be locked in a governing relation. And conversely, an ‘unlocked’ empty nucleus which is not able to license the onset must obtain melody. This is basically the context for epenthesis. This may also be the story of jers in the first syllable, which were never lost in, for example, Polabian (Stieber 1973: 26, Polański 1993: 801). An explanation that can be offered for such cases would be that these jers could not be lost because some melody was required to license the initial onsets.[44] Compare the Polabian facts with Polish.

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[44] Recall that the inability to have initial clusters with an unlocked empty nucleus (*#CøC...) was shown to be the sole parameter disallowing word-initial false cluster in English as opposed to Polish (see section 5.6 in chapter 2).

(27)

Polabian	***Polish***	***Gloss***
tåkăč	tkać	‘weaver’
såpăt	spać	‘sleep’
ḿåglă	mgła	‘fog’
kåtü	kto	‘who’
χ́emil	chmiel	‘hop’
ṕås / pasai	pies / psy	‘dog, sg. / pl.’
dan / dańo	dzień / dnia	‘day, nom./gen.’

Note that in most of the forms in (27) the consonants which flanked the original jer were of such a type that no governing relation could be established between them in order to lock the empty nucleus. Therefore, that jer could be lost only if the resulting empty nucleus could be granted licensing properties. This happened in Polish but not in Polabian where the jer had to retain melody. In traditional accounts this case is described as a rather exceptional phenomenon where the weak jer, in terms of Havlík’s Law, was treated as a strong one. Of course, we are not answering the ultimate question as to why some languages allow their empty nuclei in this position to be licensers while others do not. This seems to be an arbitrary choice within individual systems. We may suspect that the prosodic organization at the level of the foot may be the place to look for answers to this question in the future.[45]

To return to the comparison between Irish and Slavic, it must be noted that the shifts involving stress and liquids that are observed in the history of Slavic and in modern Irish are not only dependent on the prosody, but also on the melody of the consonants involved.[46] The consonantal context in which the liquids shift seems to be invariably T–R–T, where both types of clustering, *TR* or *RT*, are possible, but only if they are licensed by a strong licenser. We will now look at some data from modern Bulgarian, a language which seems to exhibit similar effects in a similar context. The

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[45] Charette (1991) and Charette and Göksel (1998) discuss similar phenomena in French and Turkish where the first nucleus is bound by similar restrictions. See also Ségéral and Scheer (2001) and Scheer (2004) for a discussion of the special status of the first nucleus in the word.

[46] To some extent also on the melody of vowels. Shifts of the [boləgəm > blogəm] type in Irish appear to be blocked if the stressed vowel is low *a*, e.g. [gˊarəχudˊ] *gearrchuid* ‘fair amount’. Whether, and how these facts can in some way be connected to the absence of metathesis in a similar context in Polabian is not clear.

section below will also prepare us for remaining two sets of data concerning the Slavic liquid diphthongs, that is the exceptional TURT and TRUT.

2.6. Modern Bulgarian ər / rə shifts – a case for phonologically grounded optimality?

A phenomenon related to that of the liquid shifts observed in Irish and Late Common Slavic is found in modern Bulgarian (Scatton 1984, 1993, Bethin 1998). The context in which the *ər/rə* alternations occur can be roughly defined as T–R–T, that is a stem involving a liquid in between two obstruents plus a realization of a vowel on one or the other side of the liquid.[47] Here, it is not the stress placement, but the phonological status of the nuclei that plays a substantial role.

(28)	***Singular***	***Definite sg.***	***Plural***	***Gloss***
	vrəx	vərxə́t	vərxové	‘top’
	grəb	gərbə́t	gərbové	‘back’
	grəd	grədtá	gərdí	‘bosom’
	krəv	krəvtá	kə́rvi	‘blood’

Before we posit a phonological representation for the forms in (28) and propose an analysis, we must note that these words have their origin in two types of Common Slavic forms which can be schematically defined as TURT and TRUT. The former type is a liquid diphthong with a high vowel, while the latter is not a diphthong but rather an ordinary case of a liquid followed by a high vowel. Compare the modern reflexes of the words for *top* (29a) and *blood* (29b) in Bulgarian, Polish, Russian and Serbo-Croatian.

(29)	***PS***	***Bulgarian***	***Polish***	***Russian***	***Serbo-Croatian***
a.	*u̯irxu	vrəx /vərxə́t	wierzch	verx	vȓh
b.	*kruu̯i	krəv / kə́rvi	krew / krwi	krov’ / krovi	kȑv

The reflexes in (29a) go back to Proto-Slavic liquid diphthongs formed by a high vowel *i, u* and a liquid. On one theory (e.g. Stieber 1973, 1979), the

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[47] In using the vowel schwa in the transliteration of Bulgarian data to denote the fleeting vowel we follow e.g. Bethin (1998). The use of schwa also reflects the phonetic definition of this vowel which is sometimes represented as *ă* (Scatton 1993).

original Indo-European syllabic liquids first developed *i* or *u* in the preceding position, depending on their quality (*ir, il, ur, ul*). Then, the high vowels turned into the jers *ь* and *ъ* respectively, and these were subsequently lost, with the exception of the eastern dialects. After the loss of these jers the liquids became syllabic again and remained so in the south central Slavic area (Czech, Slovak, Slovene, Serbo-Croatian and Macedonian), or developed a vowel in western Slavic.[48] In eastern Slavic, the new syllabic liquids never arose. Instead, the jers were treated as strong and had to vocalize, which is reflected by the vowels *e* and *o* in e.g. modern Russian *verx* < **u̯irxu* 'top', *volk* < **u̯ilku* 'wolf'.

Another theory, e.g. Moszyński (1984: 186), assumes that the syllabic liquids of Indo-European origin survived until the stage of the fall of the Slavic community, and were continued only in the south central area. We will return to this issue after the discussion of the Bulgarian facts.

The reflexes in (29b), on the other hand, go back to structures involving an original liquid followed by a high vowel (*ri, ru, li, lu*). Here too, the high vowels changed to jers. The Serbo-Croatian reflexes *vȓh* and *kȓv* show that as a result of jer loss the liquid became syllabic in some dialects. Thus, there is a similarity here between Bulgarian and Serbo-Croatian in that the modern reflexes conflate the original TURT and TRUT even if the net result is different: in Bulgarian both TURT and TRUT are present in the *ər/rə* shifts, whereas in Serbo-Croatian both forms show syllabic liquids.

In Polish, the jer in TRъT was lost in weak positions, that is, if not followed by another jer, or vocalized in strong positions. This gives us the alternation *krew / krwi* 'blood, nom./gen.'. In Russian, just as in the case of TURT (TъRT), the jer in TRъT was treated as strong, and vocalized, regardless of whether it was followed by a vowel or a jer. Therefore, in contrast to Polish, the vowel which follows the liquid is stable and there is no vowel-zero alternation in *krov' / krovi*.

This brings us back to the Bulgarian data. What we observe here is a fluctuation in the position of the liquid depending on what follows the T–R–T sequence. Also, we see that these shifts subsume the original TURT and TRUT forms. The question is how to account for the modern Bulgarian facts, and also how to connect TURT and TRUT with the analysis of TART discussed earlier. This is not an easy task. Bulgarian seems to have conflated TURT and TRUT, and their modern reflexes, at least the singular

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[48] Both syllabic *l* and *r* survived only in Czech and Slovak to be precise, and also in some dialects of Bulgarian (Stankiewicz 1986). The remaining languages feature only syllabic *r*.

forms, are comparable to what happened with TART in non-eastern LCS dialects, that is, *r* forms a cluster with the preceding consonant (cf. TURT, TRUT > TRəT and TART > TRAT). On the other hand, other Slavic languages, with the exception of those which developed syllabic liquids, not only failed to conflate TURT and TRUT, but also their reflexes of TURT contradict the ones originating from TART, in that neither metathesis nor pleophony is observed, even though structurally both forms seem identical, i.e. TVRT.

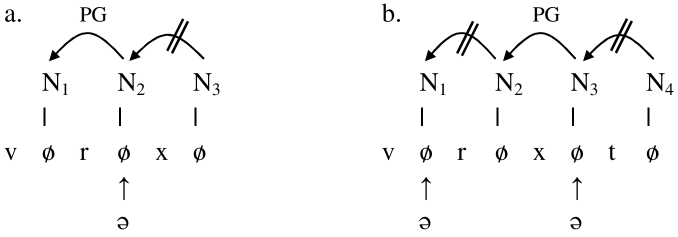
The first thing we need to do is to discuss the representation of the Bulgarian forms and propose an analysis within our model. Based on alternations of the type *vrəx* – *vərxə́t* 'top', we are entitled to propose that the phonological representation of the basic form contains only empty nuclei, and the decision as to which one is realized phonetically is determined on the basis of the nature of inflection or derivation, depending on whether these do or do not provide phonetic material after the T–R–T sequence. Since the particular dialect of Bulgarian in which the *ər/rə* alternations occur does not have syllabic liquids which would act as the head of the domain, one of the nuclei must be realized phonetically. Let us begin with the singular form first, and assume that we are dealing with a structure in which all nuclei are empty.

(30) v ∅ r ∅ x ∅

There is some justification for each instance of the empty nucleus in (30). Firstly, the nuclei surrounding the liquid alternate with zero, which is one of the diagnostic phenomena on the basis of which empty nuclei are posited in phonological representations in Government Phonology. The final empty nucleus is required in standard GP by the coda licensing principle (Kaye 1990). However, in our model, the general assumption that all phonological strings are in fact sequences of CVs equally warrants the presence of the final nucleus. The advantage of this type of representation is that the vocalic alternations need not be treated as a case of resyllabification due to vowel epenthesis or deletion, as different analyses might have it.

It must be said that the Bulgarian alternations may be easily accounted for in the standard Government Phonology model operating with *Proper Government*, that is, a relation holding between nuclei whereby an empty nucleus can remain empty if it is governed by the following nucleus which possesses melody. Empty nuclei are not proper governors. The standard analysis of *vrəx* / *vərxə́t* would look as follows.

(31)



The final empty nucleus in (31a), being empty, cannot properly govern N_2 and the latter must obtain melody. N_2, now with melody, is able to properly govern N_1 and thus we get *vrəx*. In *vərxə́t*, on the other hand, while the same mechanisms are at play, N_3 is a governor now. Therefore, N_2 remains empty but N_1 must have melody. This is not the place to repeat all the arguments against Proper Government which we have discussed in the previous chapter. However, the main reason why PG is not sufficient here is that it is blind to the nature of the consonants involved in the alternations. In our view, this is a crucial aspect of the data, in that it will allow us to accommodate some apparent exceptions within Bulgarian, for example, forms like *dəlg* 'debt' (not *dləg), and account for the dialectal variation in Bulgarian itself, to be discussed below, as well as for other systems of Slavic.[49]

In what follows we will work under two assumptions. Firstly, one of the first two nuclei in the stem must show up melodically, thus excluding sequences like *vrx or *vrxə. One justification for this assumption comes from the general principle saying that phonological domains must have a head. Secondly, consonants must be allowed to interact with each other in the analysis of *vrəx* / *vərxə́t*. Given the nature of the consonants involved, and the fact that they are separated by empty nuclei, we expect that the potential governing relations between the consonants will constitute a factor determining the outcome. In the options given below, the obvious choice involving a syllabic liquid is omitted, though this is not an impossible option in some western dialects of Bulgarian or other languages, for example, Serbo-Croatian (29). Since the basic form *vrəx* contains only empty nuclei phonologically, we may additionally assume that it has basically the same foot structure as the unaccented Late Common Slavic words and the Irish words containing only short vowels, that is, a trochee. Now, we may analyse the Bulgarian forms as a case of establishing an optimal

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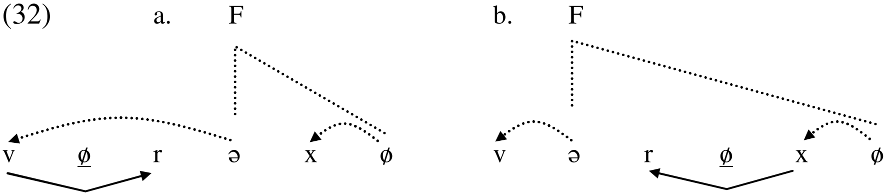
[49] More arguments pointing to the fact that the consonants must interact in these forms will follow when we discuss the development of TURT forms in such languages as Polish.

structure with respect to clustering, where optimal refers to governing relations between onsets determined by the licensing properties of nuclei. In (32), the presence of a licensing relation coming out of a nucleus suggests that it is not ‘locked’ by a governing relation.

(32)



The interesting point concerning the structures above is that although (32a) is the correct form for this particular variety of Bulgarian, there seems to be nothing illicit about (32b), that is, having *RT* clusters licensed by empty nuclei is possible in this dialect, e.g. *dəlg* ‘debt’, *vəlk* ‘wolf’. The thing is that the phonological structure offers a choice, which is present due to the fact that all nuclei are phonologically empty, and any type of relation can be contracted as long as it is licit or better than other licit ones. The difference between (32a) and (32b) really boils down to a choice between a structure in which a stronger licenser *ə* licenses a more difficult structure (*TR*ə), or a weaker licenser *∅* licenses an easier structure *RT*. The strength of the schwa lies not only in the fact that it is a realized nucleus as opposed to an empty one, but also in the fact that it is additionally under the strong branch of the foot.

In other words, the Bulgarian data can be viewed as a case of competition between the potential configuration *TR*ə and *RT∅*. And, to the extent that Bulgarian chooses the former rather than the latter (*TR*ə ⟩ *RT∅*), it appears to re-live the dilemma of the LCS dialects which opted for metathesis of liquids in TARTə forms, or the dilemma of modern Irish where [boləgəm] loses to [blogəm]. The difference is that we are dealing with different types of licensers, but at the same time, in both cases there is a strength difference at play, be it *a* vs. *ə* in LCS and modern Irish, or *ə* vs. *∅* in Bulgarian.

Thus, *vrəx* wins because it is more optimal, as it were, than *vərx* in this particular dialect (*TR*ə ⟩ *RT∅*). We must remember that *TR* is a more difficult structure to license than *RT*, therefore, Bulgarian shows that it prefers a more difficult structure when licensed by a stronger licenser than an easier structure licensed by a weaker licenser. Although the choice is made on a different level, it recapitulates the situation which in our view led to the elimination of *RT* clusters in LCS. We may predict therefore, that the effects might be different if either the foot structure was different, which is what we observed with respect to Irish, e.g. [brɑdig´ – bərdɑχ] ‘thieving, gen./nom.’, or the licensing potential of empty nuclei is stronger than in Bulgarian. There is, of course, a third possibility in which both options are equal.[50]

(33) a. TRə 〉 RTø vrəx (Bulgarian)

b. TRə 〈 RTø vərx (Bulgarian dialectal, Polish, Russian)

c. TRə = RTø vr̩x? (Bulgarian dialectal, Serbo-Croatian)?

All three options are theoretically possible due to the following factors. Firstly, *TR* and *RT* are not equal in terms of licensing demands, as there is one markedness level of difference between them. And secondly, there is also one level difference between *ə* and *ø* as licensers, which renders the two options *TRə* and *RTø* roughly equal and subject to variation depending on how strong the empty nuclei are allowed to be in a given system. We will recall that the strength of the types of nuclei is established independently with respect to particular structures, and the only condition that restricts the properties of *ə* and *ø* is that the empty nucleus may not license more than schwa with respect to structures of identical complexity. Thus, if we reverse the position of licensers in (33), then only one possibility will be theoretically allowed, that is, (*TRø* 〈 *RT*ə), because here a stronger licenser has an easier structure to license.

At this stage it is difficult to say what particular factor, or factors are responsible for the dialectal preferences in (33), when a choice between structures such as *TRə* and *RTø* is present. It must, of course, be borne in mind that when we discuss these preferences we mean contexts in which there is genuine choice involved, as in the case of Bulgarian. Firstly, the structures must be of more or less equal licensing weight (*TRə* ≈ *RTø*). The structures will never bee equal if the licensers are identical *(*TRø* ≈ *RTø*, **TRə* ≈ *RT*ə), or if easier structures have stronger licensers *(*TRø* ≈ *RT*ə). Secondly, the word form must involve a template T–R–T, that is, three onsets separated by empty nuclei, where the liquid could potentially contract

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[50] The third option will not be discussed here, though one might be tempted to claim that this configuration constitutes one of the conditions for syllabic liquids, if other necessary conditions are fulfilled. This option is available and potentially useful, as some of the western dialects of Bulgarian do have syllabic liquids, as opposed to vocalic reflexes, around the liquid. Clearly, this is an issue for further and more detailed research.

a governing relation with the obstruent on the left or the one on the right. Bulgarian is unique in providing such word forms, due to the fact that few languages may utilize only empty nuclei in the lexical representation. Note, that if a full vowel is present in the stem instead of empty nuclei, then the liquid shifts are absent, e.g. *grad* 'city' vs. *gradə́t* 'the city', and not **gərdə́t* (Scatton 1993: 196). This is because onsets cannot contract governing relations across vowels.[51]

Let us return to the possibilities in (33), and focus on the difference between (33a) and (33b). There is some evidence that empty nuclei in e.g. Polish are much stronger licensers than those in Bulgarian, which tallies neatly with the different reflexes for the word *top* in the two languages, that is *vrəx* in Bulgarian vs. *wierzch* [v′eʃx] in Polish. If we look at the right edge of the word in the two languages we see that in Polish, empty nuclei can license also *TR* clusters word-finally, whereas in Bulgarian such clusters are broken up by an epenthetic vowel. Compare, for example, Polish *wiatr* 'wind' and *dóbr* 'goods, gen. pl.' with Bulgarian *dobər* 'good, m.sg.', and *vetər* 'wind'. Of course, it would be erroneous to assume that in Polish *wierzch* [v′eʃx] the first vowel is an empty nucleus, but if we take into account the historical development of the original PS form **u̯irxu*, it is not impossible to assume that the licensing properties of the final vowel were such that it was more advantageous to retain the cluster in Polish, just as happens synchronically in those dialects of Bulgarian which look more like Polish and Russian (*vərx*).

This way of viewing things, that is, by looking at minute adjustments in the licensing strength of licensers, allows us to capture the typology of possible developments in a uniform fashion. Note that a recourse to Proper Government between nuclei is able to account for the standard Bulgarian forms but in order to capture the dialectal variation, we would need to refer to other mechanisms than Proper Government. More specifically, the dialectal developments like *vərx* would have to be explained by resorting to governing relations between consonants rather than between vowels, and it is not clear how the theoretical choice between the 'vocalic' and the 'consonantal' systems could be made to encompass the dialectal variation.[52] However,

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[51] We saw in the previous chapter that interonset relations are impossible even across nuclei with floating melodies. For onsets to see each other, the intervening nucleus must be genuinely empty.

[52] For an intriguing discussion of differences between vocalic and consonantal languages see Andersen (1978).

it is more advantageous to use a theoretical model which can uniformly bring out these distinctions.

An additional advantage of viewing the liquid shifts in Bulgarian, and indeed the dialectal variation, as a case of structural optimization conditioned by the licensing properties of nuclei, is that the vowel zero alternations of the type *vrəx* – *vərxə́t* 'top / the top' receive a truly non-derivational analysis, which cannot be easily said of the recursive application of Proper Government in (31) above.

Another interesting effect that Bulgarian liquid shifts demonstrate can be observed in the definite singular forms such as *vərxə́t* 'the top'. The choice here is between TRəTə and TəRTə, that is, sequences *TR*ə vs. *RT*ə. Note that here we have identical types of licensers but two quite different structures to license. The choice that Bulgarian makes here is the one predicted by our model of complexity scales. If there is a choice of a more complex structure (*TR*), or a less complex structure (*RT*) licensed by the same type of licenser (schwa, in this case) then we predict precisely the attested form, that is, *vərxə́t* and not **vrəxə́t*, because *RT* clusters are at level II of syllabic markedness, while *TR* clusters are at level III.

It must be stressed once again that we are dealing here with a special and rare, though possible, situation in which word-forms of the ambiguous shape T–R–T contain only empty nuclei phonologically, and while one of the nuclei must be sounded melodically in order to provide a prosodic head for the domain, the choice as to which nucleus is realized is determined by the optimal arrangement of governing and licensing relations. Such a way of viewing things is possible in a model in which governing relations are instances of strong/complex objects attracting weak/simplex ones, as in *T*→*R* or *R*←*T* governing relations. Recall that we have evidence that such preferences may operate even if one of the vowels is lexically present. For example, the Late Common Slavic shift TARTə > TRATə is parallel to what happens in *vrəx*, in that the first nucleus can license a heavier structure because it is both melodically and prosodically stronger. Also, we saw a reverse shift of the liquid, that is, to the right, when stress, and hence greater licensing strength was shifted to the second nucleus in the Irish alternation *bradaigh / bradach* [brɑdig΄ – bərˈdɑχ] < /brəˈdɑχ/ 'thieving, gen. / nom.'.

To conclude the discussion of Bulgarian, a word of comment would be in order concerning the apparent exceptions like *dəlg* instead of **dləg* 'debt', and *vəlk* instead of **vlək* 'wolf'. In our view, the existence of such exceptions to the general pattern represented by *vrəx* 'top' supports our assumption that the analysis of the Bulgarian liquid shifts must take into account the interaction between consonants rather than one between vowels (through Proper Government). In fact, each instance where the disparate behaviour of liquids is conditioned by the melodic make-up of the surrounding consonants in the T–R–T template may be taken as positive evidence in favour of consonantal interaction and against Proper Government.[53] Within the model developed in this work it is possible to point to a potential reason for the exceptional behaviour of *l* in *dəlg* and *vəlk*. In a system in which the licensing properties of nuclei are such that only 'fine tuning' of the type (*TR*ə 〉 *RT∅* vs. *TR*ə 〈 *RT∅*) decides on the dialectal variation, it is expected that the types of consonants involved in the comparison will also be of importance. The levels of syllabic complexity are not categorical and some *TR* clusters will be easier to license than others, thus allowing for a degree of micro-variation, as observed in Bulgarian.

In the previous chapter, we defined the ease of licensing of consonantal clusters in terms of complexity differential between the governor and the governee, which directly corresponds to the strength profile in the syllable contact law proposed in Murray and Vennemann (1983). Thus, for example, a geminate, or a homorganic cluster is easier to license than other types of *RT*s. Similarly, *TR* clusters involving *r* as the governee, will be easier to license than those involving *l* because the lateral is more complex in terms of elemental make-up than *r*.[54] Generally, *TR* clusters with a smaller complexity slope are disfavoured and require strong licensers.

2.7. A typology of expected liquid metathesis

An interesting typology of predicted liquid shifts seems to transpire from our discussion of Late Common Slavic, Irish and Bulgarian. To simplify the exposition we will represent it schematically and within the frame of a bisyllabic word, with stress marked where relevant by underlining the vowel. The necessary conditions for the typology to be meaningful require a word-form of roughly the shape T–R–T, and an additional proviso that both *TR* and *RT* clusters are possible when licensed by strong licensers. Given that these conditions are met, we can observe three major categories of phenomena.

The first category is one in which the foot structure, and therefore the stress, has no effect on the discrepancies in licensing properties between the first and the second nucleus (34). This may be the case either because

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[53] A similar point can be made about the exceptional behaviour of coronals in the history of Polish in the development of TURT forms, discussed below in section 2.8.

[54] In this work, it is assumed that *r* is phonologically represented by one element (A), while *l* has two elements (A,U).

there is no vowel reduction in unstressed positions, e.g. modern Polish, or because the trochaic foot is not a dominant metrical organizer, e.g. Proto-Slavic, perhaps. To this group will also belong such languages like English in which vowel reduction occurs synchronically, but the licensing properties of schwas are strong enough not to exhibit any phenomena of the type observed in this chapter.[55] This group will be viewed as one in which liquid metathesis is unlikely. The ticked-off fields illustrate the licensing properties of the relevant types of vowels, while the properties of empty nuclei are ignored here.

(34) ***unlikely liquid shifts and no epenthesis***

^{OK}T	a	RT	$\underline{a}$
^{OK}T	$\underline{a}$	RT	ə
^{OK}TR	$\underline{a}$	T	a
^{OK}TR	ə	T	$\underline{a}$

	a	ə	∅
I (C_)	✓	✓	-
II (RT_)	✓	✓	-
III (TR_)	✓	✓	-

The second category, (35) below, comprises systems in which the prosodically weak nucleus, in contradistinction to modern English, finds it difficult to license its cluster. This is the group of linguistic systems in which we observe epenthesis and/or metathesis interacting with prosodic prominence. Here the strong nucleus is symbolically represented as *a* and the weak nucleus is represented by *ə*.[56] To this group belong systems like modern Dutch in which schwa is unable to license most RT clusters, which leads to optional epenthesis, and Late Common Slavic, where, as we assume in our analysis, the prosodically triggered change in the status of the vowel directly following the RT cluster led to epenthesis and ultimately to metathesis.

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[55] Forms like *cobra*, or *vulgar* discussed in an earlier chapter show that schwas in English can license both RT and TR clusters, though not unconditionally. See Gussmann (1998), Tóth (2002) and section 3 of this chapter.

[56] The careful reader may ask what distinguishes this schwa from the English schwa. The answer is simple: its licensing properties with respect to syllabic configurations when compared with those of the full vowel. In this respect, not only schwas will be different across languages but also empty nuclei, as evident from the typology of right edge licensing discussed earlier. Even full vowels must be assumed to be different licensers in CVCV languages from those which allow for CVC or CCVC. Without such distinctions the entire typology of syllabic types and especially markedness would not make any sense in this model.

To some extent, modern Irish may also belong to (35). In this language, the relation between metathesis and epenthesis is obvious, though the epenthesis itself has slightly different conditioning than is the case in Dutch or LCS. In Irish, schwa leads to the epenthesis of *TR* clusters, e.g. *ocras* [ok^{ə}rəs] ‘hunger’, but it is able to license the licit *RT* clusters, that is, those in which the sonorant is followed by a homorganic or voiceless obstruent, e.g. *circe* [k´ir´k´ə] ‘hen, gen.sg.’. For this reason we propose two different tables for the licensing properties of nuclei in Irish on the one hand, and Dutch and LCS on the other.[57]

(35) ***likely metathesis or just epenthesis***

* T a RT ə → ^{OK}TR a T ə
↘ ^{OK}T a R^{ə}T ə

* TR ə T a → ^{OK}T ə RT a
↘ ^{OK}T ə R^{ə}T a

Irish

	a	ə	∅
I (C_)	✓	✓	-
II (RT_)	✓	✓	-
III (TR_)	✓	-	-

Dutch, LCS

	a	ə	∅
I (C_)	✓	✓	-
II (RT_)	✓	-	-
III (TR_)	✓	-	-

And finally, the third and most limited category comprises forms in which for some reason all vowels are phonologically empty. This is a rare but theoretically possible situation. In Bulgarian, such forms arose due to the disappearance of jers, and the loss of syllabic liquids. Depending on the system, the loss of jers led to the rise of syllabic liquids or to a situation in which one of the nuclei surrounding the liquid had to vocalize. Here we focus on systems with non-syllabic liquids in which one of the nuclei appears as a phonetically realized vowel, and therefore the comparison must be between *ə* which represents a realized empty nucleus and an empty nucleus, rather than two empty nuclei.[58]

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[57] For a more detailed discussion of Dutch nuclei see the previous chapter, Kager (1989), van Oostendorp (1995, 2000), Booij (1995), Ewen and van der Hulst (2001), and section 3 of this chapter.

[58] The schwa in (36) symbolizes the fact that an empty nucleus is realized, and is not a categorical representation of the melodic make-up of that vowel.

(36) ***shifts fully dependent on complexity of cluster and licensing properties of nuclei***

$^{\text{OK}}$T ə RT ∅ west Bulgarian
$^{\text{OK}}$TR ə T ∅ east Bulgarian

	a	ə	∅
I (C_)	-	✓	✓
II (RT_)	-	✓	✓
III (TR_)	-	✓	-

The licensing properties of full vowels are irrelevant here, but it must be assumed that since the schwa can license clusters up to level III of syllabic complexity, the full vowels must be able to do the same, and with more ease.[59]

Recall that the dialectal difference between TəRT∅ and TRəT∅, which could also have been the relevant options at some stage in the development of e.g. Polish and Russian, does not entail a choice between a licit and illicit structures but rather the choice of an optimal configuration between two licit ones, that is, *TR*ə ⟨ *RT*∅ in western Bulgarian dialects and *TR*ə ⟩ *RT*∅ in standard Bulgarian. This micro-variation occurs within a system where nuclei have virtually identical licensing properties, that is, the stronger schwa can license level III, while the weaker empty nucleus can license level II. In our view, the dialectal variation in Bulgarian gives further support to the abstract idea of nuclear strength and to the assumption that consonants in the data under discussion must interact. Otherwise, the dialectal variation will need to receive two separate accounts: one with Proper Government at play – the '*vrəx* dialect', and the other with Interonset Government (*vərx*).[60]

To conclude this section, we may return briefly to the general picture in the Slavic languages and remind ourselves of the dialects of LCS which seem not to have undergone metathesis of the type TART > TRAT. The typology discussed above makes it possible to speculate that perhaps Polabian and other northern Lekhitic systems allowed their weakened nuclei to continue to license the *RT* clusters.[61] This model allows for such a course of action, but it also points to other aspects of phonological organization

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[59] Recall that if a full vowel is present in the stem, the liquid shifts are absent in modern Bulgarian, e.g. *grad* 'city' vs. *gradə́t* 'the city' (not **gardə́t*).

[60] Similar minute adjustments of nuclear strength within generally established settings play an important role in distinguishing registers.

[61] Alternatively, the properties of schwas were redefined after the initial stage of epenthesis, as suggested in e.g. Milewski (1933), and thus the metathesis was preempted.

where answers can be sought. This other aspect is the prosodic system. There is some indication that this may be the right path to follow in the case of Polabian.

This language exhibited a phenomenon which is sometimes referred to as progressive accent shift, while the predominant direction of accent movement in LCS dialects was in the opposite direction (Bethin (1998: 159). The stress system of that language has also been analysed as a fixed final stress one, or one with iambic metrical organization. These points require verification, especially since there is no agreement on the issue. However, it is striking that such effects are found in a system in which metathesis failed to take place in some cases. Note that the progressive shift, e.g. **vórna > vornó* 'crow' is reminiscent of the Irish forms [brɑ̱dig´ – bərdɑ̱χ] *bradaigh / bradach* 'thieving, gen./nom.', where stress on the second syllable attracted the liquid to the following obstruent. An in-depth analysis of Polabian stress would go much beyond the scope of this work, and we must leave this speculation aside.

Below, we will look at a situation which has not been included in the typology of expected liquid shifts presented above. However, this situation naturally falls out from the typology and will further demonstrate a crucial fact concerning the model of syllabic complexity and licensing strength. Namely, if the forms contain two identical vowels in terms of their licensing potential, then no liquid shifts should occur within a T–R–T template. This roughly corresponds to the situation in the first group discussed in this section, that is, ^{OK}TRATA, ^{OK}TARTA, except that the vowels involved in this new category will be of a lower status than that of full vowels. What we saw in Bulgarian was that, as long as the licensers are of the same type, any clustering preference which comes into play should favour *RT* clusters rather than *TR* (*TR*ə 〈 *RT*ə), e.g. *vərxə́t* and not **vrəxə́t* 'the top'. Armed with such an account of the expected liquid shifts, we may attempt to provide an explanation of the apparently exceptional TURT forms in the history of Slavic, which for the most part failed to undergo metathesis in the way the TART forms did. For this reason, the data to be discussed below have usually been treated separately from the regular LCS metathesis in the relevant literature.

2.8. The non-exceptionality of TURT in Slavic

The typology of the expected liquid shifts discussed in the previous section throws new light on the set of data subsumed under the TURT category, which structurally resembles TART, except that there was no metathesis of the type TURT > TRUT.[62] The aim of this section is to demonstrate that TURT forms may belong to the same group of phenomena and that the absence of metathesis may be given a principled account. First, let us remind ourselves of the actual data. For reasons of simplicity only representative languages of three major groups will be taken into account.

(37)		**TURT** >	***tart***	***tart / trat***	***tr̩t***
	Gloss	*PS*	*Russian*	*Polish*	*Serbo-Croatian*
	‘death’	*sumirti	smert’	śmierć	smȑt
	‘top’	*u̯irxu	verx	wierzch	vȓh
	‘wolf’	*u̯ilku	volk	wilk	vûk
	‘long’	*dulgu	dolg	dług	dûg

The forms above go back to the original syllabic liquids in Indo-European. As mentioned in previous sections, there are two main theories as to the historical development of TURT. One of them assumes that depending on the quality of the original Indo-European syllabic liquids, high vowels *i* and *u* developed in the preceding position. This fact is reflected in the reconstructed Proto-Slavic forms in (37) above. The high vowels then became jers in Late Common Slavic and were subsequently lost or vocalized. In support of this view one may mention the fact that the reflexes of the vowel directly preceding the liquid in, for example, modern Russian are regular reflexes of vocalized strong jers, that is, *e* and *o*. Another theory assumes that the original syllabic liquids survived until the stage of the fall of the Slavic community and were only continued in the south central area. It is not difficult to see the advantage of the latter theory in that it bypasses the obvious exceptionality of TURT to the otherwise pervasive influence of the law of open syllables. If the liquid remained syllabic, then the forms in (37) above were not blatantly violating the law by regularly exhibiting an internal coda, because the liquid was in the nucleus.

It is not our intention to resolve the debate here, however, we will attempt to offer an analysis which would account for the more ‘cumbersome’ option, that is, the exceptional behaviour of TURT, assuming the reconstructed Proto-Slavic forms did contain high vowels which later became jers. That is, we are taking into account the possibility that some internal

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[62] Except for some intriguing cases in Polish where very precise phonotactic conditions may be stated for the shift of *l* to the initial cluster if the initial obstruent was dental, e.g. **dulgu* > ***dług*** ‘debt’.

codas may have survived the tendency to make all syllables open. Our assumption stipulates then that forms of the shape TURT went through a phase with jers, that is, extra short vowels in the first and the second syllable. The internal jers were later either lost or vocalized depending on the dialect, while the final ones were lost everywhere. Below, this shift is illustrated in a somewhat simplified fashion.

(38)	***Proto-Slavic***	***LCS***	***Russian***	***Polish***	***Serbo-Croatian***
	*TURTU	$^{?}$TЪRTЪ	Te/oRT	TART	TR̩T

It must be remembered that within the model developed in this work the law of open syllables is viewed as a by-product of a major prosodic reorganization affecting the status of nuclei as licensers, and consequently, relations between consonants as well, rather than a change in parameters or constraints which directly refer to syllable structure. It should also be borne in mind that, although the change of the high vowels *i* and *u* to jers in the word-final position of bisyllabic words neatly coincided with the changes in status of nuclei in this context, due to the establishment of the trochaic foot as the dominant prosodic organizer, the rise of jers should probably be treated as a separate phenomenon. It just happened to coincide with the prosodic reorganization and the arrival of 'weak' licensers in Slavic phonological systems, thus perhaps facilitating the phenomena triggered by the weak licensers.[63]

Let us illustrate what the phonological representations of the TURT forms could have been at the stage when high vowels were becoming jers. Note that the *RT* cluster was followed by a final vowel rather than an empty nucleus, which only developed after the loss of jers. The jers are represented as schwa vowels which expresses the fact that they were extra short vowels, and that their status as licensers is viewed as diminished in accordance with our earlier analysis of epenthesis and metathesis in TARTə > TAR^{ə}Tə > TRATə.

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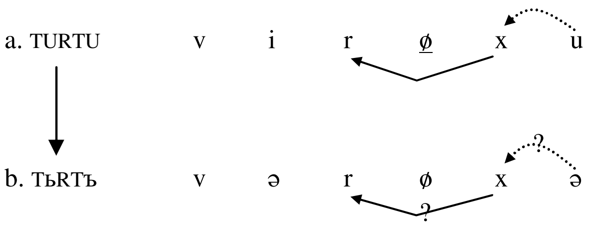
[63] The 'conspiracy' between the rise of jers and the effects of prosody finds support in the coinciding chronology of the arrival of jers and phenomena such as liquid metathesis. However, the rise of jers was mostly conditioned by the distribution of the high lax vowels rather than that of prosodically weak positions. For a discussion of non-etymological jers see the following subsection.

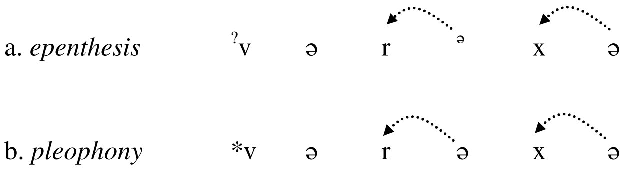
(39)



The form in (39a) reminds us of the Common Slavic TARTA at the stage before the prosodic shifts started to affect the licensing properties of the nuclei under the weak branch of the trochaic foot, while (39b) is a representation which should lead to epenthesis, due to the weakened status of the final vowel, and consequently to metathesis, just as in the development **pargu* > **par*^{ə}*gъ* > *progъ* > *prόg* ‘threshold’ in Polish.

The question is why neither epenthesis – polnoglasie in eastern Slavic – nor metathesis is reflected in the modern forms even though the context was potentially favourable for either of the two options? In other words, we would expect modern reflexes like **verex* in Russian, and **vrex/*vʒex* in Polish.[64] Does this suggest that perhaps the theory assuming that the liquids were syllabic at the time is correct? Let us first consider what could possibly have thwarted pleophony and metathesis in such forms, assuming that an initial stage with epenthesis must have taken place. Without this assumption neither of the two phenomena could have taken place, as epenthesis is regarded in this work as an indispensable factor leading to pleophony and metathesis. Secondly, in the system we constructed earlier, the absence of epenthesis in an *RT* cluster followed by a schwa would have meant that metathesis was impossible. Thus the form in (39b) should lead to the following three options, of which two will have to be immediately excluded on theoretical grounds.

(40)



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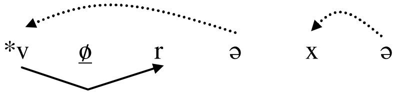
[64] For a discussion of the so called ‘secondary pleophony’ which refers to forms like *verex* in northernmost Russian dialects see Shevelov (1965: 468), and Bethin (1998: 77).

c. *metathesis*



It will be recalled that the effects of epenthesis in TARTə gave regular pleophonic reflexes in eastern Slavic, rather than metathesis, possibly due to the fact that the demand for maximally binary feet was not as strong as in other dialects of LCS, and we should expect the TURTU forms to have behaved in the same way. There are some data from northern Russian dialects which suggest that this may have been the case, in that some effects of epenthesis, called 'secondary pleophony', are found in these dialects. One of the peculiarities of these forms is that, unlike in the regular pleophonic reflexes, for example, *béreg* 'shore', the forms with secondary pleophony do not occur before a vowel in the following syllable (Shevelov 1964: 468). This produced alternations of the type *verest / verstá* 'verst, gen.pl./ nom.sg.', and *tórog / tórga* 'market/gen.sg.', which look like regular vowel-zero alternations, that is, jer lowering in strong position, or epenthesis, depending on which model we assume. At any rate, the reflexes of the alternating vowels need not be viewed as effects of vowel copying because they are the regular reflexes of lowered jers. In fact, if there is any evidence pointing to the nature of these vowels, it suggests that they cannot be effects of pleophony, because they behave differently from the regular cases by alternating with zero.

There is one clear difference between the original TART and TURT forms which may have been detrimental to the ultimate outcome of epenthesis. Pleophony should perhaps be treated as a case of vowel copying. If this is correct, it is not easy to imagine what quality could have been copied from a reduced vowel, a schwa, which was most probably devoid of any concrete melody.[65] Thus, although one might not be entirely satisfied by this solution, we may claim that the absence of pleophony in TURT was a result of the fact that there was no melody in the stem to copy. Possibly, the same argument could be used to explain why the dialects of modern Bulgarian, which show three realizations in the T–R–T context, that is: TRəT, TəRT and

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[65] In Government Phonology, vowels are defined in terms of the resonance elements I, A, U. While the high lax vowels *i* and *u* must be viewed as containing the elements I and U respectively, it is not clear how the jers / schwas should be represented. They could still have retained their elements in operator position or lost them completely.

TR̥T, strangely miss the pleophonic form TəRəT. Thus, this analysis makes a direct reference to the nature of the stem vowel in accounting for the outcome. The crucial aspect of this nature is the melody, or rather its absence in TURT. Below, we will also refer to another aspect of the nature of vowels, that is, their status as licensers, which to some extent is also connected with the melody.

For this model, the absence of pleophony is less of a problem than accounting for the absence of metathesis in TURT in the west Slavic dialects like Polish (40c). This area must be assumed to have a stronger tendency to retain the bisyllabic kind of foot, hence the metathesis in the regular TART forms. Thus, barring cluster simplification, we should expect either metathesis or 'return to the fold', as it were, which could only be achieved by redefining the licensing properties of reduced nuclei with respect to the licensing of *RT* clusters. The reason why this option is better than metathesis seems simple: if the *RT*ə sequence cannot be maintained, then how can the word-form be rescued by creating *TR*ə, which would mean that a licenser of the same status would license a more complex structure? Recall that in our model *TR* clusters constitute level III of syllabic complexity while *RT* clusters are at level II. Thus, the model of complexity scales and licensing strength precludes metathesis in such forms.[66]

In a sense, we are dealing here with a situation which is very similar to the one found in modern Bulgarian definite singular forms. Let us remind ourselves of the relevant data and analysis.

(41)	***Singular***	***Definite sg.***	***Plural***	***Gloss***
	vrəx	vərxə́t	vərxové	'top'
	grəb	gərbə́t	gərbové	'back'
	grəd	grədtá	gərdí	'bosom'

While the choice in the non-definite singular form is between two different types of licensers, that is, *ə* and *ø*, in the definite forms we are dealing with identical licensers and the choice is between *TR*ə and *RT*ə. In such a case, the obvious outcome is one in which the easier / lighter consonantal configuration is preferred (*TR*ə 〈 *RT*ə). Thus, for the western Slavic dialects, we may hypothesize, the best option was to retain the epenthesized form (TəR$^{\text{ə}}$Tə), despite the strong pressure to conform to the maximally binary

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[66] The problem of *TR* clusters followed by reduced vowels in LCS will be returned to below in section 2.10.

structure of words, until the reanalysis of the licensing properties of the final schwa allowed for the licensing of the more palatable cluster, which was *RT*. It is not impossible that the eastern dialects followed the same strategy. While there was no strong pressure for bisyllabicity, vowel copying was still impossible due to the ‘colourless’ nature of the first vowel, therefore, a return to an *RT* cluster followed by a schwa with a redefined licensing ability is also observed in this group of languages.

It follows that in this analysis, the re-evaluation of the licensing abilities of nuclei must be recognized as a possible phonological adjustment in the historical development. It is worth mentioning that in modern Slavic languages the same clusters are now licensed by empty nuclei word-finally, which strongly points to some adjustments in the licensing abilities of this type of nuclei as well. One must also remember that some adjustments in the licensing abilities of nuclei are made synchronically across registers of the same phonological system.[67]

To summarize the discussion of the TURT group, we may say that, assuming that these forms indeed contained high lax vowels which later became jers, the reflexes in which the *RT* clusters were retained may be accounted for by the same system which we used in the analysis of the regular cases of metathesis and pleophony. This was also the system which was used to derive the typology of expected liquid shifts in a broader linguistic sense, and which seems to be able to cover the apparently exceptional data subsumed under the TURT category. First of all, we assumed that a stage of epenthesis (TUR^{ə}T) must be postulated because, just as in the case of TAR^{ə}T, the change in the licensing status of the final nucleus must have undermined the integrity of the *RT* cluster, and as we remember, an epenthetic context is indispensable as one of the conditions on the occurrence of metathesis. In the regular TART forms, this led to pleophony or metathesis, while in TURT, neither of the two phenomena prevailed.

We claim that the absence of metathesis or pleophony was due to the nature of the remaining vowel in the stem. It had no phonologically defined melody to spread and produce pleophony in eastern Slavic, and it was too weak to license a *TR* cluster in the western dialects, thus excluding metathesis. Both situations find some support in the modern Bulgarian facts. The former situation – the absence of pleophony – still remains a mystery even in Bulgarian, in which among the various dialectal reflexes of the

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[67] Two examples of the role of the licensing properties scale in distinguishing registers was discussed in previous chapters of this work in relation to Dutch (e.g. Kager 1989) and Malayalam (Mohanan 1986, Cyran 2001).

historical liquid diphthongs involving high vowels, the pleophonic form *vərəx* is missing. The difference is that with respect to Bulgarian we have evidence that the phonological representation of the stem has no melodically defined vowel, whereas for the historical development of TURT in eastern Slavic, this remains in the sphere of assumption. In the latter situation – the absence of metathesis – the final solution to the dilemma also reminds us of the situation in modern Bulgarian in which, given that the nuclei are of an equal status, preference is given to the lighter cluster, that is *RT* rather than *TR* (*vərxə́t* and not **vrəxə́t* 'the top'). We may claim then, that the phonological properties of the reduced, or reducible vowels were such that neither vowel copy nor metathesis were possible, and that at some stage, one of the properties – the licensing strength – of the word-final vowels was re-analysed to allow for *RT*ə.

This model is also able to account for the actual data even if we assume that the Indo-European syllabic liquids were preserved until the break-up of the Slavic community. That is, there were no high vowels in front of the liquids and hence no jers in this position.[68] However, it must be assumed that historically the words ended with vowels. The crucial question is when the syllabic liquids ceased to be syllabic? Theoretically, we may consider three configurations: one in which the liquids became non-syllabic, before the shift *i/u* > *ь/ъ* in word-final position, that is, when there were still no jers finally (42a); secondly, this happened while the final vowels were jers (42b); and finally, when the final nucleus was already empty due to the loss of jers (42c). Structurally, we must assume that the liquid which ceased to be syllabic was flanked by empty nuclei on both sides. In this situation, one of the two empty nuclei must be realized, very much like in the modern Bulgarian cases discussed in previous sections. Let us consider the three possibilities mentioned above.

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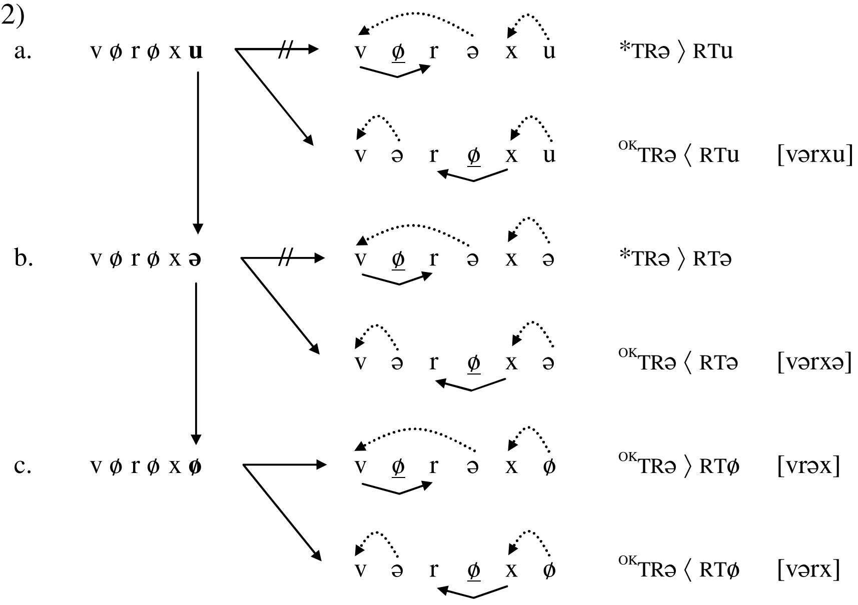
[68] Recall that one of the problems with this theory is that the east Slavic forms show the regular reflexes of strong jers, that is, *e* and *o* in this context. Although it is slightly beside the point we are trying to make here, this problem could be viewed as spurious if we assume that the strong jers were merely empty nuclei which, just like in modern Slavic languages, were assigned the relevant language-specific melodies when realized. This way of viewing things eliminates the conflict between the two competing theories on the development of syllabic Indo-European liquids and is fully compatible with the options presented in (42).

(42)



The model developed in this work leaves us with no option but to say that as long as the word-final nucleus contained some melody – even schwa – the only possible outcomes were those with an *RT* cluster rather than *TR*. This follows from the syllabic complexity scale, which disallows more complex structures and favours the less complex ones if the licenser is of the same status in both cases. Thus, (42a) and (42b) show that whatever the chronological relationship between the loss of syllabicity in the case of liquids and the changes in final high lax vowels, the outcome should be the same, as long as the final nucleus is not yet empty. This is confirmed by the existing modern reflexes, in which the final nucleus is empty because of the later, regular development *i/u* > *ь/ъ* > *ø* across all Slavic languages.

Only (42c) represents a situation in which either option is possible, this is due to the fact that the final nucleus is empty at the time of the loss of syllabic liquids, in which case we expect fluctuations of the type found in the dialectal variation of modern Bulgarian. It should be mentioned that Old Bulgarian had syllabic liquids in the forms which exhibit the shifts discussed in previous sections. On the other hand, the liquid shifts are a fairly recent innovation. As for other Slavic languages, there is some evidence that at least in east Slavic, the syllabicity of liquids was lost very early, that is before the loss of final jers (Bernštejn 1961, 1963). The scheme in (42) makes it clear that in such cases the only possible outcome is one in which the *RT* cluster is retained.

One should bear in mind that the above discussion has omitted the south Slavic developments of syllabic liquids. It seems obvious however, that these facts do not constitute any problem for the understanding of the place of TURT in the overall development of Slavic. The question of the nature of syllabic liquids in general, however, goes beyond the scope of this work.

2.9. Jers and clusters in the history of Slavic

In this section we would like to review a number of points made throughout this chapter with respect to the development of jers, concerning their rise and fall in various positions and across linguistic systems.

In general, we assume that the jers originated from the high lax vowels *i* and *u*, though historical studies in Slavic languages mention a few other contexts, such as the reduction of endings e.g. *–os, –om* (IE **u̯l̥k^{u}os* > PS **vl̥'kъ* 'wolf'), or the elimination of syllabic liquids, e.g. PS **vl̥'kъ* > *vьlkъ* 'wolf'.[69] We may call these sources of jers etymological, in that their origin may be traced back to some earlier form or another. However, we have also seen cases where word forms behaved as if they contained a jer whose source was not etymological. Recall the earlier discussion of the data from early Polish, in which the metathesized forms caused vocalization of the jer in the preposition (e.g. Łoś 1928, Lehr-Spławiński 1931, Stieber 1973). Some data are repeated below.

(43)

webłocie	/vъbъ$^{?}$łocie/	'in the mud'
wegłowę	/vъgъ$^{?}$łovę/	'into the head'
weproch	/vъpъ$^{?}$rox/	'into dust'

The words for *mud*, *head* and *dust* go back to TART forms and result from the liquid metathesis TART > TRAT. It appears that despite the fact that initial clusters of the branching onset type were possible in the system in their own right, there was a representational difference between the former and the newly created sequences of rising sonority. We represent the difference in terms of the presence or absence of a governing relation, a distinction which seems to be employed even in modern Polish to account for such

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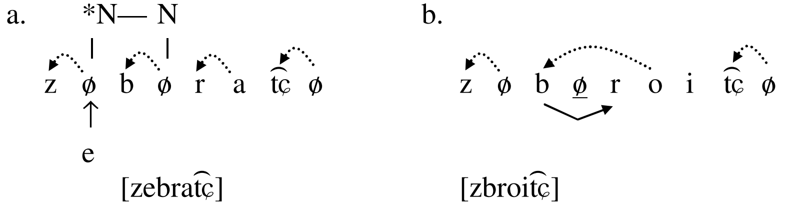
[69] Here, as will be remembered from the earlier discussion, the actual origin of the first jer in **vьlkъ* may have involved a stage when first a high vowel *i* was inserted before the liquid which was later reduced to a jer, in which case we can ascribe this jer to the same source as the others (*i,u* > ь,ъ).

facts as *zebrać* ‘collect’ vs. *zbroić* ‘arm’.[70] The interpretation of the modern distinction, which we believe to be equally applicable to the early Polish forms in (43), is given below in a simplified manner.

(44)



The stem *brać* begins with a sequence of consonants which are not in a governing relation /bør/. This is possible only if the empty nucleus inside the sequence is able to license its onset. Such an ‘unlocked’ empty nucleus is visible to the phonology and subject to conditions on the occurrence of empty positions within a phonological word. When prefixed, the form in (44a) exhibits a sequence of two empty ‘unlocked’ positions (*ø–ø), in which case the first one must be realized as [e].[71] In (44b), there is only one unlocked empty nucleus, that of the prefix. Therefore, the restriction *ø–ø does not apply and no vowel appears in the prefix.

This somewhat sketchy analysis demonstrates an important point concerning the place of jers in the model presented in this work, namely, in many ways, they exhibit some affinity with empty nuclei. This model assumes that empty nuclei are present inside each phonetically observable cluster, but they divide into two types with respect to their phonological function. On the one hand, there are empty nuclei which are ‘locked’ inside governing relations between the surrounding onsets and remain phonologically inactive (44b), and on the other hand, there are the ‘unlocked’ empty nuclei which are visible to the phonology (44a). Their visibility is reflected in the fact that they are subject to various conditions or constraints on the occurrence of unlocked empty positions. For example, such empty nuclei

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[70] This distinction was discussed in detail in section 6.2.4 of chapter 2.

[71] This happens due to the regular application of what is traditionally known as Havlík’s Law, the Lower rule in Generative Phonology (Gussmann 1980), Proper Government in standard Government Phonology (Charette 1991, Gussmann and Kaye 1993), or the effect of the NO LAPSE constraint interacting with other relevant constraints in the Optimality version of Government Phonology (Rowicka 1999). For more details see chapter 2.

may be allowed only if they are able to license the directly preceding consonantal material. We may refer to this condition on the licensing abilities of such nuclei as paradigmatic, that is, pertaining to the inherent properties of the nuclei.

However, there are also conditions of a syntagmatic nature. These conditions pertain to the relation of the nucleus to other material in the phonological string, and may be divided into two types: a) conditions on sequences of empty nuclei, where we are dealing with the relation of the empty nucleus to other empty nuclei in the phonological string, and b) conditions referring to the relation between the nucleus and the consonantal material directly preceding the nucleus, which imposes licensing demands on the unlocked empty nucleus.

It is clear that the second syntagmatic condition should directly interact with the paradigmatic one which defines the licensing properties of the nuclei, and the direct result of this interaction should be vocalization of the empty nucleus, or loss of consonantal material, if the paradigmatic properties of the nucleus do not match the syntagmatically imposed licensing demand. Such effects can be easily illustrated. Earlier in this chapter we mentioned two cases which seem to contradict the general pattern of Havlík's Law demanding that a jer in weak position, followed by a full vowel, should disappear. The first example concerned Polabian forms such as *tåkăč* 'weaver', *såpăt* 'sleep', and *ḿåglă* 'fog', which have Polish counterparts in *tkać*, *spać* and *mgła* respectively. We may say that the jer was lost in Polish because the empty nucleus was granted the licensing ability to sanction its onset, while in Polabian, the nucleus had to retain its melody for this purpose. The other example of retaining vocalic melody where we expect a jer in weak position to have disappeared is that of the Russian forms in which the jer followed a cluster, for example, *krov' / krovi* 'blood/ gen.sg.'.

In Polish, this jer was lost in weak position, that is, when followed by a full vowel, because it was able to license the preceding TR cluster. However, when followed by another empty nucleus, it has to be realized due to the first syntagmatic condition disallowing sequences of empty positions (*ø–ø), thus yielding the alternation *krew / krwi*. The condition *ø–ø is responsible for vowels appearing in forms like *zebrać* (44a) and the alternations of the type *sen / snu* 'dream/gen.sg.', that is, the regular vowel-zero alternations. Thus, while the alternation with zero in the weak position in Polish is the result of the syntagmatic restriction *ø–ø, in Russian, the absence of the alternation could be analysed as due to paradigmatic properties of nuclei as licensers, in that the loss of the jer in that position was not possible in this system because the resulting empty nucleus was not afforded the required licensing properties.[72]

To summarize: the vocalization of empty nuclei – once unlocked – has two main sources. Firstly, they obtain melody due to syntagmatic restrictions on sequences of such empty nuclei. Secondly, they may have to be realized due to their paradigmatic properties as licensers in particular syntagmatic contexts, that is, when the complexity of the structure to be licensed exceeds the abilities of the nucleus. Such a formulation of the vocalization of empty nuclei is able to cover not only the regular cases of jer vocalization, that is, in strong positions (Havlík's Law), but also the vocalization of historical jers in weak positions, that is positions in which they should have disappeared, but instead obtained melody.

It seems, then, that jers, after disappearing, behave like the empty nuclei of modern languages, and vice versa, unlocked empty nuclei behave like historical jers. At this juncture it is prudent to refer to another instance of non-etymological jers, which at the same time constitutes a crucial part of the system constructed in this chapter. It will be recalled that one of the problems that the Slavic liquid metathesis posed for the model of complexity scales and licensing strength, was the simple fact that the Late Common Slavic systems seem to have lost internal codas (*RT* clusters), while retaining branching onsets (*TR* clusters). In other words, the less marked / complex structures were eliminated while the more complex ones were not. The analysis of metathesis presented in this work, which heavily relies on prosodic organization, allows us to bypass the problem by pointing to the methodological incorrectness of comparing the existence of *TR* clusters licensed by a strong nucleus ($^{\text{OK}}$*TR*a) with the elimination of *RT* clusters when followed by the weak licenser (**RT*ə). Thus the only viable context in which the clusters *TR* and *RT* could be compared is that preceding an identical weak licenser, that is, TATRə vs. TARTə. We predict that, similarly to the *RT*ə context, where we postulated a stage with epenthesis which led to metathesis or pleophony (**RT*ə > $^{?}$R^{ə}Tə), the *TR* clusters must also have been broken up by epenthesis, very much like the modern Irish form *ocras* /okrəs/ > [ok^{ə}rəs] 'hunger' which was discussed in section 2.5. In other words, the governing relation T→R could no longer be maintained before the weaker licenser, and the intervening empty nucleus changed its status

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[72] For a thorough discussion of the chronology of the loss of jers in the context of consonantal clusters see e.g. Duma (1979).

to an unlocked one. It became phonologically active and was subject to all the pertinent conditions.

Just as in the case of TARTə > $^{?}$TAR^{ə}Tə, the epenthesis in TATRə > $^{?}$TAT^{ə}Rə must remain in the sphere of hypothesis. However, in $^{?}$TAR^{ə}Tə the evidence supporting the assumed epenthesis is indirect – it is obtained by pointing to the crucial role of this phenomenon in the conditions which brought about metathesis, and also by evoking data from modern languages like Irish, where the assumed stages are attested.[73] With $^{?}$TAT^{ə}Rə, on the other hand, some evidence for the assumed development can be found within the Slavic languages of today.

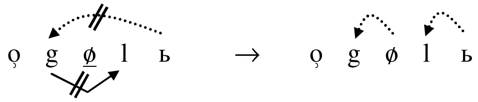
Some historical TATRA forms show vowel – zero alternations within the *TR* cluster, which points to the existence of a historical jer. However, there was no etymological jer in this position. Let us look at the data in (45) below.

(45)

	Polish	
**ǫglĭ*	węgiel / węgla	‘coal, nom.sg./gen.sg.’
**árdla*	radeł / radło	‘plough, gen.pl./nom.sg.’
**ognĭ*	ogień / ognia	‘fire, nom.sg./gen.sg.’
**mъgla*	mgieł / mgła	‘mist, gen.pl./nom.sg.’

In our analysis the rise of this non-etymological jer may be given a straightforward account. First of all, we predict that the governing relation *T→R* in these forms was broken up due to the fact that the licenser for this structure was weak. In this respect, the same assumption was made with respect to the first stage in the metathesis of TART forms in section 2.4. In other words, the empty nucleus within the cluster became unlocked and subject to syntagmatic restrictions.

(46) **ǫglĭ*



Whether the empty nucleus was actually vocalized (ǫg^{ə}lь) or not (ǫglь) is immaterial and in fact impossible to establish. Thus, we may only say that these forms may have had an epenthetic vowel, but they equally well may have not. For as long as the word-final jer was not lost, this unlocked empty

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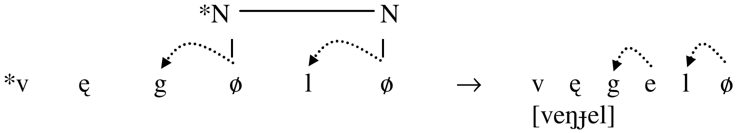
[73] Possibly, the pleophonic forms in eastern Slavic languages could also be used as evidence in support of an initial epenthesis stage in the elimination of *RT* clusters in prosodically weak positions.

nucleus was only subject to one syntagmatic condition, that is, licensing of the preceding onset /g/. If the paradigmatic properties of the nucleus allowed for this, it remained silent, if they did not, it had to be vocalized. Thus we may expect a variation here (ǫglь / ǫg^{ə}lь) .

The crucial change of context occurred with the loss of the final jer, which occurred across all Slavic dialects. It produced a sequence of two unlocked empty nuclei, which is disallowed, probably universally (Rowicka 1999). In this new situation, the fact that both nuclei were able to license their simplex onset did not matter and the left-hand empty nucleus had to be realized phonetically.[74] In the history of Polish the word for *coal* additionally developed a prosthetic onset.

(47)



Note that in cases where the paradigm provides an inflectional vowel, the preceding empty nucleus may remain empty, e.g. *węgla* ‘coal, gen.sg.’, *ognia* ‘fire, gen.sg.’ in Polish.

We also need to add that the properties of nuclei as licensers may change over time. For example, in Polish, word-final empty nuclei were eventually assigned the potential to license not only *RT*, but also *TR* clusters. This fact may be responsible for such differences as those observed between modern Polish and Bulgarian. The tables below contain only the relevant information concerning the licensing settings for the empty nucleus.

(48) ***Bulgarian dobər / dobrə ‘good, m.sg./f.sg.’***

vetər	‘wind’
ogən	‘fire’

	a	ə	ø
I (C_)	-	-	✓
II (RT_)	-	-	✓
III (TR_)	-	-	

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[74] We may assume that both empty nuclei were potential licensers of their simplex onsets for the following reason. For the word-final empty nucleus to arise, it had to be granted licensing abilities of at least level I of syllabic complexity. Thus at this stage the medial empty nucleus should have been able to do the same. It seems that some Slavic languages, like Polish, eventually allowed their empty nuclei to license much more, as will be seen shortly. Recall also our discussion of the right edge of the word in Polish in the previous chapter.

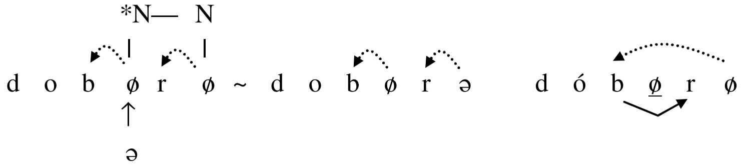
Polish dobro / dóbr 'good/gen.pl'

wiatr	'wind'
ogień / ognia	'fire/gen.sg.'

	a	ə	ø
I (C_)	-	-	✓
II (RT_)	-	-	✓
III (TR_)	-	-	✓

Because Bulgarian never allowed its empty nuclei to license level III of syllabic complexity, that is *TR* clusters, any word-final *TR* must be broken up in a regular fashion unless a full vowel follows. Polish seems to have reanalysed some of the *TøR* sequences as *TR* clusters, that is, in the historical development the governing relation *T→R* licensed by an empty nucleus became licit again, e.g. *wiatr* 'wind'. It is interesting to note, however, that the reanalysed forms typically contain a simplex governee *r* rather than *l* or *n*. That is, only the less complicated relations of the branching onset type are licensed by an empty nucleus, which is fully predicted by this model.[75] Other Polish forms exhibit the same type of vowel –zero alternation as Bulgarian. The representation of the Bulgarian alternation *dobər / dobrə* 'good, m.sg./f.sg.' as opposed to Polish *dóbr* 'good, gen.pl.' is given below.

(49) a. ***Bulgarian*** b. ***Polish***



To summarize briefly, in this section an attempt was made to show how the model of complexity scales and licensing strength is able to account for the phenomenon of the rise of non-etymological jers in Slavic phonology, their modern reflexes, and the alternations that accompany them. The non-etymological jers are merely unlocked empty nuclei which changed their status due to the break-up of the governing relation between the surrounding onsets. The break-up is fully predicted in words like **ǫglĭ* 'coal', **árdla* 'plough', **ognĭ* 'fire', because the phonological context was exactly the same as that for the break-up of the 'easier' *RT* clusters in TART forms.

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[75] For a discussion of the right edge of the word in modern Polish with respect to the licensing properties of nuclei and types of possible *TR* clusters see chapter 2, as well as the following section.

TR clusters, being a more complex syllabic configuration than RTs, could not but undergo the same process. The later developments depended on the shape of the following nucleus. If it historically contained a jer, then the loss of that jer produced the present vowel–zero alternations (Bulgarian *dobər / dobrə* ‘good, m.sg./f.sg.’), unless the final empty nucleus was afforded the necessary licensing potential, like in Polish, in which case forms like *wiatr* ‘wind’ or *dóbr* ‘good, gen.pl.’ arose.

At this point we are in a position to categorically state that within this model, the loss of word-final jers which took place across the Slavic languages cannot be viewed as a phenomenon reintroducing closed syllables. The syllables remained open, except that the nucleus had no melody.[76]

2.10. The phonological conditions on liquid metathesis – conclusions

In this chapter, we investigated the phonological conditions which underlie the phenomenon of liquid metathesis. Although it may be erroneous to view metathesis itself as a phonological process *per se*, it is possible to determine the purely phonological conditions on its occurrence with some precision. In general, it seems that what is needed is an interaction of a special kind between higher prosody – foot structure, and syllable structure, defined by the licensing strength of nuclei. The precise context for metathesis can be viewed as a situation where, for whatever reason, a cluster involving a liquid may not be licensed, thus leading to epenthesis, that is, the appearance of an additional vowel. In this context, metathesis is most likely to occur if there is also a strong tendency to retain the binary nature of the foot.

It is relatively trivial to observe that some relation exists between foot structure, epenthesis and metathesis. All that is required is a survey of relevant data from different systems. What is more difficult is to find a non-arbitrary formal link between these seemingly unconnected phenomena. The model employed in this analysis establishes a direct link between the prosodic position of nuclei making-up feet and syllable structure, because in this model the nuclei control syllabification (clustering) while being themselves subject to slight, prosodically determined adjustments of their inherent licensing strength. In this respect, the licensing strength of nuclei is the integrating factor in the phenomena in question.

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[76] For a thorough review of phonological arguments against treating final clusters as codas see Harris and Gussmann (1998).

The discussion of metathesis is based mainly on complex historical developments in Slavic languages, but reference is also made to modern Slavic languages as well as modern Irish. The latter language seems to exhibit identical effects, thus providing additional support for the analysis of the historical data, especially since some elements of the analysis must remain in the sphere of assumption. A tentative typology of expected liquid shifts was also proposed which falls out directly from the model. Reference to the licensing properties of nuclei allowed us to view the Bulgarian liquid shifts as a case of structural optimization of word-forms. The choice of data was partly dictated by the model developed in this work, which is an attempt to combine the scalar understanding of syllabic complexity (Kaye and Lowenstamm 1981) and the licensing strength of nuclei within Government Phonology, with three important proposals concerning the phonological structure which have been made within this theory.

The first of them is the radical view which regards syllable structure as a sequence of CVs, that is, onsets and nuclei (Lowenstamm 1996, Scheer 1996, Rowicka 1999). The presence of a surface cluster means that there is an empty nucleus inside it. Also, just as in standard GP, the surface word-final consonant or consonant cluster is followed by an empty nucleus phonologically. In this approach, governing relations, which constitute the central tenet of Government Phonology, are contracted between onsets, across such nuclei. Empty nuclei which are locked inside the governing relations are not visible to phonology in any meaningful way until they become unlocked. The latter type of empty nuclei may be employed in a given system only if they are afforded licensing properties, otherwise they must be vocalized. Unlike standard GP, it is assumed here that empty nuclei need not be licensed in order to remain empty. The only conditions on their emptiness refer to their paradigmatic ability to license preceding consonantal material, and an additional universal syntagmatic condition / constraint on sequences of such unlocked empty nuclei, that is, *ø–ø (Rowicka 1999). The two conditions are sufficient to account for some very complex consonantal clusters in Polish, as demonstrated in chapter 2.

The second proposal is that of Government Licensing, stipulating that each governing relation between consonants must be licensed by nuclei (Charette 1990, 1991, 1992). Clusters should not occur in systems in which nuclei are unable to government-license. The extension of this proposal consists in replacing the parametric nature of this property of nuclei with a scale of syllabic complexity, including simplex onsets, *RT* and *TR* clusters (levels I–II–III respectively), against which the strength of nuclei – as licensers – is gauged. This way, the fairly abstract notion of strength becomes quite concrete as it can always be read off from the surface strings. Syllabification and the markedness of syllable structure is viewed as a direct consequence of the interaction between the scale of complexity and the strength of different types of licensers (a–ə–ø).

The third proposal which has its place in the model developed in this work is the theory of Licensing Inheritance, which assumes that licensing potential is distributed within the prosodic word in such a way that the prosodically strong positions may exhibit greater potential, while the recessive positions show depleted licensing potential. This means that the site of weakening processes is located inside the trochaic foot, that is, when licensed by the weak nucleus (Harris 1997). From this proposal, mostly dealing with effects within simplex onsets, it was only a short step to more complex structures, that is, *RT* and *TR* governing domains.[77]

The Slavic data demonstrate precisely the prediction made by Harris, in that the inherent licensing strength of nuclei became subject to adjustments imposed by a higher prosodic organization. In this analysis, the elimination of *RT* clusters in the history of Slavic is claimed to have had its source in a change of metrical organization, which affected the status of nuclei as licensers of inter-consonantal governing relations, that is, syllabification. Thus, the cause of what is generally known as the law of open syllables may lie above the level of the syllable itself. If this claim proves correct, the model used here is able to capture the facts in a direct fashion.

Structurally speaking, we may hypothesize at this stage, most of the processes subsumed under the general phenomenon of the law of open syllables in Slavic targeted a word-internal CV (Onset-Nucleus sequence), which was manipulated in various ways by individual systems depending on what type of melody was lodged in that particular fragment of representation. Note that O_2–N_2 in (50) below is an object of competition between N_1 and O_3. As a result, an N_1–N_2 relation will yield vocalic outcomes, while O_2–O_3 relations – conditioned by the licensing strength of N_3 – will yield consonant clusters. Thus, in effect, we are dealing with a competition between N_1 and N_3. The effects occurred within a foot which could be constructed on the two melodically sounded nuclei, and in which the potential of N_3 was diminished due to the increasingly prominent trochaic organization of word-forms in Slavic.

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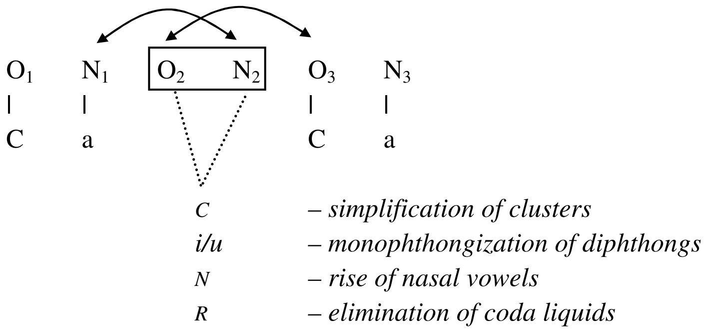
[77] Harris (1997), in fact suggests that one of the consequences of the theory of licensing inheritance is that it could be extended to syllable structure effects.

(50)



C = consonant, N = nasal, R = liquid, a = full vowel

For example, the simplification of consonantal clusters such as Lithuanian *sã**pn**as* > CS **sŭnŭ* (Mod. Polish *sen*) ‘sleep’ can be viewed as a loss of the minimal prosodic unit O_2–N_2 together with the attached melody, that is /p/. The monophthongization of diphthongs, e.g. Lithuanian *snaĩgala* > CS *sněgŭ* ‘snow’ could be understood as a fusion of melodies in the N_1–N_2 relation. The rise of nasal vowels may also be viewed as consonant loss, except that the property of nasality was retained and realized on the first nucleus in those systems that accepted nasal vowels, or lost together with the syllabic string O_2N_2, as in the case of east Slavic, e.g. PS **mĕnsă* ‘meat’ > Pl. *mięso*, R. *mjáso*.

The elimination of liquid diphthongs, that is, liquids in the coda position, is but part and parcel of this general assault on the O_2–N_2 domain. Recall, that in this model, a coda is in fact a consonant which is governed by the following consonant. The head of this relation is in turn licensed by its nucleus.[78] It follows that one reason why a given system may eschew codas is some sort of redefinition of the licensing properties of its nuclei. In fact, this redefinition can go both ways: either the nuclei become unable to license governing relations between the consonants in an *RT* cluster – this entails the loss of codas, or the nuclei may become able to perform the licensing, in which case the system obtains internal codas.

Finally, it must be repeated that the loss of final jers in Slavic did not create closed syllables, that is, final codas. The loss of jers involved only a substantive aspect of phonological structure whereby the melody of the vowel was lost, thus completing the weakening path *i*/*u*>ь/ъ>*ø*. On the

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[78] It is crucial to bear in mind that in this model whether a language has codas or not is decided outside the domain of the syllable, that is, through the licensing properties of the following nucleus.

other hand, the formal structure remained the same. In this respect our view on the phenomenon of jer loss agrees with that of e.g. Shevelov (1964) and Bethin (1998), in that it need not be viewed as a dramatic change in the history of Slavic. Obviously, our arguments are quite different from theirs.

3. Clustering at word edges

3.1. Introduction

We have been consistently delaying the discussion of two very important issues which must be somehow accounted for in the Complexity Scales and Licensing model. The first one concerns the structure of the branching rhyme and in particular the effects that have traditionally been explained by making reference to this structure, for example, compensatory lengthening, or closed syllable shortening. The other issue concerns the structure of the left edge of the word. So far, most of our discussion of clustering at this edge centred around complex onsets where the main organizing agent was the rightward interonset relation yielding *TR* clusters, with additional complexities being derived from the presence of unlocked empty nuclei, as in the Polish words *krwi* [krf] < /kø̲røf´i/ 'blood, gen.sg.', or *tkliwy* [tklivɨ] < /tøkø̲livɨ/ 'tender'.[79] The question of course is what inhibits the *RT* clusters from occurring in this position. Recall that *RT* clusters are at level II of formal complexity, hence we should expect these clusters to occur initially with more freedom than *TR*s, which are at level III. The predominant phonotactic pattern across languages, however, is of the opposite type. Somehow, *TR* clusters are much better initially than *RT*s.

Since both problems mentioned above, that is, the structure of the branching rhyme and the restrictions on *RT* clusters word-initially, seem to converge on the question of how leftward interonset relations function in phonological representation (*R*←*T*), a uniform interpretation of the two aspects is called for. It will be shown in this section that such an analysis is possible. For this reason, we first look more closely at the effects connected with the traditional structure of the branching rhyme, with a view to demonstrating how our model may capture the two seemingly unconnected aspects. The irony of the situation is that traditionally, word-initial conso-

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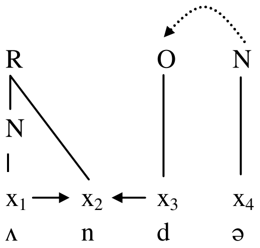
[79] Recall that the underlined empty nucleus is locked within an interonset governing relation. Only the unlocked empty nuclei are licensers.

nant clusters have been assumed to be onsets, whereas, in our analysis of the left edge we will look at the fragment of representation which has been associated with the opposite edge of the syllable, that is, the rhyme.

3.2. Branching rhymes revisited

Before we show how the main functions of the branching rhyme can be accounted for within the CSL model, let us first briefly remind ourselves of these functions and how they were captured within the standard model of Government Phonology.

(51) ***under***



The structure of the branching rhyme (x_1–x_2) is in fact quite a complex configuration, which is not independent of what follows. The rhymal complement (x_2), which is governed by the head of the constituent, that is, the nucleus (x_1), must also be governed by the following onset (x_3), which in turn must be licensed by its nucleus (x_4). Altogether, then, a branching rhyme involves a structure in which four skeletal positions are involved. It appears that all these dependencies have their expression in phonological phenomena.[80] We will in a while review the most important of them.

The rightward governing relation between x_1 and x_2 defines a branching constituent in standard GP. This is the only instance in the model in which the governor does not impose substantive conditions on the governee. However, the nature of government poses a limit on the size of the constituent. We we may speak of quantitative restrictions within a branching rhyme, whereby, for example, super heavy rhymes (SHR) are generally not allowed.

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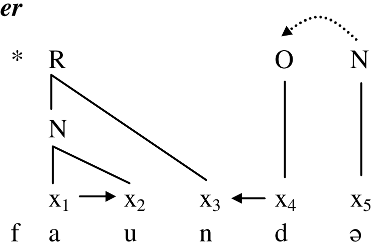
[80] The analysis of liquid metathesis presented in the previous section clearly demonstrated that the so called branching rhyme is in fact strictly dependent on the interaction between x_2 and x_3 in (51), which in turn is conditioned by the licensing properties of the nucleus in x_4. In syllabic terms, we would have to say that the branching rhyme depends on the status of the nucleus in the following syllable.

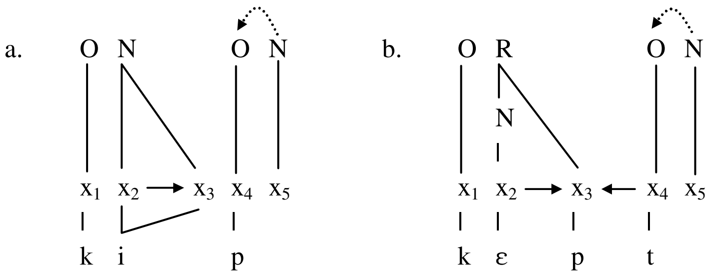
(52) ***founder***



In GP, an SHR involves three positions, that is a bi-positional branching nucleus followed by a rhymal complement. It is obvious that the existence of data exhibiting the forbidden structure sits awkwardly with the theory in which all constituents are maximally binary branching. The problem with the structure in (52) is that the complement of the branching rhyme cannot be governed by the head of this constituent, because government is local (Kaye, Lowenstamm and Vergnaud 1990: 200). There are two reasons why this representation is tolerated in GP, apart form the obvious one, namely, that forms which must be given this structure do occur. Firstly, the rhymal complement is governed by the following onset, and thus, it does not remain unlicensed. And secondly, such forms are quite severely restricted in English, in that they mostly involve coronal and homorganic clusters (e.g. Harris 1994: 77).

If the melodic conditions are not met, such structures are simplified by, for example, shortening the vowel. This course of events may be assumed to have occurred in forms like *keep / kept*.

(53)



Thus, *closed syllable shortening* is explained in standard GP as an effect of the rhyme striving to maintain its maximally binary branching character. Of course, one must admit that the existence of SHR is a source of unease for a restrictive model like GP.

Another effect, normally derived from the branching nature of the rhyme, is the stress attraction in words like *agenda, veranda* etc., as compared with *aroma, arena* etc. (Harris 1994: 42). The generalization that may be made here is that a branching rhyme weighs the same as a long vowel, that is, a branching nucleus, and, therefore, both attract stress.

Returning now to the structure in (51), it is the governing relation between the rhymal complement and the following onset ($x_2 \leftarrow x_3$) that is responsible for melodic restrictions on the 'coda', for example, the homorganicity requirements concerning nasals followed by stops, and the general pattern of falling sonority / rising complexity in *RT* clusters. One must bear in mind that the rhymal complement is the only position which is identified with the 'coda' in GP. Thus, word final single consonants do not cause closed syllable shortening, and do not attract stress in English, because they are onsets and not complements of a branching rhyme.[81]

It is interesting that the rhymal complement, that is the 'coda', is the only position in the phonological representation of standard GP which is doubly governed. This may be viewed as a weak point of the theory, but it also makes some interesting predictions. Since two governors compete for this position, there may be cases when one of them loses. For example, if the onset cannot govern the preceding 'coda' we expect two outcomes. One involves epenthesis of, for example, the Irish type: *feirge* [f′er′ᵊg′ə] 'anger, gen.sg.', whereby a vowel is introduced within the cluster. The second may involve the loss of the 'coda', in which case the position is taken over by the rhyme, as it were, and *compensatory lengthening* (*CL*) occurs, as in the historical development of English *night* [nait < niːt < nixt] (Harris 1994: 34).[82]

The two effects illustrated in (54) may be said to derive from a single factor, namely, the 'coda' consonant cannot be governed by the following onset.

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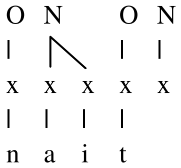
[81] See Kaye (1990: 318) for an analysis of Yawelmani closed syllable shortening which also occurs before a word-final consonant. It is shown that it is the parameterization of the final empty nucleus and not the final consonant that is responsible for the shorting.

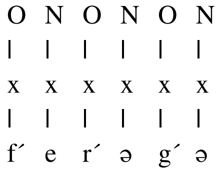
[82] It is difficult to say what effects we should expect if the 'coda' cannot be governed by the head of the rhyme. This observation points to the fact that the crucial fragment of the representation of what we used to treat as the branching rhyme is in fact the governing relation of the 'coda' with the following onset, and the licensing of that onset from the following nucleus. This argues in favour of our approach to branching rhymes, which ignores this structure and fully relies only on the relevant aspect of (51), that is, $x_2–x_3–x_4$.

(54)

a. ***result of CL***



b. ***result of epenthesis***



Although in this work we try to remain as non-derivational as possible, we cannot fail to notice that compensatory lengthening and epenthesis, which arise as a result of the absence of *R←T*, create structures which are quite disparate from the branching rhyme. One is a branching nucleus and the other is a sequence of onsets and nuclei. To salvage the model, it may be claimed that *CL* is a case of historical reanalysis, while epenthesis may indeed be viewed in static terms: all we need to say is that the inability of *rg* in *feirge* 'anger, gen.sg.' to contract a governing relation means that lexically such relations are absent, and we are dealing with a sequence of onsets rather than with a cluster which is broken up in the course of derivation. However, if we consider cases of synchronic optional instances of epenthesis as in the Dutch word *kerker* [kɛr(ə).kər] 'dungeon', where the optionality is also connected with style variation, the model in which [kɛrkər] will have the structure of the branching rhyme, and [kɛrəkər] a sequence of onsets, cannot be said to capture the facts in the most elegant way, as the stylistic variation would involve two dramatically different representations of the same word. In other words, speakers would have to have two lexicons.

A CV model, such as CSL, is not just more elegant, it also provides solutions for serious problems connected with theory and data.

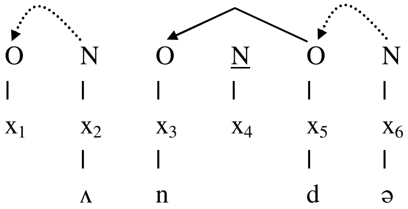
3.3. Branching rhymes CV-lized

3.3.1. Epenthesis and compensatory lengthening

In standard GP, there is no theoretically sound explanation for the existence of super heavy rhymes, because of the maximal binarity of constituents, which follows from the formal conditions on government (locality and directionality). Another problem in this model concerns the structural distinction between a branching rhyme on the one hand, a branching nucleus, and a sequence of onsets and nuclei, whereas, phonological phenomena such as compensatory lengthening and epenthesis seem to point to the need for connecting the three structures somehow.

Let us first provide a CV representation of the English word *under* in order to illustrate the main differences with respect to the branching constituent approach, before we show how *CL* and epenthesis may be formally connected with *RT* clusters.

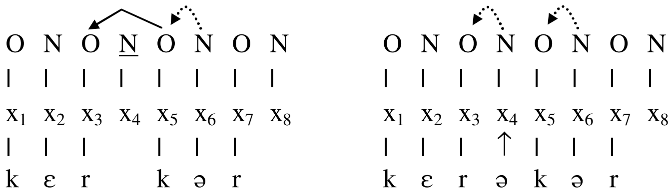
(55) ***under***



Recall that the crucial aspect of what we used to view as a branching rhyme is the leftward governing relation of the interonset type (LIO), which must be licensed by the following nucleus. The 'locked' empty nucleus ($\underline{x}_4$) remains phonologically inert as long as it is enclosed within the governing relation. When unlocked, due to the absence of the governing relation, it must license its onset (x_3). For this purpose, the nucleus is vocalized in some languages, yielding epenthesis, or the onset is lost, yielding compensatory lengthening.

Let us first briefly look at epenthesis on the basis of the earlier discussed Dutch case, that is, *kerker* [kɛr(^{ə}).kər] 'dungeon'. It will be recalled that a similar analysis was proposed in this chapter to deal with the early stages of what subsequently led to liquid metathesis in the history of Slavic languages.

(56)


a. [kɛrkər]

b. [kɛr^{ə}kər]

It was proposed in chapter 2 that the difference in register leading to the fluctuation between epenthesized and non-epenthesized forms can be reduced to one aspect of phonological organization, that is, to the licensing properties of nuclei. In (56a), the more formal style, the licensing strength of the nucleus x_6 is set to license the governing relation. On the other hand, in the less formal variety, the properties of schwas are weaker and they suffice to license only simplex onsets. The interonset governing relation *r←k* cannot be contracted, and the nucleus x_4 is unlocked. As such, it is subject to various restrictions. First of all it must license its onset. Secondly, it may not be followed by another empty unlocked nucleus (*∅–∅). In Dutch, this nucleus must be vocalized, as word-internal empty nuclei are not licensers.[83]

Thus, epenthesis in CSL does not involve serious structural alterations, all that is changed is the presence or absence of a governing relation, this in turn being due to the licensing properties of nuclei. Note that these two factors are responsible for the syllabic organization of speech in this model, and the direct reference to them in accounting for epenthesis, as well as the fact that the process does not involve any formal restructuring, render this model attractive.

The representation in (56b) also shows the formal difference between the so called reduction schwa lodged in x_6 and the epenthetic schwa in x_4 (van Oostendorp 2000: 131). The sources for these are different in that one is the result of the loss of active vocalic elements in weak prosodic positions, while the other one is the result of the vocalization of a lexically empty nucleus. Thus, melodically and functionally, that is, in terms of licensing abilities, they are identical. The latter property is constant for all types of schwas within a particular language, dialect or register. Thus for example, vowel reduction will be conditioned by the licensing properties assigned to schwas, in that a vowel should not be reduced in contexts in which a schwa would not be able to license a particular structure. This prediction will be shown to be correct below. On the other hand, the licensing properties established for empty nuclei will cause them to be vocalized if they are unable to license particular structures, as in [kɛrᵊkər]. So it seems that while the properties of schwas are stable, they may arise as the result of two disparate phenomena.

The formal distinction between reduction and epenthetic schwas which is based on their source (ə < a) vs. (ə < ∅), is also necessary in the analysis

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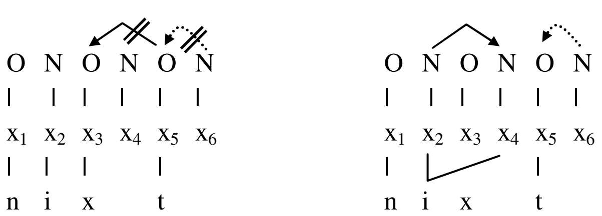
[83] Recall that there is variation among languages as to whether word-internal empty nuclei may license and how much material they can sanction. In chapter 2 we saw that in Polish word-internal empty nuclei have similar licensing properties as domain-final ones. On the other hand in standard French, word-internal clusters have to be licensed by at least a schwa (…*CØ*…, …*RTə*…, …*TRə*…), while in Saint Etienne French only *TR*s require a schwa (…*CØ*…, …*RTØ*…, …*TRə*…).

of Irish. The former type behaves like an underlying vowel and may separate onsets of different quality, for example, *asal / asail* [ɑsəl ~ ɑsəl´] ‘donkey/gen.sg.’, whereas the latter behaves like an empty nucleus and the two onsets must agree in quality. The forms *solas / solais / soilse* [soləs ~ sel´ɪʃ ~ si:l´ʃə] ‘brightness, nom. / gen. /pl.’ illustrate this property of epenthetic schwas in Irish.[84] Thus we predict that schwas will act uniformly as licensers, but they will exhibit different effects depending on their source. In this respect, the model strikes a balance between derivational and strictly non-derivational or surface-based models, in that we have fully static conditions on schwas as licensers, thus deriving the grammatical forms, while derivation consists solely in the phonetic implementation of underlying structures in agreement with these static conditions. In the case of the two types of schwas, ‘derivation’ consists in the phonetic interpretation of full vowels and empty nuclei in their particular contexts. If a vowel finds itself in a weak prosodic position, most of its elements will not be licensed, and hence, not pronounced (a > ə). On the other hand, if an empty position is unlocked and must perform the licensing for which an empty nucleus is insufficient, then the position is vocalized (ø > ə). Thus the amount of derivation is negligible in both cases.[85]

Let us now turn to an account of compensatory lengthening in CSL, which will additionally show us how long vowels are represented in this model. For this purpose we will look at the historical development of the word *night*.

(57)


a. ***pre-deletion stage***
b. ***compensatory lengthening***

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[84] The vowel [ɪ] in [sel´ɪʃ] results from the strong palatalizing context. Nonetheless it is a schwa-like vowel.

[85] van Oostendorp (2000: 132) distinguishes a third type of schwa which he calls underlying. We predict that this schwa will license the same amount of melodic material in onsets as any other schwa, while it will pattern with reduction schwas if such effects are at play in Dutch.

The representation in (57a) in fact encapsulates two stages of the development: one at which the form was pronounced as [nixt] and involved an interonset governing relation sponsored by the final nucleus, and a stage at which the governing relations were no longer possible, due to, say, the weakening of the licensing properties of the final nucleus.[86] The latter situation had to be resolved. Notwithstanding the details of the actual reasons for the fact that instead of epenthesis the cluster is simplified by deleting the spirant, the net result of the deletion is that a sequence of two empty positions (x_3–x_4) arises. The resolution of this situation in the history of English consisted in utilizing the nuclear position to form a long vowel (57b). The alternative would consist in utilizing the onset position to form a geminate, a situation which took place in the history of Italian, where the etymologically related form is *notte* (< Latin stem *noct-*). Thus, epenthesis, compensatory lengthening and gemination may be accounted for as a redistribution of melodies in virtually the same structural configuration. What makes the difference is the type of relations that consonants or vowels contract.

It follows from this analysis that the structure of long vowels in CV phonology involves the presence of an empty onset enclosed between two nuclei. We will see presently how this structure may shed light on such phonological facts as the existence of super heavy rhymes (SHR) and closed syllable shortening in a direct way, provided other assumptions are made as well.[87]

3.3.2. The double licensing of LIO?

In this section we will try to demonstrate that, with certain new assumptions relating to the prosodic organization, the CSL model may capture both closed syllable shortening and the existence of super heavy rhymes. If this can be done, the CV mould will not only be shown to be more elegant than the binary branching approach but it will also be superior theoretically, in that it will predict that such exceptional structures should occur, and when they do arise, that they will be restricted melodically. It is worth reminding ourselves of a general tendency that seems to hold in phonologi-

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[86] Weakening as well as strengthening of the licensing properties of final empty nuclei must be recognized as possible mechanism of phonological change. An example of strengthening was discussed in the previous chapter in section 6.3.2.

[87] The reader is referred to existing studies which utilize slightly different models of CV (Lowenstamm 1996, Scheer 1998b, 2004, Rowicka 1999, Polgárdi 2002); in these, vowel length is discussed in detail.

cal representation, namely, that melodic restrictions on consonants and consonant clusters are connected with weaker licensing. We begin by enumerating a few observations from English, which concern the role of the nucleus directly preceding the leftward interonset relation, with a view to showing that there is some relationship between the nucleus and the type of the following *RT* cluster (*VRT*).

Szigetvári (1994: 193) notes that word-final [mp, ŋk] in English occur only in monosyllables, that is, after stressed vowels. Gussmann (1998) extends this observation also to laterals and, in the relevant dialects, also approximants followed by non-coronal stops. The restrictions below are taken from Gussmann (1998: 123).

(58)	***nasal***		***lateral***		***approximant***	
labial	*əmp		*əlp	*əlb	*ɚp	*ɚb
coronal	ənt	ənd	əlt	əld	ɚt	ɚd
velar	*əŋk	*əŋ	*əlk		*ɚk	*ɚg

The extensive corpus in Tóth (2002: 42) supports these observations. Thus, for the starred clusters to be licensed finally, a full vowel is required in the preceding context, for example, *camp* [kæmp], *bank* [bæŋk], *gulp* [gʌlp], *milk* [mɪlk]. Some of these clusters may be preceded by a schwa if they are not word-final, for example, *companion* [kəmˈpænɪən], *combine* [kəmˈbaɪn], which we fully predict because RT clusters are primarily licensed by the following nucleus.

The interesting fact here is that the schwa may occur before a sonorant followed by a coronal stop, for example, *accident* [ˈæksɪdənt], or *errand* [ˈerənd]. One might also add here the *s+consonant* clusters, which for us also constitute *RT* clusters, for example, *forest* [ˈfɔrəst]. Note that *s* followed by a non-coronal stop is also found mostly in mono-syllabic words of the type *desk, wisp*, etc., and is generally absent in sequences like *[…əsp#, …əsk#] (Tóth 2002: 45). A similar phenomenon is found in Dutch in which vowel reduction is not possible before *RT* clusters other than *s* or a sonorant followed by a dental obstruent. We will return to this issue shortly.

To capture the requirement on the shape of the nucleus directly preceding an *RT* cluster, let us tentatively propose that the following licensing relation obtains between nuclei flanking a leftward interonset relation.[88]

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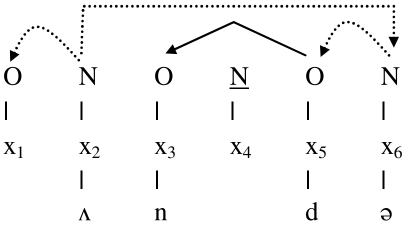
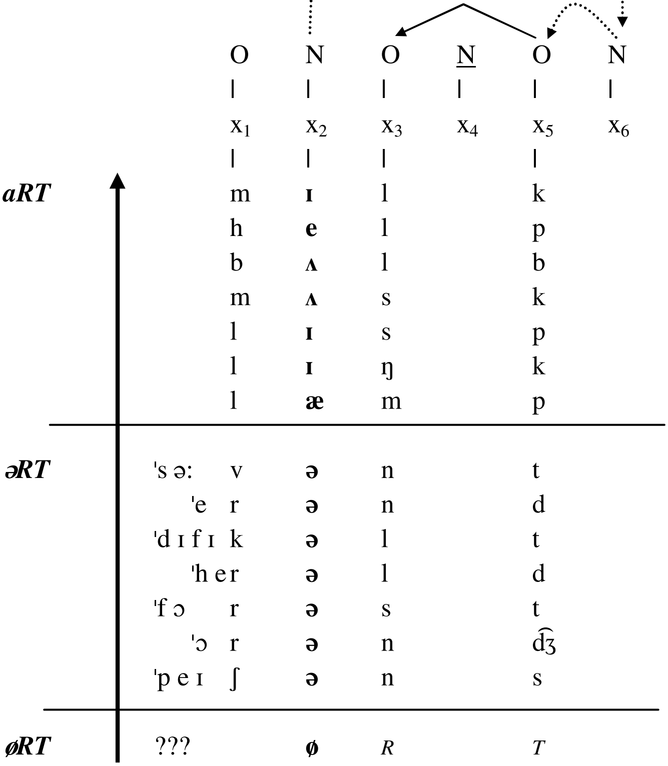
[88] It is obvious that this proposal in a sense revives the branching rhyme. We will shortly see how (59) differs from it.

(59) ***under***



To return now to the English restrictions on *VRT* sequences, it appears that the vowel *V* is restricted to the unreduced type before some *RT* clusters. On the other hand, the schwa vowel is possible before a set of homorganic *RT*s in which the sonorant(*R*) or *s* are followed by coronal stops. Thus, it seems that we are dealing here with a scale of licensers very much resembling those discovered in chapter 2, that is, [a–ə–ø], where *a* = full vowel. The difference is that these licensers occur before the *RT* clusters, not after.

(60)



aRT		m	ɪ	l	k
		h	e	l	p
		b	ʌ	l	b
		m	ʌ	s	k
		l	ɪ	s	p
		l	ɪ	ŋ	k
		l	æ	m	p
əRT	's əː	v	ə	n	t
	'e	r	ə	n	d
	'd ɪ f ɪ	k	ə	l	t
	'h e	r	ə	l	d
	'f ɔ	r	ə	s	t
	'ɔ	r	ə	n	d͡ʒ
	'p e ɪ	ʃ	ə	n	s
øRT	???		ø	*R*	*T*

Note that, with the exception of *øRT*, of which we will say more later, we seem to be dealing with a familiar scale of licensers – the *RT* clusters which follow a full vowel are less restricted melodically than those after a schwa. We must also bear in mind that these clusters are primarily licensed by the following nucleus, hence some possible clusters are missing here because they may not appear before an empty nucleus, for example, *lg, mb, ŋg*. The question is what the last category of strings, that is, *øRT* may represent. If our model is anything to go by, and if we are correct in assuming that there is such a thing as double licensing of LIO, then we must admit that the model predicts the existence of *øRT*, as well as pointing to the fact that this structure should be highly restricted melodically. Before we show this, let us concentrate a bit more on the distinction *aRT* vs. *əRT*.

It is interesting that, in terms of melodic restrictions on clusters, the *əRT* group coincides with what we find in English super heavy rhymes. In such cases, there is always the temptation to refer to the extrasyllabic status of coronal obstruents.[89] However, these clusters occur both word-finally and medially, hence, recourse to extrasyllabicity does not solve anything, and a solution which connects the two contexts should be sought. The data below are reproduced from Harris (1994: 76).

(61)

	Final	***Medial***
VVnt	saint, mount	fountain
VVnd	rind, sound	flounder
VVlt	revolt, colt	poultry
VVld	child, field	shoulder
VVnd͡ʒ	range, scrounge	angel
VVns	pounce, ounce	council

What connects the above cases of SHR and the *əRT* sequences, in our view, is the fact that the nucleus directly preceding the *RT* cluster is prosodically weak in both cases. In other words, the second part of a long vowel or diphthong is functionally, that is with respect to double licensing, equal to schwa. This fact can be easily derived from the structure of long vowels both in standard and in CV Government Phonology, that is, whether we use branching nuclei or sequences.

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[89] See also the discussion of Dutch below.

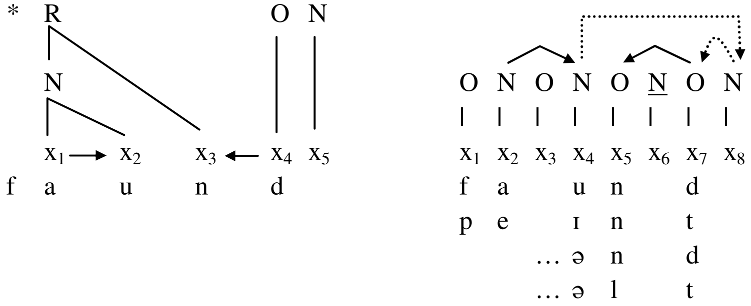
(62) a. ***branching nucleus*** b. ***sequence***

The governed position may be equated with schwa not only because it may be claimed to be phonologically empty, but first and foremost, because it is in a weak prosodic position as far as the relation with the preceding nucleus is concerned. This allows us to include diphthongs in the group of phenomena connected with SHR. Despite the fact that diphthongs contain a melody in the second position, the position is prosodically weak, and diphthongs behave like long vowels. Note that melodically, the second fragment of diphthongs in English is restricted to [ɪ] and [ʊ] as in [aɪ, eɪ, aʊ, oʊ], and to schwa, as in [ɪə, uə].

There is, however, one crucial difference between what we may expect from a branching nucleus (62a) as opposed to a sequence (62b), which works in favour of the latter. As mentioned above, the restrictions *aRT* vs. *əRT* illustrated in (60) could be easily accounted for in the traditional GP model by referring to the structure of the branching rhyme. For example, it might be claimed in that model that the governing relation between the head of the rhyme and the complement, which is the foundation of the branching constituent, imposes structural conditions on what type of 'coda' can be governed by a schwa, and also determine where a full vowel is required. A theoretical explanation for this condition would not be difficult to think of. For example, it may be the case that a schwa can govern 'codas' only if they are already strongly governed by the following onset. This would be compatible also with our view on what an easy-to-license cluster is. An easy cluster is one in which for purely melodic (homorganicity), or complexity reasons (steep complexity profile), the governing relation between consonants is stronger, and hence the cluster is more integral and easier to license.

However, this explanation could not be extended to what happens in super heavy rhymes. Recall that in this structure, the coda is not governed by anything within the branching rhyme because it is not adjacent to the head, that is, x_1 in (63a). Let us repeat the structure of SHR for convenience, and compare it with a CV representation.

(63) a. b.

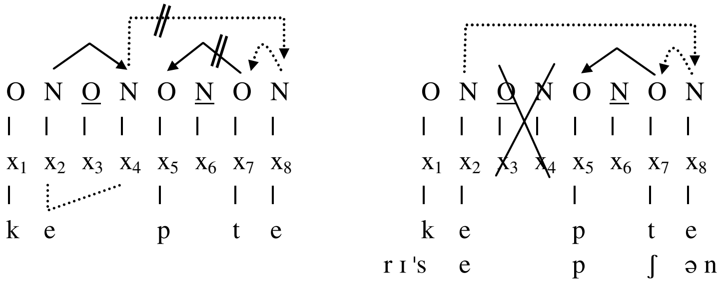


In (63a), there is no theoretical connection between x_2 and x_3 other than phonetic adjacency, which is now the only generalization left which would enable standard GP to cover the uniformity of *VVRT* and *əRT* in English. However, it is not clear how phonetic adjacency might affect the shape of the entire cluster. On the other hand, the structure in (63b) provides a theoretical platform for connecting the two contexts formally, whereby the fragment of the phonological representation of SHR beginning with x_4, that is the prosodically weak nucleus, is exactly the same as in *əRT*, for example, in *errand* ['erənd].

Thus, it seems that we have a uniform way of accounting for restrictions on *RT* clusters in English, which additionally provides a theoretical rationale for the existence of SHR. This structure is not illegal, but at the same time we know why it is so restricted melodically in English. This is because it is an almost exact copy of similar restrictions in well-behaved rhymes. The question is, of course, what happens with *RT* clusters which do not fall under the pattern [nt, lt, nd, st, ld] etc., if by any chance they are preceded by a long vowel. The answer that must be given is that either such a cluster will not arise, or that the preceding vowel will have to be shortened. This is the case of closed syllable shortening, for which we now have a ready solution.

In the history of English, there are cases where some formerly analytic suffixes were reanalysed as synthetic in certain forms. As a result long vowels were shortened if an *RT* cluster was formed, for example, *keep* < [ke:pan] ~ *kept* < /[kepte]/ < /[[ke:pø]te]/ (e.g. Kaye 1990: 312). In general, a similar account may be given to forms like *receive* / *reception, describe* / *description* etc. In this model, closed syllable shortening is motivated by the need to provide a strong licenser for the following cluster. To achieve this, the entire sequence of empty O_3N_4 is reduced.

(64)


a. b.

The illustration in (64a) shows the stage after the reanalysis of *–te* as synthetic. The cluster *pt* cannot be licensed if preceded by a weak licenser, therefore, vowel shortening occurs. The emerging picture of long vowels seems to suggest that the left edge, or the first nucleus, behaves like a full vowel, whereas the right edge, that is the second nucleus, behaves like a schwa with respect to what follows. Let us now turn to a well-known problem in Dutch which may be said to depend precisely on this divide.

3.3.3. More on Dutch schwa

It has been noticed by a few authors that the distribution of schwa in Dutch resembles that of long vowels (e.g. Trommelen 1984: 18, Kager 1989: 209). To capture this fact, Trommelen (1984: 19) assumes that schwa patterns with long vowels because it is a long vowel. Let us look at some of the data which led to this conclusion.

One of the restrictions on short vowels in Dutch is that they do not occur word-finally (65a). However, both schwa and long vowels do (65b, c).[90]

(65)

a.	b.	c.
*[mi:kɑ]	[mi:kə] *Mieke* 'name'	[mi:ka:] *mica* 'mica'
*[hɪndɪ]	[hɪndə] *hinde* 'hind'	[hɪndi:] *Hindi* 'Hindi'

---

[90] The data come from Trommelen (1984: 19) and Kager (1989: 209). However, we generally follow the transcription of Dutch vowels given in Booij (1995: 4) where the short vowels are transcribed as [ɪ, ɛ, ɔ, ʏ, ɑ]. The only modification that we introduce, for the sake of clarity, is that the long vowels are additionally marked for length [i:, y:, u:, e:, ø:, o:, a:].

Another context in which schwa seems to pattern with long vowels is preceding a tautosyllabic sequence in which the second member is a non-dental. Such clusters may only be preceded by a short vowel (66a).

(66)

a.	b.	c.
[dɑmp] *damp* 'vapour'	*[a:dəmp]	*[da:mp]
[dɑŋk] *dank* 'thanks'	*[ɑdəŋk]	*[da:ŋk]
[wɑlm] *walm* 'smoke'	*[ɑwəlm]	*[wa:lm]

If the consonant sequences are of a particular shape, then schwas and long vowels may precede them. The forms in (67a) show əRT sequences, while those in (67b) illustrate super heavy rhymes.

(67)

a.	b.
[ɑrənt] *arend* 'eagle'	[ma:nt] *maand* 'month'
[hɔndərt] *honderd* 'hundred'	[ha:rt] *haard* 'hearth'
[wɛrəlt] *wereld* 'world'	[be:lt] *beeld* 'image'

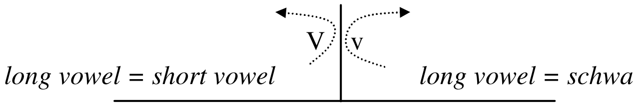
The reader will have noticed that the contexts in which schwa and long vowels may precede RT sequences are very similar to what we saw with respect to English in (60) and (61).

The list of similarities between schwa and long vowels is longer and can be further observed in diminutive allomorphy and comparative suffixes (Trommelen 1984: 20). However, there are also differences between schwa and the long vowels. First of all, unlike long and short vowels, schwa is not stressable. In fact, one might also enumerate a list of contexts in which short and long vowels pattern together in opposition to the schwa vowel. For example, there are consonants and clusters which cannot be followed by schwa, e.g. **hə*, **ŋχə*. To this we may add the absence of complex onsets before schwa, that is *TRə, and the optional epenthesis in 'heavy' RT clusters licensed by a schwa, that is RəTə. The latter cases were discussed at length in section 4.1 of the preceding chapter.

The general observation that can be made concerning the alignment of schwa with long vowels on the one hand, and long vowels with short ones on the other, is that schwa patterns with long vowels with respect to what follows, while long and short vowels pattern together with respect to stressability and the preceding context. Recall, that a CV representation of long vowels predicts this split.

For the purpose of illustration let us use the symbol *V* for a short vowel, and *v* for a schwa, while long vowels and diphthongs will be represented as *Vv*. The left edge of long vowels will behave like short vowels, while the right edge will pattern with schwa.

(68) ***long vowel split***



The word-final restrictions can now be accounted for quite straightforwardly if we assume that Dutch allows only weak nuclei word-finally. Whatever the actual wording of this condition or constraint, we expect that Dutch will not end its words with *V*. The remaining possibilities, then, include long vowels, schwas, and even empty nuclei, all of which may be equated with the symbolic *v*.

(69) ***word-final restriction on nuclei in Dutch***:

*…*V#*	*[mi:kɑ]
^{ok}…*v#*	[mi:ka:] ‘mica’ [mi:kə] ‘Mieke’ [dɔktɔr] ‘doctor’

Thus, word-finally, schwa patterns with long vowels and empty nuclei because all of these structures can be identified with *v*, that is, a weak nucleus, in the relevant context. In the case of long vowels, it is their right edge which can be identified with *v*.

Another instance where schwa behaves like a long vowel concerns the context preceding an RT sequence which does not contain a dental consonant (70a). This effect can be accounted for by means of our proposal that LIO must be doubly licensed. Just as in English, a schwa may discharge licensing in this context if the RT sequence is of the ‘easy’ type (70b).[91]

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[91] Let us recall from our earlier discussion in chapter 2, section 4.2, that ‘easy’ or ‘light’ clusters are homorganic or involving coronality.

(70) a. ***conditions on vowel reduction in Dutch: *…v*mp**

^{ok}…*V*mp	[dɑmp] *damp* 'vapour'
*…*v*mp	*[ɑdəmp] *[da:mp] *[ɑdmp]

b. ***licensing of 'easy' LIO in Dutch***

^{ok}…*V*nt	[mɑnt] *mand* 'basket'
^{ok}…*v*nt	[ɑrənt] *arend* 'eagle' [ma:nt] *maand* 'month'
*…*ø*nt	*[ɑrnt]

With respect to (70a), we predict that an empty nucleus cannot provide licensing in a situation where a schwa cannot either. Note, however, that in the context in which a schwa and a long vowel are allowed (70b), short unreduced vowels behave in the same way, just as our model predicts. On the other hand, an empty nucleus cannot provide the necessary support for LIO, even though it can be labelled as *v*. It would be interesting to find at least one instance of this type of licensing, because the theory predicts its existence even though we expect such structures to be severely restricted in type.[92]

Let us now represent graphically the situations in which long vowels pattern with short ones, in opposition to schwas. This concerns contexts in which licensing of preceding rather than following material is involved. We begin with the restrictions **hə, *ŋχə*.

(71) a.

^{ok}*hV* ^{ok}*hVv*	
**hv*	(*hə, *hø#)

b.

^{ok}*ŋχV* ^{ok}*ŋχVv*	
**ŋχv*	(*ŋχə, *ŋχø#)

We may conclude that the consonant [h] and the cluster [ŋχ] require strong licensers, hence, neither schwas nor empty nuclei can license them. The same applies to syllabic configurations, which we have already discussed in some detail in chapter 2.

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[92] This structure may be postulated in the case of such forms as *eerst* [e:rst] < /e:røstø/ 'first', *ernst* [ɛrnst] < /ɛrnøstø/ 'seriousness' (Booij 1995: 27). See also the discussion of similar cases in Polish in section 3.5 of this chapter.

(72)

a.	b.
^{ok}*TRV*	^{ok}*RTV*
^{ok}*TRVv*	^{ok}*RTVv*
———	- - - - -
$^{*?}$*TRv*	$^{*??}$*RTv*

As for complex onsets, only full vowels can license such structures, with the exception of pretonic schwas, for example, *brevet* [brəvɛt] 'patent'. On the other hand, both schwas and empty nuclei may license 'easy' RT clusters (72b), while the more difficult structures are optionally epenthesized before a schwa, and almost obligatorily epenthesized before an empty nucleus (Kager 1989: 214).

To conclude, the split structure of long vowels, in which the first element behaves like a short vowel with respect to the licensing of preceding consonantal material, and the second element behaves like a schwa with respect to the following context, accounts not only for those cases in which schwas pattern with long vowels, but for all possible allegiances involving short, long, reduced and empty nuclei. Note that this analysis can only be achieved if we assume that the role of nuclei is to license a particular formal configuration, and that the nuclei themselves occur in contexts determining their licensing properties. It is also possible only if we discover all the licensing paths that may occur within a phonological word.

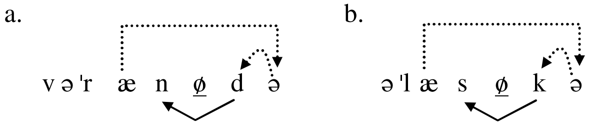
Let us now turn to the role of empty nuclei in the licensing of LIO, that is *ØRT*, which have been alluded to on several occasions above. The following discussion will hopefully move us closer to providing some explanations for the restriction on RT clusters at the left edge of the word.

3.4. The magic of the left edge

The obvious candidate which might illustrate the pattern *ØRT* and thus fill in the gap in the scale of licensers in the double licensing of LIO is the *s+consonant* sequence, which was referred to as the 'magic' context in chapter 2 (section 5.2). It will be recalled, that in Standard GP, the magic context word-initially involves the presence of an empty nucleus in front of the *s+C* sequence. In this section we will not obtain answers to the question why *s+C* is special, although clearly it is special because it is, for some reason, the easiest type of leftward interonset government. However, we will look at some arguments showing that a double licensing analysis can be used to account for such clusters. They are predicted by the scale of double licensers given in (60) above. *ØRT* may be used if the empty nucleus is afforded sufficient properties allowing for the double licensing of LIO. We will also look at the distribution of the magic context within the word in Polish and see that there are many questions that still need to be answered concerning both the magic context and the double licensing of LIO itself. Let us first remind ourselves of the reasons why standard GP viewed *s+C* as a true *RT* cluster rather than a complex onset. However, we will use simplified CV representations to illustrate this point.

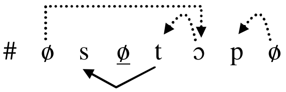
One of the main reasons why *s+C* clusters are not viewed as complex onsets is their recurrent and fairly consistent behaviour, in that they pattern with coda-onset clusters rather than with complex onsets. An example of this comes from the accentual system of English. In nominal forms, a word with three short vowels is stressed on the anti-penultimate nucleus, for example, *cinema* [ˈsɪnəmə]. On the other hand, forms containing a long vowel or a branching rhyme exhibit stress attraction by these structures, as in *veranda* and *aroma*. Since *Alaska* behaves like *veranda* in attracting stress on the vowel preceding the cluster, it is assumed that the two words have identical syllabic structures. This is illustrated below in (73).

(73)



As for the mechanism of stress attraction by the structures in (73), it may be proposed that the licensing relation between the nuclei enclosing the leftward governing relation attracts stress just like the long vowel in *aroma*, because both involve a relation between two nuclei of the strong-weak type. Recall that we identify the second element of long vowels and diphthongs with schwa. Thus, the two structures are formally similar and may be said to form a branching foot. We have no intention of trying to account for stress placement in English here. Let us, therefore, only conclude that word-internal *s+C* clusters behave like an *RT* cluster and must be given this structure in other contexts, for example, word-initially in words like *stop*.

(74)



It was argued in Kaye (1992) that word-initial *s+C* sequences are preceded by an empty nucleus. Since *s* was in the coda of the preceding rhyme, the empty nucleus had to be proposed as the head of that dummy structure. The empty nucleus, it will be recalled, like any empty nucleus in Standard GP, had to be licensed by something. Since it may remain silent in some languages while in others it has to have melody, for example, the distinction between Italian *stadio* and Spanish *estadio*, a parameter was proposed to capture this fact, and the name ‘magic’ licensing was given to it to express the fact that we do not know why the context of the following *s+C* should have this effect on the preceding empty nucleus.

It is interesting, and perhaps detrimental to the ‘magic’ parameter approach, that both situations may occur in one language, for example Welsh (Thomas 1992: 322). In this language some forms which historically had a schwa in the relevant context, for example, *[əsˈprədjon] *ysbrydion* ‘spirits’, have lost the initial vowel and are pronounced [ˈsprədjon].[93] The loss, however, did not take place in related but shorter forms, for example, [ˈəsprɨd] *ysbryd* ‘spirit’. This variation, which clearly may be given a prosodically based phonological account, sits awkwardly with the idea of the ‘magic’ licensing parameter, because we would have to say that the parameter is phonologically conditioned, rather than being a grammatical setting.

On the other hand, any phonological conditioning of this type works to the advantage of the Complexity Scales and Licensing model. In our analysis the roles in the magic context are reversed. It is the empty nucleus that is providing support for the magic *s+C* cluster through the double licensing of LIO. If we are correct then the magic context is one case illustrating the scale of licensers in the pre-*RT* context (*aRT* > *əRT* > *øRT*). This means that we do not need to refer to any parameter for this structure. It will occur in languages in which empty nuclei have the property of licensing such structures, just as it is the case with empty nuclei word-finally and medially. Since an *RT* preceded by an empty nucleus is at the bottom of the hierarchy, this means that melodic restrictions on the occurrence of this structure will be heavy and parallel to those on branching onsets word-finally. Such structures will be rare and highly conditioned. Thus, we know why the magic context is generally limited to *s+C*, although we still do not understand why this particular cluster is allowed here. We also predict that some phonologically based conditions may lead to variation of the Welsh type.

Recall that we find a gradation in both English and Dutch with respect to the type of nucleus that precedes an *RT*. We saw that a full vowel is required before the more ‘difficult’ *RT*s (*…amp*), while schwa was allowed before the ‘easy’ types (*…ənt*). The question was if the full scale of licensers can be found in some systems, which would also include (*…øRT*), and if so,

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[93] The schwa is stressable in Welsh.

what would be the nature of the restrictions on the *RT*. In what follows we will see that the magic clusters may be extended to include a number of different clusters in Polish. We will also look at other contexts within the word in which *ØRT* may occur. This will show that the presence of the empty nucleus in front of these clusters is not only found word-initially.

3.5. 'Magic', left, right and centre

Two points will be made in this section. Firstly, that in Polish the 'magic' context seems to be extended in that the first element of the cluster is in fact a set of *s*–type consonants. Secondly, it will be shown that the magic context is not only limited to word-initial position, in which we only assume that such clusters are preceded by an empty nucleus, and hence claim that word-initial *s+C* is the missing configuration *ØRT* in the double licensing scale. In Polish, the 'magic' context is present also word-medially and finally, where we must postulate the preceding empty nucleus.

Below, a list of clusters with initial *s*–type consonant is presented.

(75) a. **[s]+*C***

spód 'bottom'
skok 'jump'
stok 'slope'
schab 'sirloin'
słońce 'sun'

b. **[z]+*C***

zboże 'grain'
zgaga 'heartburn'
zdrowie 'health'
złoto 'gold'
znój 'hardship'

c. **[ʃ]+*C***

szpinak 'spinach'
szkoła 'school'
sztywny 'stiff'
szwaczka 'seamstress'

d. **[ʒ]+*C***

żbik 'wildcat'
żgać 'stab'
żmija 'viper'
żniwa 'harvest'

e. **[ɕ]+*C***

śpioch 'sleepyhead'
ścigać 'chase'
śliczny 'beautiful'
śmiały 'brave'
śnieg 'snow'

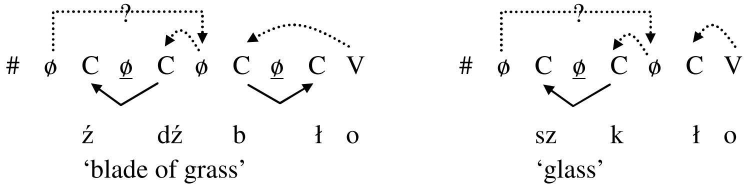
f. **[ʑ]+*C***

źdźiebełko 'speck'
źle 'badly'
źrebak 'colt'

It appears that, unlike in English, Polish allows for an extension of the ‘magic’ context to include various *s*–type consonants. We see both voiceless and voiced congeners as well as different places of articulation. All the forms in (75) should be treated as *RT* clusters, that is, leftward governing relations. Polish, in this respect, is not so restricted in terms of the melodic shape of the initial ‘magic’ clusters.

At this point we should note two very interesting forms involving the ‘magic’ context initially, namely, *źdźbło* [ʑd͡ʑbwo] ‘blade of grass’ and *szkło* [ʃkwo] ‘glass’. Both involve an initial cluster of more than two consonants, where the first two represent the ‘magic’ cluster, which is in turn followed by another onset or cluster. Note that in each case the ‘magic’ sequence must be assumed to be followed by an empty nucleus.[94] This we know on the basis of the related forms *źdźebełko* ‘blade of grass, dim.’ and *szkieł* ‘glass, gen.pl.’, where this nucleus shows up phonetically.[95]

(76)



The problem with these two forms lies in the fact that the magic cluster is in fact enclosed between two empty nuclei, in which case they should be ungrammatical due to the NO LAPSE constraint (*∅–∅), which disallows sequences of two visible (unlocked) empty nuclei. It appears then, that the ‘magic’ context still presents us with a number of theoretical problems. Similar ‘ungrammatical’ sequences will be shown to occur in the word-final context in Polish. However, let us first inspect the word-medial context, where we gain evidence that the ‘magic’ sequence is preceded by an empty nucleus.

A number of forms can be assumed to have this structure. Although the data below still revolve around the initial clusters, the ‘magic’ cluster *s+C*

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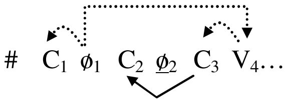
[94] To be more precise, this nucleus contains a floating melody, which we should posit on the basis of the related forms *źdźebełek* ‘blade of grass, dim.gen.pl.’ and *szkieł* ‘glass, gen.pl.’. This detail is omitted here for simplicity. See chapter 2, sections 6.2.4 and 6.3.2 for a detailed discussion of nuclei with floating melodies.

[95] We have seen earlier that the word *źdźbło* is exceptional also with respect to the behaviour of the sequence [bw]. See section 5.5 in chapter 2.

follows rather than precedes another consonant.[96] The forms are listed under the phonological representation that they correspond to.

(77)



l	ś	n	i	ć		‘glitter’
m	ś	c	i	ć		‘avenge’
m	sz	cz	ę			‘I avenge’
k	sz	t	a	ł	t	‘shape’
b	z	d	u	r	a	‘nonsense’

One thing is clear from the above illustration. The ‘magic’ context must be assumed here to be preceded by an empty nucleus ($ø_1$) due to the fact that the string is preceded by another onset. Thus, we can be sure that *øs+C*, which has only been assumed for words like *skok* ‘jump’ (77a), as a direct translation of the Standard GP structure into CSL, takes the same form in the word-medial context. We are indeed dealing with a string *øRT*, and hence, a case of double licensing of LIO performed by an empty nucleus.

As already discussed in chapter 2, the ‘magic’ cluster *s+C* can additionally be extended in that the *s*–type consonant may be followed by a rightward governing relation, the traditional branching onset (*TR*). This allows us to account for four consonant clusters initially, that is, an onset followed by *øsTR*. The resulting string *CøsTR* is shown below with examples.

The extension consists in allowing the governing onset C_3 not only to govern leftwards, but also rightwards. In this respect the string *str* is in no way different from what is found initially in English *string*, or Polish *strona* ‘page’. The difference lies in the fact that this sequence follows another onset C_1, as in *pstry* ‘gaudy’ (pø*s*←*t*→*r*) and is therefore word-medial, as it were. Here, we may tentatively include forms resulting from prefixation. They are marked with a raised question mark, e.g. *wzgląd*$^?$ ‘regard’. An interesting point that should also be made here is that the first onset in these complex clusters is limited to a labial stop or fricative, a restriction which must be left unaccounted for.

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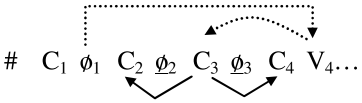
[96] Forms in which the ‘magic’ sequence is further removed from the left edge are readily available, e.g. *państwowy* /[paɲøstvovɨ]/ ‘belonging to state’. We will return to them below in connection with the behaviour of the suffix *–stwo / –stw*.

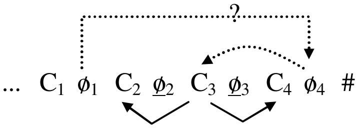
(78)



p	s	t	r	y	‘gaudy’
p	s	t	r	y k a ć	‘click’
p	s	t	rz	y ć	‘make gaudy’
w	s	t	r	ę t n y	‘awful’
w	s	k	rz	e s i ć	‘resurrect’
w	z	d	r	a g a ć się$^{?}$	‘hesitate’
w	z	g	l	ą d$^{?}$	‘regard’
w	z	d	ł	u ż$^{?}$	‘along’

Finally, let us look at the word-final context, in which the ‘magic’ cluster will occur before an empty nucleus. Predictably, the problem of two visible empty nuclei reappears in this context. One empty nucleus precedes the ‘magic’ cluster, while the other follows – the domain-final empty nucleus. Consider the following data. In the left column, the forms contain a vowel and the end of the word and are therefore unproblematic. The problem begins when the inflectional ending is an empty nucleus in the genitive plural forms.

(79)



okropieństwo	~	okropie	ń	s	t	w	‘atrocity/ gen.pl.’
poselstwo	~	pose	l	s	t	w	‘envoy/ gen.pl.’
panieństwo	~	panie	ń	s	t	w	‘maidenhood/ gen.pl.’
państwo	~	pa	ń	s	t	w	‘state/ gen.pl.’
lekarstwo	~	leka	r	s	t	w	‘cure/ gen.pl.’
pospólstwo	~	pospó	l	s	t	w	‘mob/ gen.pl.’
wychodźstwo	~	wycho	dź	s	t	w	‘emigration/ gen.pl.’

It is clear that the genitive forms, just as the exceptional *źdźbło* and *szkło*, discussed above, constitute a theoretical problem, in that the final empty nucleus $\emptyset_4$ must see the preceding unlocked nucleus $\emptyset_1$.[97] What is more,

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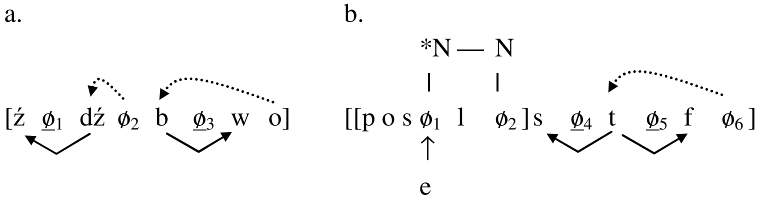
[97] Recall that the underlined empty nuclei are locked by interonset relations and are not visible to each other.

they are supposed to be in a relation of double licensing of LIO, that is, the governing relation between C$_2$ and C$_3$. It is interesting to note, however, that we are dealing only with one such string, namely, *øSTRø*, which is a nominalizing suffix *–stwo / –stw*.[98]

The presence of the two empty nuclei seems to be beyond doubt. The domain-final nucleus is postulated in most varieties of GP in cases of surface final consonants. The medial nucleus ø$_1$, on the other hand, must be postulated for two reasons. Firstly, it must separate the onset C$_1$ from the following cluster, and secondly, it causes vocalization of the floating melody in the preceding nucleus of such forms as *okropieństwo* cf. *okropny* < /okropø$_e$nɨ/ 'awful', *poselstwo* cf. *poseł / posła* < /posø$_e$wø ~ posø$_e$wa/ 'envoy, nom.sg. / gen.sg.', and *panieństwo* cf. *panna / panien* < /panø$_e$na ~ paɲø$_e$nø/ 'maiden, nom.sg. / gen.pl.'.

One solution that can be proposed in connection with the sequence of two empty nuclei in the forms under discussion is a possibility that the suffix *–stwo / –stw* is analytic, just as the diminutive suffix *–ek*, discussed in chapter 2. Namely, it is separated from the stem by a domain boundary. The other assumption that one would have to make here in order to avoid the violation of the NO LAPSE constraint, however, is that this suffix does not begin with an empty nucleus, but with an onset. This solution could also be applied to the representation of the problematic *źdźbło* and *szkło*, in which a sequence of two empty nuclei is found word-initially. The structures below illustrate this possibility. Additionally, the suffix *–stwo / –stw* is shown as analytic.[99]

(80)



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[98] This fact, however, does not eliminate the problem in any way, as there is a handful of isolated lexical items such as *wiorst* 'verst, gen.pl.', *herszt* 'ringleader', *kunszt* 'craftsmanship', *garść* 'handful', and *sierść* 'fur' where it reappears.

[99] A non-analytic option for the suffix *–stwo / –stw* would not solve anything, as ø$_2$ in (80b) would also be visible to ø$_6$.

It is noteworthy that in both cases we are dealing with the ‘magic’ cluster on the left edge of their respective domains.[100] In this sense, the sequence *stfø* in *poselstw* ‘envoy, gen.pl.’ behaves identically to the sequence *ʑd͡ʑø* in *źdźbło* ‘blade of grass’.

This interpretation looks promising in that it bypasses the problem of two empty nuclei in a row, though it requires further research, as it opens up a new possibility, namely, that *RT* clusters will show a four-way distinction concerning the double licensing of LIO, that is, (*aRTV*, *əRTV*, *øRTV*, *RTV*). The last option shows no double licensing requirement. At this stage, this is as far as we can get with our proposal concerning the peculiar configuration of *s+C* and its distribution in Polish. A theoretically sound explanation of these facts may be achieved. Regrettably, we are not able to provide it at this stage. In this respect, the ‘magic’ context still remains magic. It must be borne in mind, however, that the problem really concerns two lexical items (*źdźbło, szkło*), one suffix, that is, *–stw* in *poselstw* and a handful of interesting lexical items such as *wiorst* ‘verst, gen.pl.’, *herszt* ‘ringleader’, *kunszt* ‘craftsmanship’, *garść* ‘handful’, and *sierść* ‘fur’.

3.6. Conclusions

In section 3, an extension to the model was proposed which consists in recognizing an additional licensing relation which we tentatively dubbed the double licensing of LIO. This consists in giving additional support to the nucleus which typically licenses *RT* clusters, that is, the one that follows the cluster. The proposal is based on the observation that there seems to be a dependency between the type of vowel preceding an *RT* cluster and the melodic restrictions on that cluster. This dependency betrays all the diagnostic characteristics of the licensing strength scales discussed throughout this work, namely, the scale of licensers a–ə–ø aligns with progressive melodic restrictions on the following *RT*s.

The recognition of the new licensing relation allows us to capture the phenomena typically described by reference to the structure of the branching rhyme. The CV model, supplemented with the notion of double licensing, covers all the main characteristics of branching rhymes, for example, the cases of epenthesis, closed syllable shortening, compensatory lengthening, and stress attraction. It also throws new light on the exceptionality of

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[100] In other instances of the ‘magic’ clusters, which were discussed earlier, they are followed by a phonetically expressed vowel and the problem of a sequence of two successive empty nuclei does not arise, e.g. *bzdura* ‘nonsense’ < /bøzdura/ (77).

the so called super heavy rhymes in, for example, English and Dutch. SHR is no longer an illicit structure but a predicted configuration in a model in which all syllabification is due to the licensing properties of nuclei, some of which may be empty.

The utilization of empty licensers word-medially leads to systems like Polish, a language which seems to make use of almost all the possible configurations predicted by the model of complexity scales and licensing, in contradistinction to, for example, English, which disallows such structures. This fact throws new light on the notion of extrasyllabicity. The Polish initial clusters, for example, *drgnąć* 'shudder' or final clusters, for example, *następstw* 'consequences, gen.pl.' are not extrasyllabic in any sense, partly because there is no notion of the syllable as such in this model, but partly also because they are mere instantiations of predicted strings of syllabic organization. A different question concerns the phonological behaviour of such 'exceptional' strings with respect to other possible phonological phenomena, like, for example, voice assimilation (e.g. Gussmann 1992, 2007, Rubach and Booij 1990b, Rubach 1996). In this work, our goal was to show that we are dealing with normal structures. Their phonological behaviour in other respects will have to be left for further research.

4. Chapter summary

In this chapter, we focused our attention on the influence of syllabification, as defined in the model of Complexity Scales and Licensing, on the phonological structure of words. For this purpose, we chose to deal with two aspects of word structure. One of them refers to historical change, while the other concerns the clustering at word edges.

Section 2 deals primarily with the phonological conditions on liquid metathesis in the history of Slavic languages. Reference is also made to modern languages like Bulgarian and Irish. While the former language completes the typology of expected liquid shifts that transpired from our analysis, and allows us to understand the apparently exceptional cases where metathesis did not take place (TURT), the latter language represents an exact modern version of what Slavic languages experienced historically. The Irish facts crucially bear out those aspects of our analysis of Slavic metathesis which we had to hypothesize on theory internal grounds.

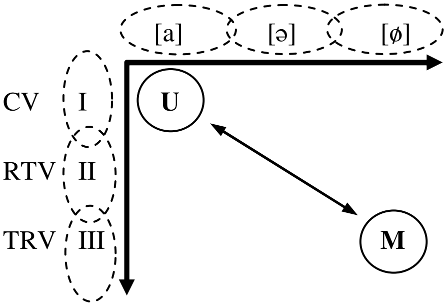
On a theoretical level, the analysis of liquid metathesis seems to support the claim of our model that the so called branching rhymes are not independent constituents. One reason for this conclusion is that their existence is decided upon in the following syllable, and depends on the licensing potential of the nucleus which directly follows the so called branching rhyme, and not on the one on which the rhyme is supposedly built. In this respect, the Slavic facts support our view of phonological organization as being reducible to the licensing properties of various types of nuclei with respect to the formally defined structural complexities of the preceding onset. Liquid metathesis of the Slavic and Irish type is also best described in a CV model in which the domain of the shifts can be schematized as T–R–T. The particular outcomes depend on which cluster affiliation of the liquid will be more optimal with respect to the types of licensers present in such forms.

Section 3 returns to the problem of branching rhymes and demonstrates the advantages of the redefined structure, involving an additional licensing mechanism, as compared to the standard approach of Government Phonology. One of these advantages is the new way of viewing so called super heavy rhymes, in which SHR can at last be integrated into the model rather than being tolerated as an exceptional structure. The analysis of SHR can be extended to aspects of Dutch phonology, notably to the analysis of the behaviour of the vowel schwa, which sometimes patterns with short vowels and sometimes with long ones. We are now able to say that the behaviour of the Dutch schwa is fully consistent.

The new proposal concerning the double licensing of leftward interonset relations (*RT* clusters) can be extended to the treatment of the so called magic context (*s+consonant*). This structure, which is preceded by an empty nucleus, is in fact predicted by the model and allows us to understand the notorious clusters at the edges of words in Polish. Additionally, if the double licensing of LIO can be maintained – the last section casts some doubt on this matter – it could be used to explain the empirical fact that in word-initial position *TR* clusters are favoured over *RT* ones. Without double licensing of LIO, initial *RT*s should be more common and less marked than branching onsets (*TR*s) – exactly as the model of CSL predicts in other positions in the word. Thus, even though the double licensing mechanism needs to be further verified and possibly redefined, some connection between the *RT* clusters and the preceding nucleus will have to be proposed. Initial restrictions on clusters are not the only effects that this proposal covers. Recall that it is used to account for a number of effects such as closed syllable shortening, the (non)exceptionality of super heavy rhymes etc.

The ‘magic’ context has been shown to fill in the ‘factorial typology’ predicted by the model of complexity scales and licensing, which consists in the interaction between the scale of formal (syllabic) complexity (I–II–III), defined as different configurations of the onset, and the scale of licenser types (a–ə–ɸ). Complex clusters in this model are a result of employing empty nuclei as licensers not only word-finally, but also word-medially and initially. The main scheme of the model, repeated below, unequivocally demonstrates that such constructs will be the most marked.

(81) ***The model of complexity scales and licensing strength***



U – most unmarked structures, M – most marked structures

Conclusion

The aim of this book was to demonstrate that, in a representation-based model, the phonological organization of speech sounds within a word is reducible to the licensing properties of nuclei with respect to structurally defined complexities which pose varying demands on the licenser. It is assumed that the primitive licensing relation is that between a nucleus and its onset (O←N). There are two main types of complexities concerning the onset position. Substantive complexity is an important aspect of phonological organisation at the melodic level, while the syllabic configurations in which the onset may be found are referred to under the heading of formal complexity.

At the melodic level, complexity is defined in terms of the number of privative primes called elements. The asymmetries in the subsegmental representations of consonants and vowels that this model leads to have been shown to play a pivotal role in understanding a number of phenomena, such as typological patterns, markedness effects, phonological processes, segmental inventories, and, what is most important, the model allows us to see a direct connection between phonological representations and processes. For example, the deletion of [g] in Welsh initial mutations is strictly related to the fact that the prime which crucially defines this object also happens to be the target of Soft Mutation.

The complexity at the syllabic level is defined in terms of formal onset configurations called governing relations, of which some are easier to license than others. The formal complexity scale is not rerankable, and corresponds directly to the markedness of syllabic types. Since each formal configuration requires licensing from the following nucleus, syllable typology can be directly derived from the licensing strength of nuclei. The interaction between the higher prosodic organisation, for example, the level of the foot, and the syllabic level is also easily expressible in this model because higher prosody is built on nuclei. Therefore, prosody may tamper with the status of nuclei as licensers by deeming some of them as prosodically weaker than others, thus producing a non-rerankable scale of nuclear licensers (a–ə–ø). The inclusion of the empty nucleus as a possible licenser allows us to unify the scale of relatively marked contexts in segmental phenomena, and also to account for such problems as extrasyllabicity, complex clusters, super heavy rhymes, and other exceptional strings. The role of nuclei as licensers in unifying various levels of phonological representation – from melody to word structure – is unquestionable. There are other areas of phonological theory which can be expressed in this model and which have only been touched on in this work. These include the role of nuclear strength scales in register switches, dialectal variation, historical development, language acquisition, and the interaction between phonology and morphology. Further work is needed in these areas in order to fully test the predictions of this model.

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