Tone-sonority Interaction in Optimality Theory: East Slavic Vowel Reduction

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Symbols and Abbreviations

acc.	-	accusative
adj.	-	adjective
adv.	-	adverb
dat.	-	dative
dim.	-	diminutive
fem.	-	feminine
gen.	-	genitive
imp.	-	imperative
inf.	-	infinitive
instr.	-	instrumental
loc.	-	locative
masc.	-	masculine
nom.	-	nominative
pers.	-	person
pl.	-	plural
sg.	-	singular
expr.	-	expressive
pejor.	-	pejorative
perf.	-	perfective
imperf.	-	imperfective
pres.	-	present
OT	-	Optimality Theory
μ	-	mora
σ	-	syllable
ω	-	prosodic word
Δ	-	head
-Δ	-	non-head
H	-	high tone
L	-	low tone
M	-	mid tone
/ /	-	intermediate representation
// //	-	underlying representation
[ ]	-	surface representation
ˈ	-	stress

j	-	palatalisation
+	-	morpheme boundary
#	-	word boundary
>>	-	ranked higher than
>	-	more prominent than
≻	-	more harmonic than
⇒	-	a winning candidate
⇐	-	a winner that is not the attested form
☹	-	the attested form that is not the winner in a tableau
*	-	ungrammatical form

Selected Symbols of Transliteration

y	-	ы; a high back vowel
j	-	й; a front glide
c	-	ц; a voiceless alveolar affricate
š	-	ш; a voiceless postalveolar fricative
ž	-	ж; a voiced postalveolar fricative
č	-	ч; a voiceless palatalised alveolar affricate
x	-	х; a voiceless velar fricative
jo	-	ё; a front glide followed by a mid back vowel
ja	-	я; a front glide followed by a low back vowel
ju	-	ю; a front glide followed by a high back vowel
’	-	ь; palatalisation

Preface

The objective of this book is to develop a model of the interaction of phonological tone with segmental quality. Current phonological theory provides no formal mechanism that would relate tone to sonority; in fact, some authors explicitly deny a possibility of such an interaction. This book aims to prove this assertion wrong. The core of the discussion is centred around patterns of vocalic neutralisation attested in East Slavic. Though the presence of tone in the phonological system of East Slavic is a well-established fact (e.g., Jakobson, 1929, 1931, 1963; Halle, 1997), its relation to vocalic sonority has gone unnoticed in the previous literature. Based on the evidence from various East Slavic dialects, the present book argues that tone can interact directly with vowel quality, the basic idea being that tonally prominent units co-occur with prominent segments.

The sound structure of East Slavic has been at the forefront of phonological investigation since the establishment of phonology as an independent field of study. This book builds on the ground-breaking work of Roman Jakobson, Morris Halle, Jerzy Rubach, and Christina Bethin, whose numerous insights into the phonology of East Slavic languages have advanced the field in many significant ways. Though the ideas developed here often depart from their views, the influence of these prominent linguists is seen throughout the book. The present study also owes much to the dialectologists who have provided comprehensive descriptions of East Slavic dialects, and whose extensive fieldwork has yielded detailed documentation of many interesting sound patterns which are analysed in the subsequent pages.

Preliminary work on the book was carried out at the University of Marburg, where I spent two years as a visiting researcher. I would like to express gratitude to the Alexander von Humboldt Foundation for the scholarship which made this research stay possible and for the financial assistance provided by the Foundation in the subsequent years. The final stage of the research during the academic year 2016-2017 was supported by a sabbatical leave from the University of Warsaw, for which I am also grateful.

I am indebted to a number of people who have contributed to the final result by offering valuable feedback and providing much encouragement during the years I have been working on the topic. First and foremost, I would like

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Finally, I wish to thank my colleagues from the Institute of Applied Linguistics who helped me in various ways. Łucja Biel has provided the encouragement and administrative assistance in obtaining a sabbatical leave that made it possible for me to complete the book. I am also grateful to the editor of the series Ewa Gruszczyńska for her guidance, and to Witold Woicki, without whose meticulous copy-editing and formatting work the text would not have been in its present shape.

My warmest and sincerest thanks go to my family and friends. This book would never have been written without their unfailing love and support.

1. Introduction

This book develops a theory of the interaction of phonological tone with segmental quality. Some authors explicitly deny a possibility of a systematic phonological interrelation between tone and sonority (Hombert *et al.*, 1979; Hombert, 1977; Schuh, 1978; Fox, 2000; de Lacy, 2007). In particular, it has been suggested that in many cases of tone-vowel interactions, tone affects vocalic quality indirectly through syllable structure, foot structure or duration (Jiang-King, 1999; Gussenhoven & Driessen, 2004; Kehrein, to appear; Köhnlein, to appear). The present book takes an opposite stand and argues that tone can interact directly with vowel quality without the mediating factors such as syllable structure or duration. This assumption is substantiated by the analysis of vowel neutralisation in East Slavic.

The relation between tone and prosodic units has been well documented in the literature. It has been demonstrated that tone can interact with stress placement (de Lacy, 2002b), duration (Zhang, 2002), and syllable structure (Gordon, 2006). Furthermore, the literature is replete with examples of the interrelation between tone and the laryngeal properties of consonants (Hombert, 1978; Bradshaw, 1999; among others). In contrast, the interaction between tone and vowel quality is not widely attested. Nevertheless, there are languages which exhibit tone-driven vowel alternations. For instance, high tone is reported to have a raising effect on vowels in Fuzhou (Yip, 1980; Jiang-King, 1999; Myers & Tsay, 2003), Foochow (Chen & Norman, 1965) and Lahu (Matisoff, 1973). Similarly, Becker & Jurgec (to appear) report a synchronic interaction of tone with vowel quality in Slovenian, where high tone co-occurs with tense vowels and low tone co-occurs with lax vowels. The opposite pattern is also attested. In Shuijingping Mang, lower tones induce vowel raising (Mortensen, 2013). High tone is correlated with low vowels in Ngizim, where the vowel [a] in the first syllable of verbs is predictably associated with High tone (Schuh, 1971). Similarly, High tones avoid high vowels in a number of Japanese dialects (Haraguchi, 1984).

The present book argues that vowel lowering attested in the immediately pretonic position in different East Slavic dialects is directly connected with the presence of High tone. Though the idea that tone constitutes a part of the phonological system of some Slavic languages has been around for decades

(e.g., Jakobson, 1929, 1931, *et seq.*; Halle, 1997; Bethin, 2005, 2006; Dubina 2012), the relationship between tone and vowel reduction has been ignored in previous analyses.[1]

The patterns of vowel reduction found in East Slavic are typologically isolated and extremely complex compared to reduction types attested in the world's languages. Typically, unstressed vowels are neutralised in favour of the central vowel schwa, as in English and Dutch (Gimson, 1970; Booij, 1995). The characteristic trait of standard Russian and of many East Slavic dialects is that they exhibit two-degree vowel reduction: neutralisation to corner vowels is found in pretonic positions and centralisation to schwa in atonic (pre-pretonic and post-tonic) contexts (Avanesov, 1984). It is noteworthy that the operation of vowel reduction varies only slightly from dialect to dialect. For instance, in the dialects with the so-called dissimilative reduction, [ə] occurs in pretonic syllables if the stressed vowel is [a], e.g. *slona* [slə'na] 'elephant' (gen. sg.). In turn, [a] is found before stressed high vowels, e.g. *slony* [sla'nɨ] id. (nom. pl.). Depending on a dialect, either [a] or [ə] is used before stressed mid vowels, so that the word *slone* id. (loc. sg.) can be pronounced as either [sla'nʲe] or [slə'nʲe] (Kuznecov, 1960; Požarickaja, 2005; Avanesov & Orlova, 1965; Kasatkin, 2005).

The picture is further complicated by the fact that the outcome of reduction is conditioned not only by the position in a word but also by the quality of the preceding segment. After palatalised consonants, [e], [a] and [o] are reduced to [i] in standard Russian, to [a] in the southern Russian dialects, as well as Belarusian, and to [e] in the central Russian dialects.[2] Hence, depending on a dialect, the word *reka* 'river' can be pronounced [rʲi'ka], [rʲa'ka] or [rʲe'ka] (compare the gen. pl. form *rek* ['rʲek]). Reduction to [e] is problematic because it contradicts the alleged universal that mid vowels are banned from prosodically weak positions in languages with vowel reduction.

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[1] The exception is constituted by Dubina (2012), who proposes a tone-based analysis of vowel reduction in Belarusian and suggests that Russian vowel reduction can also be analysed in similar terms. The model of East Slavic vowel reduction developed in this book differs substantially from Dubina's (2012) work, both in scope and the implementation of the assumption that reduction is driven by the underlying tone. Let us note the ideas presented here were developed independently and were first presented in Mołczanow (2012a, 2012b), prior to the publication of Dubina's (2012) book.

[2] The half-close front vowel appearing after palatalised consonants is transcribed with the IPA symbol [e], and the half-open front vowel in non-palatalised contexts and word-initially is represented with the symbol [ɛ]; the back mid vowel is transcribed with the symbol [o] (see section 2.1 in Chapter 3 for further discussion). Both [e] and [ɛ], as well as [o] and [ɔ] are employed in the transcription of some East Slavic dialects exhibiting a two-way contrast in the mid region (discussed in Chapters 4 and 5).

Furthermore, Russian and Belarusian dialects may exhibit either dissimilative or moderate [a]-reduction. In the dissimilative [a]-reduction, lowering to [a] is blocked before [a] in the following stressed syllable. In the moderate [a]-reduction, [a] is found before velarised consonants, whereas [i] appears before palatalised consonants. Compare the pronunciation of the words *nesla* 'carry' (past fem.) and *n'esi* id. (imp.) in the two dialects, given in (1).

(1)	*dissimilative [a]-reduction*	*moderate [a]-reduction*
neslá 'carry' (past fem.)	[nʲiˈsla]	[nʲaˈsla]
n'esí (imp.)	[nʲaˈsʲi]	[nʲiˈsʲi]

Both reduction types are unusual from the typological perspective. First, the reduction to the back vowel [a] after non-back palatalised consonants (dissimilative [a]-reduction) is at odds with the basic generalisation about the phonology of the Slavic languages which show an agreement in backness between vowels and consonants (Halle, 1959; Lightner, 1972; Rubach, 2000). In turn, the reduction to [i] attested in the moderate [a]-reduction takes place *before* palatalised consonants. This, however, is problematic because in Slavic vowels typically agree in backness with the preceding, not the following, segments.

This brief overview is meant to demonstrate that East Slavic dialects offer a rich material for the study of vowel reduction because they display minimal patterns of variation in the same contexts and in the presence of similar underlying vowel inventories. A tone-based model of vowel reduction developed in the present book unifies these apparently disparate phenomena by proposing a limited set of Optimality-Theoretic constraints (Prince & Smolensky, 1993/2004; McCarthy & Prince, 1995), whose minimal re-rankings yield the attested East Slavic vocalic patterns. On the descriptive side, this study formulates novel generalisations and presents linguistic data not previously discussed in the generative literature. However, it should be emphasised at the outset that the present study does not aim at providing a complete descriptive characterisation of the East Slavic vocalic system, but, rather, it sets out to develop a theoretical model which would derive numerous and at times contradictory phenomena from general principles governing the organisation of phonological structure.

The book is organised as follows. Chapter 2 offers a brief survey of the premises of Optimality Theory, with an emphasis on the theoretical assumptions which are employed in the analyses presented in the remainder of the book. This chapter sets the theoretical scene for the remainder of the study by presenting the model of the tone-sonority interaction which is employed in the analyses of vocalic neutralisation in the subsequent chapters. In particular, it is suggested that the interaction between tone and vowel quality is regulated by a set of constraints derived through the harmonic alignment of the sonority scale with the tonal prominence scale. Chapter 3 demonstrates how the constraints that directly relate High tone to sonority levels account for vowel neutralisations occurring in immediately pretonic positions in Russian. It is argued that [a]-reduction attested in the immediately pretonic position is directly connected with the presence of High tone. Next, Chapter 4 extends the tonal analysis to the more complex patterns of reduction attested in different East Slavic dialects with dissimilative reduction. It is demonstrated that these systems are accountable for by minimal re-rankings of constraints generating vowel reduction in Standard Russian. Chapter 5 looks at further reduction patterns in which unstressed vowels assimilate in quality to the vowel in the stressed syllable. It is argued that these dialects instantiate vowel harmony systems in which stressed syllables serve as triggers of harmony for the vocalic features [+low] and [-back]. The constraints driving vowel harmony are shown to work in concert with the constraints on the association of High tone with vocalic elements to generate complex neutralisation patterns. Chapter 6 considers cases in which High tone fails to trigger the lowering of a vowel in the immediately pretonic position. This happens in the contexts of adjacent palatalised consonants and after hard stridents, where non-high vowels undergo fronting and/or raising. An OT analysis developed in this chapter builds on the two generalisations about the Slavic phonology concerning the tendency of consonants and the following vowels to exhibit the agreement in backness and in height. We adduce evidence demonstrating that the agreement in backness and height is observed not only in consonant-vowel sequences, as has been usually assumed in the literature, but is also operative in mirror image contexts, where a vowel changes to accommodate in backness and/or height to the following consonant. A critical review of the previous accounts of East Slavic vowel reduction is provided in Chapter 7. Finally, Chapter 8 summarises the main results.

2. Theoretical background

1. Introduction

This chapter introduces basic theoretical assumptions which lie at the core of the model of the tone-sonority interaction developed in the rest of the book. The present study employs the theoretical apparatus of Optimality Theory (OT; Prince & Smolensky, 1993/2004; McCarthy & Prince, 1995) to express grammatical generalisations. The choice of the theory is motivated by the nature of the phenomena which are subject to the analysis: East Slavic dialects display rich patterns of vocalic alternations which vary only slightly from dialect to dialect. It is generally agreed that 'the fundamental descriptive and explanatory goals of OT are (i) to derive complex patterns from the interaction of simple constraints and (ii) to derive language typology by permuting rankings' (McCarthy, 2011: 5). From this perspective, OT appears to be well-suited to deal with the East Slavic data, and, in turn, these data constitute an excellent testing ground for the premises of the theory.

OT states principles governing the interaction of grammatical generalisations but is neutral as to the shape of the phonological representations. Following much of the current phonological practice, I assume nonlinear autosegmental representations (Goldsmith, 1976, 1990). The nonlinear approach is especially relevant in the context of tone-related processes discussed in the present book. Tone has played a crucial role in the inception of the autosegmental phonology, with numerous studies demonstrating that a deep understanding of tonal phenomena can only be achieved if tone constitutes an autonomous unit of representation.

This chapter is structured in the following way. Section 2 offers a brief survey of the basic assumptions of Optimality Theory. The discussion is limited to issues which bear directly on the analysis of the East Slavic vocalic alternations.[1] Section 3 focuses on the formal schemas which are employed in the construction of the OT generalisations. Section 4 introduces the model of the tone-sonority interaction which is employed in the analyses of vocalic neutralisation in the remainder of the book.

[1] For a detailed overview of OT, the reader is referred to Kager (1999) and McCarthy (2002); the tenets of autosegmental phonology are presented in Goldsmith (1976, 1990) and in numerous subsequent contributions.

2. Optimality Theory: a brief introduction

Optimality theory is a theory of constraint interactions. Constraints express generalisations about the grammatical structure of a given language. Constraints are invariant across languages and cross-linguistic variation derives from the differences in ranking only. There are two basic types of constraints. Markedness constraints define the well-formedness of the output representations, whereas faithfulness constraints regulate the mapping of the underlying forms onto surface representations. Markedness constraints are typologically and/or functionally motivated. For instance, the constraint NoCoda ('Syllables may not have codas') reflects the cross-linguistic preference for open syllables.[2] It is also phonetically grounded because coda consonants lack strong perceptual cues. Faithfulness constraints refer to both the input and the output. They regulate the preservation of lexical contrast in output forms by requiring the input and the corresponding output forms to be identical. Faithfulness is violated by both deletion and insertion, as well as by featural change, coalescence, order change, etc. Markedness constraints and faithfulness constraints are inherently in conflict. That is, the reduction in markedness entails violation of faithfulness. Conversely, the preservation of faithfulness leads to an increase in markedness. Languages differ in their resolution of conflicts between markedness and faithfulness. For example, coda consonants occur in a language in which the markedness constraint NoCoda is outranked by the faithfulness constraint Max_{SEG} prohibiting segment deletion. In languages with the reverse ranking, NoCoda >> Max_{SEG}, syllables are open (the symbol '>>' indicates dominance relation).

The language-specific ranking of constraints constitutes the grammar of a given language. Besides constraints and their rankings, the OT grammar contains GEN (for generator), which produces a set of possible output forms for each input. Another component of the grammar, EVAL (for evaluation), assesses the possible candidates: the output that incurs the least costly violation of the constraints is selected as optimal. Schematic representation of the functions of GEN and EVAL are provided below.

(1) GEN //input_i// → (cand_1, cand_2, cand_3, …cand_n)
EVAL (cand_1, cand_2, cand_3, …cand_n) → [output_i]

[2] In contrast to the mainstream OT, constraints pertaining to phonotactic structure can be viewed not as absolute requirements, but as preferences (*cf.* Dziubalska-Kołaczyk, 2001).

Constraints operate on surface representations, selecting the most optimal output from an infinite set of possible forms generated by the grammar. The evaluation of possible outputs is displayed in a tableau, as demonstrated in (2) below. Constraints are listed from left to right, with a solid vertical line indicating a domination order. The input is usually shown in the upper left-hand corner, while possible outputs are listed on the left-hand side of the tableau. A candidate which incurs a violation of the constraint heading the column is marked with '*', whereas a blank cell indicates that a given constraint is satisfied. The exclamation mark '!' means that a candidate fatally violates the constraint and is eliminated from further consideration. The correct winner is shown with an arrow.

(2) *i. Languages allowing coda consonants*

//tat//	MAX$_{SEG}$	NOCODA
⇒ a. tat		*
b. ta	*!	

ii. Languages disallowing coda consonants

//tat//	NOCODA	MAX$_{SEG}$
⇒ a. ta		*
b. tat	*!	

All the outputs shown in the tableaux above incur a violation of some constraint. In (2i), MAX$_{SEG}$ prefers the faithful candidate (2ia), whereas NOCODA chooses its unmarked competitor in (2ib). Candidate (2ia) comes out optimal because MAX$_{SEG}$ dominates NOCODA. The opposite ranking in (2ii) selects candidate (2iia) which satisfies the NOCODA by deleting the final consonants.

Classic OT assumes that inputs are mapped onto the outputs directly, without intermediate stages. This principle, dubbed parallelism, is one of the most controversial and frequently contended aspects of OT. Since its inception, OT research has accumulated a massive body of evidence proving the inadequacy of parallel evaluation in dealing with opacity. Several attempts have been made to resolve this issue without forfeiting the principle of strict parallelism;[3]

[3] The auxiliary theories include sympathy theory (McCarthy, 1999; McCarthy, 2003), output-output constraints (Kraska-Szlenk, 1995; Benua, 1997), targeted constraints (Wilson, 2001), lexically-indexed constraints (Pater, 2000), candidate chains (McCarthy, 2007), among others.

however, all of them have proven unsatisfactory for various reasons.[4] The opacity problem does not arise in the serial version of OT adopted in the present study (Inkelas & Orgun, 1995; Kiparsky, 1997, 2000; Rubach, 1997, *et seq*.; Bermúdez-Otero, 1999, 2003; Ito & Mester, 2001, 2003). The principle difference between standard OT and serial OT (called Derivational OT, Stratal OT, or LP/OT) is that the latter admits intermediate levels of derivation, each of which contains a separate constraint ranking. The evaluation of candidates proceeds in stages, with the output at $level_n$ constituting the input at $level_{n+1}$. There is a general agreement that the number of levels/strata should be kept to a minimum, and should reflect the differences between stem, word and phrase phonology.

Slavic languages with their complex morphological structure provide a strong argument for the derivational levels in phonology. Rubach (1997, *et seq*.) demonstrates that the assumption of a serial evaluation of the candidate forms allows for a more insightful analysis of numerous opaque processes in various Slavic languages, including palatalization, glide insertion, yer vocalisation, or syllabification. A particularly convincing piece of evidence for level distinction comes from Russian, which has two contradictory processes, [i]-palatalization and [i]-retraction (Rubach, 2000a). The former palatalises hard consonants before the front vowel [i], whereas the latter retracts [i] after hard consonants. The two processes operate on segmentally identical inputs in different morpho-syntactic contexts: palatalisation applies inside words, and retraction applies at word boundaries e.g. *bratiška* //brat+iška// → [bratʲiškə] 'brother' (dim.) *vs. brat Iška* //brat#iška// → [bratiškə] 'brother Iška (proper name)'.[5] Parallel OT cannot generate the forms [bratʲiškə] and [bratiškə] with one set of ranked constraints, and Rubach (2000a) argues that the problem can only be solved if OT admits two distinct phonological modules corresponding to the lexical and the post-lexical levels in Lexical Phonology (Kiparsky, 1982). The data from East Slavic dialects discussed in Chapters 5 and 6 of this book furnishes further motivation for level distinction. For instance, we demonstrate in Chapter 5 that an interaction of vowel neutralisation and [e]-retraction which produces opaque forms such as *vedjom* //vʲeˈdʲ+em// [vʲiˈdʲom] 'lead' (1st pers. pl. pres.) *vs. medvedjom* //mʲedvʲeˈdʲ+om// [mʲɪdvʲaˈdʲom] 'bear' (instr. sg), is straightforwardly accounted for in the model assuming that vowel neutralisation is a level 1 process and [e]-retraction is a level 2 process.

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[4] See, for example, Rubach (2000b) and McCarthy (2007) for a review and critique of different approaches to opacity within OT.

[5] Here and below, '+' stands for a morpheme boundary and '#' indicates a word boundary.

3. Generalised alignment and constraint hierarchies

Besides faithfulness and markedness, a class of constraints which have proven to play a significant role in phonology as well as in syntax is represented by constraints on the alignment of edges of constituents. Originally employed to match syntactic and prosodic constituents (Selkirk, 1986), the notion of alignment has been adopted to relate the edges of morphological and phonological constituents (McCarthy & Prince, 1993). Alignment constraints are stated using the following general format.

(3) *Generalized Alignment*
$\text{Align}(\text{Cat}_1, \text{Edge}_1, \text{Cat}_2, \text{Edge}_2) =_{\text{def}}$
$\forall\ \text{Cat}_1\ \exists\ \text{Cat}_2$ such that Edge_1 of Cat_1 and Edge_2 of Cat_2 coincide.
Where
$\text{Cat}_1, \text{Cat}_2 \in \text{PCat} \cup \text{GCat}$
$\text{Edge}_1, \text{Edge}_2 \in \{\text{Right}, \text{Left}\}$

Generalized Alignment as defined in (3) above demands that an element standing at the Edge of any Cat_1 also stands at the Edge of some Cat_2. Typically, alignment constraints map the edges of grammatical categories, such as words and morphemes, onto the edges of prosodic categories, e.g. prosodic words or syllables. For instance, ALIGN (Stem, R, σ, R) requires that the right edge of a stem coincides with the right edge of a syllable. McCarthy & Prince (1993) point out that alignment constraints can also be extended to compare phonological categories, such as syllables, feet, features, or subsegmental nodes. Alignment constraints of the latter type are employed to map tonal units onto prosodic constituents in Chapter 2 of the present study.

Another general technique of constraint construction concerns the expression of implicational universals and natural scales in OT. One example of a natural scale is constituted by a sonority hierarchy, which orders segments on a scale from the most to the least prominent. As is well known, languages employ sonority in determining the position of syllable nuclei and margins: the greater the sonority the better nucleus that segment makes, and, conversely, the lesser the sonority the more likely the segment is to occur in a syllable margin. This generalisation is expressed in OT by combining the sonority hierarchy (vowel > liquid > nasal > fricative > stop) with the syllable-position prominence scale (Peak > Margin) to form universal constraint hierarchies (Prince & Smolensky, 1993/2004: 147-148):

(4) *a. Peak Hierarchy*: *P/*t* >> … >> *P/*i* >> *P/*a*
b. Margin Hierarchy: *M/*a* >> *M/*i* >>… >> *M/*a*

The rankings derived from natural linguistic scales are universally fixed. This assumption allows us to express cross-linguistic implicational generalisations. For instance, the ranking in (4a) reflects the fact that languages can only have vocalic nuclei, or vocalic and liquid nuclei, and languages which, for example, have nasal nuclei, also allow liquid and vocalic nuclei (e.g. English, Czech), whereas there are no languages which would allow liquid and vocalic nuclei but not vocalic nuclei.

The technique for scale combination, referred to as harmonic alignment, is formally defined in (5) below (after Prince & Smolensky, 1993: 149). (Note: the symbol ">" means 'is more prominent than', "≻" stands for 'is more harmonic than', and ">>" indicates a dominance relation.)

(5) *Harmonic Alignment*
Suppose given a binary dimension D_1 with a scale X > Y on its elements {X, Y}, and another dimension D_2 with a scale a > b > … > z on its elements. The *harmonic alignment* of D_1 and D_2 is the pair of Harmony scales:
H_X: X/a ≻ X/b ≻ ... ≻ X/z
H_Y: Y/z ≻ ... ≻ Y/b ≻ Y/a

The *constraint alignment* is the pair of constraint hierarchies:
C_X: *X/z >> … >> *X/b >> *X/a
C_Y: *Y/a >> *Y/b >> … >> *Y/z

Originally designed to analyse Imdlawn Tashlhiyt Berber syllabification (Prince & Smolensky, 1993), harmonic alignment has been employed to deal with sonority-driven stress (Kenstowicz, 1997), tone-driven stress (de Lacy, 2002b), and different types of segmental neutralisations (Crosswhite, 1998; Gouskova, 2003; de Lacy, 2006; among others). The present study uses harmonic alignment in the analysis of the East Slavic vocalic neutralisation (see Chapter 2). Building on the work of Crosswhite (2001) and de Lacy (2006), the so-called extreme vowel reduction is accounted for in terms of the constraints derived through the harmonic alignment of the sonority scale with two prosodic prominence scales. These constraints require prosodically dominant positions (foot and syllable heads) to favour high sonority segments, and prosodic non-heads (unstressed syllables) to prefer low sonority segments.

More importantly, harmonic alignment is employed to form new constraints that directly relate high tone to sonority levels. This is achieved by conflating the sonority scale with the tonal prominence scale, as in (6) below.

(6) i. a. *Sonority scale*: a > ɛ,ɔ > e,o > i,u > ə > ɨ
b. *Tonal prominence scale*: H > M > L

ii. *The harmonic alignment*
H/a ≻ H/ɛ,ɔ ≻ H/e,o ≻ H/i,u ≻ H/ə ≻ H/ɨ
M/ɨ ≻ M/ə ≻ M/i,u ≻ M/e,o ≻ M/ɛ,ɔ ≻ M/a

iii. *The constraint alignment*
*H/ɨ >> *H/ə >> *H/i,u >> *H/e,o >> *H/ɛ,ɔ >> *H/a
*M/a >> *M/ɛ,ɔ >> *M/e,o >> *M/i,u >> *M/ə >> *M/ɨ

These constraints are discussed in detail in the next section, where we provide the motivation for the constraints on the relation between tone and sonority. We also look at the attested cases of the interconnection between tone and vowel quality and explore the implications of the present theory for typology.

4. Interaction of tone with vowel quality

Tone is a suprasegmental feature which frequently occurs in prosodic systems. It is manifested phonetically by a change in the fundamental frequency F_0. Languages with pitch distinctions have been traditionally classified as tone languages and pitch accent languages. In the former, the occurrence of contrastive pitch contours is unrestricted, while in the latter, there is an association between pitch and accent.[6] Typical representatives of pitch accent languages are Swedish and Serbo-Croatian, where tonal contrasts occur on or near a stressed syllable.

While the relation between tone and accent has been well documented in the literature, less known is the fact that the occurrence of tone can be conditioned not only by accent, but also by other suprasegmental as well as segmental properties. The relation between tone and the segmental make-up as well as quantity is seen in the distribution of tone in West Germanic dialects. The historical development of tonal contrasts in the German Rhine Franconian and Dutch Limburgian dialects was affected by the melodic and moraic make-up of the syllable (Schmidt, 1986). In the present-day Limburg Dutch, for instance,

[6] There is no general agreement concerning the typology, see Section 4.2. in Chapter 3 for further discussion.

the tonal contours (HL, LHL) are found only in syllables containing non-high tense vowels or a combination of a lax vowel and a sonorant *m*, *n*, or *l*. Another example of a historical interaction of tone with vowel quality comes from the Mon-Khmer languages, in which open RTR vowels [e_i, o_u, ɛ, ɔ, a] co-occur with higher pitch, and closed, ATR vowels [ə, i, u, e, o] with lower pitch (Yip, 2002). Furthermore, Becker & Jurgec (to appear) report a synchronic interaction of tone with vowel quality in Slovenian, where high tone co-occurs with tense vowels and low tone with lax vowels. Unlike West Germanic dialects, which show a static distribution of tonal contrasts over particular syllable types, Slovenian adjusts tone in native words and alters vowel quality in loan words. Another case of a tonally-driven vowel alternation has been described in Shuijingping Mang, in which vowels raise when correlated with relatively low tones (Mortensen, 2013).

Typically, phonological tone is realized phonetically by pitch. However, it has been pointed out in the literature that there are other conceivable ways to express tone (Lockwood, 1983; see van der Hulst (1999: 73ff.) for discussion). Just as phonological accent can be manifested by different phonetic means, underlying tone can have different phonetic exponents. There is evidence that tone can be expressed by prolonged duration, with or without phonetic pitch contour (Lockwood, 1983; Bethin, 2006). Bethin (2006) reports tone-induced lengthening of pretonic vowels in East Slavic dialects, which exhibit vowel lengthening in positions preceding stressed syllables. Phonetic measurements demonstrate that, while vowels in unstressed positions are considerably shorter than stressed vowels, vowels in positions immediately preceding stressed vowels often exceed them in length.[7] Some examples are shown in (7), reproduced from Bethin (2006: 130). Note that length is not contrastive in these dialects, and the symbol *V:* shows phonetic duration.

(7)	golova	[gəloːˈvaː]	‘head’
	rukava	[rəkaːˈvaː]	‘sleeves’
	daleko	[dəleːˈkoː]	‘far away’
	ogurtsi	[uguːrˈtsɨː]	‘cucumbers’

Bethin (2006) argues that pretonic lengthening found in the Archaic Vladimir-Volga Basin and other East Slavic dialects reflects an underlying tonal contour.

[7] In Vladimir dialects, relative durations are as follows: initial V – 25%, pretonic V – 105%, stressed V – 100%, final V – 42% (Al’muxamedova & Kul’šaripova, 1980: 45, cited from Bethin, 2006: 131).

Phonetically, there is a rising-falling or a falling pitch contour, distributed over the stressed and the immediately pretonic syllable, with a prominence peak occurring on the pretonic syllable. As dynamic tones are better cued by long vowels, the vowel in immediately pretonic position is lengthened to accommodate a pitch rise, schematically shown in (8).

(8)
	LH	L			LH	L	
	C V	ˈC V	⇒	C	V:	ˈC	V

The attraction of tonal contours to long vowels is motivated phonetically. It has been demonstrated in the literature that a pitch rise takes longer time to produce than a pitch fall. Therefore, a tonal contour is expected to be better expressed phonetically on a long segment (Ohala, 1978). Moreover, there is a correlation between tone and vowel height, which is rooted in physiological properties of the vocal apparatus. Low vowels are inherently longer because they are produced with a wider aperture than mid and high vowels (Lehiste, 1970). As tonal contrasts, especially high tone, favour long segments, low vowels are predicted to constitute a better docking site for high tone than high vowels (Bethin, 2006).

There are indications in the literature that an underlying tone may cause lengthening which is not accompanied by phonetic pitch on the surface. In his analysis of Estonian word-initial length, Lockwood (1983) suggests that syllable-initial lengthening in Estonian is best analysed as an exponent of a phonological tone. Namely, while Estonian exhibits a short/long contrast both in vowels and consonants, a three-way length distinction is found in word-initial position. This is illustrated in (9) below.

(9)
lina	[ˈlina]	‘flax’	//lina//	koli	[ˈkoli]	‘rubbish’	//koli//
linna	[ˈlin·a]	‘of a town’	//linna//	kooli	[ˈko·li]	‘of school’	//kooli//
linna	[ˈlin:a]	‘to a town’	//^linna//	kooli	[ˈko:li]	‘to school’	//^kooli//

In Lockwood’s analysis, overlong segments are produced by the lengthening of long vowels and geminate consonants. This lengthening, in turn, is induced by an underlying tonal contour.

To recapitulate, the following typology emerges from the interaction of tone with segmental quality and duration. First, lexical tone can be manifested phonetically by pitch, as in pitch-accent languages such as Serbian or Swedish. Next, an underlying tone can be realized phonetically as pitch only

in specific contexts. For instance, the distribution of pitch is curtailed by vowel quality and/or syllable duration in West Germanic dialects. Furthermore, there is evidence that lexical tone can be expressed by length only, without changes in pitch (e.g. Estonian). Finally, Bethin (2006) suggests that lexical tone can be manifested phonetically by adjusting vowel quality. Since low vowels are intrinsically longer, vowel lowering can be used as another strategy to increase vowel duration, and, as a result, to render it a better docking site for a phonological tone.

As mentioned in the previous section, the generalisation that tonally prominent units are expected to co-occur with prominent segments can be expressed by a set of Optimality-theoretic constraints which are derived by harmonic alignment of two natural linguistic scales. The prominence scales which are relevant to the analysis of tone-vowel relation are the sonority hierarchy and the tone hierarchy. Sonority hierarchy ranks segments on a scale ranged from the most to the least sonorous (Sievers, 1881; Jespersen, 1904; Vennemann, 1972; Selkirk, 1984).[8] The following partial ranking of vowels has been adapted from de Lacy (2006: 68).

(10) *Vowel sonority hierarchy*

low	mid-low	mid-high	high	mid	high
peripheral >	peripheral >	peripheral >	peripheral >	central >	central
vowels	vowels	vowels	vowels	vowels	vowels
{a}	{ɛ,ɔ}	{e,o}	{i,u}	{ə}	{ɨ}

De Lacy (2002b) assumes the following scale of tone types, which expresses the idea that high tone is more prominent than lower tones.

(11) *Tonal prominence hierarchy*

H > M > L

The formal mechanism of prominence alignment crosses the most and the least prominent elements of the two scales, one of which should be binary (Prince & Smolensky, 1993/2004). I suggest that only High and Mid tones combine with sonority hierarchy. As a result, there are constraints banning the combination

[8] There is no generally accepted definition of sonority and the phonetic basis of sonority distinctions is a debatable issue. See Szpyra-Kozłowska (1998) and Parker (2002) for an overview of the different proposals and discussion.

of vowels of different sonority levels with High tones and Mid tones, but not with Low tones. The markedness constraints which are produced by crossing the sonority scale with the tonal scale are formulated in (12).

(12)
*H/ɨ: Incur a violation for every high central vowel associated with a High tone.
*H/ə: Incur a violation for every mid central vowel associated with a High tone.
*H/i,u: Incur a violation for every high peripheral vowel associated with a High tone.
*H/e,o: Incur a violation for every mid-high peripheral vowel associated with a High tone.
*H/ɛ,ɔ: Incur a violation for every mid-low peripheral vowel associated with a High tone.
*H/a: Incur a violation for every low vowel associated with a High tone.

*M/ɨ: Incur a violation for every high central vowel associated with a Mid tone.
*M/ə: Incur a violation for every mid central vowel associated with a Mid tone.
*M/i,u: Incur a violation for every high peripheral vowel associated with a Mid tone.
*M/e,o: Incur a violation for every mid-high peripheral vowel associated with a Mid tone.
*M/ɛ,ɔ: Incur a violation for every mid-low peripheral vowel associated with a Mid tone.
*M/a: Incur a violation for every low vowel associated with a Mid tone.

In OT, one way to state implicational generalisations is to postulate universally invariant ranking (Kenstowicz, 1997).[9] The combination of sonority hierarchy with tonal prominence produces the following rankings, repeated from (6iii) above:

(13) a. *H/ɨ >> *H/ə >> *H/i,u >> *H/e,o >> *H/ɛ,ɔ >> *H/a
b. *M/a >> *M/ɛ,ɔ >> *M/e,o >> *M/i,u >> *M/ə >> *M/ɨ

The constraint schemata in (13a) express a generalisation that low vowels are better carriers of the High tone than mid vowels, and that mid vowels are better carriers of the High tone than high vowels, etc. In contrast, the ranking in (13b) state that mid tones favour higher vowels over the low vowels. The tableaux in (14) serve to illustrate the point.

[9] Another way to express implicational generalisations in OT is to state the constraints in the form of context generalisations, which stand in a subset or 'stringency' relation (Prince, 1998; de Lacy, 2002a, *et seq*.). The stringency approach can account equally well for the data analysed in this study as the fixed ranking.

(14) a. *High tone interacting with vocalic sonority*

	*H/ɨ	*H/ə	*H/i,u	*H/e,o	*H/ɛ,ɔ	*H/a
a. H | ɨ	*!					
b. H | ə		*!				
c. H H | | ɪ, u			*!			
d. H H | | e, o				*!		
e. H H | | ɛ, ɔ					*!	
⇒ f. H | a						*

b. *Mid tone interacting with vocalic sonority*

	*M/a	*M/ɛ,ɔ	*M/e,o	*M/i,u	*M/ə	*M/ɨ
⇒ a. M | ɨ						*
b. M | ə					*!	
c. MM | | ɪ, u				*!		
d. MM | | e, o			*!			
e. MM | | ɛ, ɔ		*!				
f. M | a	*!					

This theory predicts the following patterns of vowel-tone interaction:

(15) a. High tone favouring lower vowels.

b. Mid tone favouring higher vowels.

c. Low tone not interacting with vowel quality.

Since low vowels favour the High tone and high vowels prefer Mid tone, it is expected that languages might employ vowel lowering which would lead to a decrease in the number of violation marks of markedness constraints stated in (15) above. The correlation of the High tone with a lower vowel (pattern (15a) is attested in a number of languages exhibiting vowel-tone interactions. In Taiwanese, for instance, High tone is associated with lower vowels (Zee, 1980). Lax (lower) vowels co-occur with higher tones in Rengao (Gregerson, 1976) and Western Cham (Edmondson & Gregerson, 1993). Verbs in Ngizim (Schuh, 1971) have a predictable High tone on the vowel [a].[10]

The interaction of the Mid tone with vocalic quality, as predicted by (15b) is attested in Shuijingping Mang (Mortensen, 2013). The vowels are raised when correlated with the underlying mid tones (mid falling ML tones and low rising LM tones).

The historical development of vowel contrast in West Germanic Limburgian dialects provides an example of the interaction of both High and Mid tones with vowel height.[11] In the conservative tonal dialects of Maastricht, there is a tonal contrast between Accent 1 (a fall from high to low, HL) and Accent 2 (a mid level tone (M) or a weak rise to mid (LM), both followed by a late fall). This contrast has brought about differences in vowel qualities in other Limburgian dialects. In Weert, the diphthongs /ɛi, œy, ɔu/ were decomposed into a sequence of low vowels and glides /æj, œj, ɑβ̯/ when they co-occurred with a HL tonal contour (Accent 1). No such change took place when the diphthongs were associated with the Mid level tone or with a weak rise to mid (Accent 2). In the tonal dialect of Sittard, higher vowels are associated with Accent 2, while lower diphthongs co-occur with Accent 1. The Mechelen-aan-de-Maas dialect exhibits a similar pattern: mid vowels change into a lower vowel in syllables with Accent 1 and into a higher vowel in syllables with Accent 2. In terms of the theory of the vowel-tone interaction presented in this book, all these alternations can be analysed as a result of the interaction of markedness *H/a and *M/ɨ with feature faithfulness constraints.

Furthermore, the lack of constraints on the association of vowels with the Low tone predicts that it should freely combine with all vowels and not be

[10] Similar morphologically-conditioned interaction between tone and vowel quality exists in Eastern Maninkakan (Spears, 1968) and Kinande (Mutaka, 1994). For further examples, see Becker & Jurgec (to appear).

[11] The discussion of the Limburgian dialects is based on Gussenhoven & Driessen (2004); see references therein for individual dialects.

phonologically active in triggering vocalic change. This prediction is borne out as there are no documented cases of vowel-tone interaction, where the Low tone would require a vowel of a particular quality, whereas the High and Mid tones would combine with any vowel.

The remainder of this book illustrates the theory of tone-vowel interaction using the data from East Slavic. The next chapter demonstrates that the constraints of the *H/V family are active in Russian, where they generate vowel reduction in immediately pretonic positions, while the ensuing chapters present further evidence for the theory from various vowel neutralisation processes attested in East Slavic dialects.

Finally, let us note that the term "vowel reduction" can refer to both phonetic and phonological reduction in the literature. Phonetic reduction results from the undershoot of vocalic targets, which is dependent on speech tempo, style, prosodic and segmental context. Phonetic reduction is gradient and typically leads to the shrinkage of vocalic space, without the concomitant reduction of the number of vowel contrasts. Phonological reduction, in turn, refers to stress-dependent neutralisation of the lexical distinctions which is categorical and not affected by factors such as speech rate or register. The present book is concerned with phonological reduction, and the terms "vowel reduction" and "neutralisation" are used interchangeably to refer to categorical substitution of vocalic qualities in unstressed positions.

3. Tone-driven vowel alternations: Russian

1. Introduction

The goal of this chapter is to demonstrate how the constraints that directly relate high tone to sonority levels account for vowel neutralisations occurring in immediately pretonic positions in Russian.[1] The characteristic trait of standard Russian is that it exhibits a two-pattern vowel reduction: reduction to corner vowels is found in immediately pretonic positions and centralisation to schwa in atonic contexts (Avanesov, 1984). In addition, the quality of the reduced vowel depends on the secondary articulation of the preceding consonant, with the front vowel [i] appearing after palatalised consonants, and the back vowel [a] occurring after hard consonants.

The phenomenon of Russian vowel reduction, due to its complexity and reliance on both prosodic as well as segmental context, has received a great deal of attention and has often been used as a textbook example in the phonological literature (Jakobson, 1929; Halle, 1959; Miller, 1972; Halle & Vergnaud, 1987; Gussmann, 2002; Odden, 2005; Padgett & Tabain, 2005; among others). In the framework of Optimality Theory, recent studies include Alderete (1995), Crosswhite (2000, 2001), de Lacy (2006), Mołczanow (2007), Iosad (2012). Though these models have provided a number of descriptive and theoretical insights, they do not account for all reduction patterns found in Russian.[2] The present study rethinks the motivation for Russian vowel reduction in a novel way, adding a new dimension to the discussion of the vocalic system of Russian.[3] The proposal is based on the assumption that pretonic vocalic neutralisations are driven by the presence of an underlying tonal contour. The idea that a high tone constitutes a part of the phonological system of Russian goes back to Jakobson (1929, 1931, *et seq.*), and has been employed in the subsequent descriptions of the Slavic prosodic systems (Halle, 1997; Bethin, 2006; Dubina, 2012). However, the relation between tone and vowel reduction has not been explored in the previous studies. This chapter argues that [a]-reduction attested

[1] The term 'pretonic' refers to positions preceding the stressed syllable, and 'posttonic' designates positions following the stressed syllable. The term 'atonic' indicates positions not immediately preceding the stressed syllable, while 'unstressed' collectively refers to all positions which are not marked for stress.

[2] Further discussion and critique of some of these models are provided in Chapter 7.

[3] An earlier version of the material presented in this chapter appeared in Mołczanow (2015).

in the immediately pretonic position in Russian is directly connected with the presence of High tone.

The chapter is organised as follows. First, we introduce basic facts concerning Russian segmental system and present basic generalisations concerning vowel reduction (Section 2). Next, Section 3 develops an analysis of vowel reduction in atonic syllables. Section 4 argues that extreme reduction is blocked in immediately pretonic syllables due to High tone, which is spread from the stressed syllable. An analysis accounting for the blockage of the extreme reduction in hiatus and phrase-initial positions is developed in Section 5. Section 6 concludes.

2. Descriptive background

2.1. Russian segmental inventory

Russian has a basic six-vowel system: //i, ɨ, e, o, u, a//.[4]

(1) *Standard Russian Vowel Inventory*

	front	central	back
close	i	ɨ	u
half-closed	e		
mid	(ɛ)		o
low		a	

It should be noted that the front mid vowel [ɛ], shown in parentheses, is a positional variant of the half-closed vowel [e], appearing after [t͡s], [š], or [ž] and in word-initial position. The mid back vowel [o] has been described as falling "between half-open and half-close but nearer to half-open than to half-close" (Jones, 1923/1969: 55). Though it is the same height as [ɛ], it has been a standard practice to use the IPA symbol [o] because the Russian mid back vowel is tense.[5] Furthermore, the high vowels [i] and [ɨ] occur in complementary distribution, the former is found after soft consonants and the latter after hard consonants. There has been a long debate in the literature whether the

[4] Data and basic generalisations presented in this section come from standard descriptions of Russian phonetics, such as Jones & Ward (1923/1969), Avanesov & Ožegov (1959), Avanesov (1984), Timberlake (2004), Knjazev (2006), and others. Russian words and proper names have been transliterated using the International Scholarly System of transliteration, with the exception of letters ë and э, which are transliterated as *jo* and *e*, respectively.

[5] It should be also noted that [o] contrasts with a more open lax vowel [ɔ] in many Russian dialects (Avanesov & Orlova, 1965; see Chapter 4 for futher discussion).

segments in question are different phonemes or allophones of one phoneme. I assume, after Lightner (1972), Melvold (1990), and Plapp (1996), that the underlying high unrounded //ɨ// is a separate phoneme of Russian. The following binary features have been standardly used to describe Russian vowels:

(2) *Feature specifications of Russian vowels*

	i	u	ɨ	e	o	a
high	+	+	+	–	–	–
low	–	–	–	–	–	+
back	–	+	+	–	+	+
round	–	+	–	–	+	–

Russian consonants are either soft (palatalised) or hard (velarised). In the palatalised consonants, the tongue moves forwards and its upper part is raised towards the front of the hard palate, while in the velarised segments, the tongue moves backwards and raises its dorsum at different heights towards the soft palate (Broch, 1911: 224).[6] The Russian consonantal inventory is presented in (3) below. It does not include contextual variants resulting from voice assimilation; for a more detailed description, see Timberlake (2004). Palatalisation is indicated with a superscript [ʲ], velarisation is not marked. Note that palatalisation is contrastive for most consonants except for the dental affricate [t͡s], which is hard, and the alveo-palatal affricate [čʲ] and the palatal glide [j], which are always soft.

(3) *Russian Consonantal Inventory*

	bilabial	labio-dental	dental	(alveo-)palatal	velar
voiceless stop	p pʲ		t tʲ		k kʲ
voiced stop	b bʲ		d dʲ		g gʲ
voiceless affricate			t͡s	čʲ	
voiced affricate					
voiceless fricative		f fʲ	s sʲ	š šʲ:	x xʲ
voiced fricative		v vʲ	z zʲ	ž žʲ:	
nasal stop	m mʲ		n nʲ		
lateral			l lʲ		
trill			r rʲ		
glide				j	

[6] Palatalised consonants are also referred to as soft, and velarised consonants are also called hard or non-palatalised in the present book.

2.2. Vowel reduction

The full set of vocalic contrasts presented in (1) is found only in stressed syllables.[7] Two degrees of reduction are observed in unstressed syllables. In immediately pretonic positions, the inventory is reduced to four vowels [i], [ɨ], [u] and [a] (moderate reduction). The unstressed [i], [ɨ] and [u] are produced with a lower position of the tongue than their stressed counterparts. Phonetically, they are defined as half-close lax vowels and usually transcribed as [ɪ], [ɬ], and [ʊ], respectively (Jones, 1923/1969). In the present book, the symbols [i], [ɨ], and [u] will be used for vowels in both stressed and immediately pretonic positions, and symbols [ɪ], [ɬ], and [ʊ] will be employed for other positions.

The quality of the reduced vowel depends on the secondary articulation of the preceding consonant. After a hard consonant or word-initially, the mid vowel //o// is lowered and unrounded, resulting in an [a]-like sound.[8] Traditional sources transcribe this sound as a not fully open central vowel [ʌ] (Ščerba, 1912; Jones, 1923/1969; Avanesov, 1984). However, Panov (1967) notes that "not all speakers of literary Russian employ this pronunciation, the majority pronounce [a] instead of [ʌ]".[9] Kasatkina (2005) further reports that the pronunciation of a 'compressed' sound [ʌ] is characteristic of the standard Russian spoken in the areas, in which local dialects lack vowel reduction, such as Northern Russian regions, Ural, Siberia, and Ukraine. In Moscow and surroundings, as well as areas in which local dialects neutralize the distinction between //o// and //a// in an unstressed syllable, a fully open sound [a] in immediately pretonic positions does not differ in quality from its stressed counterpart (see also Vysotskij, 1984: 35). Following Vysotskij (1984), Kasatkina (2005), and others, the outcome of the //o// – //a// neutralisation in the pretonic syllable is transcribed with the symbol [a]. This process is illustrated in (4).

(4) [o] – [a]

kot [ˈkot] 'cat' (nom. sg.)	–	kota [kaˈta] (gen. sg.)
stol [ˈstol] 'table' (nom. sg.)	–	stola [staˈla] (gen. sg.)
bok [ˈbok] 'side' (nom. sg.)	–	boka [baˈka] (nom. pl.)
zori [ˈzorʲɪ] 'dawn' (nom. pl.)	–	zorja [zaˈrʲa] (nom. sg.)
koról' [kaˈrolʲ] 'king' (nom. sg.)	–	korolja [kəraˈlʲa] (gen. sg.)

[7] In the present study, the term "accent" is employed for an abstract prosodic feature, whereas "stress" refers to the surface properties of utterances.

[8] Vowels in pretonic syllables reduce to [i] after soft consonants. This process is discussed and analysed in Chapter 6.

[9] Cited after Kasatkina (2005: 31), translation is mine.

Extreme reduction occurs in post-tonic (5a) and not immediately pretonic positions (5b), in which all vowels, with the exception of //u// and //ɨ//, are centralised to [ə] after hard consonants and to a front vowel [ɪ] after palatalised consonants. The unstressed vowels [ʊ] and [ɪ] do not lose their timbre, though they are shorter and lower than their stressed counterparts //u// and //ɨ//.[10] (Note: a capital letter 'V' stands for a vowel.)

(5) a. *Post-tonic positions*

V – [ə]

volos [vaˈlos] 'hair' (gen. pl.)	–	volos [ˈvoləs] 'hair' (nom. sg.)
golov [gaˈlof] 'head' (gen. pl.)	–	nagolovu [ˈnagələvʊ] '(defeat) utterly'
zerkal [zʲirˈkal] 'mirror' (gen. pl.)	–	zerkalo [ˈzʲerkələ] (nom. sg.)
skazat' [skaˈzatʲ] 'tell'	–	vyskazat' [ˈvɨskəzətʲ] 'outspeak'

b. *Not immediately pretonic positions*

V – [ə]

gorod [ˈgorət] 'town'	–	gorodok [gəraˈdok] 'small town'
golos [ˈgoləs] 'voice' (nom. sg.)	–	golosov [gəlaˈsof] (gen. pl.)
parus [ˈparʊs] 'sail' (nom. sg.)	–	parusa [pəruˈsa] (nom. pl.)
maska [ˈmaskə] 'mask'	–	maskarad [məskaˈrat] 'masquerade'

The extreme reduction is blocked in absolute word-initial position, where //a// and //o// neutralise to the low vowel [a] instead of the expected schwa. Some examples are given below.

(6) odinokij [adiˈnokʲɪɻ] *[ədiˈnokʲɪɻ] 'lonely'
okružat' [akruˈžatʲ] *[əkruˈžatʲ] 'surround'
akvarel' [akvaˈrʲelʲ] *[əkvaˈrʲelʲ] 'watercolour'
arendovat' [arʲɪndaˈvatʲ] *[ərʲɪndaˈvatʲ] 'rent'

Knjazev (2006: 41) presents experimental data which demonstrates that blocking effects are found only in phrase-initial position, whereas word-initial vowels which are preceded by consonant-final words within the same phrase undergo extreme reduction.

(7) a. ogorod [agaˈrot] 'garden'
iz ogoroda [iz əgaˈrodə] 'from the garden'
vskopal ogorody [fskaˈpal əgaˈrodɨ] 'he dug gardens'

[10] The reduction of atonic /u/ and /ɨ/ is not suspended in casual speech, where both vowels neutralise to [ə] (Zemskaja, 1973).

b. Aleksandr [alʲiˈksandr] ‘Alexander’
ot Aleksandra [at əlʲiˈksandrə] ‘from Alexander’
krax Aleksandra [ˈkrax əlʲiˈksandrə] ‘the fall of Alexander’

In addition, the application of vowel reduction is blocked in hiatus sequences. While reduction is regular when the second member in hiatus is a high vowel, for example *naizust’* [nəiˈzusʲtʲ] ‘by heart’, *naugad* [nəuˈgat] ‘by guesswork’, reduction to schwa does not take place in hiatus consisting of //o// or //a//, as illustrated in (8) below. It should be noted that vowel sequences are rare in native morphemes, but they occur freely at prefix/preposition boundaries and in borrowings. Here are some examples, taken from Avanesov (1984) and Shapiro (1968).

(8)	//oo// → [aa]	voobšče [vaapˈšʲːe] ‘generally’,
		sootnošenie [saatnaˈšenʲɪi̯ə] ‘ratio’
	//oa// → [aa]	poakkompaniroval [paakəmpaˈnʲirəvəl] ‘he accompanied’
	//ao// → [aa]	naobum [naaˈbum] ‘random’
		naoborot [naabaˈrot] ‘conversely’
	//aa// → [aa]	zaalet [zaaˈlʲetʲ] ‘grow scarlet’
		zaaplodirovali [zaaplaˈdʲirəvəlʲɪ] ‘they applauded’

Similarly, extreme reduction is blocked when //o// or //a// is preceded by //e//.[11]

(9)	//eo// → [ɪa]	ne otdam [nʲɪadˈdam] ‘I will not give away’
		neodnokratnyj [nʲɪadnaˈkratnɨi̯] ‘frequent’
	//ea// → [ɪa]	neakkuratnyj [nʲɪakuˈratnɨi̯] ‘untidy’
		reabilitacija [rʲɪabʲɪlʲiˈtat͡sɨi̯ə] ‘rehabilitation’

It should also be noted that the vowels [o] and [a] are reduced to [ə], instead of the expected [ɪ], after palatalised consonants in some grammatical endings, for example, *kurjat* [ˈkurʲət] ‘smoke’ (3rd pers. pl.) *vs. kurit* [ˈkurʲɪt] ‘smoke’ (3rd pers. sg.), *cf. sem’desat* [ˈsʲemʲdʲɪsʲɪt] ‘seventy’.[12]

In sum, the outcome of vowel reduction is dependent both on the prosodic as well as on the segmental context. The vowel inventory //i, ɨ, u,

[11] In informal speech, the unstressed sequence [ɪa] can be pronounced [ɪə], or further simplified to [ɪ], and sequences [aa] can be reduced to [a] (Shapiro, 1968: 24,25). However, Avanesov (1984: 108) emphasises that such pronunciation is non-literary and warns against it.

[12] The issues concerning morphological blocking effects will not be subject of the present investigation; see Bethin (2012) for discussion and analysis.

e, o, a// found in stressed syllables is shrunk to the vowels [i], [ɨ], [u], [a] in immediately pretonic syllables (moderate reduction) and to [ɪ], [ɤ], [ʊ], [ə] in atonic positions (extreme reduction). In moderate reduction, vowels //o// and //a// are neutralised to [a] after non-palatalised consonants and to [i] after palatalised consonants.[13] The remainder of this chapter develops an OT analysis of vowel reduction taking place after hard consonants in atonic and pretonic positions. Before developing the tonal account of moderate vowel reduction, I present the analysis of extreme reduction, which can be considered a more general pattern as it takes place in positions which do not immediately precede stressed syllables.

3. Extreme reduction

Vowels in positions which do not immediately precede stressed syllables undergo extreme reduction. Typically, contrasts among non-high vowels are neutralised into schwa after hard consonants and into [i] after soft consonants. It has been suggested in the literature that this type of reduction is driven by the pressure to reduce sonority in prosodically recessive positions (Crosswhite, 2001; de Lacy, 2006).[14] Based on a functionally-oriented model of de Lacy (2006), I assume that reduction in atonic syllables results from an interplay of the sonority markedness scales with prosodic positions. Specifically, de Lacy (2006) suggests that prosodic heads and prosodic non-heads impose conflicting demands as to the sonority of the melodic content they contain: prosodic heads favour high sonority segments, such as the low vowel [a], whereas prosodic non-heads prefer low sonority high central vowels, such as [ɨ]. In OT, this generalisation is expressed by the constraints which are formed by crossing the sonority scale (ɨ,ʉ > ə > … > a) with prosodic prominence scale (prosodic heads > prosodic non-heads). The constraints in (10) below are formulated based on de Lacy (2006: 288).[15] Note: the symbol '-Δ_{ω}' stands for prosodic non-heads and 'Δ_{σ}' represents syllable heads. For instance, *Δ_{σ}{ɨ,ʉ} reads as follows:

[13] Reduction to [i] in the context of palatalised segments is discussed in Chapter 4.

[14] A similar notion of vowel reduction as a simplification of the comlex vocalic structures in prosodically weak positions is expressed by the Element Theory of Government Phonology (Kaye *et al.* 1985; Harris, 1990, 1994; Kaye, 1990; Charette, 1991). However, unlike the present model, the Element Theory views the relative markedness as 'directly read-off from the representations rather than extrinsically encoded on the basis of observation' (Cyran, 2010: 5).

[15] De Lacy (2006: 288) formulates these constraints as context generalisations, which stand in a stringency relation.

'Incur a violation for every head of a syllable that contains a segment with sonority which equals {ɨ, ʉ}'.

(10) a. *-Δ_{ω}{a} >> *-Δ_{ω}{ɛ,ɔ} >> *-Δ_{ω}{e,o} >>*-Δ_{ω}{i,u} >> *-Δ_{ω}{ə} >> *-Δ_{ω}{ɨ,ʉ}

b. *Δ_{σ}{ɨ,ʉ} >> *Δ_{σ}{ə} >> *Δ_{σ}{i,u} >> *Δ_{σ}{e,o} >> *Δ_{σ}{ɛ,ɔ} >> *Δ_{σ}{a}

Vowels in unstressed syllables are heads of the syllabic domain but non-heads of prosodic words. As only low sonority vowels [ɪ], [ɨ], [ʊ] and [ə] are allowed in atonic positions in Russian, extreme reduction can be assumed to be driven by the constraints in (10a) above exerting the pressure to reduce sonority in prosodic non-heads.

The decrease in the sonority of atonic vowels takes place at the expense of violating identity constraints, such as IDENT-V[-high] and IDENT-V[+back], which are outranked by the markedness constraint *-Δ_{ω}{i,u}. According to the sonority hierarchy, there are two vowels, [ɨ] and [ə], which are less sonorous than [i,u]. Both vowels occur in pretonic positions in East Slavic dialects. The high vowel [ɨ] is found in a number of systems with dissimilative [a]-reduction, e.g. in Žizdra (Vajtovič, 1968).[16] Given that there is a pressure to reduce sonority in prosodic non-heads, less sonorous [ɨ] makes a better reduced vowel than [ə]. However, [ə] is also found in pretonic positions, in fact, it is more widespread than [ɨ].[17] It is often assumed in the literature that schwa is a defective vowel which is devoid of a melodic content (Anderson, 1982; Oostendorp, 1995; Cyran, 2010; among others). In this view, schwa is represented as an empty root node, defined only for the major class feature [-cons]. Consequently, reduction of a full vowel to [ə] does not lead to the violation of IDENT constraints because there is no value of a given feature in the output which can be compared to the input. In dialects which reduce atonic vowels to [ɨ], schwa is disallowed by the constraint militating against empty root nodes, here informally referred to as *ə ('A vocalic root dominates a vocalic place node', see van Oostendorp, 1995: 138). As raising to [ɨ] entails a violation of IDENT[-high], the ranking of *ə *vs.* IDENT[-high] determines which vowel, [ɨ] or [ə] will surface as optimal in a given dialect. This is illustrated in Tableau (11) by the hypothetical evaluation of the vowel //o//. Note that the candidates (11a) and (11b) fare equally well on

[16] In dissimilative [a]-reduction, the quality of the reduced vowel in the pretonic position depends on the quality of the stressed vowel. Different patterns of dissimilative reduction are discussed in detail in Chapter 4.

[17] Vajtovič (1968: 115) reports that very often a vowel of an intermediate quality between [ɨ] and [ə] is heard in Belarusian dialects.

the constraint *-Δ_{ω}{i,u}. The ranking *IDENT[-high] >> *ə chooses schwa in candidate (11a), while the reverse ranking, *ə >> IDENT[-high], gives preference to [ɨ].

(11) *Extreme reduction*

//o//	*-Δ_{ω}{i,u}	IDENT[-high]	*ə
a. ə			*
b. ɨ		*	
c. o	*!		

Tableau (12) below shows how the interaction of constraints generates reduction to [ə] in the Standard Russian word *volos* [ˈvoləs] 'hair', nom. sg. (*cf.* the nom. pl. dim. form *volosiki* [vaˈlosʲɪkʲɪ]). Note that the candidates (12a) and (12b) fare equally well on the constraint *-Δ_{ω}{i,u}. The tie is resolved by the constraint IDENT[-high] because the reduction to a featureless schwa comes at no cost, while reduction to any other vowel violates faithfulness.

(12) *Extreme reduction: Standard Russian*

//ˈvolos//	*-Δ_{ω}{i,u}	IDENT[-high]	*ə
⇒ a. ˈvoləs			*
b. ˈvolɨs		*	
c. ˈvolos	*!		
d. ˈvolas	*!		

Interestingly, high vowels are resistant to reduction and only non-high vowels are neutralised to schwa in dialects with dissimilative reduction. Pretonic //o// and //a// are reduced to [ə] after hard consonants whereas underlying //ɨ// surfaces as [ɨ]. The nonreduction of high vowels follows from the constraint set established above, as shown in Tableau (13) below. IDENT[-high] is mute with respect to an input containing a high vowel and, consequently, candidate (13b) with a non-reduced [ɨ] harmonically binds a candidate with a schwa (13a).

(13) *Non-reduction of high vowels*

//ɨ//	*-Δ_{ω}{i,u}	IDENT[-high]	*ə
a. ə			*
⇒ b. ɨ			
c. o	*!		

To summarise, extreme reduction takes effect because prosodically recessive positions are required to contain low-sonority vowels. As it leads to the emergence of the least marked vowel [ə], Russian atonic reduction can be viewed as a TETU (The Emergence of The Unmarked) effect (McCarthy & Prince, 1994). In the next section, we turn to the reduction pattern attested in positions immediately preceding tonic syllables.

4. Tone-driven reduction

4.1. Introduction

It is noteworthy that two seemingly disparate processes are found in the same position in East Slavic. That is, the so-called moderate reduction in Contemporary Standard Russian occurs in the position in which some East Slavic dialects exhibit lengthening (Vojtovič, 1972a; Belaja, 1974; Bethin, 2006). This is illustrated in (14) with different pronunciations of the word *nosit'* 'to carry'.

(14) //no'sʲitʲ// *nosit'* 'to carry'

a. [naˈsʲitʲ]: reduction	*Standard Russian*
b. [noːˈsʲitʲ]: lengthening	*Belarusian dialect of Malyja Aŭciuki*
c. [naːˈsʲitʲ]: reduction *and* lengthening	*Ukrainian Upper Snov Basin dialects*

The mid vowel //o// is lowered to [a] in the immediately pretonic syllable in Standard Russian (14a), and lengthened in the pretonic position in the Belarusian dialect of Malyja Aŭciuki (14b). Interestingly, immediately pretonic vowels undergo both reduction and lengthening in Ukrainian Upper Snov Basin dialects (14c).

Bethin (2006) argues that pretonic lengthening in East Slavic is caused by a rising tone which is associated with the immediately pretonic prestressed

syllable. Instrumental measurements as well as impressionistic descriptions confirm the presence of the LHL contour in this context at least in some dialects (Bethin, 2006).

Tone has played an important role in the development of Slavic, and its presence is manifest in the present-day Slavic languages (Jakobson, 1929, 1931, *et seq*.; Inkelas & Zec, 1988; Halle, 1997; Bethin, 1998, 2006; Dubina, 2012; and others). Contrastive tone is employed in the dialects of Serbian and Croatian (Lehiste & Ivić, 1986). In addition to East Slavic dialects (Bethin, 2006), non-contrastive tone has been postulated for standard Russian (Halle, 1997) and Belarusian (Dubina, 2012).

Bethin (2006) argues that the lengthening of pretonic vowels found in East Slavic dialects is due to the underlying tonal contour LHL. Furthermore, she relates intrinsic vowel duration to sonority and the ability to carry High tone in dissimilative Russian dialects (Bethin, 2006: 144-146). It is suggested that High tone prefers more sonorous vowels to vowels with lower sonority. The distribution of High tone in dissimilative dialects is shown in (28), reproduced from Bethin (2006: 145).

(15) *Tonal contour in the dissimilative dialects*

H L		HL
CV_1ˈCV_2	~	CV_1ˈCV_2
V_1= non-high V_2 = high		V_1= high V_2 = non-high

Dubina (2012) extends this analysis to Standard Belarusian and suggests that the increased prominence of the immediately pretonic syllable results from a process of Anticipatory H-spreading (p. 187).

(16) *Anticipatory H-spreading (Dubina, 2012)*

H

ɣaládranačkaj

‘tramp’ (fem., dim., instr. sg.)

According to Dubina (2012), the lowering of mid vowels to [a] occurring in immediately pretonic syllables of Belarusian increases the intrinsic duration, which, in turn, promotes the production of the pitch contour.

Anticipatory H-spreading postulated for Belarusian mirrors the analysis of Inkelas & Zec (1988), who suggest that pitch contrasts attested in the Neo-Štokavian dialects of Serbian and Croatian are due to the leftward spreading of the lexically specified High tone, as shown in (17a) and (17b) below.

(17) *Neo-Štokavian leftward tone spreading*

a. Short Rising	b. Long Rising
H	H
paprika	raazlika
'pepper'	'difference'

Furthermore, Halle (1997) assumes that in Standard Russian, like in the majority of languages with free lexical stress, the head of the word is assigned a High tone, while all other positions are supplied with low or neutral tones.

(18) *Standard Russian (Halle, 1997)*

.	(*
V	V
|	|
L	H

Kasatkina (2005) notes that in the present-day Moscow pronunciation, the reduced [a] found in unstressed syllables is a fully open vowel, not differing in quality from its stressed correspondent. Based on these observations and following Bethin (2006) and Dubina (2012), I assume that in dialects with [a]-reduction, immediately pretonic vowels lower because they are linked to the High tone. In structural terms, Standard Russian is identical to Neo-Štokavian, in which the High tone H is linked to the immediately pretonic syllable; see (19) below. The difference between the two languages lies in the way the phonological tone is manifested on the surface: Neo-Štokavian employs pitch rise, while Russian exhibits vocalic lowering.

(19) *Standard Russian*

V	V
L	H

The underlying high tone may or may not be realised phonetically by non-contrastive pitch rise. Phonetic measurements of the Moscow Standard Russian

show that immediately pretonic [a] exceeds in duration the vowel in the stressed syllable in different positions within a phrase: the duration of [a] constitutes 121% of the duration of the stressed vowel if the stressed vowel is [i], and 61% of the duration of the stressed [a] (Kasatkina, 2005: 33); see also Knjazev (2006: 50) for vowel duration measurements in different positions within a phrase). According to phonetic descriptions, high amplitude rise occurs over the immediately pretonic syllable in words in focus position in Standard Russian. Jones & Ward (1923/1969: 220) report a falling pitch on the last stressed syllable in declarative sentences, and a high pitch on the preceding unstressed syllables. Rozanova (1988: 215) and Kasatkina (2005: 39) observe that there is a non-contrastive pitch rise on the immediately pretonic vowel in focus position in the Moscow variant of Standard Russian. Nikolaeva (1977: 99) also reports a pitch rise on the immediately pretonic syllable in phrase-initial position in trisyllabic words stressed on the final syllable. However, as there are no measurements of pitch on immediately pretonic syllables in non-focus positions as well as in weak (not phrase-initial) positions within a phrase, more instrumental data is needed to (dis)confirm the present theory.

Concluding briefly, I assume that a High tone is present in the lexical representation of words in Standard Russian, which is in line with previous accounts developed by Halle (1997) and Bethin (2006). In the former account, the High tone is linked to a stressed syllable (Halle, 1997), while in the latter, either the immediately pretonic or the stressed syllable carry the High tone, depending on the vowel quality of the stressed syllable (Bethin, 2006). The present analysis is different as it assumes that the High tone is associated to the vowel in both stressed and in immediately pretonic positions.

4.2. Excursus: Tone and accent

There are several ways in which tone can relate to stress in systems allowing tonal contrasts only on the stressed syllables. In languages such as Japanese, underlying tone supposedly does not interact with stress, whose assignment is independent of tone (Poser, 1984). Other prosodic systems show an interplay between tone and metrical system. Tone is assigned on the basis of the underlyingly accented syllables in Norwegian (Withgott & Halvorsen, 1984), while stress is predictable from the lexical tone in Golin (Hayes, 1995). The bilateral interaction between tone and stress is present in the Neo-Štokavian dialect of

Serbian or Croatian, as analysed in Zec (1999), where stress sets limitations on the distribution of tone, and tone influences the structure of metrical feet.

As we have seen, the distribution of High tone in Russian is also limited by the position of the stressed syllable. There has been much debate in the literature as to the classification of the systems in which the location of tone is predictable from the location of accent. In general, the question is whether such systems should be identified as tonal, accentual, or both. Whereas most researchers go for the third option, the classification of such languages is often subject to much disagreement and methodological vagueness. To give one example, the prosodic system of Tokyo Japanese has been analysed using a tonal accent approach, a pitch-accent approach, and a restricted tone approach (for further discussion and references, see van der Hulst, 1999: 66). The problem lies in distinguishing stress from tone in a language which makes a distinctive use of phonetic pitch, since it is not clear whether pitch expresses phonological tone or is used as a cue to stress. As Odden (1999: 189) expresses it, 'The question is whether there is ever any hope of being able to hear a difference between tone and stress: the answer seems to be that there is not.' Despite this analytical indeterminacy, numerous attempts have been made in the literature to establish a typology based on the relationship between accent and tone. The one in (20) below is taken from Hyman (2006: 237):

(20) *Classification of languages according to whether they have stress accent, tone, both or neither (Hyman, 2006)*

	+stress accent	-stress accent
+tone	Maˈya, Usarufa, Fasu, Serbo-Croatian, Swedish, Norwegian, Ayutla Mixtec, …	Yoruba, Igbo, Kuki-Thaadow, Skou, … (Tokyo Japanese, Somali, Western Basque, …)
-tone	English, Russian, Turkish, Finnish, …	Bella Coola, French, Tamazight, Bengali, …

It can be seen from the table in (20) that Russian is located in the lower left quadrant, together with toneless stress accent languages such as English or Turkish. As argued previously, the present study takes an opposite stance and assumes, together with Jakobson (1929, 1931, *et seq.*) and Halle (1997), that tone *is* present in the lexical representation of Russian. On this view, Russian should go into one of the upper cells, the further question being whether it should be grouped together with the stress accent or non-stress accent languages. There

are several phonetic and phonological cues pointing to the presence of stress in Russian. On the phonological side, all words in Russian contain only one prominent syllable (thus fulfilling the basic requirements of obligatoriness and culminativity), and only this syllable can support a full set of vowel contrasts. Phonetically, Russian stress is manifested by vowel duration, quality and intensity (Bondarko, 1977; Zlatoustova, 1981). According to Beckman (1986), the latter are definitional properties of a stress accent language. So, given that both stress and tone characterise the prosodic system of Russian, it should be classified together with systems such as Ma'ya and Serbo-Croatian, shown in the upper left quadrant. These languages are often referred to as 'pitch-accent', mainly because they use F_0 to mark prominent syllables (Beckman, 1986).

There is much controversy in the present-day prosodic phonology as to what constitutes a pitch-accent language. Based on the conclusions of Beckman's (1986) acoustic study of stress and pitch accent languages, Levi (2005: 74) provides the following phonetic definitions.

(21) a. STRESS LANGUAGES: languages that modulate phonetic stress (cues such as pitch, loudness, duration, and vowel quality) in marking a phonologically prominent syllable.

b. PITCH-ACCENT LANGUAGES: languages that modulate only pitch in marking a phonologically prominent syllable.

Hyman (2006) adduces phonological arguments against treating pitch-accent as a separate category, and concludes that pitch-accent represents a cover term for systems which use different properties of both tone and stress systems. Fox (2000), on the other hand, draws a distinction between *pitch accent* and *tonal accent*,[18] the former referring to languages such as Japanese, in which pitch is argued to constitute a sole exponent of accent, and the latter represented by systems in which both tone and stress interact, with tone subordinated to a cumulative accent, as in Serbo-Croatian, Norwegian and Swedish. In turn, van der Hulst (2014) distinguishes a further category of *restricted tone* systems, which have pitch modulation on one syllable in a word, but, unlike tonal accent systems, do not exhibit a paradigmatic tonal contrast.[19]

[18] The term tonal accent has been introduced by Hyman (1978) to refer to languages that exhibit tonal contrast only in the stressed syllable.

[19] In fact, Hyman (2006) and van der Hulst (2011, 2014) suggest that all pitch-accent systems should be analysed as restricted tone systems. For further discussion and other proposals, see Beckman (1986), Hyman & Wilson (1991), Ladd (1996), van der Hulst (1999, 2011, 2014), Fox (2000) and Hyman (2006), among others.

Since both the classification in (20) as well as the definition in (21a) are built on a premise that tone is always realised as phonetic pitch, they only include languages that use F_0 to single out a prominent syllable. However, as mentioned earlier in Section 4.1, there are no instrumental measurements which would allow us to state that pitch rises are identified with word stress in Russian, and the presence of High tone has been established based on its interaction with segmental content. Namely, it has been argued that the increased sonority constitutes the main exponent of High tone. In the absence of evidence for the use of F_0 to mark word-level prominence, Russian cannot be legitimately classified as a pitch-accent language on phonetic grounds (given the definition in (21b) above). Yet, the tonal distribution in Russian parallels closely the behaviour of tone in the prosodic systems of languages commonly referred to as pitch-accent or tonal accent, in that in all of them the location of a H tone is fully predictable from the position of accent. A noteworthy point of similarity between Russian and pitch accent languages lies in their lack of ability to license additional degrees of stress. Levi (2005: 74) points out that 'perhaps the most important difference [between stress and pitch languages] is that PA [pitch accent] languages do not show a secondary level of prominence, whereas many stress languages do'. Interestingly, neither Russian nor Belarusian, the two East Slavic languages with phonological tone, have secondary stress, whereas a closely related Ukrainian, for which phonological tone has never been postulated in the literature, does exhibit secondary degrees of prominence (Łukaszewicz & Mołczanow, to appear a, b).

In phonological terms, the distribution of High tone in Russian comes closest to the restricted tone systems and tonal accent systems, as defined by Hulst (1999: 64) (see (22) below), with a caveat that in Russian tone is realised phonetically not by the F_0 modulations, as in the prototypical restricted tone and tonal accent systems discussed in the literature,[20] but by an increased sonority of the tone-bearing units.

(22) a. *Restricted tone analysis*
Pitch as an exponent of (non-contrastive) tones

b. *Tonal accent analysis*
Pitch as an exponent of tone, which associates to accents

[20] For instance, restricted tone systems have been established on the basis of Kinga (Schadeberg, 1973), Safwa (Voorhoeve, 1973), Nubi (Carlos Gussenhoven, 2006); tonal accent systems include Northern Pame and Yaitepec Chatino (Suárez, 1983).

Restricted tone analysis (22a) assigns a H tone to one syllable per word, either lexically or grammatically, whereas tonal accent analysis (22b) assigns accent (lexically or by rule), which is later associated with a contrastive tone. Let us recall that Russian has a free stress system, in which the distribution of H tone is subordinated to the position of lexical accent. Hence, such a system calls for a hybrid analysis, in which accents are associated with tone, as in (22b), but tone is non-contrastive. Adding the fact that, instead of pitch, tone is expressed by increased sonority, the model needed to account for the Russian data can be summarised as follows: 'Increased sonority as an exponent of non-contrastive tone, which associates to accents'. The next section formulates this generalisation in terms of OT constraints.

4.3. Analysis

Before moving to the analysis, a few remarks on Russian metrical system are in order. As noted previously, Russian is a free-stress language. It is generally agreed that accent has to be specified in the underlying representation in languages with unpredictable stress. Lexically accented vowels function as head elements in the hierarchical prosodic structure, which consists of syllables, feet, phonological words and phrases (Nespor & Vogel, 1986). The structure of the Russian foot is the subject of a long-standing debate. In the absence of evidence that would uncontroversially point to one or the other foot type, both left-headed (trochaic) or right-headed (iambic) feet have been postulated in the literature on purely theoretical grounds. An iambic foot has been proposed by Halle & Vergnaud (1987), Melvold (1990), Alderete (1995), and Crosswhite (2001), whereas a trochaic foot has been assumed by Idsardi (1992), Halle & Idsardi (1995), Halle (1997), and Lavitskaya & Kabak (2014). The present study assumes right-headed feet; it should be noted, however, that the choice of a particular foot structure does not bear directly on the model of vowel reduction developed in this book, and the analysis can be recast in terms of the trochaic footing (*cf.* Mołczanow, 2015).

I assume for the time being that only accent is specified in the lexicon in Russian and the stressed syllable is supplied with the High tone and unstressed syllables are supplied with Low tones in the surface representation. Alternatively, it can be assumed that only High tone is lexically present, and accent is assigned on the surface to the high-pitched syllable, as in Belarusian

(*cf.* Dubina, 2012); or, pitch can be analysed as an exponent of accent without the mediation of tone. While the latter option cannot be accepted in the present analysis where tone is assumed to play an active role, there is no principled way to exclude the former possibility. At present, the choice between either the underlying accent or the underlying tone does not affect the core of the analysis, because surface regularity in OT is implemented through constraints on the output representation. However, we will argue in Chapter 3 below that both accent and tone are present in East Slavic dialects exhibiting different types of nondissimilative [a]-reduction.

In OT, High tone (H) is assigned to the stressed syllable due to the following constraint (Yip, 2002: 85):[21]

(23) HEAD = H: Head syllables should be H.

Let us assume that the Low tone is forced onto unstressed syllables by the constraint NON-HEAD = L.

(24) NON-HEAD = L: Non-head syllables should be L.

In addition to being associated with the stressed syllable, the High tone spreads leftwards to the preceding syllable. In OT, this is achieved by the interplay of the following constraints, adapted from Yip (2002: 83-84):

(25) a. ALIGN-L(H, FT): Every High tone should be aligned with the left edge of a foot.[22]

b. DEP-T: No insertion of tones.

The ranking of constraints is shown in Tableau (26). The faithful candidate (26d) incurs a fatal violation of HEAD = H because it contains a stressed syllable which is not linked to the High tone. The configuration in which the High tone is associated only to the stressed syllable (26b) violates ALIGN-L(H, FT)

[21] De Lacy (2002b) develops a restrictive theory of the interaction between tone and prominence, which suggests two hierarchies of negative markedness constraints: *HD/L >> *HD/H and *NON-HD/H >> *NON-HD/H. These hierarchies account for the cross-linguistic preference for stressed syllable to carry the H tone and for unstressed syllables to be linked to the L tone. While these constraints can successfully derive the surface tone distribution in languages with contrastive lexical tone, they are not employed in the present analysis because it is not immediately clear how they could force the insertion of tones in a language without an underlying tone specification.

[22] ALIGN-L(H, FT) expresses the same generalisation as the Spreading rule postulated by Inkelas & Zec (1988) and Halle (1997) for Serbo-Croatian, and Anticipatory H-spreading, suggested by Dubina (2012) for Belarusian.

because a syllable intervenes between the High tone and the left edge of the foot. Candidate (26c) complies with ALIGN-L(H, FT) but incurs a fatal violation of HEAD = H.

(26) *Russian metrical structure*

//σσˈσσ//	HEAD = H	NON-HEAD = L	ALIGN-L(H, FT)	DEP-T
L L H L ⇒a. σ(σˈσ)σ				****
L L H L b. σ(σˈσ)σ			*!	****
L H L L c. σ(σˈσ)σ	*!	*		****
d. σ(σˈσ)σ	*!	***		

In most versions of the current metrical theory, stress is defined as a head of the hierarchical prosodic structure, which constitutes a separate tier. Although there is a correlation between metrical structure and tone, the latter is represented on a tier of its own (Goldsmith, 1990). The interaction between the two tiers is evident in (26): the location of tone is circumscribed by the location of stress, and the spreading of tone is further dependent on metrical structure, in that foot structure affects the direction of tone spreading.[23] As H tone is distributed over two syllables, it can be assumed that is the foot is the domain of tone.[24]

Turning to the analysis of vowel reduction, let us consider the evaluation of the word *voda* [vaˈda] 'water', nom. sg. (*cf.* acc. sg. form *vodu* [ˈvodʊ]), shown in Tableau (27). For compactness, the range of candidates is limited to those that are relevant to the analysis of moderate reduction.

[23] It is important to point out that the leftward spreading of the High tone does not constitute evidence for iambic footing, as it is possible to achieve the association of H with the immediately pretonic syllable using a constraint requiring the alignment of the High tone with the left edge of the word (*cf.* Mołczanow 2015).

[24] Comparable foot-based tonal patterns have been suggested for Norwegian and Swedish, in which contrastive pitch is associated with both syllables in a trochaic foot (Rischel, 1963; Vanvik, 1963; discussed in Fox, 2000); and for Serbo-Croatian, whose tonal distribution has been argued to be defined in terms of foot structure (Zec, 1999).

(27) *[a] – reduction*

//voˈda//	ALIGN-L(H, FT)	*H/ə	*H/e,o	*H/a	IDENT[-low]	IDENT[+round]
⇒ a. (vaˈda) L H				**	*	*
b. (voˈda) L H			*!	*		
c. (vəˈda) L H		*!		*		
d. (voˈda) L H	*!					

The candidate (27a) wins over the faithful candidate (27b) because it lowers the immediately pretonic mid vowel and thus avoids violating the markedness constraint *H/e,o. Candidate (27d) eschews violation of markedness constraints by not spreading the High tone to the immediately pretonic syllable, but it fatally violates ALIGN-L(H, FT). Reduction to schwa in candidate (27c) is not an option due to the violations of the high-ranked markedness constraints *H/ə.

The vowels in the stressed syllables do not lower under the pressure of tone. It has been long known that certain positions, including stressed syllables, resist phonological change (Trubetzkoy, 1939). In OT, this observation has been incorporated into the positional faithfulness approach, stating that faithfulness constraints are stronger in some positions (Beckman, 1997; Casali, 1997). In the case at hand, stressed syllables are the privileged position where markedness considerations are overridden by the following requirement to preserve feature identity:

(28) IDENT-V[feature]$_{\text{HD}_{\text{FT}}}$: In stressed syllables, a given value of the feature on a vowel in the input must be preserved on the corresponding vowel in the output.

The evaluation of stressed vowels is illustrated in Tableau (29).

(29) *Preservation of vocalic contrast in stressed syllables*

//ˈkot//	IDENT-V[feature]$_{\text{HDFT}}$	*H/e,o	*H/a	IDENT[-low]	IDENT[+round]
H ⇒ a. (kot)		*			
H b. (kat)	*!		*	*	*

High vowels should also lsower under the constraint scheme suggested in (13) in Chapter 2. However, they do not undergo reduction in Standard Russian. Notably, high vowels also do not lengthen in East Slavic dialects, in which lengthening of the immediately pretonic vowels is conditioned by a tonal contour (Bethin, 2006). Experimental phonetic studies have demonstrated that high vowels are produced with higher fundamental frequencies than low vowels (Lehiste & Peterson, 1961; Mohr, 1971; Hombert *et al.*, 1979). So it might be the case that higher intrinsic pitch renders high vowels good carriers of High tone. However, it is not clear whether this fact is responsible for the absence of reduction and lengthening of high vowels. I assume that the reduction of high vowels is blocked by a high-ranked faithfulness constraint IDENT-V[+high] mandating that correspondent vowels in the input and the output are [+high].

As shown in (30) by the evaluation of the word *duša* [duˈša] ‘soul’, nom. sg. (*cf.* nom. pl. form *dušy* [ˈdušɨ]), the faithful candidate (30a) wins despite the violation of the markedness constraints *H/i,u and *H/a because it preserves an underlying high vowel.

(30) *Non-reduction of high vowels*

//duˈša//	IDENT-V[+high]	*H/i,u	*H/a
L H ⇒ a. (duˈša)		*	*
L H b. (daˈša)	*!		**

Let us now consider the reduction of the unstressed vowel [e]. In native Russian words, this vowel can only occur after palatalised consonants.[25] In borrowings, however, the vowel [e] is found after hard consonants and in word-initial

[25] For the analysis of [e]-reduction after palatalised consonants, see Chapter 6.

position, e.g. *etaž* [ɛˈtaš] 'floor'*, sentencija* [sɛnˈtɛnc̬i̯ə] 'maxim'. According to the prescriptive norms, only fully assimilated borrowings undergo vowel reduction and the occurrence of reduced/unreduced vowels in loanwords is subject to much variation. For instance, the word *fonetika* 'phonetics' can be pronounced either [foˈnɛtʲikə] or [faˈnɛtʲikə], where the immediately pretonic //o// can optionally reduce to [a]. The present system of constraints predicts the same reduction pattern for the vowel [e] in immediately pretonic positions. However, unlike [o], [e] never reduces to [a] even in fully assimilated borrowings and native speakers find the pronunciations such as *[aˈtaš] and *[sanˈtɛnc̬i̯ə] unacceptable (Crosswhite, 2001: 107). To account for the asymmetrical behaviour of the unstressed mid vowels in borrowings, I assume that the lowering of [e] is prevented by a high-ranked faithfulness constraint IDENT-V[-back]:

(31) IDENT-V[-back]: Correspondent vowels in the input and the output are [-back].

The ranking IDENT-V[-back] >> *H/a ensures that [e] does not change into [a] under the pressure to maximise sonority of the immediately pretonic vowels. The evaluation of the word *etaž* [ɛˈtaš] 'floor' in (32) below illustrates the point.

(32) *Non-reduction of [e]*

//ɛˈtaž//	IDENT-V[-back]	*H/a
L H ⇒ a. (ɛˈtaš)		*
L H b. (aˈtaš)	*!	*

The ranking which generates vowel neutralisation in immediately pretonic positions is summarised in Figure 1. For compactness, the constraints on the co-occurrence of the High tone with different vowels are collectively referred to as *H/V.

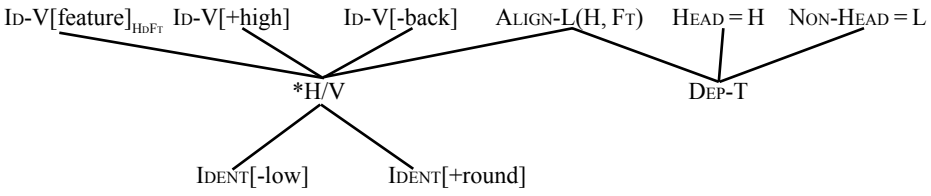

Figure 1. *Pretonic reduction: Interim ranking*

In sum, the lowering of mid vowels is driven by the family of constraints *H/V, which dominate the faithfulness constraints IDENT[-low] and IDENT[+round]. High vowels are excluded from lowering because *H/a is outranked by IDENT-V[+high]. The ranking argument for ALIGN-L(H, FT) >> *H/a is based on the fact that the leftward spreading of the High tone takes place even though it produces a marked structure, as illustrated in Tableau (27) above. The evaluation of the word *moloko* [məlaˈko] 'milk' in (33) below shows the generation of the two-degree reduction pattern.

(33) Two-degree reduction

//moloˈko//	Align-L(H, Ft)	*H/ə	*H/e,o	*H/a	*-Δ_{ω}{e,o}
L L H ⇒ a. mə(laˈko)			*	*	*
L L H b. mə(ləˈko)	*!		*		
L L H c. mo(loˈko)	*!		*		**
L L H d. mə(loˈko)			**!		*
L L H e. ma(ləˈko)		*!	*		*
L L H f. mo(laˈko)			*	*	**!
L L H g. mo(ləˈko)	*!		*		*
L L H h. mə(loˈko)	*!		*		*

The ranking of constraints established for Standard Russian correctly chooses candidate (33a) as the optimal output. It is noteworthy that candidates (33a-d) are attested in different East Slavic dialects. Candidate (33b) wins in regional literary Russian with the high-ranked *-Δ_{ω}{e,o}. Vowel reduction is lacking in systems in which faithfulness constraints are undominated, found in the Northern dialects of Russian (as in candidate (33c). Candidate (33d) is optimal in Vladimir-Volga Basin dialects with incomplete [o]-reduction. This is achieved

by the ranking ALIGN-L(H, FT), *-Δ_{ω}{e,o} >> IDENT[-low] >> *H/e,o. No constraint rankings will favour candidates (33e) and (33f) as they contain a superset of violations incurred by candidate (33a). Similarly, candidates (33g) and (33h) are predicted not to be attested as no constraint permutations will make them defeat candidate (33b).

In the next section, we consider contexts in which lowering to [a] is not warranted by the presence of H tone. It is argued that [a]-reduction occurs in cases where, for a number of reasons, extreme reduction fails to apply.

5. Phrase-initial and hiatus blocking of extreme reduction

Traditional descriptions of Russian report blocking of the extreme reduction in absolute phrase-initial position, for example, *ogorod* [agaˈrot] 'garden', *okružat'* [akruˈžatʲ] *[əkruˈžatʲ] 'surround'. In addition, reduction to schwa does not occur in hiatus positions in which //o// or //a// is preceded by //e// or followed by another //o// or //a//, for instance, *neodnokratnyj* [nʲɪadnaˈkratnɨ̯j] 'frequent', *naoborot* [naabaˈrot] 'conversely' (see Section 2.2 in this chapter for details).

It is noteworthy that schwa cannot occur in word-initial position in many languages, including Dutch (Booij, 1995), German (Wiese, 1996) and French (Anderson, 1982). In Dutch, reduction to schwa is also prohibited in onsetless syllables inside words. The phonotactic restrictions on the distribution of schwa have been standardly attributed to its structure. As schwa is assumed to be devoid of melodic content, van Oostendorp (1995: 123) suggests that the gaps in the distribution of [ə] can be accounted for by assuming that an empty vowel cannot occur in a syllable with an empty onset. In terms of OT, a ban on syllables consisting of consecutive empty positions is expressed by means of the following constraint (van Oostendorp, 1995):

(34) CONTOUR: If the head of a syllable is empty, its onset may not be empty.

Assuming that CONTOUR is an undominated constraint in Russian, we expect reduction to a schwa to be blocked both phrase-initially as well as in word-medial positions. While extreme reduction does not take place phrase-initially, it applies regularly in vowel-initial words which occur inside a phonological phrase, as in *vskopal ogorody* [fskaˈpal əgaˈrodɨ] 'he dug gardens', *cf. ogorod*

[agaˈrot] ‘garden’. However, the failure of extreme reduction to be blocked in phrase-internal positions does not constitute counterevidence for the operation of Contour. Knjazev (2006: 36-42) offers ample evidence demonstrating that there is resyllabification across word boundaries in Russian. Therefore, a sequence of a consonant and a vowel flanking two adjacent words is monosyllabic, as in [fskaˈpa.lə. gaˈro.dɪ]. In this scenario, Contour does not block extreme reduction because schwa is preceded by an onset which is filled with a melodic material.[26] When a word-initial vowel occurs after another vowel, as in *moi ogorody* [maˈi agaˈrodɪ] ‘my gardens’, reduction to schwa is prevented because the reduced vowel is not preceded by a tautosyllabic consonant.

It should be noted that sequences of word-internal schwa preceded by another vowel are found in borrowings, for example, *violončel’* [vʲɪəlanˈčʲelʲ] ‘violoncello’, *period* [pʲiˈrʲiət] ‘period’.[27] However, there is no agreement in the literature regarding the phonetic realisation of the reduced vowel. Shapiro (1968: 24) transcribes //io// as [ɪa] in the word *violončel’* [vʲɪalanˈčʲelʲ] ‘violoncello’. Kalenčuk & Kasatkina (2013: 76-78) record two pronunciations, [ɪa] and [ɪə], for the sequences //io//, //ia//, for example, *diagonal’* [dʲɪagaˈnalʲ]/ [dʲɪəgaˈnalʲ] ‘diagonal’; and [ɪə] for //ɨa//: *nacionalizacija* [nət͡sʲɨənalʲiˈzat͡sɨ̯jə] ‘nationalisation’. According to Avanesov (1984: 109-110), hiatus sequences consisting of a high vowel followed by a non-high vowel are tautosyllabic as they tend to be pronounced as centring diphthongs. Avanesov (1984:110) transcribes them as [ᶦə], [ᶦə] [ᵘa], for instance, *nacionalizacija* [nət͡sʲəənalʲiˈzat͡sɨ̯jə]. A schwa which is a part of a diphthong [ᶦə], [ᶦə] does not occur in an onsetless syllable, and, consequently, is not within the purview of Contour.

Reduction to schwa is also blocked in the first position in hiatus involving vowels //o// and //a//, so instead of the expected [əa], the underlying //aa//, //oo//, //ao// and //oa// reduce to [aa]. Some examples from Section 2.2 are repeated below.

(35) //oo// → [aa] *voobšče* [vaapˈšʲːe] *[vəapˈšʲːe]‘generally’,
//ao// → [aa] *naoborot* [naabaˈrot] *[nəabaˈrot] ‘conversely’

[26] Contour has to operate at the level of a phrase, after the resyllabification at word boundaries takes effect; otherwise, it would block reduction in vowel-initial words occurring in phrase medial positions.

[27] Vowel reduction is suspended in borrowings which are perceived as foreign words, whereas borrowings which cease to be felt as foreign undergo vowel reduction (Jones, 1923; Shapiro, 1968).

The blocking of the extreme reduction in hiatus positions can be assumed to constitute a case of coarticulation, where the first vowel assimilates to the height feature of the following low vowel. In OT terms, assimilation is compelled by the following markedness constraint:

(36) AGREE-VV[+low]: two adjacent heterosyllabic vowels agree in the feature [+low].

Since schwa is an empty segment, not specified for any features, the sequence [əa] does not comply with AGREE-VV[+low]. The evaluation of the unstressed string //aa// is shown below.

(37) *Blocking of extreme reduction in hiatus positions*

//aa//	AGREE-VV[+low]	Contour	*-Δ_{ω}{i,u}
⇒ a. a.a			**
b. ə.a	*!		*
c. ə.ə		*!	

Assimilation to the following vowel in hiatus is blocked when the reduced vowel is followed by a high vowel (38a) or when the first vowel is front (38b).

(38) a. //au// → [əu] *pauka* [pəuˈka] ‘spider’ (gen. sg.).[28]
b. //ea// → [ɪa] *neakkuratnyj* [nʲɪakuˈratnɨ̯ˌj] *[nʲaakuˈratnɨ̯ˌj] ‘untidy’

Assimilation in hiatus with high vowels, as in (38a) is blocked by the faithfulness constraints requiring the identity of the height features. The evaluation of the unstressed sequence //au// is displayed in Tableau (39). On the one hand, progressive assimilation (candidate (39d) is prevented by a high-ranked IDENT-V[+high]. It was demonstrated in Section 4.3 that this faithfulness constraint is responsible for blocking the reduction of high vowels in Russian. On the other hand, regressive assimilation is ruled out by the low-ranked *-Δ_{ω}{i,u}, which plays a decisive role in choosing between candidates (39a) and (39c). Notably, candidate (39c) is the optimal output in casual speech (see fn. 24). This can be formalised by assuming that a generic constraint AGREE-VV[Feature] requiring an agreement of all vocalic features is high-ranked in informal register in Russian.

[28] In casual speech, the vowel [ə] may optionally assimilate to the following [u]: *pauka* [pəuˈka] ~ [pɔuˈka] ‘spider’ (gen. sg.) (Paufošima, 1980).

(39) *Extreme reduction in hiatus positions*

//au//	IDENT-V[+high]	AGREE-VV[+low]	*-Δ_{ω}{i,u}	IDENT-V[-high]
⇒ a. ə.u			*	
b. a.u		*!	**	
c. ʊ.u			**!	*
d. a.a	*!		**	

The blockage of assimilation in (38b) is analysed in Tableau (40), which shows the evaluation of the initial sequence of the word *neakkuratnyj* [nʲɪakuˈratnɨ̯ˌ] 'untidy'. The faithful mapping (candidate (40a) and the assimilated sequence [a.a] in candidate (40c) lose due to the undominated AGREE[+high] ('A consonant and a following vowel agree in height'), which overrules the markedness constraint AGREE-VV[+low].

(40) *[i] – reduction in hiatus positions*

//nʲea//	AGREE[+high][29]	IDENT-V[-back]	AGREE-VV[+low]	*-Δ_{ω}{i,u}
⇒ a. nʲɪ.a			*	*
b. nʲe.a	*!		*	**
c. nʲa.a	*!	*		**

The final point to be addressed concerns the quality of a reduced vowel in onset-initial positions. Here, //o// and //a// neutralize in favour of the low vowel [a], which is identical to the outcome of moderate reduction taking place in immediately pretonic positions. However, the lowering to [a] in onsetless atonic syllables cannot be attributed to the interaction with a High tone, because the High tone is only associated with vowels which occur in tonic and immediately pretonic positions. It was demonstrated in Section 3 that there is pressure to reduce sonority in unstressed syllables in Russian, which is expressed by the constraint *-Δ_{ω}{i,u}. This constraint assures that only high vowels and schwa are allowed to occur in atonic positions. While schwa is excluded from atonic onsetless syllables by the high-ranked CONTOUR, both [o] and [a] fail on *-Δ_{ω}{i,u} (see the evaluation of the initial vowel in the word *ogorod* [agaˈrot] 'garden' in Tableau (42)). I assume that the tie between [a] and [o] is resolved by a constraint *Δ_{σ}{e,o}, which prefers high-sonority syllable heads (adapted from de Lacy, 2006: 288).

[29] Agree[+high] is further discussed in Section 2.2 of Chapter 6.

(41) $*\Delta_{\sigma}\{e,o\}$: Incur a violation for every head of a syllable that contains a segment with sonority equalling {e,o}.

(42) *Phrase-initial blocking of extreme reduction*

//o//	CONTOUR	$*\text{-}\Delta_{\omega}\{i,u\}$	$*\Delta_{\sigma}\{e,o\}$	IDENT-V[-high]
⇒ a. a		*		
b. o		*	*!	
c. ə	*!		*	
d. u		*		*!

In order not to block the reduction to schwa in atonic positions which are not within the purview of CONTOUR, $*\text{-}\Delta_{\omega}\{i,u\}$ must dominate the constraint $*\Delta_{\sigma}\{e,o\}$ forcing high-sonority nuclei.[30] The ranking established above is presented in Figure 2.

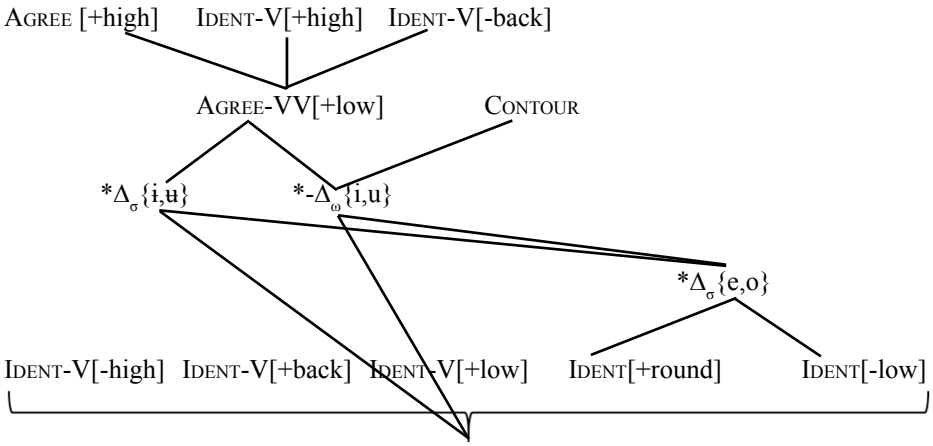

Figure 2. *Extreme reduction: Interim ranking*

To conclude, the extreme reduction is blocked phrase-initially and in hiatus sequences consisting of non-high vowels. In the present analysis, these two contexts are subsumed under a broader rubric of an onsetless syllable. The high-ranked CONTOUR disallows schwa to occur in a syllable without a filled onset. However, no reduction to schwa is observed in vowel-initial words in phrase-internal positions. It has been argued that this data does not constitute

[30] This analysis is parallel to de Lacy's (2006) account of Catalan.

counterevidence because schwa does not occur in onsetless syllables in these contexts. Furthermore, the blockage of extreme reduction does not result in a faithful mapping between the input and the output. Instead, the onset-initial //o// lowers to [a], which makes this process similar to reduction found in immediately pretonic positions. Despite the surface parallelism, it is suggested that vowel lowering in immediately pretonic syllables and in atonic onsetless syllables are produced by two different mechanisms. In the former case, the neutralisation to a low vowel [a] has been motivated by its association with the High tone, while in the latter, the reduction is forced by a prosodic well-formedness constraint $*\Delta_{\sigma}\{e,o\}$ requiring sonority maximisation in syllabic heads.

6. Summary

This chapter developed an analysis of vowel reduction in the present-day Standard Russian. Based on the insight of Bethin (2006), it was assumed that tone can directly interact with vowel quality due to the family of markedness constraints *H/V, which are derived by combining the sonority scale with the tonal prominence scale. Specifically, it was argued that the general pattern of vowel reduction is generated by the requirement to decrease vocalic sonority in prosodically recessive positions, where //o// and //a// neutralise to [ə]. Vowels in immediately pretonic positions do not reduce to schwa due to the High tone, which forces the lowering of //o// to [a]. Additionally, the blocking of extreme reduction in phrase-initial and hiatus positions has been attributed to the prohibition against onsetless syllables headed by the featureless vowel schwa.

In the next chapter, we turn to more complex patterns of reduction attested in different East Slavic dialects. It is demonstrated that these systems are accountable for by minimal rerankings of constraints generating vowel reduction in Standard Russian.

4. Dissimilative vowel reduction

1. Introduction

Many East Slavic dialects exhibit an unusual pattern of vowel reduction, in which the quality of a reduced vowel in the pretonic position depends on the quality of the stressed vowel.[1] Such patterns, traditionally referred to as dissimilative types of reduction, are widespread in the South Russian dialect area, as well as in the Eastern Belarusian dialects and in the dialects spoken in the north-eastern part of Ukraine. In a typical case, [ə] occurs if the stressed vowel is low (see (1a) below), whereas [a] is found before high stressed vowels (1b), and, depending on a dialect, either [a] or [ə] are used before stressed mid vowels (1c).

(1)	a. vodoj	[vəˈda]	‘water’ (nom. sg.)
	b. vody	[vaˈdɨ]	id. (gen. sg.)
	c. vodoj	[vaˈdɔi̯]/[vəˈdɔi̯]	id. (instr. sg.)

In addition, some dialects exhibit types of reduction in which dissimilation before non-low vowels is combined with assimilation before the low vowel [a]. For instance, mid vowels trigger reduction to [ə] (2c), while high and low vowels induce reduction to [a] in the preceding syllable (2a-b):

(2)	a. vodoj	[vaˈda]	‘water’ (nom. sg.)
	b. vody	[vaˈdɨ]	id. (gen. sg.)
	c. vodoj	[vəˈdɔi̯]	id. (instr. sg.)

Also, there exist dialects with dissimilative reduction which draw a distinction between back and front mid vowels. Back mid vowels are grouped together with high vowels in triggering [a]-reduction (3a), while front mid vowels and low vowels induce [i]-reduction in the pretonic syllable (3b).

(3)	a. selit’	[sʲaˈlʲitʲ]	‘to settle’
	selo	[sʲaˈlɔ]	‘village’ (nom. sg.)
	b. sele	[sʲiˈlʲe]	id. (dat. sg.)
	sela	[sʲiˈla]	id. (gen. sg.)

[1] Unless indicated otherwise, data description is based on the standard sources such as Kuznecov (1960), Avanesov & Orlova (1965), Vajtovič (1968), Avanesov (1974), Kasatkin (2005), Požaric-kaja (2005).

Overall, there are over fifteen distinct types of dissimilative reduction described in the literature. The present analysis assumes that numerous and complex reduction patterns attested in East Slavic arise due to two major factors. First, minimal permutations between HEAD=H and the members of the *H/V family of constraints yield basic dissimilative types of [a]-reduction and [ja]-reduction. Second, the dissimilative systems can exhibit intersyllabic assimilation in vowel quality, both in height and in backness, which gives rise to further patterns of vowel neutralisations. Only the dialects exhibiting assimilation in height are called assimilative in the traditional descriptions of Russian dialects, whereas the dialects which show assimilation in backness are not considered to be assimilatory in nature. Instead, they are classified together with dissimilative patterns (*cf.* Kuznecov, 1960; Avanesov, 1974; Kasatkin, 2005; Požarickaja, 2005). Furthermore, Crosswhite (2000, 2001) argues that pretonic vocalic patterns in these dialects are not dependent on the vowel in the tonic syllable but are caused by a soft consonant which immediately follows the pretonic vowel. I suggest an alternative interpretation which builds on the assumption that the East Slavic dialects instantiate vowel harmony systems in which stressed syllables serve as triggers of harmony for the vocalic features [-back] and [+low]. The constraints driving vowel harmony work in concert with the constraints on the association of High tone with vocalic elements to generate complex neutralisation patterns.

This chapter is organised as follows. First, Section 2.1 lays out basic generalisations concerning the main patterns of dissimilative reduction operating in different East Slavic dialects. Next, section 2.2 develops a tonal analysis couched in terms of Optimality Theory. Issues concerning other possible cues to phonological tone, such as duration and pitch, are discussed in Section 2.3.1. Section 2.3.2 brings in data from pretonic length dialects, which, though in many ways similar to the dissimilative patterns discussed earlier, are argued to be generated by a separate mechanism. Section 4 summarises the main results.

2. Dissimilative patterns (Type I)

2.1. Basic facts

As mentioned above, East Slavic dialects spoken in the southern and south-western regions of Russia as well as in the eastern parts of Belarus and Ukraine show a variety of patterns of vocalic neutralisations in pretonic positions. These patterns are called dissimilative vowel reduction, because in the majority of cases, the vowel [a] in the tonic syllable cannot be preceded by another [a],

and stressed high vowels cannot follow the high vowel [i]. As pointed out by Crosswhite (2001: 65), the term 'dissimilative' is traditionally used by the Russian dialectologists without implying either a synchronic featural dissimilation or a historical development of the vocalism in these dialects. The same use of the term 'dissimilative' is adopted in the present study, where it is employed to label any pattern in which the quality of the tonic vowel affects the outcome of pretonic reduction.

Present-day East Slavic dialects vary in having a six-, seven-, or an eight-vowel system in stressed positions (Kasatkin, 2005: 31).

(1) *East Slavic vowel systems*

(a)	i	ɨ	u	(b)	i	ɨ	u	(c)	i	ɨ	u
					e				e		o
	ɛ		ɔ		ɛ		ɔ		ɛ		ɔ
		a				a				a	

A given vowel system is not an attribute of geographically-delimited areas, but can occur in any type of a dialect group (Avanesov & Orlova, 1965). The most widespread is the six-vowel system (1a) which historically developed from the eight-vowel system by merging high and low mid vowels into one vowel quality. The seven and eight-vowel systems (1b-c), referred to as archaic in traditional grammars, are less common. In most Southern Russian dialects with eight-vowel system (1c), the high mid vowel //o// can be optionally realised as [ɔ] (Savinov, 2013a). Kasatkina (2000: 98) reports that archaic systems are attested in the 10% of the texts in the corpus of recordings collected in the southern Russian dialectal area during the second half of the 20th century.

Distinct types of dissimilative reduction are attested after hard and soft consonants. The former is referred to as dissimilative [a]-reduction, while the latter is traditionally called dissimilative [ja]-reduction. Three main types of dissimilative [a]-reduction and [ja]-reduction have been described in the literature, named Žizdra, Obojan' and Don patterns (henceforth, I will call these patterns Type I for the ease of reference). Let us note that the names refer to reduction patterns and not to dialects, as one pattern is usually attested in several dialects. The dialects are often spoken in different geographical areas and differ with respect to other phonological, grammatical and semantic features. Archaic (Obojan'/Zadon) patterns have been attested in Kursk, Belgorod,

Voronež, Tula, and Kaluga regions. Žizdra, which is the most common pattern, is widespread in the north-eastern Belarus as well as in the western and eastern regions of the Southern Russian dialect area (Brjansk, Tula, Rjazan', Voronež, Tambov regions) (Kasatkina, 2000; Požarickaja, 2005). The Don type is found in isolated dialects spoken in the basin of the river Don. This type is commonly found after soft consonants, whereas a parallel dissimilative [a]-reduction pattern is rare after hard consonants. In fact, it has been considered unattested and dubbed theoretical in dialectology textbooks (Avanesov, 1974). However, Kasatkina (2000) presents recent fieldwork data which show this type to be present in dialects spoken in Belgorod, Lipeck, Voronež and Kaluga regions.

As mentioned above, all dissimilative patterns use the low vowel [a] in pretonic positions before the high vowels and, depending on the quality of the preceding consonant, either [ə] or [i] if the vowel in the stressed syllable is low. The quality of the non-low reduced vowel depends on the preceding consonant: [ə] is used after hard consonants, while [i] occurs after soft consonants. The reduction pattern before high and low vowels is schematically shown in (2) below.

(2) *Dissimilative vowel reduction before high and low vowels*

pretonic	tonic
a	i ɨ u
ə/i[2]	a

The reduction before high and low vowels is illustrated in (3). The data are taken from standard descriptive sources (Avanesov, 1974; Kasatkin, 2005; Požarickaja, 2005), and from the acoustic corpus of the Russian dialects (Sappok *et al.*, 2016).

(3) *Dissimilative reduction before high and low vowels in the tonic syllable (all dissimilative patterns)*

a. Before high vowels in the tonic syllable
i. [a] after hard consonants

vodica	[vaˈdʲicə]	'water' (dim.)
govorit'	[gəvaˈrʲitʲ]	'say'
travy	[traˈvɨ]	'grass' (gen. sg.)
sovy	[saˈvɨ]	'owl' (gen. sg.)
popu	[paˈpu]	'priest' (dat. sg.)
sažu	[saˈžu]	'sit' (1st pers. sg.)

[2] After soft consonants, [e] instead of [i] is used in the Zadon pattern of dissimilative [ja]-reduction.

ii. [a] after soft consonants

belit’	[bʲaˈlʲitʲ]	‘whiten’
pogljadi	[pəɣʲaˈdi]	‘look’ (imp.)
cvety	[cvʲaˈtɨ]	‘flowers’
rjabyx	[rʲaˈbɨx]	‘pockmarked’ (gen. sg.)
tjanu	[tʲaˈnu]	‘pull’ (1st pers. sg.)
smejutsja	[sʲmʲaˈjut͡s:ə]	‘laugh’ (3rd pers. pl.)

b. Before low vowels in the tonic syllable

i. [ə] after hard consonants

skazal	[skəˈzal]	‘say’ (past 3rd pers. sg.)
stakan	[stəˈkan]	‘a glass’
tatarin	[təˈtarʲɪn]	‘Tatar’
voda	[vəˈda]	‘water’
trava	[trəˈva]	‘grass’

ii. [i] after soft consonants

nesla	[nʲiˈsla]	‘carry’ (fem. past)
beda	[bʲiˈda]	‘hardship’
prjamaja	[prʲiˈmajə]	‘straight’ (fem.)
menjat’	[mʲiˈnʲatʲ]	‘change’
gljadjat	[ɣʲiˈdʲat]	‘look’ (3rd pers. pl.)
zemla	[zʲiˈmlʲa]	‘earth’
sela	[sʲiˈla]	‘village’ (gen. sg.)
sestra	[sʲiˈstra]	‘sister’
sedaja	[sʲiˈdaja̯]	‘grey-haired’ (fem.)
rjabaja	[rʲaˈbaja̯]	‘pockmarked’ (fem.)
veljat	[vʲiˈlʲat]	‘order’ (3rd pers. pl.)

The difference between the patterns consists in their treatment of mid vowels. In Žizdra, mid vowels behave similarly to high vowels, while in Don, mid vowels group together with low vowels. In Obojan’, half-close mid vowels pattern with high vowels and half-open vowels with low vowels (see examples in (4) below). Žizdra and Don types are more common in dialects with five vowels, whereas Obojan’ and Zadon patterns are usually attested in seven-vowel systems. Obojan’ and Zadon are called archaic because they preserve the distinction between high mid and low mid vowels. Archaic types of dissimilation have been first described at the beginning of the twentieth century by Vasiljev (1904) and Durnovo (1917). Savinov (2013) reports that the results of the fieldwork conducted in 1999-2010 demonstrate that this type of dissimilation is still active in Southern Russian dialects, affecting both native vocabulary as well as recent borrowings.

It should be noted that Žizdra and Don patterns are also attested in eight- and seven-vowel systems, and the archaic patterns are often found in systems distinguishing five vowels under stress. In the latter, the prevocalic

contrast [ə] – [a] is preserved before etymological high and low mid vowels despite the absence of any phonetic distinction (*cf.* Knjazev, 2000: 82-83). To simplify the presentation of the relevant facts, I abstract away from these variations and consider only those dialects which exhibit archaic reduction patterns in the presence of the surface contrast between [ɛ], [ɔ], and [e], [o]. The illustrative data are provided in (4) below.

(4) *Dissimilative reduction before mid vowels in the tonic syllable (Žizdra, Obojan', Don)*

a. Žizdra: [a] after hard and soft consonants

[a]		
vodoj	[vaˈdɔi̯]	'water' (instr. sg.)
sovjonyš	[saˈvʲɔniš]	'owl' (dim.)
dajot	[daˈjɔt]	'give' (3rd pers. sg.)
trave	[traˈvʲɛ]	'grass' (dat. sg.)
selo	[sʲaˈlɔ]	'village' (nom. sg.)
sestroj	[sʲaˈstrɔi̯]	'sister' (instr. sg.)
gljadel	[ɣlʲaˈdʲɛl]	'look' (masc. past)
lesok	[lʲaˈsɔk]	'forest' (dim.)

b. Don: [ə] after hard and [i] after soft consonants

[ə]		
noge	[nəˈgʲɛ]	'leg' (dat. sg.)
popom	[pəˈpɔm]	'priest' (instr. sg.)
takoj	[təˈkɔi̯]	'such' (masc. nom. sg.)
varjonyj	[vəˈrʲɔni̯i̯]	'cooked' (masc. nom. sg.)
[i]		
rekoj	[rʲiˈkɔi̯]	'river' (instr. sg.)
slepogo	[slʲiˈpɔvə]	'blind' (masc. gen. sg.)
slepoj	[slʲiˈpɔi̯]	'blind' (masc. nom. sg.)
stene	[sʲtʲiˈnʲɛ]	'wall' (loc. sg.)
zernom	[zʲirˈnɔm]	'grain' (instr. sg.)
vesjolyj	[vʲiˈsʲɔləi̯]	'merry'

c. Obojan': [a] before high mid vowels; [ə] after hard and [i] after soft consonants before low mid vowels;

[a]		
sovoj	[saˈvoi̯]	'owl' (instr. sg.)
noge	[naˈgʲe]	'leg' (dat. sg.)
pjatno	[pʲatˈno]	'spot'
rjabogo	[rʲaˈbovə]	'pockmarked' (masc. gen. sg.)
velel	[vʲaˈlʲel]	'order' (masc. past)

[ə]		
konjom	[kəˈnʲɔm]	‘horse’ (instr. sg.)
pojoš	[pəˈjɔš]	‘sing’ (1st pers. sg.)
dajot	[dəˈjɔt]	‘give’ (3rd pers. sg.)
[i]		
rjaboj	[rʲiˈbɔi̯]	‘pockmarked’ (masc. nom. sg.)
derevne	[dʲiˈrʲɛvnʲə]	‘village’ (loc. sg.)
naprjadjom	[nəprʲiˈdʲɔm]	‘spin’ (1st pl. future)

It should be emphasised that the patterns of vowel neutralisations described above are fully productive. For one thing, pretonic vowels participate in alternations in morphologically related forms, *cf. travy* [ˈtravɨ] ‘grass’ (nom. pl.) – *trava* [trəˈva] id. (nom. sg.) – *travy* [traˈvɨ] id. (gen. sg.). Furthermore, recent borrowings undergo pretonic reduction on a par with native words, e.g. *koncert* [kənˈt͡sɛrt] ‘concert’, *vagon* [vəˈgɔn] ‘wagon’ in the Don pattern of reduction (Kasatkina, 2000: 101). Similarly, Vajtovič (1968: 58) reports that loanwords are subject to the same neutralisation processes as native words in Žizdra, for instance *gektar* [ɣʲikˈtar] ‘hectare’, *materjal* [mat͡sʲiˈrjal] ‘material’, *sezon* [sʲaˈzɔn] ‘season’, *interes* [int͡sʲaˈrɛs] ‘interest’. Schematically, the patterns of dissimilative vowel reduction are represented in (5) below.

(5) *Types of dissimilative vowel reduction (Type I)*

i. After hard consonants

a. Žizdra

pretonic	tonic
a	i ɨ u ɛ ɔ
ə	a

c. Don

pretonic	tonic
a	i ɨ u
ə	ɛ ɔ a

b. Obojan’

pretonic	tonic
a	i ɨ u e o
ə	ɛ ɔ a

ii. After soft consonants

a. Žizdra

pretonic	tonic
a	i ɨ u ɛ ɔ
i	a

b. Don

pretonic	tonic
a	i ɨ u
i	ɛ ɔ a

c. Obojan’/Zadon

pretonic	tonic
a	i ɨ u e o
i/e	ɛ ɔ a

In prosodically weak positions not immediately preceding the tonic syllable, non-high vowels usually reduce to [ə] or [ɨ] after hard consonants and to the front vowel [ɪ] after palatalised consonants. South-western dialects bordering with Ukrainian and Belarusian often use [a] after hard consonants in atonic positions. There are also indications in the literature that at least in some dialects, non-high vowels in positions immediately following the tonic vowel evince the same dissimilation pattern as in pretonic positions: [a] is found after non-low stressed vowels and [ə] is attested after the low vowel [a] (Avanesov & Orlova, 1965: 68; Kasatkin, 2005: 53). Curiously, all the examples provided in the literature are stressed on the initial syllable, e.g. *xutari* [ˈxutarʲi] 'hamlet' (loc. sg.), *storonu* [ˈstɔranu] 'side' (acc. sg.), *vs. staromu* [ˈstarəmu] 'old' (dat. sg.), *jabločka* [ˈjabləčʲkə] 'apple' (gen. sg. dim.). It is unclear, then, whether the same process applies to words with the tonic syllable in non-initial position.

2.2. Rhythmic structure of the dialects with dissimilative reduction

It has been long observed that the southern Russian dialects with dissimilative reduction are characterised by a special type of rhythmic structure (Broch, 1916; Vojtovič, 1972b; Vysotskij, 1973; Kasatkina & Ščigel', 1996; among others). Whereas the rhythm of the central Russian dialects, including the standard variety, is usually described as having the structure 1-2-3-1[3], the rhythmic organisation of the dialects with dissimilative reduction exhibits two different patterns. In the majority of these dialects, rhythm has been described to vary between 1-1-3-1 and 1-2-3-1 (or 1-3-3-1, in dialects showing increased duration of pretonic vowels) (Kasatkin, 2005; Savinov, 2013b). The former type, 1-1-3-1, is found in words with the low vowel [a] in the stressed syllables, as exemplified in (6a) below. The rhythmic pattern, 1-2-3-1, occurs in words containing non-low stressed vowels (6b). The structure 1-2-3-1 is similar to the rhythm 1-2-3-1 attested in the central Russian dialects: both draw an opposition between the disyllabic domain containing the tonic and pretonic syllable (indicated with the numbers '2' and '3') and the remaining unstressed syllables (marked with '1').[4]

[3] This notation, known as Potebnja's formula, refers to the impressionistic relative salience of the syllables in different prosodic positions, with '3' standing for the strongest syllable, and '1' indicating the weakest syllable of the word (Potebnja, 1865; see also Vysotskij, 1973: 26ff for critical remarks and discussion).

[4] In the Russian literature, the two prominent syllables are referred to as the vocalic centre of the word and the overall prosodic structure is metaphorically described as 'strong centre and weak periphery' (Kasatkina, 1996a).

(6) a. *1-1-3-1* (data from Kasatkin, 2005: 25)

nakopala	[nəkəˈpalə]	‘dig up’ (fem. perf.)
prodavala	[prədəˈvalə]	‘sell’ (fem. past. imperf.)
nagljadjatsja	[nəglʲiˈdʲat͡sːə]	‘watch’ (future pl.)
vyletata	[vɨlʲiˈtalə]	‘furl out’ (fem. perf.)

b. *1-2-3-1*

podarila	[pədaˈrʲilə]	‘give a present’ (fem. perf.)
razognulsja	[rəzaˈgnulsʲə]	‘unbend’ (masc. perf.)
razdobyla	[rəzdaˈbɨlə]	‘procure’ (fem .perf.)
peresypat’	[pʲirʲiˈsɨpətʲ]	‘pour’ (inf.)

In contrast, some dialects show an alternation of strong and weak syllables: 2-1-3-1 (Vajtovič, 1968; Kasatkin, 2005; Savinov, 2013b). This pattern appears in words containing non-high vowels in the stressed syllable. When the vowel in the tonic syllable is high, the rhythm is 1-2-3-1. The examples in (7) below come from the western Belarusian dialect area (Vajtovič, 1968: 116).[5]

(7) a. *2-1-3-1*

palučaŭ	[paluˈčaw̯]	‘get’ (masc. imperf.)
zabirac’	[zabʲiˈrat͡sʲ]	‘receive’ (inf.)
garbuza	[ɣarbuˈza]	‘pumpkin’ (gen. sg.)

b. *1-2-3-1*

golovy	[ɣəlaˈʊɨ]	‘head’ (gen. sg.)
molody	[mɨlaˈdɨ]	‘young’
stanovi	[stɨnaˈʊʲi]	‘stop’ (2nd sg. imp.)

The presence of the perceptual salience (or the lack thereof) in the pretonic position in words with 1-2-3-1 rhythmic structure is usually attributed to prolonged duration. Broch (1916) states in his description of the dialects with dissimilative reduction west of Mosal’sk that the stressed vowel [a] is preceded by a short vowel, and stressed high vowels [i], [u], [ɨ] are preceded by a long vowel. Instrumental measurements of the duration of pretonic vowels in dialects with dissimilative reduction are reported in Kasatkina (1995)[6] and in Vysotskij (1973). The findings of both studies reveal differences in the duration of pretonic vowels which are related to the quality of the stressed vowel. The results of an experiment conducted by Vysotskij (1973: 37-40) demonstrate that the length of the immediately pretonic vowel constitutes 92% (113 ms *vs.* 123 ms) of the duration of the stressed non-low vowels, and 58% (70 ms *vs.* 120 ms) of

[5] See Kasatkin (2005: 53) and Savinov (2013b: 40) for similar patterns attested in the Southern Russian dialects.

[6] The same results are also presented in Kasatkina & Ščigel’ (1996).

the duration of the stressed low vowel [a].[7,8] The results reported in Kasatkina (1995: 222-223) also show a difference, albeit less spectacular, with pretonic vowels being 12 ms longer if the vowel in the stressed syllable is high.[9] The bigger difference in duration (43 ms) which emerged in Vysotskij's study is likely to result from the fact that the data was collected in a controlled experiment, while Kasatkina's findings are based on the recordings of spontaneous speech, so they are likely to be affected by segmental and syllabic structure, as well as phrasal intonation.

Since vocalic duration appears to be determined by the quality of the stressed vowels, the dissimilative reduction has been viewed by many researchers as dissimilation in quantity (e.g., Broch, 1916; Crosswhite, 2001; Kasatkina, 1996b, 2005; Vojtovič, 1972a, among others). However, it is important to bear in mind that pretonic vowels in these dialects exhibit not only quantitative, but also qualitative distinctions: the shorter segment is realised as a neutral vowel [ə], and the longer segment is phonetically a low vowel [a]. As is well known, there are intrinsic differences in duration between vowels of different heights: low vowels take longer time to be produced than high vowels (Lehiste, 1970). It is likely, then, that the acoustic distinctions in length which emerged in the studies of Vysotskij (1973) and Kasatkina (1995) can, at least partly, be explained by the fact that the low vowel [a] is inherently longer than the neutral vowel [ə]. There is no study I know of that systematically investigates the relationship between the vowel duration and height for the East Slavic languages,[10] but the measurement of the vowel durations in standard Russian provided in Kasatkina (2005: 33) show that, in the pair of nonce words *taˈtan – taˈtin,* stressed [a] is 30 ms longer than stressed [i]. Similarly, [a] is 35 ms longer than [i] in immediately pretonic positions in the words *taˈtan – tiˈtan*.[11] Assuming the comparable values for the southern Russian dialects, the differences in duration between pretonic [a] and [ə] reported in Vysotskij (1973) and Kasatkina (1995) may as well result from the intrinsic durational differences

[7] The measurements were performed based on the recordings of around 100 trisyllabic words collected from one speaker. All the words were stressed on the final syllable and contained non-high vowels preceded by non-palatalised voiceless stops and fricatives.

[8] Interestingly, the duration of the stressed non-low and low vowels is comparable (123 ms *vs.* 120 ms) and appears not to be affected by the intrinsic differences depending on vowel height (Lehiste, 1970).

[9] The data used for the analysis included 24 words of varying length and segmental structure, collected from one speaker.

[10] Such studies have been conducted for a number of languages, including English, German, Danish, Swedish and Japanese (see Lehiste, 1970: 18) and (Beckman, 1986: 141) for references).

[11] The data in Kasatkina's (2002) study has been collected from 14 speakers (6 male, 8 female). The words were recorded in different positions in three carrier sentences.

between these vowels and not from the dissimilation in quantity, as postulated by Broch, (1916), Kasatkina (1996b), Vojtovič (1972a), and others. Thus, it is likely that the perceived differences between pretonic vowels followed by high and low stressed vowels may be based not on the increased duration, but on the greater sonority, and, accordingly, greater perceptual prominence of [a], as compared to [ə]. From this perspective, the differences in duration between pretonic vowels are derivative from the differences in vowel quality, and not the other way around.[12]

As to the phonetic expression of the rhythmic prominence in non-pretonic positions, detailed acoustic measurements are scarce. Singling out the first syllable as rhythmically prominent in the structure 2-1-3-1 (see (7a) above) appears to be based on the increased duration and/or lack of phonological reduction. For instance, [ə] in the first syllable of *podošli* [pədaˈšlʲi] 'approach' (past. pl.) surfaces as [a] in *podošla* [padəˈša] id. (fem. sg. past) (Kasatkin, 2005: 53).

Fomina (1985: 121) provides measurements of the relative duration of vowels in the first and second syllables of disyllabic words with main stress on the final syllable.[13] The results, presented in (8) below, show that the initial syllable is longer than the pretonic syllable. Notably, the difference in duration is not accompanied by the difference in quality.[14]

(8) *Relative duration of vowels in the 2nd and 1st pretonic syllables (Fomina, 1985)*

	Pretonic syllables	
	2nd	1st
kozaka [kəzəˈka] 'Cossack'	60%	52%
xoxotok [xəxəˈtək] 'laugh' (dim.)	59%	55%
pjataka [pʲetəˈka] 'five roubles note'	40%	35%

Furthermore, the results of the instrumental measurements reported in Savinov (2013b: 34-35), reproduced in (9), demonstrate that initial vowels in the context 2-1-3-1 are longer than their counterparts occurring in the 1-2-3-1 rhythmic structure.[15]

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[12] This view is in line with accounts developed by Halle (1965) and Davis (1970), who analyse the alternation of [a] and [ə] in terms of quality dissimilation.

[13] The data was collected from the speakers of a Southern Russian dialect exhibiting archaic dissimilative [ja]-reduction and [a]-reduction.

[14] Fomina (1985) transcribes the reduced vowels in both initial and pretonic positions with two interchangeably used symbols, [aᵇ] and [ъᵃ], which correspond to [ə] in the IPA notation.

[15] The data was recorded in the South Russian dialect area (Voronež and Kaluga regions). The measurements are based on single word forms, taken from the recordings of spontaneous speech.

(9) *Duration of vowels (in ms) in different prosodic positions (Savinov, 2013b)*

	V_1 (σ̲σˈσ)	V_2 (σσ̲ˈσ)	V_3 (σσˈσ̲)
a. *Stressed low vowels (2-1-3)*			
podnjala [pədʲnʲeˈla] ‘fetch’ (fem.past)	132	58	171
zagadaj [zaɣaˈdaɟ] ‘think up’ (imp.)	47	22	69
sereda [sʲirʲiˈda] ‘Wednesday’	81	65	257
b. Stressed non-low vowels (1-2-3)			
počemu [pəčʲe͡aˈmu] ‘why’	62	106	70
poxotelos’ [pəxaˈtʲelɛsʲ] ‘want’ (perf.)	59	121	81
Monaxovy [manaˈxu͡owɨ] proper name	54	108	141
maslobojku [məslaˈbojku] ‘butter churn’ (acc. sg.)	50	74	67

When the vowel under stress is low (9a), the vowel in the initial syllable (V_1) exceeds in duration the vowel in the following syllable (V_2), the former ranging between 47 ms and 132 ms, and the latter varying between 22 ms and 65 ms. An opposite durational pattern is observed in (9b), where the vowel in the initial syllable is considerably shorter than the vowel in the pretonic syllable (50 ms to 62 ms *vs*. 74 ms to 121 ms). Incidentally, let us note that the pretonic vowel in (9b) is in many cases longer than the vowel in the tonic syllable, so it would be more accurate to represent the rhythmic structure of these words as *1-3-2* or *1-3-3*, instead of *1-2-3* (*cf.* Kasatkin, 2005: 25). The number *3* here serves to express the fact that the vowel it refers to is perceived as stressed, and, hence, more prominent than the preceding vowel.

3. Tonal analysis

3.1. Introduction

One of the fundamental premises of OT states that differences between languages arise due to language-specific rankings of the universal constraints. From this perspective, the subtle differences between the vowel patterns attested in various East Slavic dialects should reflect minimal variations in the rankings of the same constraints. It has been argued in Chapter 3 that [a]-reduction found

in the pretonic position in Standard Russian is tone-driven. Two structural well-formedness constraints, HEAD=H and ALIGN-L(H, FT), ensure that High tone is associated with the tonic and pretonic syllables, while the *H/V family of constraints require vowels associated with High tone to lower. Lowering to [a] maximises vocalic duration, rendering the vowel a better carrier of High tone. The constraint ranking established for Standard Russian is provided in (10) below.

(10) *Two-degree vowel reduction*
HEAD=H, ALIGN-L(H, FT)
⇓
*H/V

It will be demonstrated in the remainder of this chapter that minimal ranking permutations between HEAD=H and the members of the *H/V family of constraints generate vowel reduction systems attested in different East Slavic dialects.

Let us recall from Chapter 3 that the *H/V constraints drive the lowering of the vowel only in pretonic positions. The featural identity of vowels in stressed syllables is protected by the high-ranked positional faithfulness constraints. The architecture of OT predicts the existence of a system with a reverse ranking, where positional faithfulness constraints are dominated by the markedness constraints of the *H/V family. However, there are no dialects which would lower the stressed vowel under the pressure of *H/V. This gap can be explained by the lexical nature and the high functional load of East Slavic stress. As stress is often the only means of differentiating between words or different forms of the same word (e.g. *ko'tom* 'cat' (gen. sg.) *vs. ko'tam* 'cat' (dat. pl.)), the identity of stressed vowels needs to remain intact in order to preserve lexical contrasts.

An obvious strategy to avoid the violation of *H/V is not to have High tone in the output structure. This is achieved if the ranking HEAD=H >> *H/V (as in Standard Russian) is reversed to *H/V >> HEAD=H, and MAX-T ('No deletion of tones') is ranked below *H/V. As both tone and stress can be cued by pitch and duration, and only stress can be manifested by intensity, it is predicted that stress systems lacking High tone express prominence not only by duration and pitch but also by intensity. In this view, the loss of tone should lead to the emergence of stress systems which use intensity to a greater extent than pitch and duration. Such a system is attested in Polish, which employs intensity

as the main correlate of primary stress, with pitch and duration playing a subsidiary role (Łukaszewicz & Rozborski, 2008). In this respect, Polish stands in contrast to Ukrainian, in which stressed and unstressed syllables do not differ with respect to intensity (Łukaszewicz & Mołczanow, to appear). This difference can be attributed to the absence of the phonological High tone in Polish and its presence in Ukrainian, where High tone is manifested by the prolonged duration of the stressed syllable.

It has been mentioned above that the ranking *H/V >> HEAD=H, combined with the low-ranked MAX-T, generates systems without phonological tone. One more logical possibility is to keep the ranking *H/V >> HEAD=H and promote MAX-T to the echelon of the high-ranked constraints. In this setting, the floating tone cannot be deleted, but, with HEAD=H ranked low, it is not bound to the stressed syllable. Such a system can improve on markedness by placing High tone on another vowel if this vowel makes a better docking site for High Tone. As shown in (11), it is less of an evil to move High tone from the stressed syllable and to violate HEAD=H than to have it linked to a low sonority vowel.

(11) *Constraint ranking for dissimilative [a]-reduction: general scheme*

*H/V
⇓
HEAD=H

This constraint ranking expresses a generalization originally formulated by Bethin (2006), who suggests that dissimilative dialects realise High tone on a low stressed vowel and on the pretonic vowel when the stressed vowel is high, illustrated in (12).

(12) *Distribution of H tone in the dissimilative dialects*

It has been assumed for Standard Russian that H tone is associated to the stressed syllable due to HEAD=H, the constraint operating directly on the output representation. As HEAD=H does not have access to the underlying structure, it is not relevant whether H is present in the underlying representation. In this sense, Russian groups together with languages such as Creek, Kirundi and Winnebago, in which the location of tone is predictable from the location of stress

(Halle & Vergnaud, 1987; Hayes, 1995). In contrast to Standard Russian, High tone is not always linked to the stressed syllable in dialects with dissimilative reduction. Its place is circumscribed by the position of stress and the quality of the vowel in the stressed syllable. As a result, H appears either on the stressed syllable or on the immediately preceding syllable. In the latter case, it is not simultaneously linked to the stressed syllable, as in Standard Russian, so it is not possible to derive its presence by a constraint requiring the output association between High tone and the head of the prosodic domain. Therefore, I suggest that H tone is not lexically specified on any particular vowel but is present as a floating autosegmental feature in dialects with dissimilative reduction.[16]

3.2. Metrical structure

The output location of H tone is constrained by the metrical structure in that the floating tone docks either on the stressed syllable or on the immediately preceding syllable. In terms of OT, the floating H tone ends up linked to the stressed syllable due to Head=H, whereas the preservation of the underlying tone is required by Max-T, formulated below. These two constraints ensure that the underlying floating tone is preserved on the stressed syllable in the output. However, it was suggested above that in dialects with dissimilative reduction, H tone is associated with stressed syllable only if the latter contains a sonorous (non-high) vowel. If the vowel in the stressed syllable is high, H tone moves to the vowel in the preceding unstressed syllable. The question arising at this point is why the H tone lands on this particular unstressed syllable. Once it is free not to associate with the prosodic head, H tone could, in principle, dock onto any vowel. It could, for instance, seek out the most sonorous vowel in the word, or link to the perceptually salient word-initial syllable. Technically, the placement of H tone to the left of the stressed syllable can be accomplished by the constraint Align-L, as formulated by Yip (2002: 83).

(13) Align-L: Each T should align with the left edge of the domain (gradiently assessed).

Align-L captures the well-formedness condition proposed by Goldsmith (1990), stating that tones are associated with tone bearing units in a left-to-right

[16] Floating tones have been postulated for a number of languages, e.g. High tone for Serbo-Croatian (Zec, 1992) and for Ancient Greek (Golston, 1990), Low tone for Mixtecan (Goldsmith, 1990) and Bora (Yip, 2002), among others.

fashion. Typically, the prosodic domain referred to in (13) above constitutes a prosodic word, so such a constraint would locate H tone on the word-initial syllable. In dissimilative systems, it would successfully place H on pretonic vowels only in words with stress on the second syllable. In the remaining cases, it will incorrectly associate H to the initial vowel not immediately followed by the stressed syllable. To keep H tone on the pretonic syllable, the domain of ALIGN-L needs to be restricted to a disyllabic foot, as in (14) below.

(14) ALIGN-L(H, FT): Every High tone should be aligned with the left edge of a foot.

In languages with lexical stress, feet are constructed with reference to the lexically accented vowel, which serves as the head of the foot in the output representation. Given an input structure σ σˈσ σ,[17] there are two possible ways to parse it into binary feet: (σ σ)(ˈσ σ) and σ (σˈσ) σ, but not *(σ σ)ˈσ σ. Accordingly, the constraint ALIGN-L(H, FT) predicts that H can be realised either on the stressed syllable or on the pretonic syllable:

(15) *Hybrid metrical structure*

In both cases, H is aligned with the left edge of the foot. In (15a), the foot is left-headed (trochaic), whereas in (15b) it is right-headed (iambic). As it is customary to posit either iambs or trochees for one language,[18] (15a) and (15b) are not expected to be co-present within the same system. However, it has been argued earlier that High tone is associated with the pretonic syllable if the stressed vowel is high, and to the tonic syllable if it contains a non-high vowel. Hence, if H tone is to remain aligned with the left foot edge, and not to dock on the high stressed vowel, then one must assume the iambic structure in (15b). In (15a), the association of H with the stressed syllable triggers the placement of the foot boundary at the left edge of the stressed syllable, the resulting foot being trochaic.

[17] Syllable structure is predictable, and, hence, is not encoded in the underlying representation. I abstract away from this fact at the moment and, for convenience, use the symbol 'σ' as a shortcut.

[18] See Hyde (2002) for a metrical theory employing both foot types within one language.

Let us assume for a moment that ALIGN-L(H, FT) is low-ranked in these dialects and foot structure is either uniformly trochaic or iambic, as illustrated in (16).

(16) a. *Left-headed feet*

b. *Right-headed feet*

Iambic footing in (16b) appears to be more coherent on theoretical grounds, because in both (16bi) and (16bii) H tone lands on a syllable within the same foot. In contrast, trochaic footing generates a structure in which H associates to the vowel which is not incorporated into the same foot as the stressed syllable (16aii). Then, it appears that the most adequate way to model the relationship between tone and metrical structure is to assume right-headed feet, as in (16b) above. However, both (16a) and (16b) fail to account for the presence of secondary prominence on the initial syllable in (16ai) and (16bi) and its absence in (16aii) and (16bii) in some dialects with dissimilative reduction. As described earlier in Section 2.2, such systems exhibit increased prominence of the vowel in position removed from the main stress by one syllable if the stressed vowel is non-high, e.g. *podošla* [padəˈšla] ‘approach’ (fem. sg. past), but not if the vowel under stress is high, e.g. *podošli* [pədaˈšlʲi] id. (past.pl.). According to various sources (Avanesov & Orlova, 1965; Fomina, 1985; Kasatkin, 2005; Savinov, 2013b), rhythmic stress is manifested by the increased duration and the absence of reduction to [ə]. The problem with the iambic and trochaic footings in (16) above is that the initial syllable carrying secondary stress, as in [ˌpadəˈšla], is structurally indistinguishable from the corresponding syllable lacking subsidiary prominence, as in [pədaˈšlʲi]. Trochaic parsing in (16a) incorrectly predicts that the initial syllable should receive secondary stress in both [ˌpadəˈšla] and *[ˌpadaˈšlʲi], whereas iambic parsing in (16b) predicts that neither word should have secondary stress.

This problem is solved if we admit two foot types, whose construction is determined not only by the position of stress, but also by the location of High tone (as shown in (15) above). In this setting, the foot boundary coincides with the left edge of the stressed syllable only when it hosts High tone. Otherwise, the foot boundary shifts leftwards, to align with the syllable associated with H. The parsing of the words *podošla* and *podošli* shown in (17) serves to illustrate the point.

(17) *Hybrid metrical structure*

H	H
a. [(ˌpadə)(ˈšla)]	b. [pə(daˈšlji)]
//podošlá//	//podošlí//

Both words in (17) are trisyllabic and have main stress on the final syllable. Yet, secondary stress appears only in (17a) because H tone is associated with the monosyllabic final foot, and the remaining two syllables form a foot of their own. In (17b), H tone cannot be realised on the high vowel in the stressed syllable, so it moves to the left. The left foot boundary, which must align with H tone, shifts leftwards as well. As a result, the initial syllable remains unfooted, and the vowel undergoes reduction to [ə]. The underlying //ə// surfaces as [a] when the initial syllable occupies a head position, as in (17a) above. Following de Lacy (2006), I analyse this type of neutralisation in terms of prominence enhancement. That is, while reduction to [i], [u], or [ə] in prosodically recessive positions minimises vowel sonority (as discussed earlier in Section 3, Chapter 3), lowering serves to increase the intrinsic salience of vowels in prosodically dominant positions. According to de Lacy (2006), vowels in unstressed syllables are subject to sonority enhancement because they constitute the heads of the syllabic domain. Formally, this generalisation is couched in terms of the following set of constraints, repeated from Chapter 3.

(18) $*\Delta_{\sigma}\{\text{i,ʉ}\} >> *\Delta_{\sigma}\{\text{ə}\} >> *\Delta_{\sigma}\{\text{i,u}\} >> *\Delta_{\sigma}\{\text{e,o}\} >> *\Delta_{\sigma}\{\text{ɛ,ɔ}\} >> *\Delta_{\sigma}\{\text{a}\}$

These constraints express the generalisation that more sonorous vowels make better syllabic heads. However, in the systems with dissimilative reduction illustrated in (17) above, sonority enhancement is observed in a syllable in the foot head, but not in the foot-dependent position. To account for this difference, I suggest to limit the purview of the constraints in (18) to the syllable

occupying the foot heads. The constraint relevant for the present analysis is formulated below:

(19) $*\Delta_{FT}\{a\}$: Incur a violation for every head of a foot that contains a segment with sonority equal to {a}.

Importantly, $*\Delta_{FT}\{a\}$ does not affect vowels carrying primary stress. The absence of neutralisation in this position can be modelled by positing a positional faithfulness constraint protecting the identity of vowels which constitute the head of a Phonological Word.

Let us point out that the rhythmic pattern 2-1-3 in words such as *podošla* [padəˈšla] 'approach' (fem.sg. past) is only attested sporadically among the dialects with dissimilative reduction, and is usually only remarked upon in passing in the traditional descriptions. In the majority of dialects, the initial syllable lacks secondary stress and the vowel is usually realised as [ə] in all unstressed positions except for the pretonic one. The rhythmic structure of these dialects is described as 1-1-3 if the vowel under stress is non-high, and as 1-2-3 if the stressed vowel is high. As mentioned previously, the latter pattern characterises dialects with non-dissimilative reduction, including the standard variety.

Stress systems which do not exhibit the alternating patterns of strong and weak syllables are usually analysed by assuming non-iterative feet construction (see van der Hulst (1999) for further discussion). In languages with free stress, a foot is only built if it can be headed by a syllable which is lexically marked for accent. In this conception, the difference between dialects with and without rhythmic stress arises because the former construct multiple feet over any disyllabic domain, whereas the latter allow only one foot per word, as illustrated in (20) below.

(20) *Hybrid metrical structure*

a. Rhythmic dialects

H	H
[(ˌpadə)(ˈšla)]	[pə(daˈšlʲi)]
//pɔdɔˈšla//	//pɔdɔˈšli//

b. Non-rhythmic dialects

H	H
[pədə(ˈšla)]	[pə(daˈšlʲi)]
//pɔdɔˈšla//	//pɔdɔˈšli//

To summarise briefly, East Slavic systems with dissimilative reduction exhibit a bidirectional interaction between metrical structure and tone. The High tone interferes with the metrical structure by shifting the foot boundary leftwards, so that H can be aligned with the left foot edge when linked to the pretonic syllable. So, on the one hand, the position of lexical stress constrains the locus of High tone, whereas, on the other hand, tone affects the structure of feet. The Tableaux in (21) demonstrate how the input structure containing floating High tone is parsed into the metrical structure.

(21) *Metrical structure in the dialects with dissimilative reduction*

H i. //vɔˈda//	*H/i,u	*H/a	HEAD=H	ALIGN-L(H, FT)
H ⇒ a. vəˈda		*		
H b. vaˈda		*	*!	
H c. vəˈda		*		*!
H ii. //vɔˈdɨ//	*H/i,u	*H/a	HEAD=H	ALIGN-L(H, FT)
H ⇒ a. vaˈdɨ		*	*	
H b. vəˈdɨ	*!			
H c. vaˈdɨ		*	*	*!

As shown above, it is crucial for *H/i,u to outrank HEAD=H in order to generate the alternation between [a] and [ə] in pretonic position. In contrast, the ranking of ALIGNL(H, FT) with respect to the *H/V family of constraints cannot be determined on the basis of the forms provided in (21) above: ALIGN-L(H, FT) is ranked below *H/a, but the same result would be achieved if ALIGN-L(H, FT) were ranked higher. However, the ranking of ALIGNL(H, FT) *vis-à-vis* *H/V plays a decisive role in the evaluation of forms with lexical stress on the initial syllable. In this case, there is no vowel preceding the main stress, so H tone can either dock on the stressed syllable or on the following unstressed syllable. If

the vowel in the stressed syllable is high, its association with H runs afoul of *H/i,u. The rightward shift of H, in turn, violates ALIGN-L(H, FT). Hence, there are two predicted scenarios for forms containing a high vowel in the initially stressed syllable. If ALIGNL(H, FT) outranks *H/V, then H tone will be linked to the initial syllable irrespective of the quality of the vowel. If, on the other hand, *H/V is ranked above ALIGN-L(H, FT), then H tone will link to the vowel in post-tonic position. In the latter case, the vowel is expected to lower in order to comply with *H/i,u. In fact, both patterns are attested in the dialects with dissimilative reduction. The post-tonic reduction to [ə] is observed in the majority of dialects, e.g. *xutari* [ˈxutərʲi] 'hamlet' (loc. sg.) *vs. jabločka* [ˈjabləčʲkə] 'apple' (gen. sg.dim.). This indicates that H tone is linked to the initial stressed syllable, in agreement with the highranked ALIGN-L(H, FT). (See Tableau (22) for an illustration.)

(22) *Post-tonic non-dissimilative reduction*

H //ˈxutərʲ+i//	ALIGN-L(H, FT)	*H/i,u	*H/a	HEAD=H
H ⇒ a. (ˈxu)tərʲi		*		
H b. (ˈxuta)rʲi	*!		*	*

Some dialects, however, are reported to use [a] after non-low stressed vowels and [ə] after the low vowel [a], e.g. *xutari* [ˈxutarʲi] 'hamlet' (loc. sg.) *vs. jabločka* [ˈjabləčʲkə] 'apple' (gen. sg. dim.) (see Section 2.1). This pattern is generated under the ranking *H/i,u >> ALIGNL(H, FT), illustrated in (23).

(23) *Post-tonic dissimilative reduction*

H //ˈxutərʲ+i//	*H/i,u	*H/a	ALIGN-L(H, FT)	HEAD=H
H ⇒ a. (ˈxuta)rʲi		*	*	*
H b. (ˈxu)tərʲi	*!			

3.3. Three types of dissimilative reduction

Returning to the analysis of the dissimilative patterns, let us recall that stressed mid vowels do not exhibit a uniform behaviour in that, depending on a dialect, they trigger either reduction to [a] or to [ə]. I assume that these differences arise from the ranking permutations between HEAD=H and the constraints regulating the association of H with vowels of different sonority profiles. HEAD=H, interleaved between the members of the *H/V family of constraints, determines the sonority thresholds at which a vowel still qualifies as a carrier of High tone (see (24) below). In Žizdra (24a), HEAD=H is ranked below *H/ɛ,ɔ, which ensures that High tone is preserved only on the low vowel [a] in the stressed syllable. High tone moves to the pretonic position if vowels in the tonic syllables are non-low. As unstressed vowels are not protected by positional faithfulness constraints, they can lower to [a] to accommodate H tone. In Obojan' (24b), HEAD=H is placed one step up in the constraint hierarchy, producing a system with high mid vowels triggering [a]-reduction and low mid vowels triggering reduction to [ə]. HEAD=H is situated yet higher in Don (24c), where all non-high vowels are allowed to carry High tone.

(24) *Dissimilative patterns (Type I)*

a. Žizdra	b. Obojan'	c. Don
*H/i,u	*H/i,u	*H/i,u
⇓	⇓	⇓
*H/e,o	*H/e,o	**HEAD=H**
⇓	⇓	⇓
*H/ɛ,ɔ	**HEAD=H**	*H/e,o
⇓	⇓	⇓
HEAD=H	*H/ɛ,ɔ	*H/ɛ,ɔ
*H/a	⇓	⇓
	*H/a	*H/a

To illustrate how this ranking generates dissimilative reduction patterns, let us first consider the contexts before high and low vowels in the stressed syllables. Let us recall that high vowels trigger [a]-reduction, and low vowels trigger [ə]-reduction in all dissimilative dialects. This is achieved due to the ranking of Head=H below *H/i,u, as shown in the Tableaux in (25) (for compactness, only relevant constraints are shown).

(25) *Dissimilative reduction before low and high vowels (all types of dissimilative reduction)*

H i. //voˈda//	*H/i,u	*H/a	HEAD=H
H ⇒ a. vəˈda		*	
H b. vaˈda		*	*!
H ii. //voˈdɨ//	*H/i,u	*H/a	HEAD=H
H ⇒ a. vaˈdɨ		*	*
H b. vəˈdɨ	*!		

In (25i), the constraint HEAD=H chooses candidate (25ia) in which High tone docks on the stressed vowel [a]. In (25ii), the high vowel [ɨ] in the stressed syllable is not sonorous enough to host H tone, so the tone docks onto the immediately preceding syllable (candidate (25iia).

The outcome of reduction before stressed mid vowels is determined by the ranking of HEAD=H with respect to *H/e,o and *H/ɛ,ɔ (see the ranking scheme in (24) above). The Tableaux in (26) show the evaluation of the words *sovoj* ‘owl’ (instr.sg.) and *sovjonyš* ‘baby owl’ in the three patterns of dissimilative reduction. To simplify the presentation, foot structure is not indicated, and only relevant constraints are shown.

(26) *Dissimilative [a]-reduction before mid vowels*
i. *Žizdra*

H //sɔˈvʲɔnɨš//	*H/e,o	*H/ɛ,ɔ	*H/a	HEAD=H
H ⇒ a. saˈvʲɔnɨš			*	*
H b. səˈvʲɔnɨš		*!		

ii. *Don*

H //sɔˈvoj//	HEAD=H	*H/e,o	*H/ɛ,ɔ	*H/a
H a. saˈvoj	*!			*
H ⇒ b. səˈvoj		*		

iii. *Obojan'*

H //sɔˈvjɔniš//	*H/e,o	Head=H	*H/ɛ,ɔ	*H/a
H a. saˈvʲɔniš		*!		*
H ⇒ b. səˈvʲɔniš			*	
H //sɔˈvoj//	*H/e,o	HEAD=H	*H/ɛ,ɔ	*H/a
H ⇒ a. saˈvoj		*		*
H b. səˈvoj	*!		*	

As shown above, the ranking of HEAD=H beneath both *H/e,o and *H/ɛ,ɔ, places H tone on the pretonic syllable, as in Žizdra (see candidate (26ia). The opposite ranking generates the Don pattern, in which H tone is realised on the stressed syllable and pretonic vowels are subject to extreme reduction (26ii). The third option, with HEAD=H interleaved between *H/e,o and *H/ɛ,ɔ, is instantiated by the Obojan' pattern (26iii). Here, H tone can be linked to the half-open vowels [e] and [o], but not to the half-close vowels [ɛ] and [ɔ]. As a result, pretonic vowels undergo [a]-reduction before [e] and [o], and extreme reduction before [ɛ] and [ɔ].

As mentioned earlier in this chapter, parallel dissimilation patterns are attested after soft consonants. The main difference between the two contexts (hard *vs.* soft consonants) lies in the quality of the reduced vowel: schwa is found after hard consonants, while [i] or [e] after soft consonants, e.g. *solit'* [səˈlʲitʲ] 'to salt' *vs. selit'* [sʲiˈlʲitʲ] or [sʲeˈlʲitʲ] 'to settle'. Front vowels appear

after soft consonants due to the markedness constraint PAL ('A consonant and a following vowel agree in backness', Rubach, 2003: 216)[19], and the further raising to [i] is motivated by AGREE[+high] ('A consonant and a following vowel agree in height', Mołczanow, (2007: 206).[20] The choice of either [e] or [i] in a given dialect is made by the relative ranking of AGREE[+high] *vis-à-vis* IDENT[-high]: the former constraint opts for [i], while the latter gives preference to the output [e]. The point is illustrated by the evaluation of the words *selom* //sʲɛˈlɔm// 'village' (instr. sg.) in the Obojan' type of dissimilative [ja]-reduction.

(27) *Dissimilative [ja]-reduction: Obojan'*

H //sʲɛˈl+ɔm//	*H/e,o	HEAD=H	*H/ɛ,ɔ	*H/a	Pal	AGREE [+high]	IDENT [-high]
⇒ a. H sʲiˈlɔm			*				*
b. H sʲaˈlɔm		*!		*	*	*	
c. H sʲɛˈlɔm			*			*!	
d. H sʲəˈlɔm			*		*!		

Candidate (27a) wins because it satisfies both PAL and AGREE [+high], at the cost of violating a lower-ranked IDENT[-high]. Candidate (27c) comes out as optimal in Zadon, where IDENT[-high] outranks AGREE [+high].

In some dialects, [e] and [i] occur in free variation (Djačenko, 2013: 341). Standard Optimality Theory deals with variation by forfeiting the principle of a total ordering of constraints, as first defined by Prince & Smolensky (1993/2004), and assuming that some constraints may be unranked with respect to one another (Kiparsky, 1993; Anttila, 1997, *et seq*.).[21] When two constraints are crucially unranked, either ranking is randomly chosen in the process of the input-output mapping. In order to model the variation between [e] and [i], AGREE[+high] has to be unranked with respect to IDENT[-high]. In this setting,

[19] PAL is called PAL-æ in Rubach (2003). This is a generic constraint subsuming all front vowels. Rubach (2003) distinguishes further constraints, referring to palatalisation in the context of *j*, *i*, and ɛ.

[20] See Chapter 6 below for further discussion.

[21] There is a considerable body of literature on the OT modelling of variation; for a comprehensive overview, see Bermúdez-Otero (2007) and Coetzee & Pater (2011).

pretonic [i] surfaces if AGREE[+high] dominates IDENT[-high], while pretonic [e] appears under the opposite ranking of the two constraints.

3.4. Phonetic realisation of High tone as increased F_0

In the account laid out above, the alternations in vowel quality in the dissimilative patterns are assumed to arise due to different locations of High tone. Non-high pretonic vowels reduce to [a] when linked to H, and reduction to [ə] or [i] takes place when High tone is associated with the vowel in the stressed syllable. The key idea of the present analysis is that tone interacts directly with vowel quality without the mediation of phonetic pitch. Vowel lowering, which is initiated by the High tone, serves to increase the duration and sonority of the tone-bearing unit. Nevertheless, the question arises whether there are other prosodic differences between words in which H is aligned with pretonic vowels and words in which H is linked to the tonic vowels. Specifically, it is possible that the vowels associated with High tone could display the heightened values of F_0. There are indications in the literature pointing to the differences in pitch between words containing different vowel qualities in the tonic syllable. However, detailed instrumental measurements of the dialects in question are rare, and the descriptions are mostly based on impressionistic evidence.[22] In addition, the methodology of the existing acoustic studies does not allow to draw any definite conclusions.

Broch (1916) describes a fixed rising-falling LHL and the falling HL pitch contours in non-focal positions in dialects in the Mosal'sk region: 'the highest (rising) tone belongs to the syllable before the stressed one, while the stressed syllable itself is pronounced at a lower interval' (Broch, 1916: 46, cited after Bethin, 2006: 145). Kasatkina (2002) provides a fragmented acoustic characterisation of pitch contours in words carrying phrasal accent in the southern Russian dialect spoken in the Rjazan' region. Similarly, the pretonic syllable is reported to have a higher tone than the following stressed syllable. However, the data given in Kasatkina (2002) is insufficient to show whether there are differences in timing of the F_0 peak between words with low and non-low stressed vowels.[23]

[22] See Bethin (2006) for an overview of the available literature on F_0 in the East Slavic dialects.

[23] In the absence of acoustic measurements confirming the presence of rising pitch contours on the pretonic syllables, it might be objected that the positing of the phonological tonal distinction which is not realised as pitch contrast phonetically serves a purely diacritic purpose. However, the same problem arises in analyses accounting for the East Slavic reduction patterns in terms of dissimilation in quantity (Broch, 1916; Vojtovič, 1972a; Kasatkina, 1995; Crosswhite, 2001). For instance, an OT analysis developed by Crosswhite (2001) assumes an abstract distinction →

Kasatkin (2005: 25) states that the tonic vowel has lower pitch than the pretonic vowel [a], but does not comment on the pitch contour of the words with the vowel [ə] in the pretonic syllable. Based on the impressionistic observations of the pitch contours in the dialects with dissimilative reduction, Kasatkina (2005: 41) reports pitch contrasts which depend on the quality of the pretonic vowel: words containing pretonic [a] are realised with a high falling pitch on the pretonic vowel and a low pitch on the tonic vowel. Conversely, words with pretonic [ə] exhibit low rising pitch on the pretonic vowel and the rising or high pitch on the following tonic vowel.

These observations are only partially confirmed by the PRAAT-based acoustic analysis conducted by Savinov (2013b: 26-27), who provides descriptions of F_0 contours of single words (the word *drova* [drəˈva] 'wood' occurring in focus and non-focus position, and the words *Karanikov* [kaˈranʲikaf] 'proper name' and *ostavalisja* [astəˈvalʲisʲa] 'stay' (past pl.) in focus position). In non-focal context, the pitch on the pretonic [ə] is lower compared to the heightened pitch of the following stressed vowel. In focus positions, pretonic [ə] is characterised by a high pitch with a subsequent decrease on the following stressed syllable.

A preliminary examination of the pitch contours in the corpus of the southern Russian dialects (Sappok *et al.*, 2016) reveals that in the majority of cases, rising pitch occurs on the pretonic syllables in the words bearing phrasal accent, whereas pitch contrasts between tonic and pretonic syllables appear to be neutralised in non-nuclear positions.[24] Visual inspection of the pitch contours does not allow us to answer the question concerning the possible differences in the alignment of the F_0 peaks between words with low and non-low vowels under stress, and a detailed acoustic study of this phenomenon is left for future research. However, given the results of the acoustic investigations of other languages both with non-distinctive as well as with distinctive pitch, pitch contours are not likely to be detected in positions other than nuclear in the dialect database. For example, the results of an acoustic perceptual study conducted by Nakatani & Aston (1978)[25] demonstrate that pitch is not used as a stress cue in words occurring outside of focus positions in English, and listeners identify stressed syllables in such words on the basis of duration and vowel quality. So

in vocalic duration (zero mora *vs.* one mora *vs.* two moras) which does not express a lexical contrast and is employed simply to identify the locations of different types of neutralisations.

[24] The database is available at http://rureg.hs-bochum.de. It contains over around 12 hours of spontaneous speech samples collected from the speakers of the southern Russian dialects.

[25] Cited after Beckman (1986).

the pitch contrasts between MAma and maMA in the postnuclear position are overridden by the sentence intonational contours (see Beckman (1986: 61) for further discussion). Similarly, the distinctive contrast between two tone accents is neutralised in non-focal positions in the Franconian dialects of Roermond (Fournier, 2008) and Arzbach (Köhnlein, 2011). It may be the case then that an analogous mechanism is at work in the southern Russian dialects. Needless to say, a controlled phonetic study is needed to find out how pitch contrasts are realised in different contexts and how they interact with the intonational grammar above the word level.

4. Pretonic length dialects

4.1. Basic generalisations and previous studies

As mentioned earlier in Chapter 3, some East Slavic dialects exhibit an unusual type of prosodic structure with pretonic vowels exceeding in duration the following tonic vowels (Vojtovič, 1972a; Belaja, 1974; Bethin, 2006). In the south-eastern Belarusian dialects and in the north-eastern Ukrainian dialects, the non-high pretonic vowel is lengthened if the vowel in the tonic syllable is high or high mid, as illustrated in (28). In the Upper Snov Basin dialects, increased duration is accompanied by the neutralisation of non-high vowels (28b).

(28) *a. South-Eastern Belarusian dialect of Aŭciuki*[26]

i. *Long vowels*

sestru	[sʲɛːˈstru]	‘sister’ (acc. sg.)
hodoŭ	[ɣɔːˈdow]	‘year’ (gen. pl.)
bryhadziram	[briɨɣaːˈdziram]	‘crew chief’ (instr. sg.)

ii. *Short vowels*

sestra	[sʲɛˈstra]	‘sister’ (nom. sg.)
skazoŭ	[skaˈzɔw]	‘he said’
byki	[bɨˈkʲi]	‘bull’ (nom. pl.)

b. *Upper Snov Basin Ukrainian dialects*[27]

i. *Long vowels*

xodili	[xaːˈdʲilʲi]	‘they went’
kažu	[kaːˈžu]	‘I say’
pesku	[pʲɛːˈsku]	‘sand’ (nom. sg.)

[26] Data come from Vojtovič (1972a), Borise (2015).

[27] Examples are taken from Belaja (1974), Bethin (2006).

ii. *Short vowels*

kota	[kaˈta]	‘cat’ (gen. sg.)
voza	[ʋaˈza]	‘cart’ (gen. sg.)
pomolola	[pamaˈlɔla]	‘she ground up’

The presence of pretonic lengthening has been confirmed by instrumental studies. Belaja (1974) reports on the measurements of the duration of the pretonic [a] in the Upper Snov Basin dialects, where the duration of [a] exceeds in duration the following stressed high vowel. The examples provided in Belaja (1974: 26) show that the difference between the tonic and the pretonic vowels ranges from 100 ms to 160 ms (e.g. in *vozy* [vaːˈzɨ] ‘cart’ (nom. pl.). [a] = 240 ms and [ɨ] = 100 ms). For comparison, the pretonic vowel [a] is 190 ms shorter than the following stressed [a] in the word *kotjaka* [kaˈtʲaka] ‘cat’ (expr.).[28] Belaja’s results are consistent with the findings of a recent acoustic study conducted by Borise (2015) in the area where the Aŭciuki pattern has been attested in the past century.[29] The measurements of the vocalic duration in the pretonic and tonic positions reveal statistically significant differences in the duration of pretonic vowels. Non-high pretonic vowels are on average 28 ms longer than the high vowels in the tonic positions and 59,77 ms shorter than the following non-high tonic vowels (Borise, 2015: 5).[30]

Bethin (2006) suggests that pretonic lengthening is triggered by lexical tone (for details, see Chapter 3). However, the descriptions of pitch patterns of these dialects are inconclusive as to whether the increased duration is accompanied by contrastive pitch. In the older sources, the long pretonic vowels are reported to be pronounced with a rising-falling pitch in the Belarusian dialect of Aŭciuki (Vojtovič, 1972a: 22). In a recent acoustic study of the Aŭciuki dialect, Borise (2015) found no significant difference between the F_0 maxima of the vowels in the tonic and pretonic positions. The mean values amounted to 231,8 Hz *vs.* 230,0 Hz for pretonic and tonic vowels in pretonic length contexts (stressed high vowel), compared to 198 Hz *vs.* 203 Hz for vowels in words containing stressed non-high vowels.[31] Borise (2015) takes these facts to indicate

[28] Belaja (1974) provides raw measurements for individual items, recorded in the carrier sentences produced with different intonation patterns (declarative, interrogative, exclamative, listing).

[29] Compare the descriptions in Kryvicki (1959) and Vojtovič (1972a).

[30] The data was collected from three female speakers (aged 61, 80, 83). The analysis is based on the 75 tokens with pretonic vowels occurring in the contexts warranting pretonic lengthening (a low and a mid-low pretonic vowel and a high tonic vowel) and 25 tokens with two non-high vowels in the pretonic and tonic positions.

[31] In addition, vowels in the pretonic length contexts have been demonstrated to have higher intensity than the following stressed vowels.

that pretonic syllables lack a rising-falling pitch contour, and concludes that pretonic prominence in this dialect cannot be analysed in terms of phonological tone. Instead, it is suggested that the increased duration of the pretonic syllable serves to manifest stress, whose domain extends to two syllables (tonic and pretonic).

However, a growing body of experimental work shows that measurements of the maximum F_0 values cannot be reliably employed to differentiate between different pitch events (see Barnes *et al.* (2012) for references and discussion). For example, a perceived tonal contrast may arise from analogous F_0 maxima which are aligned differently relative to the segmental material. Experimental research also shows that an F_0 peak is perceived as lower in pitch than F_0 plateau with the same maximum F_0 values (’t Hart, 1991; D’Imperio, 2000; Barnes *et al.*, 2010, 2012; Niebuhr, 2007; Knight, 2008). Knight & Nolan (2006) further demonstrate that the alignment of the offset of F_0 plateau plays a key role in expressing contrast. It might be the case then that F_0 maxima in Borise’s measurements reflect plateaux on the pretonic vowels and peaks on the tonic vowels, in which case the former would be perceived as higher in pitch. Notably, Borise (2015: 6) reports a significant difference in mean pitch values between vowels occurring in different contexts: both pretonic and tonic vowels are around 30 Hz higher in the pretonic length contexts. This is shown in (29) below.

(29) *Mean vowel pitch in unmarked and pretonic prominence contexts (Borise 2015)*

	V_1	V_2
1. Unmarked	198,0 Hz (non-high vowels)	203,0 Hz (non-high vowels)
2. Pretonic length	231,8 Hz (non-high vowels)	230,0 Hz (high vowels)

Apparently, these results show the difference between the two contexts (unmarked *vs.* pretonic length), but no notable pitch contrast between V_1 and V_2 within the same condition (condition 1: 198 Hz *vs.* 203 Hz; condition 2: 231,8 Hz *vs.* 230,0 Hz). Let us note that in condition 2, pretonic vowels are non-high, while tonic vowels are high. It has been known for some time that vowel quality is related to fundamental frequency: higher vowels have higher intrinsic F_0 (Lehiste & Peterson, 1961; Hombert, 1977, 1978; and others). For example, Lehiste & Peterson (1961) demonstrate that in American English, [i] is about 20 Hz higher than [a] (183 Hz *vs.* 163 Hz). Given these facts, the non-high

vowel (V_1) in the pretonic length context is expected to be associated with a lower F_0 than the high vowel (V_2), so the comparable F_0 values indicate that the pretonic non-high vowel *is* in fact produced with an increased F_0. As seen in the unmarked condition (1), non-high vowels V_1 and V_2 both have a pitch of 200 Hz, which is around 30 Hz lower than the pitch maximum of the corresponding vowel in the pretonic length context. To conclude, Borise's findings do not provide sufficient evidence for excluding the presence of a tonal distinction in the Aŭciuki dialect.

A 'singsong' rising-falling or a rising-falling-rising pitch has been reported to occur in the Upper Snov Basin dialects (Belaja, 1974: 29). Based on the instrumental measurements, Belaja (1974) asserts that while pretonic [a] is associated with high fundamental frequency, high front vowels [i] and [ɨ] carry no tonal prominence. At the same time, pretonic [a] has lower F_0 than the following stressed high back [u] and the diphthongs [ie] and [uo]. This result is unexpected given that both back and front high vowel as well as high mid diphthongs induce lengthening of the vowel in the preceding syllable. In sum, the results of the Belaja's study do not fully support the generalisation that pretonic lengthening is accompanied by the heightened F_0 values.

However, the absence of distinctive pitch contrasts in pretonic length dialects does not imply that tone is not part of a phonological system of these dialects. Perception studies on the relationship between tones and tone-bearing units have amply demonstrated that segments with F_0 excursions are perceived as longer than otherwise identical segments produced with a level F_0 (Cumming, 2011; Lehiste, 1976; Lehnert-LeHouillier, 2007; Yu, 2010). Interestingly, Yu (2010) notes that the oppositions between rising and falling tones can develop into systems with contrastive vowel length. In the Weert dialect of Dutch, for instance, distinctions in vocalic duration correspond to tonal contrasts in the neighbouring dialect of Baexem (Heijmans, 2003). As shown in Table (30), reproduced from Heijmans (2003: 15), Weert long vowels correspond to the falling-rising pattern (Accent II) in Baexem, whereas short vowels correspond to a falling pitch contour (Accent I).

(30) *Average vowel durations in Weert and Baexem (in milliseconds) (Heijmans, 2003)*

Weert		*Baexem*		*gloss*
kni:n	220	kni:n^{II}	186	rabbit
knin	143	kni:n^{I}	177	rabbits
stɛin	273	ʃtɛin^{II}	254	stone
stæjn	192	ʃtɛin^{I}	219	stones

Given that dynamic F_0 increases perceived duration, the complex tonal contour of Accent II may have been reinterpreted as prolonged vocalic duration in the Weert dialect.[32] A parallel mechanism may be responsible for the evolution of pretonic length in East Slavic dialects, where the subjective increase in length provoked by the pitch contour has been reanalysed as an independent durational phenomenon. That is, the listeners probably misinterpreted the perceived lengthening effect of the contour tone as the actual duration of the tone-bearing units. In effect, pretonic lengthening took on the role previously assigned to a pitch contour. Increased duration, then, is functionally analogous to a pitch rise in that both express an underlying H tone.[33]

It has been argued in Chapter 3 that vocalic lowering ([a]-reduction) attested in various East Slavic dialects is also driven by a phonological tone which interacts directly with vocalic quality. However, though both [a]-reduction and lengthening have the same underlying source (H tone), the two phenomena stem from phonetically distinct mechanisms. Whereas lengthening is perceptually-driven, [a]-reduction is best explained in articulatory terms. There is a substantial body of evidence showing that rising tones are better expressed on longer vowels (Ohala & Ewan, 1973; Gandour, 1977; Zhang, 2002, 2004). Since low vowels are intrinsically longer, they make better carriers of tone than mid or high vowels. So, on the one hand, the listeners perceive increased duration of vowels associated with a pitch excursion, and, in response, lengthen pretonic vowels. On the other hand, the speakers lower the vowels so that they can better accommodate the tonal contour.

The present model differs from Bethin's (2006) analysis, which explains the interaction of tone with both vocalic quantity and quality in terms

[32] This and related phenomena are discussed in Yu (2010). For further discussion of the listener-based sound change, see Ohala (1981, *et seq*.), Blevins & Garrett (2004), Hansson (2008), and the work cited therein.

[33] This interpretation is consistent with the listener-based theory of sound change (Ohala, 1981, *et seq*.).

of articulatory adaptations to the requirements of the rising pitch contour (*cf.* Bethin, 2006: 139). However, as demonstrated in the remainder of this section, the recognition of an additional perceptually-based mechanism allows for a better understanding of a number of processes taking place in the East Slavic dialects.

In a typical case, either lengthening or lowering are attested within a given system.[34] The former is widespread in the Aŭciuki and Vladimir-Volga Basin dialects[35], while the latter occurs in the dialects with [a]-reduction. Curiously, the two processes co-occur in the Upper Snov Basin dialects. If pretonic lengthening and vowel lowering are generated by the same articulatory mechanism, whose primary purpose is to maximise vocalic duration, it is unclear why some systems employ them simultaneously. The co-existence of the two processes in the Upper Snov Basin dialects is straightforwardly accounted for on the view that lowering is an articulatory adaptation while lengthening is a perceptual response to the underlying tone.

More curiously, the Belarusian dialect of Aŭciuki discussed above has an optional process of [a]-reduction, which only occurs in contexts not warranting pretonic lengthening. This is illustrated by the data in (31), taken from (Vojtovič, 1972a: 22).[36]

(31) *Aŭciuki pretonic reduction and lengthening*

Nom.	[ˈstol]	[ˈkonʲ]	[raˈsa] ~ [rɔˈsa]	[ʊɔːˈlɨ]
Gen.	[staˈla] ~ [stɔˈla]	[kaˈnʲa] ~ [kɔˈnʲa]	[rɔːˈsɨ]	[ʊɔˈlɔw]
Dat.	[stɔːˈlu]	[kɔːˈnʲu]	[rɔːˈsʲe]	[ʊɔˈlɔm] ~ [ʊaˈlam]
Acc.	[ˈstol]	[ˈkonʲ]	[rɔːˈsu]	[ʊɔːˈlɨ] ~ [ʊɔˈlɔw]
Instr.	[staˈlɔm]	[kaˈnʲɔm] ~ [kɔˈnʲɔm]	[raˈsoi̯u]	[ʊaˈlamʲi]
Loc.	[stɔːˈlʲe]	[kɔːˈnʲu]	[rɔːˈsʲe]	[ʊaˈlax] ~ [ʊɔˈlɔx]
	‘table’	‘horse’	‘dew’	‘oxen’

[34] Interestingly, high vowels are immune to pretonic lengthening in the dialects in question. This fact invokes an obvious parallel with the [a]-reduction patterns where high vowels are not subject to neutralisation in pretonic positions. The symmetrical behaviour of high vowels in systems with [a]-reduction and pretonic length receives a natural explanation in the analysis assuming that both processes are triggered by phonological tone. The floating underlying High tone never docks on the high pretonic syllables due to the high-ranked *H/i,u. As a result, pretonic high vowels are low-toned, and, as such, do not require perceptual or articulatory adjustments in the form of lengthening and/or lowering.

[35] See Bethin (2006: 128-132) for further description of the Vladimir-Volga Basin dialects.

[36] These data come from Vojtovič’s (1972a) fieldwork conducted in the Aŭciuki dialect area. Vojtovič asked schoolchildren and adult speakers to inflect some nouns and verbs, as well as elicited these forms by asking prompting questions.

In stems with the underlying vowel //o//, the [ɔ] ~ [a] variation is attested before the endings beginning with non-high vowels, e.g. *konja* [kaˈnʲa] ~ [kɔˈnʲa] 'horse' (gen. sg.).[37,38] In some cases, only the reduced variant is attested, as in [staˈlɔm] 'table' (instr. sg.). Most importantly, no variation is possible before stressed high or mid high vowels, where only the lengthened mid vowel [ɔː] appears, e.g. *konju* [kɔːˈnʲu] id. (dat. sg.). The absence of a variant with a long [a], as in *[kaːˈnʲu], is surprising in view of the fact that the underlying [a] is regularly lengthened in words such as *travu* [traːˈʊu] 'grass' (acc. sg.), *cf. travoju* [traˈʊɔi̯u] id. (instr. sg.). Also, as [a] has intrinsically greater duration, one might expect variation between [ɔː] ~ [a] in the pretonic length contexts. However, the form *[kaˈnʲu] is not attested. The fact that [a]-reduction is blocked in words such as [kɔːˈnʲu] shows that it is not driven by the same force as lengthening. That is, if lengthening is used to render the vowel a better host of H tone, then one wouldn't expect it to conflict with lowering, which serves essentially the same purpose.

To conclude, the tone-driven processes attested in East Slavic dialects, pretonic vowel neutralisation and lengthening, are motivated by two phonetically distinct mechanisms. Specifically, we have argued that while vowel neutralisation is best accounted for in articulatory terms, pretonic lengthening is rooted in perception. Next section formalises this generalisation in terms of the OT analysis.

4.2. Aŭciuki pretonic lengthening and neutralisation: an OT analysis

It should be noted that, unlike the articulatory-based lowering, the perceptually-based lengthening is non-teleological in nature, and, thus, not readily amenable to analysis in terms of the output-oriented Optimality Theory. The listener-based adjustment of vowel length can be indirectly modelled in terms of a constraint forcing lengthening of the vowels which are associated with a tonal contour (Zhang, 2002; Gordon, 2006). Bethin (2006) argues that immediately pretonic syllables are linked to the LH contour in the East Slavic dialects exhibiting pretonic length. The following OT constraint, taken from Gordon

[37] The Aŭciuki dialect has an eight-vowel system [i-ɨ-u-e-o-ɛ-ɔ-a] under stress. In unstressed syllables, the vowels [e] and [o] reduce to [ɛ] and [ɔ], respectively.

[38] There is usually no variation before the stressed [ɔ]: the pretonic vowel is realised as an unreduced [ɔ] in this context due to the harmony for the feature [+round], which is characteristic of the South-eastern Belarusian dialectal area (Vajtovič, 1968; Vojtovič, 1972a).

(2006: 105), induces lengthening in systems in which the LH contour is present in the abstract representation.

(32) LH=Long: A contour tone is licensed by a rime with two syllabic timing slots.

LH=Long works in concert with the members of the *H/V family of constraints to generate the Aŭciuki pattern discussed above (illustrated in (28) and (31)). *H/V ensures that H tone is associated with the pretonic vowel when the vowel under stress is high, and LH=Long causes lengthening of the high-toned vowel. Given free rein, *H/V would cause lengthened mid vowels to lower. However, it was pointed out above that mid vowels in pretonic length contexts are exempt from [a]-reduction (see examples in (31) above). This can be modelled using the faithfulness constraint Ident[-low]. Ranked above *H/V, Ident[-low] blocks the lowering of mid vowels. The ranking of constraints generating pretonic lengthening is presented in Tableau (33), which shows the evaluation of the word stolu [stɔːˈlu] ‘table’ (dat. sg.).[39]

(33) *Aŭciuki pretonic lengthening*

H //stoˈlu//	LH=Long	Ident[-low]	*H/i,u	Head=H	*H/ɛ,ɔ	*H/a
⇒ a. stɔːˈlu (LH L)				*	*	
b. stɔˈlu (L HL)			*!			
c. stɔˈlu (LH L)	*!			*	*	
d. staːˈlu (LH L)		*!		*		*

It has been mentioned above that Aŭciuki lengthens pretonic vowels if the vowel under stress is high or mid high. Like the Obojan’ pattern of dissimilation, Aŭciuki disallows high and mid high vowels to host High tone, which is analysed by ranking Head=H just above *H/ɛ,ɔ. The comparison of candidates (33a) and (33b) shows that the latter loses because it links H to the high vowel [u] in the stressed syllable. The optimal candidate (33a) avoids the violation of

[39] Let us note that the underlyingly tense vowel //o// surfaces as the lax [ɔ]. This issue is addressed later in this section.

a high-ranked *H/i,u by associating H tone with a more sonorous segment in pretonic position. Candidate (33c) does not lengthen pretonic [ɔ], and, hence, is excluded by LH=LONG. Finally, the least marked candidate (33d) is eliminated due to the fatal violation of the faithfulness constraint IDENT[-low].

Turning now to the contexts which do not license pretonic lengthening, let us observe that here vowels show a variation between [a] and [ɔ], e.g. *stola* [staˈla] ~ [stɔˈla] 'table' (gen. sg.). Also, similarly to pretonic length contexts, the underlying distinction [o] – [ɔ] is neutralised in unstressed positions in favour of the lax vowel [ɔ].[40] It is important to note that the lowering of /o/ to [ɔ] or [a] is not motivated by tone, which docks on the stressed mid vowel [ɔ] in these cases. Mid vowels are prohibited from unstressed positions in many languages, e.g., Basque (Hualde, 1991), Bulgarian (Lehiste & Popov, 1970), Catalan (Recasens, 1991). Crosswhite (2001) interprets the reduction of mid vowels to peripheral segments [a], [i], [u] as a contrast-enhancing process which creates a maximally dispersed vowel system [i-u-a]. On this view, mid vowels are eliminated by the constraint License-Nonperipheral/Stress 'Nonperipheral vowels are licensed only in stressed positions' (Crosswhite, 2001: 24). While successfully dealing with the cases of [a]-reduction, as in *stol* [ˈstol] 'table' – *stolom* [staˈlɔm] id. (instr. sg.), this constraint obviously cannot generate the Aŭciuki o/ɔ neutralisation, e.g. *kon'* [ˈkonʲ] 'horse' (nom. sg.) – *konja* [kɔˈnʲa] id. (gen. sg.) – *konju* [kɔːˈnʲu] id. (dat. sg). To account for a similar lax/tense neutralisation attested in Slovene, Crosswhite introduces an additional constraint banning the feature [ATR] from unstressed (monomoraic) positions (Lic-[ATR]/μμ 'Feature specifications for [ATR] may only occur in association with bimoraicity).[41] Assuming that Aŭciuki stressed vowels are bimoraic, and that [o]/[ɔ] opposition is accountable for in terms of the [ATR] distinction, the constraint Lic-[ATR]/μμ can generate the reduction of //o// to [ɔ] in *konja* [kɔˈnʲa]. However, this analysis fails in cases such as *konju* [kɔːˈnʲu], where the deletion of the feature [ATR] befalls a long vowel.

The Aŭciuki data can be successfully dealt with in terms of an alternative model suggested by de Lacy (2006), who argues that mid vowels reduce to [a] not to optimise perceptual contrast, but to enhance prominence. This generalisation is captured by a set of markedness constraints which prohibit low-sonority vowels in syllable heads (see Section 3.2 above):

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[40] Similarly, the unstressed front mid vowel //e// is reduced to [ɛ], e.g. *dzed* [dzʲet] 'grandfather' – *dzedy* [dzʲɛˈdɨ] id. (nom. pl.) (Vojtovič, 1972a: 23).

[41] In Slovene, the tense/lax opposition is only maintained in long stressed vowels (Bidwell, 1969, cited in Crosswhite, 2001: 31).

(34) $*\Delta_{\sigma}\{\text{i,ʉ}\} >> *\Delta_{\sigma}\{\text{ə}\} >> *\Delta_{\sigma}\{\text{i,u}\} >> *\Delta_{\sigma}\{\text{e,o}\} >> *\Delta_{\sigma}\{\text{ɛ,ɔ}\} >> *\Delta_{\sigma}\{\text{a}\}$

On this view, both reduction to [ɔ] and to [a] are generated by the mechanism serving to increase the sonority of syllable heads. The switch from /o/ to [ɔ] is driven by $*\Delta_{\sigma}\{\text{e,o}\}$. A further, optional, change from [ɔ] to [a] is induced by $*\Delta_{\sigma}\{\text{ɛ,ɔ}\}$. Thus, this model provides a uniform account for the Aŭciuki reduction patterns.

It was pointed out earlier that the variation between [ɔ] and [a] is attested in positions not warranting pretonic lengthening, as in *stola* [staˈla] ~ [stɔˈla] 'table' (gen. sg.). Standard Optimality Theory deals with optionality by forfeiting the principle of a total ordering of constraints, as first defined by Prince & Smolensky (1993/2004), and assuming that some constraints may be unranked with respect to one another (Kiparsky, 1993; Reynolds, 1994; Anttila, 1997; *et seq.*). When two constraints are crucially unranked, either ranking is randomly chosen in the process of the input-output mapping. In order to model variation between [ɔ] and [a] attested in Aŭciuki, $*\Delta_{\sigma}\{\text{ɛ,ɔ}\}$ has to be unranked with respect to IDENT[-low]. In this setting, pretonic [a] surfaces if $*\Delta_{\sigma}\{\text{ɛ,ɔ}\}$ dominates IDENT[-low] (shown in (35i) below), while pretonic [ɔ] appears under the opposite ranking of the two constraints (35ii).

(35) *Aŭciuki pretonic reduction*

i. [a]-reduction: $*\Delta_{\sigma}\{\text{ɛ,ɔ}\}$ >> IDENT[-low]

//stoˈla//	$*\Delta_{\sigma}\{\text{e,o}\}$	$*\Delta_{\sigma}\{\text{ɛ,ɔ}\}$	IDENT[-low]
a. stɔˈla		*!	
⇒ b. staˈla			*
c. stoˈla	*!	*	
a. stɔːˈla		*!	

ii. [ɔ]-reduction: IDENT[-low] >> $*\Delta_{\sigma}\{\text{ɛ,ɔ}\}$

//stoˈla//	$*\Delta_{\sigma}\{\text{e,o}\}$	IDENT[-low]	$*\Delta_{\sigma}\{\text{ɛ,ɔ}\}$
⇒ a. stɔˈla			*
b. staˈla		*!	
c. stoˈla	*!		*

In its present form, this model predicts that the ranking $*\Delta_{\sigma}\{\varepsilon,ɔ\}$ >> IDENT[-low] producing [a]-reduction should also be randomly chosen in the pretonic length contexts. Thus, similarly to words such as *konjom* [kaˈnʲɔm] ~ [kɔˈnʲɔm] 'horse' (instr. sg.), lengthened vowels should also be subject to variation. Yet, the long vowel [ɔ:] does not undergo lowering, and *[kaːˈnʲu] is not an attested variant of *konju* [kɔːˈnʲu] 'horse' (dat. sg.). For some reason, the constraint $*\Delta_{\sigma}\{\varepsilon,ɔ\}$ driving [a]-reduction of short vowels does not induce the same change in long vowels. This problem is solved if we posit a structural distinction between the forms *konju* [kɔːˈnʲu] and *konjom* [kaˈnʲɔm] and assume that vowels in the pretonic length contexts, similarly to stressed vowels, are protected by positional faithfulness. In this scenario, syllables are parsed into an iambic foot in pretonic length contexts ($\sigma\text{ˈ}\sigma_{[+high]}$), as in $[(kɔːˈnʲu)_{FT}]$, and left unfooted elsewhere (in the $\sigma\text{ˈ}\sigma_{[-high]}$ contexts), e.g. $[ka(\text{ˈ}nʲɔm)_{FT}]$. Then, the identity of vowels in footed syllables is protected by a faithfulness constraint $\text{IDENT}[\text{-low}]_{F_T}$ ('In syllables parsed into feet, [-low] on a vowel in the input must be preserved on the corresponding vowel in the output'). The remaining vowels undergo neutralisation under the pressure of the markedness constraint $*\Delta_{\sigma}\{\varepsilon,ɔ\}$.

Then, the question arises why pretonic vowels are parsed into feet in the $(\sigma\text{ˈ}\sigma_{[+high]})_{FT}$ but not in the $\sigma(\text{ˈ}\sigma_{[-high]})_{FT}$ contexts. Let us recall that the two structures differ with respect to the realisation of the underlying tone: High tone is associated with the pretonic syllable if the stressed vowel is high, and to the tonic syllable if it contains a non-high vowel (Bethin, 2006). It was suggested earlier in this chapter that the placement of H tone with respect to the stressed syllable is regulated by the constraint ALIGN-L(H, FT) ('Every High tone should be aligned with the left edge of a foot'). We argued that High-ranked ALIGN-L(H, FT) generated a hybrid metric system with iambic footing when H tone was linked to the vowel in pretonic position, and trochaic footing when H was realised on the stressed vowel. Assuming the same type of the interaction between tone and foot structure is operative in Aŭciuki, the words *konju* [kɔːˈnʲu] 'horse' (dat. sg.) and *konjom* [kaˈnʲɔm] id. (instr.sg.) are prosodified as follows.

(36)

The structural difference in (36) allows us to explain the distinct behaviour of pretonic vowels in (36a) and (36b). Specifically, [a]-reduction in the former is driven by the constraint $*\Delta_{\sigma}\{\varepsilon,ɔ\}$ ('Incur a violation for every head of a syllable

that contains a segment with sonority less than or equal to {ɛ,ɔ}'), which dominates the generic faithfulness constraint IDENT[-low]. The effect of $*\Delta_{\sigma}\{\varepsilon,\mathrm{ɔ}\}$ is overridden in (36b), where the identity of the pretonic vowel is protected by a high-ranked $\text{IDENT[-low]}_{\text{FT}}$.

This analysis allows us to explain a phenomenon related to stress perception in Aŭciuki. Namely, it has been often remarked in the fieldwork descriptions that stress seems to shift leftward in words with a long pretonic syllable (Kryvicki, 1959; Belaja, 1974; Borise, 2015). This auditory impression has been reported both by researchers, as well as native speakers (Belaja, 1974: 29). Yet, it is not the case that stress has moved from its etymological position one syllable to the left in words showing pretonic length. Borise (2015) reports that native speakers point to the etymologically correct position when explicitly asked to assign stress. Also, vowels in etymologically stressed syllables never undergo vowel reduction, which indicates that they do occur in the metrically dominant position. So, on the one hand, both native speakers and non-native listeners perceive the leftward stress shift in words with pretonic length. On the other hand, native speakers' intuitions and the lack of vowel reduction indicate that stress remains in its original position. This ambiguous relationship between pretonic length and stress is accounted for in the present model, which assumes that the foot boundary shifts leftwards when H tone is expressed on the pretonic syllable (shown in (36b) above). The originally stressed syllable still occupies the head position within the foot, but the left boundary of the foot, associated with foot head in (36a), is aligned with the left edge of the pretonic syllable in (36b). On this view, the indeterminate status of the pretonic syllable with respect to stress can be assumed to arise from the exceptional footing of syllables in pretonic length contexts.

Let us note that the parsing of the word *konjom* [kaˈnʲɔm] 'horse' (instr. sg.) shown in (36) produces a monosyllabic foot. Monosyllabic feet are disallowed by the constraint Foot Binarity (FTBIN) ('Feet are binary at some level of analysis (μ, σ)', Prince and Smolensky 1993/2004). In order to generate the structure in (36a), Foot Binarity has to be outranked by ALIGN-L(H, FT). To recapitulate, the partial rankings responsible for the Aŭciuki pretonic reduction are as follows.

(37) *Aŭciuki*
a. ALIGN-L(H, FT) >> FTBIN
b. $\text{IDENT[-low]}_{\text{FT}}$ >> $*\Delta_{\sigma}\{\varepsilon,\mathrm{ɔ}\}$ >> IDENT[-low]

The ranking in (37a) ensures that H tone is always aligned with the left edge of the foot, irrespective of whether H docks on the tonic or the pretonic syllable, whereas the ranking in (37b) eliminates mid vowel from prosodically weak (unfooted) positions. The interaction of constraints generating the output forms of the words *stola* [staˈla] 'table' (gen. sg.) and *stolu* [stɔːˈlu] id. (dat. sg.) is illustrated in Tableaux (38).

(38) *Aŭciuki pretonic reduction*

H i. //stoˈla//	*H/i,u	HEAD=H	ALIGN-L (H, FT)	FTBIN	IDENT $[\text{-low}]_{\text{FT}}$	$*\Delta_{\sigma}\{\varepsilon,ɔ\}$	IDENT [-low]
LH L a. (stɔːˈla)		*!				*	
L HL b. stɔ(ˈla)				*		*!	
L HL ⇒ c. sta(ˈla)				*			*
L HL d. (stɔˈla)			*!			*	
H ii. //stoˈlu//	*H/i,u	HEAD=H	ALIGN-L (H, FT)	FTBIN	IDENT $[\text{-low}]_{\text{FT}}$	$*\Delta_{\sigma}\{\varepsilon,ɔ\}$	IDENT [-low]
LH L ⇒ a. (stɔːˈlu)		*				*	
L HL b. stɔ(ˈlu)	*!			*			
LH L c. (staːˈlu)		*			*!		*

The opposite ranking, FTBIN >> ALIGN-L(H, FT), produces a system with disyllabic iambic feet always comprising pretonic and the following tonic vowels. When combined with the reduction pattern generated by the constraints in (37b), the ranking FTBIN >> ALIGNL(H, FT) produces a system exhibiting [a]-reduction in all unstressed syllables except for the pretonic position. This ranking is shown in (39) below.

(39) *Incomplete okan'e dialects*
FTBIN >> ALIGN-L(H, FT)
IDENT[-low]$_{FT}$ >> *Δ_{σ}{ɛ,ɔ} >> IDENT[-low]

Such a pattern is attested in the Central Russian dialects with the so-called incomplete *okan'e*, in which unstressed vowels reduce to [a], whereas pretonic vowels retain their quality, e. g. *boroda* [barɔˈda] 'beard' (Kasatkin, 2005: 53). The Tableau in (40) illustrates the point.

(40) *Incomplete okan'e*

H //bɔrɔˈda//	FTBIN	ALIGN-L(H, FT)	IDENT[-low] FT	*Δ_{σ}{ɛ,ɔ}	IDENT[-low]
H ⇒ a. ba(rɔˈda)		*		*	*
H b. bara(ˈda)	*!				**
H c. bɔ(rɔˈda)		*		**!	
H d. ba(raˈda)		*	*!		**

The winning candidate (40a), unlike its contender in (40b), eschews the violation of FTBIN by parsing the lexically accented syllable together with the immediately preceding syllable into a right-headed foot. The faithful candidates (40c) violates *Δ_{σ}{ɛ,ɔ} twice because it contains two unstressed mid vowels. The constraint *Δ_{σ}{ɛ,ɔ} is satisfied by candidate (40d), which turns both unstressed vowels into [a], but by doing so incurs a fatal violation of the faithfulness constraint IDENT[-low]$_{FT.}$ Candidate (40a) comes out as optimal because it keeps the vowel in the pretonic (footed) syllable intact, only reducing the unfooted vowel in the initial syllable. This move allows to achieve a decrease in markedness at a minimal cost of violating the low-ranked IDENT[-low].

A slightly different ranking, with *Δ_{σ}{ɛ,ɔ} upgraded above faithfulness constraints (shown in (41) below), results in a pattern with vowels in all unstressed positions undergoing [a]-reduction. This type of neutralisation occurs

in the Ukrainian Upper Snov Basin dialects discussed in the preceding section, e.g. *boroda* [baraˈda] 'beard', *golosa* [ɣalaˈsa] 'voice' (nom. pl.) (Belaja, 1974: 22).

(41) *Upper Snov Basin dialects*
FTBIN >> ALIGN-L(H, FT)
$*\Delta_{\sigma}\{\varepsilon,ɔ\}$ >> IDENT[-low], $\text{IDENT[-low]}_{\text{FT}}$

The evaluation of the candidate forms in the Upper Snov Basin dialects is illustrated in Tableau (42).

(42) *Upper Snov Basin dialects*

H //bɔrɔˈda//	FTBIN	ALIGN-L(H, FT)	$*\Delta_{\sigma}\{\varepsilon,ɔ\}$	$\text{IDENT[-low]}_{\text{FT}}$	IDENT[-low]
H ⇒ a. ba(raˈda)		*		*	**
H b. ba(rɔˈda)		*	*!		*
H c. bara(ˈda)	*!				**
H d. bɔ(rɔˈda)		*	**!		

Let us recall that another vowel commonly attested in prosodically weak position is a schwa. We have previousely assumed that reduction to [ə] constitutes prominence reduction in prosodically recessive positions, driven by the constraint $*\text{-}\Delta_{\omega}\{i,u\}$ (formulated in Section 3 in Chapter 3). If $*\text{-}\Delta_{\omega}\{i,u\}$ and not $*\Delta_{\sigma}\{\varepsilon,ɔ\}$ occupies a dominant position in the constraint hierarchy, as shown in (43) below, then all unstressed vowels reduce to low sonority vowels, such as [ə]. This type of reduction is attested in the regional dialects spoken in the eastern and western Russia (Knjazev, 2000: 87).

(43) *Regional Russian*
$*\text{-}\Delta_{\omega}\{i,u\}$ >> IDENT[-low], $\text{IDENT[-low]}_{\text{FT}}$

The interaction of constraints generating reduction to [ə] in regional Russian is shown in Tableau (44).

(44) *Regional Russian*

H //bɔrɔˈda//	*-Δ_{ω}{i,u}	*Δ_{σ}{ɛ,ɔ}	IDENT[-low]$_{FT}$	IDENT[-low]
H ⇒ a. ba(raˈda)	**!		*	**
H d. bə(rəˈda)		**!	*	**

Finally, the ranking of *Δ_{σ}{ɛ,ɔ} and *-Δ_{ω}{i,u} below the faithfulness constraints generates a pattern without phonological reduction. Lack of phonological neutralisation in unstressed positions is a distinctive trait of most northern Russian dialects (Kuznecov, 1960; Avanesov, 1974), Southern Belarusian dialects (Vajtovič, 1968), as well as of standard Ukrainian (Ziłyński, 1932; Toc'ka, 1973).

Interestingly, stressed syllables both in Ukrainian as well as in the northern Russian dialects are characterised by prolonged duration. In northern Russian, the relative duration of the vowels in stressed and the preceding unstressed syllable is expressed by the proportion 45:55:100 (Vysotskij, 1973; cited from Požarickaja, 2005: 25-26). Similarly, recent instrumental measurements reveal that syllables carrying primary stress are on average 1.5 times longer than other syllables within a word in Ukrainian (Łukaszewicz & Mołczanow, to appear). It has been argued earlier that the main phonetic exponent of High tone in pretonic length dialects is duration. By the same token, one may speculate that the underlying High tone is responsible for the increased duration of the stressed syllables in northern Russian and in Ukrainian. Of course, this does not mean that duration always signals High tone. As High tone is always associated with the stressed syllable, it is not possible to determine whether the observed increase in duration expresses tone or stress (or both). However, as High tone has been postulated for other East Slavic languages as well as for some dialects (see Bethin (2006) for the East Slavic dialects with pretonic length, Dubina (2012) for standard Belarusian, Mołczanow (2015) for Moscow Russian), it is likely that increased duration attested in Ukrainian and in the northern dialects of Russian also reflects the underlying tone.

5. Conclusion

This chapter has looked at the pretonic alternations which are conditioned by the vowel quality of the following stressed syllable. It has been argued that these alternations are explicable in terms of phonological tone, which can be correlated with both segmental and suprasegmental properties. On the segmental level, H tone triggers lowering of pretonic vowels in dialects with dissimilative reduction. On the suprasegmental level, tone is associated with increased vocalic duration in pretonic length dialects.

There is a long-standing debate in the literature concerning the origin of dissimilative and non-dissimilative reduction, with numerous attempts made to determine which of the two processes emerged first in East Slavic. Beginning with Šaxmatov (1915), most Russian dialectologists (Durnovo, 1917; Avanesov, 1952; Gorškova & Xaburgaev, 1981; and others) considered dissimilative [a]-reduction to arise first, with non-dissimilative reduction constituting a further development consisting in the spread of [a] to all pretonic positions, irrespective of the quality of the vowel in the tonic syllable. Conversely, Kurylo (1928), van Wijk (1934/1935), Vaillant (1950), Čekmonas (1987) present a view that non-dissimilative [a]-reduction is an earlier development, which formed the basis for dissimilative reduction. In Vojtovič (1972a, 1972b), as well as in more recent studies of Kasatkin (1999) and Savinov (2013b) dissimilative reduction is assumed to represent a rhythmically-conditioned realisation of non-dissimilative [a]-reduction. That is, it is argued that dialects with dissimilative reduction are characterised by an alternation of short and long syllables, and the phonetic realisation of the low vowel [a] reflects the temporal differences between metrically strong and weak positions.[42] However, this account is problematic because, first, the alternation of strong and weak syllables constitutes the most widespread pattern cross-linguistically, whereas the dissimilation patterns attested in East Slavic dialects are typologically isolated. Second, attributing the cause of the vocalic alternations to the rhythmic structure does not explain why most dialects with dissimilative reduction limit the alternation to the disyllabic domain of the tonic and the immediately adjacent syllable.

In the present model, vocalic changes in quality and quantity are triggered by High tone, whose position is determined by the stressed syllable, so the absence of dissimilation in positions removed from main stress by more

[42] A similar idea underlies a recent model of vowel reduction in standard Russian developed by Iosad (2012).

than one syllable is the expected result. At the same time, this analysis does not preclude the existence of systems in which tonally-driven alternations co-occur with quantitative and qualitative changes resulting from the metrical footing. Such patterns are attested in dialects which contrast full and reduced vowels in the structures 1-2-3 and 2-1-3, e.g. *gospoda* [gəspaˈda] 'gentlemen', *podoždi* [pədaˈždi] 'wait' (imp.) *vs. bosikom* [basʲiˈkɔm] 'barefoot', *golubej* [galuˈbʲeɻ] 'dove' (gen. pl.) (see Avanesov & Orlova, 1965: 67).

Furthermore, the chicken-and-egg question as to which type of reduction (dissimilative or non-dissimilative) is 'primary' ontologically does not arise in the optimality-theoretic model, where both patterns are generated by means of the same set of constraints (Head=H, Align-L(H, Ft), and the members of the *H/V family). Specifically, nondissimilative [a]-reduction is the result of the ranking Head=H, Align-L(H, Ft) >> *H/V, whereas dissimilative patterns are generated by the opposite arrangement of these constraints: *H/a >> Head=H, Align-L(H, Ft). Both rankings are equally possible, so it is a matter of chance which one will be picked up by a given system. Moreover, it is predicted that the sound change can go in both directions: the promotion of Head=H above all members of the *H/a constraint family results in a switch from dissimilative to non-dissimilative reduction, whereas the demotion of Head=H leads to the emergence of various dissimilation patterns. In sum, H tone is the most important factor initiating both dissimilative and nondissimilative reduction, with the two patterns instantiating different types of the interaction of tone with metric and segmental structure.

In the next chapter, we look at several other patterns of dissimilative reduction where the quality of the pretonic vowel is determined by the vowel under stress. These systems exhibit a complex interplay between tone-driven neutralisations with intrasyllabic harmony in backness and height.

5. Harmonic systems

1. Introduction

In the previous chapter, we considered reduction patterns in which the quality of the pretonic vowel was determined by the sonority level of the vowel under stress (called Type I for the ease of reference). In addition, several other patterns of reduction are reported in the literature. Among these, four types (called Ščigry, Sudža, Mosal'sk, and Dmitrov) are described under the heading 'other dissimilative reduction patterns', and five further types (Novoselki, Kidusovo, Orexovo, Kultuki, and Bel'sk) are referred to as assimilative-dissimilative types of reduction (*cf.* Avanesov, 1974; Kasatkin, 2005; among others). These patterns share one common trait: in addition to dissimilation, as in Type I, they exhibit some kind of feature harmony between the vowel in pretonic position and the following stressed vowel. I argue in this chapter that these additional types arise as a result of the harmonic processes affecting vowels in pretonic positions. That is, they combine one of the Type I constraint rankings with assimilation in backness and/or height.

While systems showing backness harmony are quite common, e.g. Tuvan (Anderson & Harrison, 1999), Turkish (Clements & Sezer, 1982), Hungarian (Vago, 1973), Finnish (Kiparsky, 1973), harmony for the feature [+low] is rarely attested cross-linguistically (Rose & Walker, 2011). One example comes from the Bantu languages, where high vowels are lowered to [e] and [o] if the first vowel of the stem is non-high (Clements, 1991; Hulst & Weijer, 1995). However, as the low vowel //a// does not act as a trigger of the [low] harmony, it is a matter of debate whether the lowering operating in the Bantu languages involves the spread of the feature [low]. The present chapter describes several vocalic systems attested in the southern Russian dialects in which the vowels in pretonic syllables harmonise with the low vowel [a] in the tonic syllable. The East Slavic data described in this chapter enriches the typology of harmonic systems by bringing in uncontroversial cases of vowel harmony which can be straightforwardly interpreted as the assimilation of the feature [+low].

The structure of this chapter is as follows. First, Section 2 analyses patterns which show harmony for the feature [-back] (referred to as Type II).

Next, Section 3 discusses systems exhibiting assimilation of the feature [+low] (called Type III). The conclusions are presented in Section 4.

2. Backness harmony (Type II)

2.1. Basic facts

Let us recall that in Type I systems, [a] occurs before non-high vowels in Žizdra, before high vowels in Don, and before high and high mid vowels in Obojan'. Likewise, additional patterns of reduction, first recorded in Ščigry, Sudža, Mosal'sk and Dmitrov, use [a] before high vowels and [i] before back vowels. They are different from Type I in the quality of pretonic vowels before front mid vowels in stressed syllables: [i] appears instead of [a] either before [ɛ] (Ščigry), or before [ɛ] and [e] (Sudža, Mosal'sk and Dmitrov). In what follows, Ščigry, Sudža, Mosal'sk and Dmitrov will be called Type II patterns for ease of reference.

The Ščigry pattern is attested in the same area as the Obojan' pattern (Kursk, Belgorod, and Voronež regions) (Požarickaja, 2005: 64). The Dmitrov type has been reported to occur in the Kursk and Belgorod regions (Avanesov, 1974: 152). The Sudža type is commonly found in the large part of the Southern dialect area to the east of Brjansk and to the north of Belgorod, in the southern part of the Orel region, in most of the territory in the Kursk region, and in the south-eastern Belarus (the Gomel' region) (Vajtovič, 1968: 63; Požarickaja, 2005: 65). The Mosal'sk type is widespread in the eastern group of the Southern Russian dialect area (Kaluga region) and in the north-eastern parts of Belarus (the Vitebsk region) (Avanesov, 1974: 152; Vajtovič, 1968: 58ff.).[1] Some examples illustrating the reduction before mid vowels in the four patterns are provided below.

[1] Vajtovič (1968) calls this pattern the Vitebsk type of dissimilative [ja]-reduction.

(1) *Type II: Reduction before mid vowels in the tonic syllable*

Ščigry	*Dmitrov*	*Sudža*	*Mosal'sk*	*Gloss*
a. Before etymological /o/ in the tonic syllable				
[sʲaˈlo]	[sʲaˈlo]	[sʲaˈlɔ]	[sʲaˈlɔ]	*selo* 'village' (nom. sg.)
[sʲaˈstroi̯]	[sʲaˈstroi̯]	[sʲaˈstrɔi̯]	[sʲaˈstrɔi̯]	*sestroj* 'sister' (instr. sg.)
[rʲaˈkoi̯]	[rʲaˈkoi̯]	[rʲaˈkɔi̯]	[rʲaˈkɔi̯]	*rekoj* 'river' (instr. sg.)
[slʲaˈpovə]	[slʲaˈpovə]	[slʲaˈpɔvə]	[slʲaˈpɔvə]	*slepogo* 'blind' (masc. gen. sg.)
[pʲatˈno]	[pʲatˈno]	[pʲatˈnɔ]	[pʲatˈnɔ]	*pjatno* 'spot'
[rʲaˈbovə]	[rʲaˈbovə]	[rʲaˈbɔvə]	[rʲaˈbɔvə]	*rjabogo* 'pockmarked'
b. Before etymological /e/ in the tonic syllable				
[sʲaˈlʲe]	[sʲiˈlʲe]	[sʲiˈlʲɛ]	[sʲiˈlʲɛ]	*sele* 'village' (loc. sg.)
[vʲaˈlʲel]	[vʲiˈlʲel]	[vʲiˈlʲɛl]	[vʲiˈlʲɛl]	*velel* 'order' (masc. past)
[sʲtʲaˈnʲe]	[sʲtʲiˈnʲe]	[sʲtʲiˈnʲɛ]	[sʲtʲiˈnʲɛ]	*stene* 'wall' (loc. sg.)
[ɣlʲaˈdʲel]	[ɣlʲiˈdʲel]	[ɣlʲiˈdʲɛl]	[ɣlʲiˈdʲɛl]	*gljadel* 'look' (masc. past)
c. Before etymological /ɔ/ in the tonic syllable				
[sʲaˈlɔm]	[sʲiˈlɔm]	[sʲaˈlɔm]	[sʲaˈlɔm]	*selom* 'village' (instr. sg.)
[zʲarˈnɔm]	[zʲirˈnɔm]	[zʲarˈnɔm]	[zʲarˈnɔm]	*zernom* 'grain' (instr. sg.)
[slʲaˈpoi̯]	[slʲiˈpoi̯]	[slʲaˈpɔi̯]	[slʲaˈpɔi̯]	*slepoj* 'blind' (masc. nom. sg.)
[lʲaˈsɔk]	[lʲiˈsɔk]	[lʲaˈsɔk]	[lʲaˈsɔk]	*lesok* 'forest' (dim.)
[pʲatˈnɔm]	[pʲitˈnɔm]	[pʲatˈnɔm]	[pʲatˈnɔm]	*pjatnom* 'spot' (instr. sg.)
[rʲaˈbɔi̯]	[rʲiˈbɔi̯]	[rʲaˈbɔi̯]	[rʲaˈbɔi̯]	*rjaboj* 'pockmarked'
d. Before etymological /ɛ/ in the tonic syllable				
[dʲiˈrʲɛvnʲə]	[dʲiˈrʲɛvnʲə]	[dʲiˈrʲɛvnʲə]	[dʲiˈrʲɛvnʲə]	*derevne* 'village' (loc. sg.)
[vʲiˈsʲɔləi̯]	[vʲiˈsʲɔləi̯]	[vʲiˈsʲɔləi̯]	[vʲaˈsʲɔləi̯]	*vesjolyj* 'merry'
[nʲiˈsʲɔm]	[nʲiˈsʲɔm]	[nʲiˈsʲɔm]	[nʲaˈsʲɔm]	*nesjom* 'carry' (1st pl. pres.)
[nəprʲiˈdʲɔm]	[nəprʲiˈdʲɔm]	[nəprʲiˈdʲɔm]	[nəprʲaˈdʲɔm]	*naprjadjom* 'spin' (1st pl. future)

The four patterns are schematically represented in (2). The mechanism at work in the four systems is the same as the one operating in Type I dissimilation

patterns: [a] is pronounced in the pretonic syllable if the stressed syllable contains high vowels and [i] is found before a low vowel in the next syllable in all these dialects. As to the mid vowels in stressed positions, a distinction is drawn between back and front vowels, as illustrated in the examples in (1). The vowel [a] is found before both back mid vowels [o] and [ɔ] in Ščigry and Sudža/Mosal'sk, which makes this type of dissimilation similar to the one found in Žizdra. In Dmitrov, only half-open [ɔ] induces reduction to [i], while half-close [o] is preceded by [a], as in the Obojan' type of dissimilation. Sudža and Mosal'sk differ in terms of their treatment of the stressed [ɔ] after soft consonants, which originally comes from //ɛ//. In Mosal'sk, [a] is found before both the underlying and derived [ɔ], while in Sudža, like in Ščigry, [a] is pronounced before the underlying [ɔ], and [i] is pronounced before [ɔ] which comes from //ɛ//.

(2) *Dissimilative vowel reduction after soft consonants: Type II*

a. Ščigry

pretonic	tonic		
a	i	ɨ	u
	e		o
i	ɛ, ɔ (> ɛ)		ɔ
			a

b. Dmitrov

pretonic	tonic		
a	i	ɨ	u
	e		o
i	ɛ		ɔ
			a

c. Sudža

pretonic	tonic		
a	i	ɨ	u
i	ɛ, ɔ (> ɛ)		ɔ
			a

d. Mosal'sk

pretonic	tonic		
a	i	ɨ	u
i	ɛ		ɔ
			a

2.2. Analysis

I propose that Type II patterns constitute a combination of dissimilative reduction (as in Type I) with assimilation in backness between vowels in two neighbouring syllables. It has often been noted in the literature that both Standard Russian as well as many East Slavic dialects exhibit various patterns of vowel harmony (Paufošima, 1981; Paufošima, 1983; Kasatkina, 1996a). Kasatkina (1996a) demonstrates that Russian dialects show different degrees of

assimilation in height both between tonic and pretonic syllables, as well as in positions not immediately preceding tonic syllables. Furthermore, Kasatkin (1999) argues that in the Northern dialects of Russian, the alternations ɛ – *i* and *a* – ɛ, e.g. *bɛ̲lyj* [ɛ] 'white' – *bi̲lenkij* [i] id. (dim.), *gla̲nu* [a] 'look' (1st pers. sg. pres.) – *glɛ̲net* [ɛ] id. (3rd pers. sg. future), which are traditionally assumed to be triggered by the following palatalised consonant, are in fact conditioned by the front vowel in the adjacent syllable. The argument is based, among others, on the fact that these alternations are attested in dialects which do not exhibit a contrast between soft and hard consonants (*cf.* Kasatkin, 1999: 398ff.) I assume that a similar mechanism is at work in Type II reduction patterns, where pretonic non-high vowels neutralise into [i] instead of the expected [a] if the following stressed syllable contains a front vowel.

Long-distance feature assimilations are widely attested cross-linguistically, and vowels in stressed syllables often act as triggers of harmony. For instance, pretonic vowels assimilate in height to a stressed high vowel in Servigliano Italian (Walker, 2005). The fact that unstressed vowels are more likely to harmonise with the adjacent vowel has been taken to indicate that these harmony patterns have an articulatory basis (Majors, 1998; see Rose & Walker (2011) for further discussion). The present data is compatible with several theoretical options which are employed in the optimality theoretic literature to enforce vowel harmony. These include feature alignment (e.g., Kirchner, 1993; Pulleyblank, 1996), feature agreement (e.g., Lombardi, 1999; Baković, 2000), and spreading (e.g., Walker, 2000; Padgett, 2002).[2] However, Padgett (2002) points out that alignment incorporates directionality in the statement of constraints, while in most cases of harmony, the trigger occurs in the salient position. Therefore, the direction of spreading can be derived from independent factors, such as positional faithfulness. In the case of the East Slavic dialects, the unstressed vowels assimilate to the following stressed vowels. As the identity of the stressed vowels is protected by the positional faithfulness constraints, only unstressed vowels are targets of harmony. Let us note that the choice between agreement and spreading is not crucial from the perspective of harmonic patterns attested in East Slavic. Following Lombardi (1999), Baković (2000), and others, I assume that vowel harmony is driven by the agreement constraints mandating featural identity between adjacent vowels. In the Type II neutralisation patterns, pretonic and the following tonic vowels are required to

[2] See (McCarthy, 2011; Rose & Walker, 2011) for a review and criticism of different OT approaches to vowel harmony.

agree in the feature [-back]. To ensure that vowels in other unstressed positions are not targeted by [-back] harmony, I assume that the agreement constraint in (3) below operates within the foot domain.

(3) AGREE-VV[-back]$_{FT}$: vowels in a foot have the same value for [-back].[3]

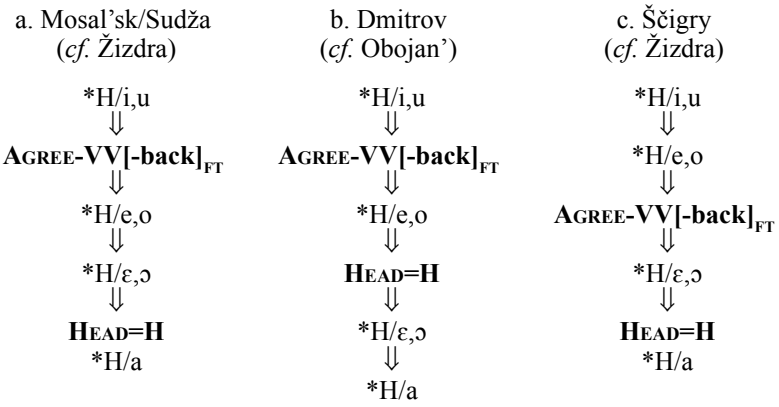
Returning to Type II reduction patterns attested in East Slavic, these systems combine assimilation in the feature [-back] with Type I patterns of dissimilative reduction. The type of dissimilation in Ščigry, Sudža and Mosal'sk is analogous to the one found in Žizdra, while Dmitrov is similar to the Obojan' pattern. Therefore, it can be assumed that the ranking of HEAD=H with respect to the members of the *H/V family of constraints in these dialects is the same as the ones established in Chapter 4 (Section 2.2) for Žizdra and Obojan'. The innovation of Type II reduction patterns consists in promoting AGREE-VV[-back]$_{FT}$ to such a position in the constraint hierarchy, where it can override the pressure exerted by *H/V. (See the ranking scheme in (4) below.) To be able to induce fronting (and subsequent raising), AGREE-VV[-back]$_{FT}$ has to be ranked above the constraint demanding that stressed vowels carry High tone (HEAD=H). In addition, AGREE-VV[-back]$_{FT}$ must dominate at least one of the members of the *H/V family to ensure that it is more important to agree in the feature [back] with the following vowel than to realise High tone on a more sonorous vowel. There are two locations in the constraint hierarchy at which AGREE-VV[-back]$_{FT}$ can be ranked above HEAD=H in the Žizdra pattern (shown in (4a) and (4c) below), and one place to rank it above both HEAD=H and one of the *H/V constraints in the Obojan' pattern (4b). As demonstrated in (4) below, all these options are exploited by the dialects with Type II reduction patterns.[4]

The tableaux in (5) illustrate how the constraint system established in (4) generates reduction in Mosal'sk. The words *selit'* [sʲaˈlʲitʲ] 'to settle', *selom* [sʲaˈlɔm] 'village' (instr. sg.), *sela* [sʲiˈla] id. (gen. sg.), and the relevant part of the word *selenij* [sʲiˈlʲɛ] 'settlement' (gen. pl.) serve as diagnostic forms. Only a subset of possible output candidates is shown for compactness.

[3] At first sight, it seems that Type II pattern of reduction could result from the assimilation in the feature [+back]. However, such an analysis does not work because the constraint AGREE-VV[+back] would incorrectly block [i]-reduction before the low vowel [a].

[4] Let us note that AGREE-VV[-back]$_{FT}$ does not combine with the Don pattern. In this type of dissimilation, the only possibility to rank AGREE-VV[-back]$_{FT}$ above Head=H and above one of the *H/V constraints dominating Head=H would be to place it above *H/i,u. This would produce an unattested system in which [i] appears before front mid and high vowels, as well as before the low vowel [a]. The pretonic vowel [a], in turn, would surface only before the back vowels [ɨ] and [u]. However, such a pattern is arbitrary as it shows neither dissimilation (because [i] is found before both low and high vowels) nor the assimilation in backness (because [i] can be followed by both front and back vowels).

(4) *Dissimilation patterns after soft consonants: Type I*



(5) *Dissimilative [ja]-reduction: Mosal'sk*

H i. //sʲɛˈl+itʲ// *selit'*	*H/i,u	AGREE-VV [-back]FT	*H/ɛ,ɔ	*H/a	Head=H
H b. sʲiˈlʲɪtʲ	*!				
H ⇒ b. sʲaˈlʲitʲ		*		*	*
H ii. //sʲɛˈl+ɛ// *selenij*	*H/i,u	AGREE-VV [-back]FT	*H/ɛ,ɔ	*H/a	Head=H
H ⇒ a. sʲiˈlʲɛ			*		
H b. sʲaˈlʲɛ		*!		*	*
H iii. //sʲɛˈl+ɔm// *selom*	*H/i,u	AGREE-VV [-back]FT	*H/ɛ,ɔ	*H/a	HEAD=H
H a. sʲiˈlɔm			*!		
H ⇒ b. sʲaˈlɔm				*	*
H iv. //sʲɛˈl+a// *sela*	*H/i,u	AGREE-VV [-back]FT	*H/ɛ,ɔ	*H/a	Head=H
H ⇒ a. sʲiˈla				*	
H b. sʲaˈla				*	*!

AGREE-VV[-back]$_{FT}$ is unable to force [i]-reduction in *selit'* [sʲaˈlʲitʲ] (5i) due to a higher-ranked *H/i,u, which prohibits the association of High tone with high vowels. Both *selenij* [sʲiˈlʲɛ] (5ii) and *selom* [sʲaˈlɔm] (5iii) contain mid vowels in the tonic syllable. In (5ii), the comparison of the winning candidate (5iia) with the less optimal contender (5iib) shows how AGREE-VV[-back]$_{FT}$ triggers reduction to [i] in *selenij* [sʲiˈlʲɛ]. In contrast, AGREEVV[back]$_{FT}$ is mute in *selom* [sʲaˈlɔm] (5iii) because it has a back vowel in the tonic syllable.

The Dmitrov pattern parallels Mosal'sk in ranking AGREE-VV[-back]$_{FT}$ immediately below *H/i,u. This ranking ensures that pretonic vowels assimilate in the feature [-back] to the following mid front vowels but not to the high front vowels. Unlike Mosal'sk, Dmitrov distinguishes between high mid and low mid back vowels, which induce distinct reduction patterns in the pretonic syllable: [a] surfaces before [o] and [i] before [ɔ] in the stressed syllable. This is achieved by ranking Head=H above *H/ɛ,ɔ and below *H/e,o. Tableaux in (6) below show that the input vowel //ɛ// maps onto the vowel [a] in (6i) due to the high-ranked *H/e,o, which gives preference to the form [sʲaˈlo] (6iib). *H/e,o is mute in (6ii), so the optimal output [sʲiˈl ɔm] is chosen by HEAD=H.

(6) *Dissimilative [ja]-reduction: Dmitrov*

H i. //sʲɛˈl+o// *selo*	*H/i,u	AGREE-VV [-back]$_{FT}$	*H/e,o	HEAD=H	*H/ɛ,ɔ	*H/a
H a. sʲiˈlo			*!			
H ⇒ b. sʲaˈlo				*		*
H ii. //sʲɛˈl+ɔm// *selom*	*H/i,u	AGREE-VV [-back]$_{FT}$	*H/e,o	HEAD=H	*H/ɛ,ɔ	*H/a
H ⇒ a. sʲiˈlɔm					*	
H b. sʲaˈlɔm				*!		*

To summarise briefly, the assimilation in the feature [-back] in Dmitrov, Sudža and Mosal'sk is induced by front mid vowels but not by the front high vowel [i]. These patterns have been analysed by sandwiching AGREE-VV[-back]$_{FT}$

between *H/i,u and *H/e,o, which ensures that only mid vowels act as triggers of assimilation in these dialects.

A one-step demotion of the constraint AGREE-VV[-back]$_{FT}$ produces a different pattern of reduction, attested in Ščigry (see the ranking scheme in (4c). As shown in Tableaux (7) below, the two input forms (7i) and (7ii) containing stressed mid vowels trigger two different reduction patterns: [sʲiˈlʲɛ] and [sʲaˈlɔm]. The [i]-reduction in the former is driven by the constraint AGREE-VV[-BACK]. In (7i), candidates (7ia) and (7ic) both satisfy AGREE-VV[-back]$_{FT}$ and violate *H/ɛ,ɔ and *H/a. The tie is resolved by AGREE[+high], which favours candidate (7ia), in which a palatalised consonant is followed by a high vowel. AGREE-VV[-back]$_{FT}$ is mute in (7ii), so *H/ɛ,ɔ chooses the candidate with [a]-reduction.

(7) *Dissimilative [ja]-reduction: Ščigry*

H i. //sʲɛˈl+ɛ// *selenij*	*H/i,u	*H/e,o	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	*H/a	HEAD=H	AGREE [+high]
H ⇒ a. sʲiˈlʲɛ				*			
H b. sʲaˈlʲɛ			*!		*	*	*
H c. sʲɛˈlʲɛ				*			*!
H ii. //sʲɛˈl+ɔm// *selom*	*H/i,u	*H/e,o	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	*H/a	HEAD=H	AGREE [+high]
H ⇒ a. sʲaˈlɔm					*	*	*
H b. sʲiˈlɔm				*!			

The constraint system established so far ensures that High tone is shifted leftwards whenever the vowel in the stressed syllable is non-low. A pretonic vowel linked to High tone lowers to [a] because High tone is better expressed on the more sonorous low segments. However, the vowel [a] is back, so [a]-reduction creates a marked structure in forms with a front vowel in the tonic syllable. In the case of the tonic [ɛ] (as in (7i) above), AGREE-VV[-back]$_{FT}$ ranked above *H/ɛ,ɔ prevents High tone from moving to the pretonic syllable. As AGREE-VV[back]$_{FT}$ is ranked below *H/e,o, High tone shifts to the pretonic

vowel when the stressed syllable contains [e] (see candidate (8a) in Tableau (8) below. However, the comparison of candidates (8b) and (8c) demonstrates that the ranking AGREE-VV[-back]$_{FT}$ >> *H/ɛ,ɔ prefers candidate (8c) because, unlike the intended winner (8b), it complies with AGREEVV[back]$_{FT}$.

(8) *Dissimilative [ja]-reduction: Ščigry*

H //sʲɛˈlʲ+e// *sele*	*H/i,u	*H/e,o	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	*H/a	HEAD=H	AGREE [+high]
H a. sʲiˈlʲe		*!					
H ☹ b. sʲaˈlʲe			*!		*	*	*
H ⇐ c. sʲɛˈlʲe				*		*	*

Thus, the present analysis predicts that the pretonic vowel should surface as [ɛ] before front high and/or high mid vowels, and as [a] before the corresponding back vowels. This prediction applies to Ščigry, which distinguishes between the underlying vowels //e// and //ɛ//, but not to Mosal'sk, Dmitrov and Sudža. These patterns lack the underlying //e// because they neither preserve the surface contrast between [e] and [ɛ] nor exhibit differences in reduction patterns depending on the etymological origin of [ɛ] (i.e., [ɛ] > //e// and [ɛ] > //ɛ//). Interestingly, traditional grammars report that a pretonic vowel preceded by a soft consonant can be realised phonetically by a range of sounds (Durnovo, 1917; Avanesov, 1974; Kasatkin, 1999; Kalenčuk & Kasatkina, 2013). On the one hand, Durnovo (1917) and Avanesov (1974) classify pretonic vowels into *a* and *non-a*: the former appears before high vowels and the latter before low vowels in the following stressed syllable. Non-*a* is reported to be realised by sounds placed on a continuum between [ɛ] and [i]. Kasatkin (1999, 2005), on the other hand, demonstrates that *a* can surface as a sound whose quality ranges from [a] to [ɛ], and argues that it is more appropriate to classify pretonic vowels into *i* and non-*i*, the latter represented by the variants [a] and [ɛ]. The OT model of dissimilative reduction developed in this book is consistent with Kasatkin's (1999b, 2005) classification of pretonic vowels into *i* and non-*i*. However, the present analysis predicts that the choice between [a] and [ɛ] in the Ščigry pattern should not be random: [a] should occur before back vowels, and [ɛ] should be used before front vowels in the tonic syllable. Impressionistic descriptions available in the literature are not sufficient and further instrumental studies are

needed to validate this assumption. However, the data from dialects with the Obojan' pattern of [a]-reduction provide support to the analysis predicting that the variation between [a] and [ɛ] is conditioned by the vowel in the following syllable. Kasatkina & Ščigel' (1995) report that pretonic //a// and //o// are realised as the front vowel [æ] before [ɛ] in the next syllable, for example *otec* [æˈtʲɛc] 'father' (Kasatkina & Ščigel', 1995; Savinov, 2013a). Therefore, it is likely that a similar co-articulation effect occurs in Ščigry, where //a// is fronted to [ɛ] or [æ] in the context of the following front vowel.

It was mentioned above that the Sudža pattern is minimally different from Mosal'sk in the way it treats the stressed vowel [ɔ] which originally comes from //ɛ//. In Mosal'sk, [a] is attested before both underlying and derived [ɔ], while in Sudža, [a] is found before the underlying //ɔ//, while [i] occurs before [ɔ] which is historically derived from //ɛ//. The same pattern of pretonic reduction before the vowel [ɔ] is found in Ščigry. As shown in (9) below, the system of constraints established so far predicts that words like *seljodka* //sʲɛˈlʲɔd+k+a// 'herring' should surface with the pretonic [a] in dialects which rank HEAD=H below *H/ɛ,ɔ and, therefore, disallow vowels [ɛ] and [ɔ] to carry High tone.

(9) *i. Mosal'sk*

H //sʲɛˈlʲɔd+k+a//	*H/i,u	AGREE-VV [-back]$_{FT}$	*H/e,o	*H/ɛ,ɔ	*H/a	HEAD=H
H a. sʲiˈlʲɔtkə				*!		
H ⇒ b. sʲaˈlʲɔtkə					*	*

ii. Sudža/Ščigry

H //sʲɛˈlʲɔd+k+a//	*H/i,u	*H/e,o	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	*H/a	HEAD=H
H ☹ a. sʲiˈlʲɔtkə				*!		
H ⇐ b. sʲaˈlʲɔtkə					*	*

The constraint *H/ɛ,ɔ outranks HEAD=H in Sudža, Mosal'sk and Ščigry.[5] However, only Mosal'sk reduces a pretonic vowel to [a], e.g. *seljodka* [sʲaˈlʲɔtkə], while Sudža and Ščigry have [i] in this position, e.g. [sʲiˈlʲɔtka]. One way to generate the correct output for Sudža and Ščigry would be to re-rank HEAD=H above *H/ɛ,ɔ. This, however, would produce a completely different type of dissimilation (the Obojan' type), incorrectly generating reduction to [i] before hard consonants, *[sʲiˈlɔm] instead of *[sʲaˈlɔm].

Alternatively, it can be assumed that [i]-reduction is not triggered by the front vowel in the stressed syllable but by the following soft consonant. This generalisation lies at the core of the OT analysis of dissimilative [ja]-reduction suggested by Crosswhite (2001), who generates the change to [i] by means of the markedness constraint Cʲ_Cʲ/[+front] ('A vowel may not occur between two palatalised consonants unless it is [+front]', Crosswhite, 2001: 93). In Sudža and Ščigry, high-ranked Cʲ_Cʲ/[+front] correctly generates [i]-reduction both before the front mid vowel [ɛ], as in *sele* [sʲiˈlʲɛ], as well as before the back vowel [ɔ], e.g. *seljodka* [sʲiˈlʲɔtka]. However, this analysis is problematic for several reasons.

First, the model deriving [i]-reduction by means of the constraint Cʲ_Cʲ/[+front] fails to account for the Mosal'sk pattern of reduction, which is similar to Sudža, except for the lack of [i]-reduction before the stressed [o] preceded by a soft consonant in words such as *seljodka* [sʲaˈlʲɔtka]. Cʲ_Cʲ/[+front] incorrectly triggers [i]-reduction in such cases: *[sʲiˈlʲɔtka]. Crosswhite (2001) acknowledges this problem and, based on the comment of Avanesov & Bromlej (1986: 103) that the Mosal'sk pattern is rarely attested, suggests that this pattern 'results from morphological re-interpretation of the dissimilative pattern, or from dialect mixing' (Crosswhite, 2001: 70).[6] For this reason, the Mosal'sk pattern is excluded from the analysis (*cf.* Crosswhite, 2001: 97). However, Avanesov & Bromlej (1986) only describe the Russian dialects, whereas the Mosal'sk type is widespread in the East Slavic dialects spoken in Belarus (Vajtovič, 1968: 58ff.). Therefore, the exclusion of the Mosal'sk pattern on the grounds of its rare attestation is not warranted.

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[5] In Dmitrov, the vowels [ɛ] and [ɔ] preserve the high tone due to the ranking HEAD=H >> *H/ɛ,ɔ, which correctly derives pretonic reduction to [i] in this dialect.

[6] The description of the Mosal'sk pattern provided by Crosswhite (2001: 70) incorrectly suggests that pretonic vowels reduce to [i] before the hard consonant followed by the stressed vowel [ɔ]: [sʲiˈlɔm] 'village' (instr. sg.). This is, clearly, not what one would expect if the [i]-reduction was triggered by the soft consonant. However, the descriptive sources uniformly report that pretonic vowels neutralise in [a] in this context, as in [sʲaˈlɔm] 'village' (instr. sg.) (*cf.* Avanesov & Orlova, 1965: 51; Kasatkin, 2005: 45; and others).

Another unwelcome consequence of Crosswhite's analysis is that the constraint $C^j\_C^j$ /[+front] does not generate correct outputs in forms with a palatalised consonant followed by a high mid back vowel [o] in the stressed syllable. In Sudža, for instance, $C^j\_C^j$/[+front] produces forms [C^jiC^je], [C^jiC^jɛ], [C^jiC^jɔ] and [C^jiC^jo], the first three of which are attested. The fourth one, [C^jiC^jo], is predicted to be possible but unattested because [o] 'does not occur after C^j' (Crosswhite, 2001: 69). Though true in a historical sense, this generalisation is not valid synchronically, as [o] appears in the place of etymological [ɛ] after soft consonants due to analogy in a number of words (Avanesov, 1974: 217ff.). For instance, *detę* [ɛ] 'child' has changed into *detjo* [o] by analogy to words such as *selo* [o] 'village', preserving palatalization of the consonant [t^j]. Avanesov (1974: 217) reports that in systems with archaic types of dissimilation, such as Obojan' and Dmitrov, the non-etymological [o] occurring after soft consonants functions similarly to the etymological one in that it fails to induce [i]-reduction, for instance *plečom* [pl^jaˈč^{j}om] 'shoulder' (instr. sg.), *bel'jo* [b^jaˈl^jjo] 'linen' (nom. sg.) (see also Zaxarova, 1959). These forms are contrasted with words such as *pleče* [pl^jiˈč^{j}e] 'shoulder' (dat. sg.), *bel'e* [b^jiˈl^jje] 'linen' (dat. sg.), in which [e], the front counterpart of [o], triggers [i]-reduction in the pretonic syllable. In Crosswhite's model, both *plečom* [pl^jaˈč^{j}om] and *pleče* [pl^jiˈč^{j}e] come within the purview of $C^j\_C^j$/[+front], which incorrectly derives [i]-reduction in *plečom* *[pl^jiˈč^{j}om]. The Sudža pattern is more complicated in that it does not distinguish between [o] and [ɔ] phonetically – both are pronounced [ɔ]. However, the two vowels are distinct phonologically as they trigger two different reduction patterns: [ɔ] (>o) induces [a]-reduction and [ɔ] (>ɔ) triggers [i]-reduction, *cf. vedjom* [v^jiˈd^jɔm] *vs. medvedjom* [m^ji$d^j$$v^j$aˈ$d^j$ɔm] (Avanesov, 1974: 218). The constraint $C^j\_C^j$ /[+front] does not distinguish between the two contexts, incorrectly generating [i]-reduction in *medvedjom* *[m^ji$d^j$$v^j$iˈ$d^j$ɔm].

Next, the analysis locating the trigger of dissimilative [ja]-reduction solely in the palatalised consonant makes wrong predictions for words with the pretonic vowel followed by consonantal clusters. First, this model generates incorrect reduction pattern in pretonic positions before a cluster of a soft consonant followed by a hard consonant. In the Dmitrov type of dissimilation (repeated in (10) below), [i]-reduction occurs before the stressed high mid front vowel [e] but not before its back correspondent [o].

(10) *Dmitrov reduction pattern*

pretonic	tonic	
a	i ɨ	u
	e	o
i	ɛ	ɔ
		a

According to Crosswhite (2001: 98), C^{j}_C^{j}/[+front] is assumed to be mute when the pretonic vowel is followed by the stressed [o], because [o] does not occur after soft consonants. However, there are words in which stressed [o] is preceded by a cluster of a soft plus a hard consonant, e.g. *sjal'co* 'a small village'. If [i]-reduction is triggered by C^{j}_C^{j}/[+front], this word should be pronounced *[s^{j}il^{j}ˈco], on a par with *sele* [s^{j}iˈl^{j}e] 'village' (dat. sg.). This prediction is not borne out: words such as *sjal'co* [s^{j}al^{j}ˈco] exhibit reduction to [a] in Dmitrov (Zaxarova, 1959; Kasatkin, 2005: 45).[7]

In addition, a cluster of a hard consonant followed by a soft one is also not within the purview of the constraint C^{j}_C^{j}/[+front]. So it is predicted that pretonic vowels preceding the cluster CC^{j} should not be subject to [i]-reduction. Contrary to this prediction, pretonic vowels reduce to [i] in these contexts, as shown by the pronunciation of the word *svetlec'* [sv^{j}iˈtl^{j}ɛt͡s^{j}] 'to grow lighter' in Mosal'sk (Vajtovič, 1968: 60). In *zjamljoj* [z^{j}aˈml^{j}ɔi̯] 'earth' (instr. sg.), the same cluster [ml^{j}] is preceded by [a]. These examples show clearly that [i]-reduction is not motivated by the following palatalised consonant.[8]

Finally, the analysis assuming that dissimilative reduction is triggered by a soft consonant cannot account for patterns attested in the Southern Russian dialects with a seven-vowel system. The type of vocalism distinguishing high mid and low mid vowels is attested in present-day archaic dialects, such as Obojan', Zadon and Novoselki (Savinov, 2013a: 318-319). These dialects palatalise consonants before the high mid vowel [e] but not before the low mid [ɛ], e.g. *vera* [v^{j}era] 'faith', *verx* [vɛrx] 'top' (Kasatkin, 1999: 393, 2005: 75;

[7] The word *sjal'co* is pronounced [s^{j}al^{j}ˈco] in all dialects with dissimilative [ja]-reduction with the exception of Don. In Don, all stressed mid vowels can carry High tone, so the raising to [i] in words such as *sjal'co* [s^{j}il^{j}ˈco] is triggered by PAL (after hard consonants, pretonic vowels reduce to schwa in this dialect, *cf. sal'co* 'lard', dim. [səl^{j}ˈco]).

[8] To support her analysis, Crosswhite (2001: 71) cites Nelson (1974: 166), who adduces data taken from the fieldwork notes of Russian dialectologists showing that [a] was recorded several times instead of [i] in words with a consonant cluster preceding the stressed vowel, e.g. [t^{j}aˈmn^{j}ɛt^{j}], [sv^{j}aˈtl^{j}ɛt^{j}], [vv^{j}aˈdr^{j}ɛ]. However, as these notes are based on one dialect with the Mosal'sk reduction pattern, it cannot be taken as a decisive argument for employing the constraint C^{j}_C^{j}/[+front].

Djačenko, 2013: 343-344). In dialects with the Novoselki type of reduction (discussed in detail in Section 3.1 below), [i] is used before the tonic [ɛ], and [a] before the tonic [e]. The analysis deriving [i]-reduction by means of the constraint $C^j\_C^j$/[+front] (*cf.* Crosswhite, 2001: 97) predicts an opposite scenario, in which *C^{j}e* but not *Cɛ* sequences induce vowel fronting in the preceding syllable.

Let us recall that the model developed in this chapter views [i]-reduction as a result of assimilation in backness between two adjacent vowels. In OT terms, this generalisation is expressed by the constraint AGREE-VV[-back]$_{FT}$ (defined in (3) above). The table in (11) compares the predictions of the models employing $C^j\_C^j$/[+front] and AGREE-VV[-back]$_{FT}$.

(11) *Comparison of $C^j\_C^j$/[+front] & AGREE-VV[-back]*

Patterns	Context	Example	$C^j\_C^j$/[+front]	AGREE-VV[-back]$_{FT}$
a. Sudža	C^jiC^jɔ	*seljodka* [s^{j}i'l^{j}ɔtkə]	✓	*[s^{j}a'l^{j}ɔtkə]
/Ščigry	C^jaC^jɔ	*medvedjom* [m^{j}id^{j}v^{j}a'd^{j}ɔm]	*[m^{j}id^{j}v^{j}i'd^{j}ɔm]	✓
b. Obojan'	C^jaC^jo	*plečjom* [pl^{j}a'č^{j}om]	*[pl^{j}i'č^{j}om]	✓
c. Dmitrov	C^jaC^jCo	*sjal'co* [s^{j}al^j't͡so]	*[s^{j}il^j't͡so]	✓
d. Mosal'sk	C^jaC^jɔ	*seljodka* [s^{j}a'l^{j}ɔtkə]	*[s^{j}i'l^{j}ɔtkə]	✓
e. Mosal'sk	C^jiCC^jɛ	*svetlec'* [sv^{j}i'tl^{j}ɛt͡s^j]	*[sv^{j}a'tl^{j}ɛt͡s^j]	✓

The comparison of the two models shows that AGREE-VV[-back]$_{FT}$ cannot deal with the Sudža pattern (11a), whereas Cj_Cj/[+front] produces incorrect outputs in Sudža (11a), Obojan' (11b), Dmitrov (11c), and Mosal'sk (11d,e). In sum, the constraint Cj_Cj/[+front] is problematic because it overgenerates [i]-reduction before soft consonants in (11a-d) and incorrectly blocks [i]-reduction before hard consonants in (11e). To conclude, the analysis employing the constraint Cj_Cj/[+front] must be rejected because it cannot adequately account for the reduction patterns attested in East Slavic dialects with dissimilative [ja]-reduction.

The alternative analysis employing AGREE-VV[-back]$_{FT}$ fails in cases where [i]-reduction occurs before the vowel [ɔ] preceded by a soft consonant. It was shown in (9) above that it cannot generate the pattern of reduction attested in Sudža and Ščigry because AGREE-VV[-back]$_{FT}$ is mute in the case of inputs containing back vowels in the stressed syllables. Let us observe that the back vowel [ɔ] in the position after soft consonants is the outcome of a

process changing *e* to *o* in stressed syllables before a hard consonant (see Chapter 5 below for further details). In many cases, stressed [ɔ] before the hard consonant alternates with [ɛ] followed by a soft consonant, e.g. *veselyj* [ˈsʲɔl] 'joyful' – *veselje* [ˈsʲɛlʲ] 'joy'. It was mentioned above that only [ɔ] which is derived from //ɛ// induces [i]-reduction in the preceding syllable, as in *veselyj* [vʲiˈsʲɔlɨ̯] 'joyful', *vedjom* [vʲiˈdʲɔm] 'lead' (1st pers. pl. pres.). In contrast, the vowel [ɔ] in words such as *medvedjom* [mʲidʲvʲaˈdʲɔm] 'bear' (instr. sg.), *plečo* [plʲaˈčʲɔ] 'shoulder', *zemljoju* [zʲaˈmlʲɔi̯] 'earth' (instr. sg.) is preceded by [a] in the pretonic syllable. Historically, this [ɔ] also comes from [ɛ] which has changed into [o] in some endings by grammatical analogy to existing forms containing [ɛ] (Avanesov, 1974: 218). However, the contrast *vedjom* [vʲi̯ˈdʲɔm] – *medvedjom* [mʲidʲvʲa̯ˈdʲɔm] demonstrates that the former [ɔ] patterns together with front vowels inducing [i]-reduction, whereas the latter [ɔ] functions as a back vowel not triggering [i]-reduction in the preceding syllable. Based on these observations, it can be legitimately concluded that [ɔ] is represented as //ɛ// in the underlying representation in dialects with dissimilative [ja]-reduction. The vowel //ɛ// causes the preceding vowel to front in words such as *vedjom* [vʲi̯ˈdʲɔm]. On the surface, however, the underlying //ɛ// is realised as [ɔ] before the hard consonant, resulting in non-surface-true forms such as [vʲi̯ˈdʲɔm]. It is well-known that standard OT assuming parallel evaluation fails to account for opaque generalisations of this type. Since the advent of OT, much evidence has been amassed indicating that the most theoretically coherent way to deal with different forms of opacity is to forfeit strict parallelism by admitting intermediate levels of derivation (Kiparsky, 1997, 2000; Rubach, 2000a,b; Bermúdez-Otero, 2003). In *vedjom* [vʲiˈdʲɔm], assimilation in backness between two adjacent vowels occurs at Level 1, whereas /ɛ/ retracts to [ɔ] at Level 2.[9]

Given that the retraction of //ɛ// to [ɔ] is triggered by the immediately following non-palatalised consonants, this process can be analysed in terms of backness assimilation between a consonant and a following vowel.[10] The constraint expressing this generalisation is stated in (12) below:

[9] Single slashes are used for the intermediate levels of representation, double slashes indicate underlying representations.

[10] Retraction before non-palatalised consonants is widespread in both stressed and unstressed syllables in East Slavic. It is attested in the stressed syllable in Standard Russian and Belarusian, as well as in the majority of Russian and Belarusian dialects. Retraction in unstressed syllables (called *jokan'e* in traditional descriptions) is common in a number of Northern Russian dialects lacking [a]-reduction, e. g. *pečʲ* [ˈpʲečʲ] 'bake' (inf.) – *pekut* [pʲoˈkut] id. (3rd pers. pl.) (Avanesov & Orlova, 1965; Kasatkin, 2005). Interestingly, the Northern Russian dialects showing retraction before hard consonants also exhibit fronting of *a* to *e* before soft consonants, e.g. *potjanut* [poˈtʲanut] 'pull' (3rd pers. pl. future) – *potjaneš* [poˈtʲenʲeš] id. (2rd pers. sg. future) – *pot'anu* [potʲaˈnu] id. (1st pers. sg. future) – *potjani* [potʲeˈnʲi] id. (imp.) (Kuznecov, 1960: 147; Kasatkin, 2005: 42). →

(12) Agree-VC[+back]: a consonant and a following vowel agree in the feature [+back].

At Level 1, AGREE-VC[+back] is inactive due to a higher ranked IDENT-V[-back]. At Level 2, the change of /ɛ/ to /ɔ/ is possible because IDENT-V[-back] >> AGREE-VC[+back] is re-ranked as AGREE-VC[+back] >> IDENT-V[-back]. The evaluation of the word *vedjom* [vʲiˈdʲɔm] is shown in (13). Note: the output of Level 1 is the input to Level 2.

(13) Sudža/Ščigry: *vedjom* //vʲɛˈdʲ+ɛm// [vʲiˈdʲɔm] 'lead' (1st pers. pl. pres.)

i. Level 1

H //vʲɛˈdʲ+ɛm//	AGREE-VV [-back]$_{FT}$	IDENT-V[-back]	AGREE-VC[+back]
H ⇒ a. vʲiˈdʲɛm			*
H b. vʲaˈdʲɛm	*!		*
H d. vʲaˈdʲɔm		*!	

ii. Level 2

H /vʲiˈdʲɛm/	Agree-VV [-back]$_{FT}$	AGREE-VC[+back]	IDENT-V[-back]
H ⇒ a. vʲiˈdʲɔm			*
H b. vʲiˈdʲɛm		*!	

In contrast to *vedjom* //vʲɛˈdʲɛm// [vʲiˈdʲɔm], [ɔ] in *medvedjom* [mʲidʲvʲaˈdʲɔm] comes from the underlying //ɔ//. The tableaux in (14) below show the evaluation of the relevant fragment of *medvedjom* [mʲidʲvʲaˈdʲɔm]. At level 1, AGREE-VV[-back]$_{FT}$ is vacuously satisfied because there is no front vowel in the stressed syllable to trigger the assimilation of the feature [back]. The choice between the candidates with [i]-reduction and [a]-reduction is made by the constraint *H/ɛ,ɔ disallowing the association of High tone with mid vowels.

Therefore, vowels and the following consonants appear to agree for both values of the feature [±back]. It is an open question whether both retraction and fronting can be derived by means of one general constraint demanding backness agreement in the *VC* sequences. As this issue is outside the scope of the present study, its resolution is left for future research.

Similarly to AGREE-VV[-back], IDENT-V[-back] is inactive, so its ranking with respect to AGREE-VC[+back] is irrelevant for the evaluation of the candidates containing the vowel /ɔ/. Therefore, the optimal candidate at Level 1 (14ia) is also the winner at Level 2 (14iia).

(14) Sudža/Ščigry: *medvedjom* //vʲɛˈdʲ+ɔm// [vʲaˈdʲɔm] 'bear' (instr. sg.)

i. Level 1

H //vʲɛˈdʲ+ɔm//	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	*H/a	IDENT-V[-back]	AGREE-VC [+back]
H ⇒ a. vʲaˈdʲɔm			*		
H b. vʲiˈdʲɔm		*!			

ii. Level 2

H /vʲaˈdʲɔm/	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	*H/a	AGREE-VC [+back]	IDENT-V[-back]
H ⇒ a. vʲaˈdʲɔm			*		
H b. vʲaˈdʲɛm	*!		*	*	*
H c. vʲiˈdʲɔm		*!		*	

Summarising briefly, this section has argued that Type II pretonic reduction constitutes a blend of tone-driven vocalic alternations, as in Type I, with the assimilation in backness between the pretonic and the tonic syllables. It has been demonstrated that this analysis is superior to the model locating the trigger of pretonic reduction in the immediately following consonant.

Traditional descriptions emphasise the fact that Type II patterns of dissimilation after soft consonants are not paralleled by corresponding patterns in the context of the preceding hard consonants (*cf.* Požarickaja, 2005: 58; Djačenko, 2013: 337). In the present model, the absence of the comparable process after hard consonants can be attributed to the blocking effect of PAL. That is, the assimilation of the feature [-back] would create a combination of a palatalised consonant and high front vowel, as in *noge* *[niˈgʲɛ] 'leg' (dat. sg.)

(*cf.* the correct form [nəˈgʲɛ]). It is well known that *Ci* sequences disagreeing in backness are prohibited in the Slavic languages (see Rubach (2000a, 2003) for discussion). This restriction might account for the absence of the [-back] harmony if the vowel in the pretonic syllable is preceded by a hard consonant. In the next section, we consider reduction types which combine Type I and/or Type II patterns with assimilation in height.

3. Height harmony (Type III)

3.1. Basic facts

Traditional grammars describe several other patterns of reduction, collectively referred to as assimilative-dissimilative [ja]-reduction (Kuznecov, 1960; Avanesov, 1974; Kasatkin, 2005; Požarickaja, 2005; and others). These types are attested in the eastern part of the Southern Russian dialect area (the regions of Rjazan', Lipeck, Voronež, Volgograd), in the Central Russian dialect area (the south-western parts of the Tver' region), as well as in the Northern area (Pskov region) (Čekmonas, 1999; Požarickaja, 2005; Paschen, 2015). These dialects show reduction to [a] if the following tonic syllable contains high and low vowels. Before mid vowels, either [i] or [a] is attested, depending on a dialect. The data illustrating assimilative-dissimilative reduction patterns provided in (15) come from Avanesov (1974: 157), Kuznecov (1960: 64) and Kasatkin (2005: 47).

(15) *i. Reduction to [a] before <u>high</u> and <u>low</u> vowels in the tonic syllable (all dialects)*

a. Before <u>high</u> vowels in the tonic syllable

nesu	[nʲaˈsu]	'carry' (1st pers. sg.)
letjat	[lʲaˈtʲit]	'fly' (3rd pers. sg.)
selu	[sʲaˈlu͡]	'village' (dat. sg.)
selit'sja	[s͡ʲaˈlʲitsːə]	'to settle'
cvety	[tsvʲaˈtɨ]	'flowers'

b. Before <u>low</u> vowels in the tonic syllable

nesla	[nʲaˈsla]	'carry' (fem. past)
beda	[bʲaˈda]	'hardship'
sela	[sʲaˈla]	'village' (gen. sg.)
menjat'	[mʲaˈnʲatʲ]	'change'
zjat'ja	[zʲaˈtʲja]	'sons-in-law'

ii. Reduction to [a]/[i] before <u>mid</u> vowels in the tonic syllable

Stressed vowels	[e]	[ɛ]	[ɔ] (>ɛ)	[ɔ]	[o]
	sele	*selenij*	*seljodka*	*selom*	*selo*
Novoselki	[sʲaˈlʲe]	[sʲiˈlʲɛnʲɪ̯]	[sʲiˈlʲɔtkə]	[sʲaˈlɔm]	[sʲaˈlo]
Orexovo	[sʲaˈlʲe]	[sʲiˈlʲɛnʲɪ̯]	[sʲaˈlʲɔtkə]	[sʲaˈlɔm]	[sʲaˈlo]
Kidusovo	[sʲiˈlʲɛ]	[sʲiˈlʲɛnʲɪ̯]	[sʲiˈlʲɔtkə]	[sʲaˈlɔm]	[sʲaˈlɔ]
Kultuki	[sʲiˈlʲɛ]	[sʲiˈlʲɛnʲɪ̯]	[sʲaˈlʲɔtkə]	[sʲaˈlɔm]	[sʲaˈlɔ]
Bel'sk	[sʲiˈlʲɛ]	[sʲiˈlʲɛnʲɪ̯]	[sʲiˈlʲɔtkə]	[sʲiˈlɔm]	[sʲiˈlɔ]
	'village' (loc. sg.)	'settlement' (gen. pl.)	'herring'	'village' (instr. sg.)	'village' (nom. sg.)

The distribution of pretonic vowels in different dialects with assimilative-dissimilative reduction is schematised in (16) below.

(16) *Dissimilation patterns after soft consonants: Type I*

a. Novoselki

pretonic	tonic		
a	i	ɨ	u
	e		o
i	ɛ, ɔ (> ɛ)		ɔ
a			a

b. Orexovo

pretonic	tonic		
a	i	ɨ	u
	e		o
i	ɛ		ɔ, ɔ (> ɛ)
a			a

c. Kidusovo

pretonic	tonic		
a	i	ɨ	u
i	ɛ, ɔ (> ɛ)		ɔ
a			a

d. Kultuki

pretonic	tonic		
a	i	ɨ	u
i	ɛ		ɔ, ɔ (> ɛ)
a			a

e. Bel'sk

	tonic		
a	i	ɨ	u
i	ɛ		ɔ
a			a

Traditionally, Novoselki is assumed to be based on Ščigry, Kidusovo on Sudža, Kultuki on Mosal'sk, and Bel'sk on Don (Avanesov, 1974; Kasatkin, 2005). Orexovo derives from the type of dissimilation not attested among East Slavic dialects. It is similar to Novoselki, differing from the latter only in the treatment

of the stressed [ɔ], which originally comes from //ɛ//, after soft consonants. In Orexovo, [a] is found before both underlying and derived *ɔ*, while in Novoselki, [a] is pronounced before the underlying //ɔ// and [i] is pronounced before [ɔ] which comes from //ɛ//. The same feature differentiates Kidusovo from Kultuki: [a] is attested before both the underlying and the derived *ɔ* in Kultuki, while in Kidusovo, [a] is pronounced before the underlying //ɔ// and [i] is pronounced before [ɔ] which is derived from //ɛ//. The Novoselki and Orexovo patterns are usually attested in seven-vowel systems distinguishing low and high mid vowels, whereas the remaining patterns are reported in systems supporting five contrastive vowel qualities (Savinov, 2013a: 318-319).

Until recently, assimilative-dissimilative types of reduction have been reported to occur only in the context of soft consonants in the dialectology literature (*cf.* Stroganova, 1955; Avanesov, 1974; Kuznecov, 1960). However, Kasatkina & Ščigel' (1995) provide data from the dialects spoken in the Southern Russian dialectal area, in which the Obojan' pattern of dissimilative [a]-reduction co-exists with assimilative reduction. These systems use [ə] before low mid vowels and [a] before high, high mid, and low vowels, as shown in (17).

(17) *Assimilative-dissimilative [a]-reduction*

pretonic	tonic		
a:	i	ɨ	u
	e		o
ə	ɛ		ɔ
a	a		

This pattern is illustrated by the data in (18) below (Kasatkin, 2005: 40).

(18)

a. travy	[traːˈvɨ]	'grass' (gen. sg.)
travu	[traːˈvu]	id. (acc. sg.)
sove	[saːˈvʲe]	'owl' (dat. sg.)
sovoj	[saːˈvoi̯]	id. (instr. sg.)
b. trava	[traˈva]	'grass' (nom. sg.)
sova	[saˈva]	'owl' (nom. sg.)
voda	[vaˈda]	'water' (nom. sg.)
c. lomtej	[ləmˈtʲɛi̯]	'slice' (gen. pl.)
laptej	[ləpˈtʲɛi̯]	'bast shoe' (gen. pl.)
nosok	[nəˈsɔk]	'sock'
platok	[pləˈtɔk]	'handkerchief'

Interestingly, the vowel [a] is lengthened if the vowel in the stressed syllable is either high or high mid (18a), but not if it is low (18b). The use of [ə] before low mid vowels, e.g. *lomtej* [ləmˈtʲɛi̯] ‘slice’ (gen. pl.), but not before high mid vowels, as in *sove* [saːˈvʲe] ‘owl’ (dat. sg.), indicates that this pattern instantiates the archaic Obojan’-like system of neutralisation.

3.2. Analysis

The occurrence of [a] instead of [ə] or [i] before the low vowel [a] in the tonic syllable has been traditionally viewed as the assimilation in height (Avanesov, 1974; Kasatkin, 2005). Crosswhite (2000, 2001) proposes an alternative analysis which assumes that the identity of the reduced vowels ([a] *vs.* [i]) is determined by the nature of the following consonant. Specifically, she argues at length that the description relying on the quality of the stressed vowel is inadequate because it provides ‘an (accidental) link between stressed vowel quality and consonant palatalization’ (Crosswhite, 2000: 149). Instead, she suggests that a better characterisation is achieved by differentiating between the two consonantal environments, as illustrated by the following description, reproduced from Crosswhite (2001: 68, 97) (Note: a shaded cell indicates that [o] does not occur in that context.)

(19) *Assimilative-dissimilative patterns (Crosswhite, 2001: 68, 97)*

i. *Kidusovo*

	CʲVCʲ_ˈ		
All stressed vowels condition reduction to [a]	i	u	← condition reduction to [a]
	e		
	ɛ	ɔ	← condition reduction to [i]
	a		

ii. *Novoselki*

CʲVC_ˈ	CʲVCʲ_ˈ		
All stressed vowels condition reduction to [a]	i	u	← condition reduction to [a]
	e		
	ɛ	ɔ	← condition reduction to [i]
	a		

In this view, the reduction to [i] in Kidusovo and Novoselki is generated by means of the constraint $C^j\_C^j$ /[+front] ('A vowel may not occur between two palatalised consonants unless it is [+front]', Crosswhite, 2001: 93).[11]

However, the description in (19) is factually incorrect as it misrepresents the actual reduction patterns attested in Kidusovo and Novoselki by stating that [a] following a palatalised consonant conditions reduction to [i] in the preceding syllable. In fact, pretonic vowels reduce to [a] in this context, which is illustrated by the following examples, taken from Avanesov (1974:157) and Kasatkin (2005: 46-47).

(20)	desjatka	[dʲaˈsʲtkə]	'ten' (nom. sg.fem.)
	zjat'ja	[zʲaˈtʲja]	'sons-in-law'
	strelat'	[strʲaˈlʲatʲ]	'shoot'
	gljadjat'	[ɣlʲaˈdʲatʲ]	'look' (3rd pers. pl.)

Hence, the analysis generating [i]-reduction in Kidusovo and Novoselki by means of $C^j\_C^j$ /[+front] is unacceptable because it fails to explain the presence of the low vowel [a] in the context of the following soft consonant.

Following traditional descriptions (e.g., Avanesov, 1974; Kasatkin, 2005), I assume that the use of [a] before the stressed low vowel in the Type III patterns is best explained as assimilation in height. In terms of OT, this generalisation is captured by the following foot-bounded constraint.

(21) AGREE-VV[+low]$_{FT}$: vowels in a foot have the same value for [+low].

First, let us consider the assimilative-dissimilative [a]-reduction, schematically represented in (17) above. This pattern represents a combination of the Obojan'-type reduction with the assimilation in the feature [+low]. Like in Obojan', the constraint HEAD=H interleaved between *H/e,o and *H/ɛ,ɔ ensures that pretonic non-high vowels merge in [a] if the vowel in the stressed syllable is either high or high mid. Let us recall that stressed low vowels in Obojan' trigger pretonic reduction to [ə]. In contrast, the assimilative-dissimilative type uses [ə] only before low mid vowels, while [a] appears before the low vowel [a] in the following syllable. This is analysed by assuming that AGREE-VV[+low]$_{FT}$ is a high-ranked constraint in the assimilative-dissimilative pattern. The ranking generating this type of reduction is shown below.

[11] The reduction to [a] taking place before [i]/[u] in Kidusovo and before [i]/[u]/[e] in Novoselki is accounted for by locating $C^j\_C^j$ /[+front] at different places among the constraints of the *μμ/X family.

(22) *Assimilative-dissimilative [a]-reduction*

H/i,u
⇓
*H/e,o
⇓
HEAD=H
⇓
*H/ɛ,ɔ
⇓
*H/a
AGREE-VV[+low]$_{FT}$

Tableaux in (23) illustrate how these constraints choose output forms for the words *sovu* [saˈvu] 'owl' (acc. sg.), *sove* [saˈvʲe] id. (dat. sg.), *sovoj* [səˈvɔi̯] id. (instr. sg.), and *sova* [saˈva] id. (nom. sg.).

(23) *Assimilative-dissimilative [a]-reduction*

H i. //soˈvu//	*H/i,u	*H/e,o	HEAD=H	*H/ɛ,ɔ	*H/a	AGREE-VV [+low]$_{FT}$
H ⇒ a. saˈvu			*		*	*
H b. səˈvu	*!					
H ii. //soˈvʲe//	*H/i,u	*H/e,o	Head=H	*H/ɛ,ɔ	*H/a	AGREE-VV [+low]$_{FT}$
H ⇒ a. saˈvʲe			*!		*	*
H b. səˈvʲe		*				
H iii. //soˈvɔi̯//[12]	*H/i,u	*H/e,o	Head=H	*H/ɛ,ɔ	*H/a	AGREE-VV [+low]$_{FT}$
H ⇒ a. səˈvɔi̯				*		
H b. sʲaˈvɔi̯			*!		*	*

[12] The word-final glide comes from the underlying high front vowel. As this issue is not relevant to the present analysis, the underlying form is shown with the final glide to simplify the presentation.

H iv. //soˈva//	*H/i,u	*H/e,o	Head=H	*H/ɛ,ɔ	*H/a	AGREE-VV [+low]$_{FT}$
H ⇒ a. saˈva					*	
H b. saˈva			*!		*	
H c. səˈva					*	*!

Let us note that though both *selu* [sʲaˈlu] (23i) and *sela* [sʲaˈla] (23iv) surface with the low vowel [a] in the pretonic syllable, the two vowels are structurally different in that only the former is linked to High tone. This analysis raises questions concerning the mapping of the phonological structure onto the phonetic form. Is there a difference in the timing of the pitch peak between the words with pretonic [a] linked to H tone, such as *selu* [sʲaˈlu], and the words with pretonic [a] not associated with H, as in *sela* [sʲaˈla]? Or, since phonological tone can be expressed by duration, are there quantitative differences between the two [a]'s? There are not many studies which would systematically investigate tonal properties of the East Slavic dialects (see discussion in Bethin (2006: 139ff) and references therein), so, at present, it is not possible to answer the question concerning the alignment of the phonological tone with phonetic pitch in the dialects in question. As to the second question, there are indications in the literature pointing to the differences in duration of the two types of [a] (Belaja, 1974; Broch, 1916; Burova & Kasatkin, 1977; Kasatkina & Ščigel', 1996; Vojtovič, 1972a). Based on the analysis of the samples of spontaneous speech collected in the Southern Russian dialectal area, Kasatkina & Ščigel' (1996: 237) report that '*a* is shortened before the stressed *a,* and lengthened before the stressed high vowels, that is *vădá – vādý'*.[13] Pretonic lengthening of [a] is also attested in the dissimilative-assimilative reduction pattern, which is illustrated in (18) above. Some examples are repeated in (24) .

(24) *Assimilative-dissimilative [a]-reduction*

a. travy	[traːˈvɨ]	'grass' (gen. sg.)
sove	[saːˈvʲe]	'owl' (dat. sg.)
b. trava	[traˈva]	'grass' (nom. sg.)
sova	[saˈva]	'owl' (nom. sg.)
c. lomtej	[ləmˈtʲɛi̯]	'slice' (gen. pl.)
nosok	[nəˈsɔk]	'sock'

[13] Translation is mine.

The differences in the duration of the pretonic [a] in (24a) and (24b) render support to the theoretical assumptions of the present model. In (24a), the pretonic syllable is the carrier of H tone, which is manifested by the increased length of the vowel [a]. In (24b), the pretonic syllable is not associated with High tone, so the pretonic [a], which is the result of the [+low] assimilation, remains short. Structurally, it is similar to [ə] in (24c) because both vowels lack H tone.

Returning to the Type III [ja]-reduction patterns, let us first consider Bel'sk, which constitutes a combination of the Don-type reduction with the assimilation in the feature [+low]. The ranking of constraints generating the Bel'sk pattern of dissimilation is shown below.

(25) *Dissimilation patterns after soft consonants: Type III*

Bel'sk
(*cf.* Don)
*H/i,u
⇓
HEAD=H
⇓
AGREE-VV[+low]$_{FT}$
*H/e,o
⇓
*H/ɛ,ɔ
⇓
*H/a
⇓
PAL

The ranking of PAL *vis-à-vis* AGREE-VV[+low]$_{FT}$ is established based on the fact that the Bel'sk reduction to [a] after soft consonants creates a consonant-vowel sequence with different specifications in backness. Hence, it is more important to satisfy AGREE-VV[+low]$_{FT}$ than to have a sequence of a vowel and a consonant agreeing in backness. This is illustrated in Tableau (26) with the evaluation of the word *sela* [sʲaˈla] village (gen. sg.).

(26) *Dissimilation patterns after soft consonants: Bel'sk*

H //sʲɛˈla//	Head=H	*H/ɛ,ɔ	*H/a	AGREE-VV [+low]$_{FT}$	PAL
H ⇒ a. sʲaˈla			*		*
H b. sʲiˈla			*	*!	

As shown above, the constraint AGREE-VV[+low]$_{FT}$ competes with PAL in the context of palatalised consonants: the former favours the low back vowel [a], whereas the latter gives preference to the front vowel [i]. The vowel [i] is a better fit from the perspective of PAL because it agrees in backness with the preceding soft consonant. Nevertheless, assimilative-dissimilative patterns of the Bel'sk type yield to the requirements of AGREE-VV[+low]$_{FT}$ and neutralise non-high vowels in the low back vowel [a].

Let us now consider the remaining Type III patterns. It has been argued earlier in this chapter (Section 3.1.2) that Ščigry, together with Sudža and Mosal'sk, constitute a combination of the Žizdra dissimilation type with the assimilation in the feature [-back]. Similarly, Dmitrov combines the Obojan' pattern with the assimilation in backness. In OT terms, this assimilation is analysed using the constraint AGREE-VV[-back]$_{FT}$, which ensures that front vowels in tonic positions are preceded by [i]. The patterns attested in Novoselki, Orexovo, Kidusovo and Kultuki (Type III) differ from Type II patterns in only one respect: they use [a] instead of [i] if the tonic syllable contains the low vowel [a]. As [a] is specified for the features [+low] and [+back], there are two ways to model this type of process: as assimilation in vowel height or as assimilation in backness. There is no empirical evidence favouring one of the analytical options. The analysis referring to the feature [+back] appears attractive in view of the fact that the assimilation to [a] in Type III dialects produces patterns in which a back vowel in the tonic syllable is always preceded by a back vowel in the pretonic syllable. However, theory-internal considerations speak against using the constraint AGREE-VV[+back]$_{FT}$ in the analysis of these dialects. First, the need for AGREE-VV[+low]$_{FT}$ is independently motivated by the patterns attested in Bel'sk and in systems with assimilative-dissimilative [a]-reduction. More importantly, the model employing AGREEVV[+back]$_{FT}$ would generate unattested systems of [a]-reduction, in which non-high vowels merge into [i] if the following stressed vowel is front, and into [a] if the vowel in the stressed syllable is back. Therefore, I assume that Type III patterns represent a combination of one of the assimilative-dissimilative Type II patterns showing assimilation in the feature [back] with assimilation in the feature [+low]. This model aligns with traditional descriptions of Novoselki as based on Ščigry, Kidusovo on Sudža, and Kultuki on Mosal'sk (Avanesov, 1974; Kasatkin, 2005). The ranking schemes generating the assimilative-dissimilative patterns are provided in (27).

(27) *Dissimilation patterns after soft consonants: Type III*

a. Orexovo/Novoselki (*cf.* Ščigry)	b. Kultuki/Kidusovo (*cf.* Mosal'sk/Sudža)
*H/i,u	*H/i,u
⇓	⇓
*H/e,o	**AGREE-VV[-back]$_{FT}$**
⇓	⇓
AGREE-VV[-back]$_{FT}$	*H/e,o
⇓	⇓
*H/ɛ,ɔ	*H/ɛ,ɔ
⇓	⇓
HEAD=H	HEAD=H
*H/a	*H/a
AGREE-VV[+low]$_{FT}$	**AGREE-VV[+low]$_{FT}$**

To illustrate how the rankings in (27) above generate correct outputs in Orexovo, let us consider the evaluation of the morphologically-related words with [e], [ɛ], [ɔ] and [a] in the tonic syllable, shown in (28). In (28i), the dat. sg. form *sele* [sʲaˈlʲe] 'village' surfaces with pretonic [a] due to the high-ranked *H/e,o, which precludes the linking of High tone to a vowel with sonority equal to *e*. In contrast, the pretonic vowel is raised to [i] in (28ii) before the tonic [ɛ] due to the ranking AGREE-VV[-back]$_{FT}$ >> *H/ɛ,ɔ. This change ensures that the vowels in the two syllables agree in backness.[14] The vowel [a] is chosen over [i] in the optimal output in (28iii) by AGREE-VV[+low]$_{FT}$, which outranks *-Δ_{ω}{i,u}, the constraint prohibiting unstressed sonorous vowels.

(28) *Orexovo*

H i. //sʲɛˈl+e// *sele*	*H/e,o	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	HEAD=H	*H/a	AGREE- -VV[+low]$_{FT}$	*-Δ_{ω}{i,u}
H ⇒ a. sʲaˈlʲe		*		*	*	*	*
H b. sʲiˈlʲe	*!						

[14] The candidate with pretonic [ɛ] would also satisfy AGREE-VV[+back]. The choice between the faithful candidate and the one showing [i]-raising is made by AGREE [+high], *cf.* the evaluation for Obojan', shown in (27) in Section 3.3, Chapter 4.

H ii. //sʲɛˈlʲ+ɛ// *selenij*	*H/e,o	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	HEAD=H	*H/a	AGREE--VV[+low]$_{FT}$	*-Δ_{ω}{i,u}
H ⇒ a. sʲiˈlʲɛ			*				
H b. sʲaˈlʲɛ		*!		*	*	*	*
H iii. //sʲɛˈlʲ+a// *sela*	*H/e,o	AGREE-VV [-back]$_{FT}$	*H/ɛ,ɔ	Head=H	*H/a	AGREE--VV[+low]$_{FT}$	*-Δ_{ω}{i,u}
H ⇒ a sʲaˈla					*		*
H b. sʲiˈla					*	*!	

The Kultuki pattern is minimally different from Orexovo in that both [e] and [ɛ] condition backness assimilation of the pretonic vowel. This difference is modelled by placing the constraint AGREE-VV[-back]$_{FT}$ one step higher in the constraint hierarchy, like in the Mosal'sk pattern (*cf.* Tableau (5) in Section 3.2.1). In Kultuki, but not in Mosal'sk, [i]-reduction is blocked by AGREE-VV[+low]$_{FT}$ before the vowel [a] in the tonic syllable.

The types of reduction found in Novoselki and Kidusovo are derived by the constraint rankings established for Orexovo and Kultuki, respectively. The patterns attested in Orexovo and Kultuki are transparent because they restrict the occurrence of the pretonic [i] to positions before the surface [ɛ] in the tonic syllable, e.g. *veselje* [vʲiˈsʲɛlʲjə] 'joy', *cf. vesjolyj* [vʲaˈsʲɔlɨ̯̂] 'joyful'. In contrast, Novoselki and Kidusovo use [i] both before the surface [ɛ] as well as before [ɔ] which comes from the underlying //ɛ//, for instance *veselje* [vʲiˈsʲɛlʲjə] 'joy', *vesjolyj* [vʲiˈsʲɔlɨ̯̂] 'joyful'. In this respect, Novoselki and Kidusovo resemble the Sudža/Ščigry patterns, which also have an opaque process of reduction before the derived vowel [ɔ]. The analysis developed above for Sudža and Ščigry (Section 3.1.2) assumes that the evaluation of the output candidates takes place at two levels. At Level 1, pretonic vowels assimilate in backness to the vowel in the tonic syllable. The stressed vowel in words such as *vesjolyj* [vʲiˈsʲɔlɨ̯̂] 'joyful' is represented as /ɛ/ at this stage, triggering [i]-reduction in the preceding syllable. At Level 2, /ɛ/ retracts to [ɔ], where any further changes of the pretonic vowels are blocked by the high-ranked faithfulness constraints.

4. Conclusion

This chapter has developed an OT analysis of different types of vocalic neutralisations attested in the East Slavic dialects. It has been argued that the variety and complexity of the East Slavic vocalic patterns are shaped by two major forces. On the one hand, the presence of the underlying High tone triggers vocalic alternations in quality and quantity in pretonic positions (Type 1 dissimilation patterns, pretonic length dialects). On the other hand, harmonic processes produce assimilation in backness and/or height of the vowels in the pretonic and tonic syllables (Type II and Type III dissimilation patterns).

The patterns of dissimilative reduction are schematically presented in Figure 3, and the constraint rankings generating these systems are provided in Figure 4 below. As shown in Fig. 3, Type I patterns (Žizdra, Obojan' and Don) arise due to the different rankings of HEAD=H with respect to the members of the *H/V family of constraints. These reduction patterns are attested both after hard and after soft consonants.

Type II patterns are found only in the context of palatalised consonants. In the present model, they derive from Type I patterns by means of the constraint AGREE-VV[-back]$_{FT}$. Located at different points in the constraint hierarchy, AGREE-VV[-back]$_{FT}$ generates four additional patterns of reduction (Ščigry, Sudža, Mosal'sk and Dmitrov) by inducing harmony for the feature [-back]. The present assumption that Type II is based on Type I patterns contrasts with traditional classifications which group Type I and Type II systems into one type, traditionally referred to as dissimilative [ja]-reduction. However, it should be noted that there are no attested systems of dissimilative [a]-reduction after hard consonants which would parallel Type II patterns of dissimilation after soft consonants (Djačenko, 2013: 337). Deriving Type II from Type I systems allows us to explain this asymmetry. Specifically, Type II systems are analysed as a combination of Type I patterns (Žizdra and Obojan') with the intersyllabic harmony for the feature [-back]. The leftward propagation of [-back] in words with pretonic vowels occurring after a hard consonant would create an illegitimate structure of a hard [+back] consonant followed by a front [-back] vowel, which is prohibited by PAL (as discussed in Chapter 6 below).

Type III systems are generated by means of the constraint AGREE-VV[+low]$_{FT}$. Since this constraint does not conflict with PAL, it is free to combine with both [ja]-reduction and [a]-reduction. Coupled with the Don type of [ja]-reduction, AGREE-VV[+low]$_{FT}$ yields the Bel'sk pattern, whereas

its combination with the Obojan' type of [a]-reduction produces systems traditionally called assimilative-dissimilative [a]-reduction (*cf.* Kasatkin, 2005: 40).

The present model predicts the existence of two more types of assimilative-dissimilative reduction which would combine the assimilation in height (driven by AGREE-VV[back]$_{FT}$) with Dmitrov and Obojan' dissimilation patterns. The absence of Dmitrov- and Obojan'-based assimilative-dissimilative patterns can be attributed to the fact that both Obojan' and Dmitrov require archaic eight-vowel systems distinguishing between high and low mid vowels. As the two-way contrast in mid vowels is only sporadically found in the present-day dialects, fewer reduction patterns are attested which would be based on eight-vowel systems.

Another possibility would be to combine AGREE-VV[+low]$_{FT}$ with the Žizdra pattern of dissimilation, in which the pretonic vowel surfaces as [a] before non-low stressed vowels and as [ə] if the stressed syllable contains [a]. In this scenario, high-ranked AGREEVV[+low]$_{FT}$ would eliminate the effect of dissimilation, producing a system of nondissimilative [a]-reduction where all vowels reduce to [a] irrespective of the quality of the vowel in the tonic position.

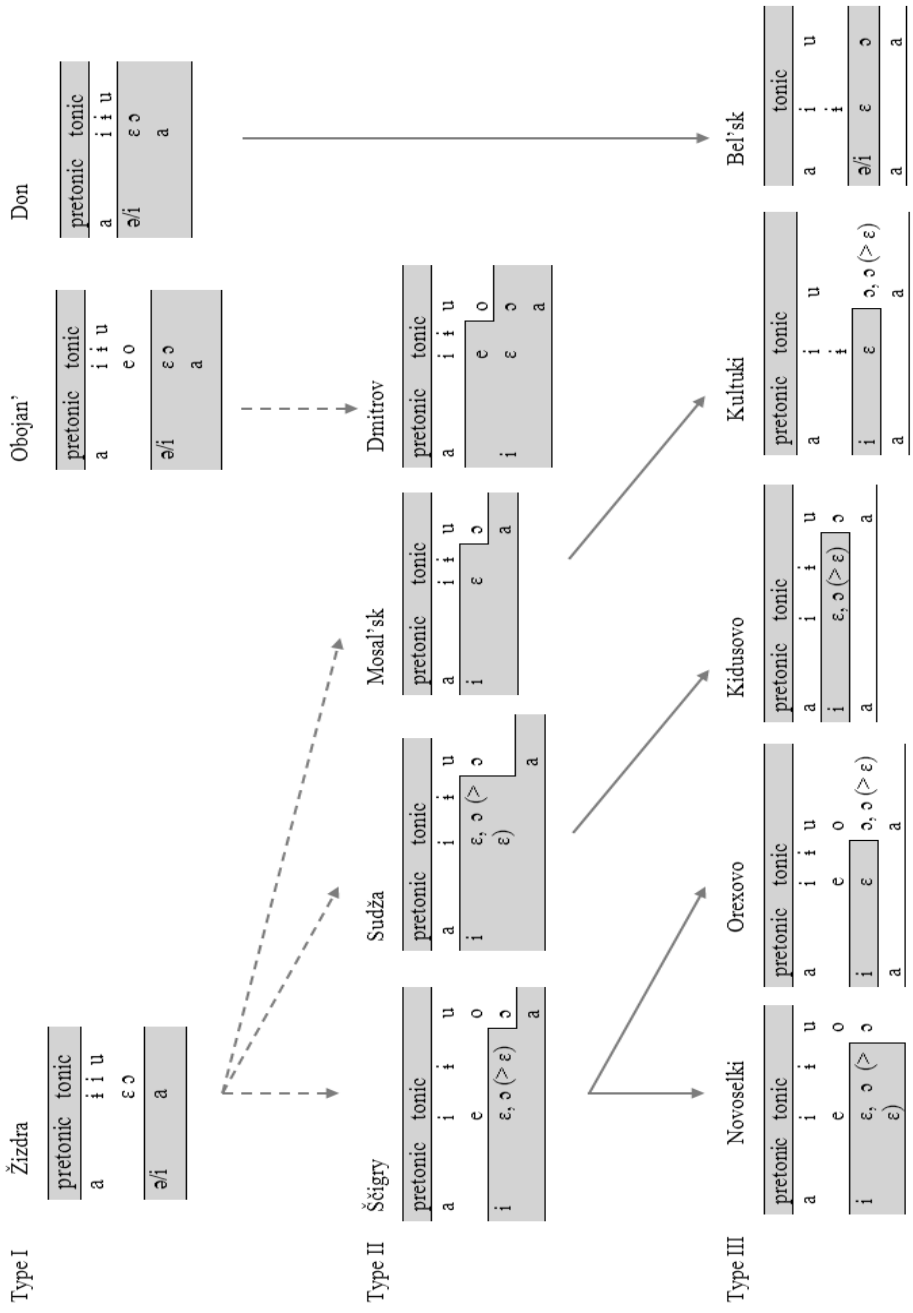

Figure 3. *Types of dissimilative [ja]-reduction*

Type I	Žizdra		Obojan’	Don
	*H/i,u ⇓ *H/e,o ⇓ *H/ɛ,ɔ ⇓ **HEAD=H** *H/a		*H/i,u ⇓ *H/e,o ⇓ **HEAD=H** ⇓ *H/ɛ,ɔ ⇓ *H/a	*H/i,u ⇓ **HEAD=H** ⇓ *H/e,o ⇓ *H/ɛ,ɔ ⇓ *H/a
AGREE-VV [-back]$_{FT}$	↓	↘	↓	↓
Type II	Mosal’sk/Sudža	Ščigry	Dmitrov	
	*H/i,u ⇓ **AGREE-VV [-back]$_{FT}$** ⇓ *H/e,o ⇓ *H/ɛ,ɔ ⇓ **HEAD=H** *H/a	*H/i,u ⇓ *H/e,o ⇓ **AGREE-VV [-back]$_{FT}$** ⇓ *H/ɛ,ɔ ⇓ **HEAD=H** *H/a	*H/i,u ⇓ **AGREE-VV [-back]$_{FT}$** ⇓ *H/e,o ⇓ **HEAD=H** ⇓ *H/ɛ,ɔ ⇓ *H/a	
AGREE-VV [+low]$_{FT}$	↓	↓		↓
Type III	Kultuki/ Kidusovo	Orexovo/ Novoselki		Bel’sk
	*H/i,u ⇓ **AGREE-VV [-back]$_{FT}$** ⇓ *H/e,o ⇓ *H/ɛ,ɔ ⇓ HEAD = H *H/a **AGREE-VV [+low]$_{FT}$**	*H/i,u ⇓ *H/e,o ⇓ **AGREE-VV [-back]$_{FT}$** ⇓ *H/ɛ,ɔ ⇓ HEAD = H *H/a **AGREE-VV [+low]$_{FT}$**		*H/i,u ⇓ **HEAD = H** ⇓ **AGREE-VV [+low]$_{FT}$** *H/e,o ⇓ *H/ɛ,ɔ ⇓ *H/a ⇓ PAL

Figure 4. *Patterns of dissimilative reduction: constraint rankings*

6. Vowel reduction in the context of palatalised consonants

1. Introduction

Previous chapters have analysed various patterns of [a]-reduction attested after hard consonants in different East Slavic dialects. We have argued that the vocalic reduction in immediately pretonic positions is driven by High tone, whose occurrence is restricted to the head foot of the prosodic word. On this view, the neutralisation of non-high vowels into the low vowel [a] takes place to accommodate High tone, which is best realised on more sonorous vowels. The present chapter considers cases in which High tone fails to trigger the lowering of a vowel in the immediately pretonic position. In most dialects with two-degree reduction patterns, [a]-reduction is blocked in the contexts of adjacent palatalised consonants and after hard stridents, where, instead of the expected lowering, non-high vowels undergo fronting and/or raising.

There are several ways in which a palatalised consonant can affect the quality of a reduced vowel. In a simple case, the non-high vowels //e//, //a// and //ɔ// are reduced to [i], [e], or [a]; for example, the word *reka* 'river' can be pronounced as [rʲiˈka], [rʲeˈka] or [rʲaˈka] (*cf.* the gen. pl. form *rek* [ˈrʲek]). These types of neutralisation are attested in the standard variety of Russian, in the central Russian dialects, and in some southern Russian and Belarusian dialects. In a complex case, the quality of the reduced vowel depends on both the preceding and the following consonant. For instance, [a] is found before hard consonants and [i] appears before palatalised consonants in dialects with the so-called moderate *jakan'e* ([ja]-reduction), e.g. [rʲaˈka] (nom. sg.) *vs*. [rʲiˈkʲi] (gen. sg.). Or, some dialects show [e]-reduction before hard consonants, e.g. [rʲeˈka], and [i]-reduction before soft consonants, e.g. [rʲiˈkʲi]. A more intricate pattern is attested in dialects such as Čuxloma, which uses [i] if the following consonant is soft, e.g. [rʲiˈkʲi], and either [a] or [e] if the following consonant is hard, the former occurring before a non-low vowel, and the latter before a low vowel in the following stressed syllable, e.g. [rʲaˈku] (acc. sg.) *vs*. [rʲiˈka] (nom. sg.).[1] Neutralisation patterns found in the context of palatalised consonants in

[1] Furthermore, some Northern Russian dialects retract the front vowel //e// if the following consonant is hard, e.g. [rʲɔˈka] *vs.* [rʲeˈkʲi]. This pattern is excluded from the present analysis because it is attested in dialects lacking High tone on the pretonic vowel (see also Footnote 10, Chapter 5).

different East Slavic dialects are summarised below, with the inflected forms of the word *reka* 'river' serving as illustrations.

(1)	*Context*	*Examples*
a. [i]-reduction	[i]/C^{j}_	[r^{j}i'ka]
b. [e]-reduction	[e]/C^{j}_	[r^{j}e'ka]
c. [ja]-reduction	[a]/C^{j}_	[r^{j}a'ka]
d. moderate [ja]-reduction	[i]/C^{j}_C^{j}, [a]/C^{j}_C	[r^{j}i'k^{j}i], [r^{j}a'ka]
e. moderate [e]-reduction	[i]/C^{j}_C^{j}, [e]/C^{j}_C	[r^{j}i'k^{j}i], [r^{j}e'ka]
f. Čuxloma [ja]-reduction	[i]/C^{j}_C^{j}, [a]/C^{j}_CV$_{[+low]}$, [e]/C^{j}_CV$_{[-low]}$	[r^{j}i'k^{j}i], [r^{j}e'ka], [r^{j}a'ku]

A further complication arises in the context of the hard stridents [š], [ž], and [t͡s], which behave inconsistently with respect to vowel reduction in the majority of the East Slavic dialects. In standard Russian, for instance, this is illustrated by the alternations such as *šjopot* ['šopət] 'a whisper' – *šeptat'* [šip'tat^{j}] 'to whisper' and *šok* ['šok] 'a shock' – *šokirovat'* [ša'k^{j}irəvət^{j}] 'to shock', where the hard strident [š] patterns together with soft consonants in [šip'tat^{j}] and with hard consonants in [ša'k^{j}irəvət^{j}], triggering raising of the mid vowel in the former and lowering in the latter.

These patterns are interesting for several reasons. First, the raising of the low vowel [a] to [e] or [i] refutes our previous assertion that vowels should lower in immediately pretonic position in order to be able to carry High tone. Second, reduction to [e] runs contra the alleged universal that mid vowels are banned from prosodically weak positions in languages with vowel reduction. Next, the fronting of back vowels [a] and [ɔ] before palatalised consonants as well as the retraction of [e] before hard consonants are unusual from the typological perspective because Slavic languages typically show agreement in backness between vowels and the preceding, not the following, consonants (Halle, 1959; Lightner, 1972; Rubach, 2000, 2003; among others). Finally, the operation of two contradictory processes ([a]-reduction and [i]-reduction) in the context of hard stridents constitutes a non-trivial case of opacity, which cannot be resolved without resorting to derivational levels.

The present chapter is structured as follows. Section 2 discusses patterns of vowel fronting and raising taking place after soft consonants. An OT analysis pursued in this section is based on the two generalisations about Slavic

phonology, concerning the tendency of consonants and the following vowels to exhibit agreement in backness and in height. Next, Section 3 demonstrates that these generalisations also hold in the C^jVC^j sequences, where a vowel changes to accommodate in backness and/or height both to the preceding and the following consonant. Apparently exceptional patterns of neutralisation attested in the context of hard sibilants are discussed in Section 4. Finally, Section 5 summarises the main results.

2. Feature assimilation in C^jV contexts

As mentioned above, [a]-reduction is blocked in the context of palatalised consonants in a number of East Slavic dialects. There are two ways in which palatalised consonants can affect the outcome of vowel reduction in unstressed *CV* sequences. First, non-high back vowels //a// and //ɔ// front to [e] after palatalised consonants in the central Russian dialects. Second, vowel fronting can be accompanied by the raising to [i] in many dialects, including the standard variety of Russian (Avanesov & Orlova, 1965; Avanesov, 1984; Kasatkin, 2005). These processes, traditionally referred to as *ekan'e* ([e]-reduction) and *ikan'e* ([i]-reduction) in the literature, are schematically shown in (2).

(2) a. [e]-reduction: a, ɔ → e /$C^j$$_{\text{—[-stress]}}$

b. [i]-reduction: e, a, ɔ → i /$C^j$$_{\text{—[-stress]}}$

The following sections demonstrate that these two processes are accounted for in a straightforward way if secondary articulation is expressed in terms of the binary features [±back] and [±high], as assumed in the Halle-Sagey model of feature geometry (Sagey, 1986; Halle, 1992, 1995, 2005). The processes in (2) aim to achieve the agreement in backness and/or height between consonants and following vowels. Specifically, the dialects with [e]-reduction show an agreement in the feature [-back], and the dialects with [i]-reduction exhibit an agreement in the features [-back] *and* [+high] (Halle, 1959; Lightner, 1972). Whereas the agreement in the feature [-back] has been generally assumed in the analysis of palatalization (Rubach (2007) and references therein), phenomena requiring an analysis in terms of the [+high] agreement are rarely documented in the literature (but see Cole, 1969; Lahiri & Evers, 1991; Halle, 2005; Rubach, 2007). Section 2.2 adduces evidence from several languages demonstrating

that [+high], just as [-back], can actively participate in phonological processes involving palatal and palatalised consonants.

2.1. [e]-reduction

This section looks at reduction patterns in which unstressed non-high vowels are neutralised into [e] when preceded by palatalised consonants. This pattern characterises some dialects in the northern and the central Russian dialectal area. It is historically older than the [i]-reduction found in the Contemporary Standard Russian and has been considered the literary norm until the first half of the 20th century (Avanesov, 1974; Kasatkin, 2005). Some examples illustrating vocalic alternations in dialects with [e]-reduction are presented below.

(3) *[e]-reduction*

a. [a] – [e]

zjat' [ˈzʲatʲ] 'son-in-law' (nom. sg.)	–	zjat'ja [zʲeˈtʲja] id. (nom. pl.)
pjatka [ˈpʲatkə] 'heel' (dim. form)	–	pjata [pʲeˈta] id. (nom. sg.)
čas [ˈčʲas] 'hour' (nom. sg.)	–	časa [čʲeˈsa] id. (gen. sg.)
rjad [ˈrʲat] 'row' (nom. sg.)	–	rjada [rʲeˈda] id. (gen. sg.)
mjaso [ˈmʲasə] 'meat' (noun)	–	mjasnik [mʲeˈsnʲik] 'butcher'

b. [ɔ] – [e][2]

sjol [ˈsʲɔl] 'village' (gen. pl.)	–	sela [sʲeˈla] id. (gen. sg.)
sjostry [ˈsʲɔstrɨ] 'sister' (nom. pl.)	–	sestra [sʲeˈstra] id. (nom. sg.)
mjotly [ˈmʲɔtlɨ] 'sweep' (nom. pl.)	–	metla [mʲeˈtla] id. (nom. sg.)
vjosny [ˈvʲɔsnɨ] 'spring' (nom. pl.)	–	vesna [vʲeˈsna] id. (nom. sg.)
rjov [ˈrʲɔf] 'roar'	–	revet' [rʲeˈvʲetʲ] 'to roar'

As shown above, only back vowels *a* and ɔ reduce, whereas immediately pretonic *e* and *i* remain intact, e.g. *lesa* [lʲeˈsa] 'forest' (nom. pl.), *mela* [mʲeˈla] 'sweep' (past. fem. sg.) *vs. lisa* [lʲiˈsa] 'vixen', *mila* [mʲiˈla] 'kind' (fem. short form) (Avanesov, 1974: 159). An overarching generalisation about Russian is that consonants and following vowels agree in backness (Halle, 1959; Lightner, 1972; Rubach, 2000 *et seq*.; Kochetov, 2002; Schwartz, 2003). That is, consonants are usually palatalised before following front vowels, both inside words

[2] The alternation *o – e* is also found in stressed syllables. Historically, it derives from a process which turned stressed *e* into *o* before a hard consonant (*cf. sjol* [ˈsʲol] 'village' (gen. pl.) – *sel'skij* [ˈsʲelʲskʲiɨ] 'village' (adj.). It is an open question whether the present-day alternations are to be analysed in terms of allomorphy or derived synchronically. See Section 4.2 for further discussion.

and at morpheme boundaries,[3] whereas across word boundaries, the front vowel [i] is retracted to [ɨ] when preceded by velarised consonants (Rubach, 2000).[4] The two processes are illustrated below with the examples from the Standard Russian.

(4) a. *Consonant palatalisation*

rot [ˈrot] 'mouth'	– rot+ik [ˈrotʲɪk] id. (dim.)
pylesos [pɨlʲiˈsos] 'hoover'	– pylesos+it' [pɨlʲiˈsosʲɪtʲ] 'to hoover'
rabota [rəˈbotə] 'job'	– rabotejka [rəˈbotʲeɨ̯kə] id. (perjor.)
kosa [kəˈsa] 'scythe' (nom. sg.)	– kose [kəˈsʲe] 'scythe' (dat. sg.)

b. *Vowel retraction*

i [i] 'and'	– kot i sobaka [ˈkot ɨ səˈbakə] 'cat and dog'
Ivan [iˈvan] 'Ivan' (proper name)	– golos Ivana [ˈgoləs ɨˈvanə] 'Ivan's voice'

Both palatalisation (4a) and retraction (4b) conspire to avoid sequences of a consonant and a vowel which disagree in the feature [±back]. Rubach (2000, 2003) expresses this generalisation in terms of the following OT constraint (Rubach, 2003: 217).

(5) PAL: A consonant and a following vowel agree in backness.

Besides constituting the main driving force of various palatalisation processes, PAL motivates the fronting of back non-high vowels in unstressed syllables (as shown in (3) above). The change of //a// and //ə// to [e] improves on markedness because it creates a sequence of two segments with the same specification of the feature [-back].

In the central Russian dialects, the raising of the unstressed //a// to [ɛ] after palatalised consonants co-occurs with the lowering of //o// to [a] after hard consonants. The examples illustrating this reduction pattern are provided below.

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[3] Consonants in some borrowings, mostly recent and unassimilated ones, lack palatalisation before the mid front vowel [ɛ], e.g. *fonetika* [fəˈnɛtʲikə] 'phonetics' (Avanesov, 1984).

[4] Unlike [ɨ], the back high rounded vowel [u] can be preceded by a soft consonant, both in stressed and unstressed syllables, for instance *val'uta* [vaˈlʲutə] 'currency', č'udit' [čʲuˈdʲitʲ] 'fool around', *ut'uga* [utʲuˈga] 'iron' (gen. sg.). The back vowel [u] is preserved after palatalised consonants due to the undominated faithfulness constraint IDENT-V[+round] ('[+round] on a vowel in the input must be preserved on the corresponding vowel in the output).

(6) Dialects with [a]-reduction

a. *Pretonic [a] after hard consonants*

stoly [staˈlɨ] ‘table’ (nom. pl.)	*cf.* stol [ˈstol] (nom. sg.)
sady [saˈdɨ] ‘garden’ (nom. pl.)	sad [ˈsat] (nom. sg.)

b. *Pretonic [ɛ] after soft consonants*

r’ady [rʲɛˈdɨ] ‘row’ (nom. pl.)	r’ad [ˈrʲat] (nom. sg.)
r’eki [rʲɛˈkʲi] ‘river’ (gen. sg.)	r’eki [ˈrʲɛkʲi] (nom. pl.)

It was argued in Chapter 3 that vowels in immediately pretonic positions carry High tone in dialects with [a]-reduction, and the lowering of //ɔ// to [a] is induced by the constraint *H/a, ensuring that High tone docks on intrinsically longer low vowels. From the perspective of *H/V, the raising of //a// to [ɛ] is an unwelcome change as High tone ends up linked to the mid vowel [ɛ], which is a worse carrier of High tone than the low vowel [a]. The reduction to [ɛ] in dialects with [a]-reduction after hard consonants is achieved if PAL outranks *H/ɛ,ɔ. Let us note that both PAL and *H/ɛ,ɔ would be satisfied if the consonant in the *Cʲa* sequence changed its backness specification. However, the fact that none of the East Slavic dialects depalatalises consonants before [a] demonstrates that faithfulness to the underlying consonantal [-back] specification is more important than the preservation of the vocalic feature [+back].[5] Formally, this is expressed by ranking IDENT-C[-back] above IDENTV[+back] (Rubach, 2000). Furthermore, instead of retracting under the pressure of PAL, front vowels retain their [-back] quality and comply with PAL by palatalising the preceding consonant.[6] Given that the identity of the consonant is protected by the high-ranked IDENT-C[-back], the sequence *Cʲa* can change either to *Cʲ*ɛ or *Cʲi* to ensure that the consonant and the following vowel agree in backness. The first option is less costly as, in addition to backness adjustment, it only involves a change of the feature [+low] to [-low], while the second option requires an additional switch from [-high] to [+high]. The constraints generating the change of //a// to [ɛ] are displayed in Tableau (7), which shows the evaluation of the word *pjata* [pʲɛta] ‘heel’ (nom. sg.) (*cf.* dim. form *pjatka* [ˈpʲatkə]).

[5] Depalatalisation of a consonant is attested before [ɛ] in Ukrainian (see Rubach (2007) for analysis and discussion).

[6] This generalisation holds for the word-level phonology. At a postlexical level, front vowel [i] retracts to [ɨ].

(7) *[ɛ]-reduction*

H //pʲa t+ˈa//	IDENT-C[-back]	PAL	*H/e,o	*H/a	IDENT [+low]	IDENT-V[+back]
L H ⇒a. pʲeˈta			*	*	*	*
L H b. pʲaˈta		*!		**		
L H c. paˈta	*!			**		

To recapitulate, unstressed low vowels are required to raise and front under the pressure of PAL, while non-low vowels are forced to lower due to the presence of High tone. The influence of palatalised consonants overrules the pressure exerted by High tone in dialects exhibiting [ɛ]-reduction, which is generated by the ranking PAL >> *H/a. The opposite ranking produces the pattern attested in dialects with the so-called *jakan'e* ([ja]-reduction), in which non-high vowels are lowered to [a] after soft consonants. This reduction type is observed in Standard Belarusian and in the southern parts of the central Russian dialectal area (Vajtovič, 1968; Požarickaja, 2005). In these systems, the evaluation of the word *pjata* [pʲaˈta] 'heel' proceeds as follows.

(8) *[ja]-reduction*

H //pʲat+ˈa//	*H/e,o	*H/a	PAL	IDENT[+low]	IDENT-V[+back]
L H ⇒ a. pʲaˈta		*	*		
L H b. pʲeˈta	*!	*		*	*

It should be noted that sequences violating PAL occur in stressed syllables, in which back vowels [a] and [o] are found after soft consonants, for instance *pjos* [ˈpʲos], *tjotja* [ˈtʲotʲə] 'aunt', *mjata* [ˈmʲatə] 'mint', *vz'át'* [ˈvzʲatʲ] 'take'. Let us recall from Chapter 2 that stressed segments are immune to change because prominent syllables license greater vocalic complexity. Formally, this has been analysed in terms of positional faithfulness (Beckman, 1997; Casali, 1997).

The palatalisation of consonants and the vowel quality of the stressed syllables is retained due to the following positional faithfulness constraints.

(9) a. IDENT-C[-back]$_{\text{HDFT}}$: In stressed syllables, [-back] on a consonant in the input must be preserved on the corresponding consonant in the output.

b. IDENT-V[+low]$_{\text{HDFT}}$: In stressed syllables, [+low] on a vowel in the input must be preserved on the corresponding vowel in the output.

c. IDENT-V[+round]$_{\text{HDFT}}$: In stressed syllables, [+round] on a vowel in the input must be preserved on the corresponding vowel in the output.

To prevent the change in stressed syllables, the constraints in (9) have to be ranked above the markedness constraint PAL. The ranking choosing the optimal output for the word *pjat'* [ˈpʲatʲ] 'five' is shown in Tableau (10). Here and below, tone is not shown when not relevant for the evaluation of candidates.

(10) *Lack of reduction in stressed syllables*

//ˈpʲatʲ//	IDENT-V[+back]$_{\text{HDFT}}$	IDENT-C[-back]$_{\text{HDFT}}$	PAL
⇒a. (ˈpʲatʲ)			*
b. (ˈpʲitʲ)	*!		
c. (ˈpatʲ)		*!	

Candidates (10b) and (10c) represent two different strategies: in (10b) the vowel is fronted, and in (10c) the consonant is depalatalised. Both of them lose due to the fatal violations of the undominated positional faithfulness constraints. In the next section we look at [i]-reduction, another process attested in the context of palatalised consonants.

2.2. [i]-reduction

In the Contemporary Standard Russian, the vowels [a], [e] and [o] are neutralised to [i] in immediately pretonic positions (Avanesov, 1974; Kasatkin, 2005). The illustrative data are presented below.

(11) *[i]-reduction*

a. [a] – [i]

svjaz' [ˈsvʲasʲ] 'connection'	–	svazat' [svʲiˈzatʲ] 'connect'
xomjak [xaˈmʲak] 'hamster' (nom. sg.)	–	xomjaka [xəmʲiˈka] id. (gen. sg.)
čaj [ˈčʲaɻ] 'tea' (nom. sg.)	–	čai [čʲiˈi] id. (nom. pl.)
očag [aˈčʲak] 'hearth' (nom. sg.)	–	očaga [ačʲiˈga] id. (gen. sg.)
morjak [maˈrʲak] 'sailor' (nom. sg.)	–	morjačok [mərʲiˈčʲɔk] id. (dim.)

b. [e] – [i]

delo [ˈdʲel] 'business' (nom. sg.)	–	dela [dʲiˈla] id. (nom. pl.)
mesto [ˈmʲestə] 'place' (nom. sg.)	–	mesta [mʲiˈsta] id. (nom. pl.)
zemli [ˈzʲemlʲɪ] 'earth' (nom. pl.)	–	zemla [zʲiˈmlʲa] id. (nom. sg.)
les [ˈlʲes] 'forest' (nom. sg.)	–	lesa [lʲiˈsa] id. (nom. pl.)
bel [ˈbʲel] 'white' (short form)	–	belit' [bʲiˈlʲitʲ] 'to whitewash'

c. [ɔ] – [i]

njos [ˈnʲɔs] 'carry' (past. masc. sg.)	–	nesi [nʲiˈsʲi] id. (imp.)
mjod [ˈmʲɔt] 'honey' (noun)	–	medovyj [mʲiˈdɔvɨɻ] id. (adj.)
kotjol [kaˈtʲɔl] 'pot'	–	kotelok [kətʲiˈlɔk] id. (dim.)
koljosa [kaˈlʲɔsə] 'wheel' (nom. pl.)	–	koleso [kəlʲiˈsɔ] id. (nom. sg.)
čjornyj [ˈčʲɔrnɨɻ] 'black'	–	černit' [čʲirˈnʲitʲ] 'to blacken'

In the analysis developed so far, reduction after soft consonants is assumed to be driven by PAL, a constraint mandating agreement in backness between adjacent segments. As [i] is a front vowel, reduction to [i] after palatalised consonants creates a sequence conforming to the requirements of PAL. However, PAL alone is insufficient to derive the change of unstressed non-high vowels [a], [e] and [o] to a high vowel [i], as shown by the evaluation of the first syllable of the word *pjata* [pʲiˈta] 'heel' (nom. sg.) (*cf.* dim. form *pjatka* [ˈpʲatkə]).

(12) *[i]-reduction: failed evaluation*

//pʲat+ˈa//	PAL	IDENT-C[-back]	IDENT-V[+back]	IDENT-V[-high]
a. pʲaˈta	*!			
☹ b. pʲiˈta			*	*
⇐ c. pʲeˈta			*	
d. paˈta		*!		

The faithful candidate (49a) is excluded by the high-ranked PAL. Candidates (49b) and (49c) fare equally well on PAL because in both of them, a soft consonant is followed by a front vowel. However, candidate (49c) wins because the

intended winner (49b) turns the underlying low vowel into a high vowel and in doing so runs afoul of IDENT-V[-high].

Since [i] is less sonorous than [e], it might be argued that the choice in favour of [i] is motivated by the constraint *-Δ_{ω}{e,o} (defined in Section 3, Chapter 3) forcing the reduction of vowel prominence in an unstressed position.[7] The point is illustrated by the evaluation shown in (13) below.

(13) *[i]-reduction*

//pʲat+ˈa//	PAL	*-Δ_{ω}{e,o}	*-Δ_{ω}{i,u}
⇒ a. pʲiˈta			*
b. pʲeˈta		*!	
c. pʲaˈta	*!		

However, this is not a viable option because dialects with [i]-reduction (such as Standard Russian) also have [a]-reduction after hard consonants in the immediately pretonic positions and reduction to [ə] in other unstressed syllables. It was assumed earlier in Chapter 3 that the two types of reduction taking place after hard consonants are generated by the ranking of the *H/V family of constraints above *-Δ_{ω}{e,o} (*cf.* the evaluation shown in Tableau (33) in Section 4.3, Chapter 3). This ranking does not produce the correct output when the vowel in the immediately pretonic position is preceded by a soft consonants. Given the choice between the high vowel [i] and the mid vowel [e], *H/i,u opts for the latter, as illustrated in Tableau (14) below.

(14) *[i]-reduction: failed evaluation*

H //pʲat+ˈa//	PAL	*H/i,u	*H/e,o	*H/a	*-Δ_{ω}{e,o}	*-Δ_{ω}{i,u}
L H a. pʲaˈta	*!			*		
L H ⇐ b. pʲeˈta			*		*	
L H ☹ c. pʲiˈta		*!				*

[7] An analysis along these lines has been developed by Crosswhite (2001).

To conclude, the process of [i]-reduction cannot be analysed, on a par with palatalisation, as an assimilation in backness between a vowel and the preceding consonant. Instead, I have argued in Mołczanow (2007, 2015) that [i]-raising constitutes an adjustment in height between two neighbouring segments. In the Halle-Sagey model of feature geometry, the contrast between soft and hard consonants is expressed with the feature [±back] (Kenstowicz, 1994: 41). As both series are produced by raising of tongue body which accompanies primary articulation, the feature [+high] has been assumed to be redundantly present in both soft and hard consonants in Russian (Rubach, 2002: 171). However, phonetic studies have demonstrated that the most salient characteristics distinguishing soft and hard series is a widening *vs*. a narrowing of the pharynx (Koneczna & Zawadowski, 1956; Halle, 1959; Fant, 1960; Kochetov, 2002). So while soft consonants are produced with a raising of the front of the tongue which is accompanied by a widened pharynx, hard consonants are articulated by retracting the tongue which results in a narrowing in the region of the uvula, and in the upper part of the pharynx (Fant, 1960: 171). In view of these facts, it is questionable whether the feature [+high] is present in both soft and hard consonants. Rather, it appears that palatalised consonants should be specified for both [-back] and [+high], whereas hard consonants are only defined by the feature [+back].[8]

An additional argument for the feature [+high] being present in palatalised consonants comes from the West Ukrainian dialects exhibiting vowel harmony. In Synevir, a dialect spoken in the Carpathian mountains, soft consonants pattern together with high vowels in triggering vowel raising (Nikolaev, 2006; Tolstaja, 2009). This is illustrated by the data in (15), taken from Tolstaja (2009).[9]

(15) *Synevir vowel raising*
ɛ → ɪ

a.	b.
[ˈdɛ] ‘where’	[ˈdɪsʲ] ‘somewhere’
[ˈbɛrɛx] ‘belt’	[ˈbɪrɪzʲi] id. (loc. sg.)
[ˈčɛrɛs] ‘belt’	[ˈčɪrɪsʲi] id. (loc. sg.)
	[ˈčɪrɪsü] id. (gen. pl.)
[ˈsvɛtɛr] ‘jumper’	[ˈsvɪtɪrʲi] id. (loc. sg.)
	[svɪtɪˈrü] id. (gen. pl.)

[8] Since non-palatalised consonants are produced with a constriction in the pharynx, they are sometimes called pharyngealised (Sawicka & Grzybowski, 1999). However, there is no evidence showing that these segments bear the redundant specification [pharyngeal].

[9] It should be noted that mid vowel raising is not conditioned prosodically because it occurs in both stressed and unstressed syllables.

ɔ → ʊ	
[ˈnɔsa] ‘nose’	[ˈnʊsʲi] id. (loc. sg.)
[ˈkɔlɛsɔ] ‘wheel’	[ˈkʊlɪsʲi] id. (loc. sg.)
[ɦɔlɔˈva] ‘head’	[ˈpʊ ɦʊlʊvʲi] id. (loc. sg.)
	[ɦʊlʊˈvʊw] id. (instr. sg.)
[bɔrɔˈda] ‘beard’	[ˈbʊrʊdu] id. (acc. sg.)

The examples above show that mid vowels [ɛ] and [ɔ] in the left-hand column (15a) change into the high vowels [ɪ] and [ʊ] when followed by soft consonants or high vowels in the next syllable (15b). This generalisation is expressed in simple terms if soft consonants, like high vowels, are specified for the feature [+high]. Thus, the raising of non-high vowels in the vicinity of soft consonants can be analysed as a case of assimilation in height (Lahiri & Evers, 1991; Rubach, 2007; Mołczanow, 2007, 2015).

In contrast to Synevir leftward spreading of the feature [+high], [i]-raising in dialects with vowel reduction propagates from the consonant to the following vowel. In terms of OT, this generalisation can be expressed by means of the markedness constraint AGREE[+high]:

(16) AGREE[+high]: A consonant and a following vowel agree in height.[10]

The constraint Agree[+high] is motivated cross-linguistically. In English, alveolar obstruents //s//, //z//, //t// and //d// become palatoalveolar [ʃ], [ʒ], [tʃ], and [dʒ] before the palatal glide [j], e.g. *habit – habitual.* As both palatoalveolar segments and the front glide [j] are specified for the feature [+high] (Chomsky & Halle, 1968), English palatalisation can be analysed as spreading of the feature [+high] from a glide to the preceding consonant. Halle (2005: 38) and Rubach (2007: 107) discuss a similar phenomenon in the Bantu language Tswana, where labials undergo palatalisation before the passive suffix *-wa*, e.g. *lop+a – lotʃ+wa* ‘request’. Rubach (2007) argues that this process is best explained in terms of agreement in [+high] between the consonant and the glide.

Returning to the raising of non-high vowels attested in Russian, let us consider the evaluation shown in Tableau (17), which demonstrates how

[10] Like PAL, AGREE[+high] belongs to the AGREE(Place) family of constraints (Gnanadesikan, 1997; Baković, 1999). Besides AGREE constraints, OT offers several other approaches to modelling assimilation (feature alignment (Kirchner, 1993), feature spreading (Padgett, 2002), feature sharing (McCarthy, 2011), among others). From the perspective of the present data, the choice of a model is not essential.

the constraint system established so far derives [i]-reduction in the word *pjata* [pʲiˈta] 'heel' (nom. sg.) (*cf.* dim. form *pjatka* [ˈpʲatkə]).

(17) *[i]-reduction: Standard Russian*

//pʲat+ˈa//	AGREE[+high]	PAL	*H/i,u	*H/e,o	*H/a	IDENT [+low]	IDENT-V [-high]
⇒a. pʲiˈta			*		*	*	*
b. pʲaˈta	*!	*			**		
c. pʲeˈta	*!			*	*	*	

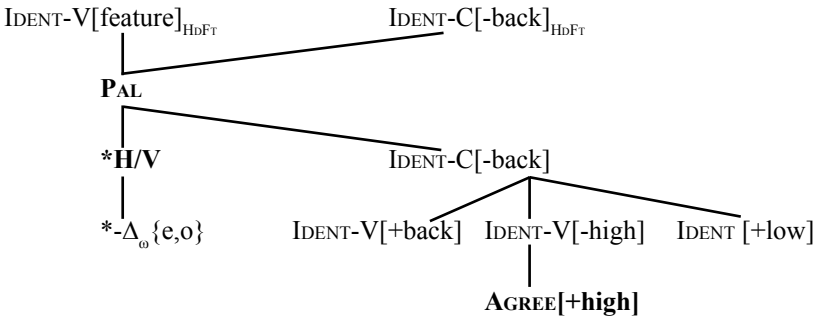
The winning candidate (17a) raises //a// to [i], which leads to the violation of a host of constraints. In particular, it runs afoul of the markedness constraint *H/i,u disallowing High tone to be realised on high vowels and two faithfulness constraints banning underlying feature modifications. Nevertheless, it fares better than the faithful contender (17b), which fatally violates AGREE[+high]. In addition, candidate (17b) does not comply with PAL as it contains a sequence of a palatalised consonant followed by a back vowel. Candidate (17c) avoids violating PAL by turning //a// into the front vowel [e]. Like the faithful candidate (17b), it is excluded by AGREE [+high], which penalises the combination of the palatalised [+high] consonants with non-high vowels.

2.3. Interim summary

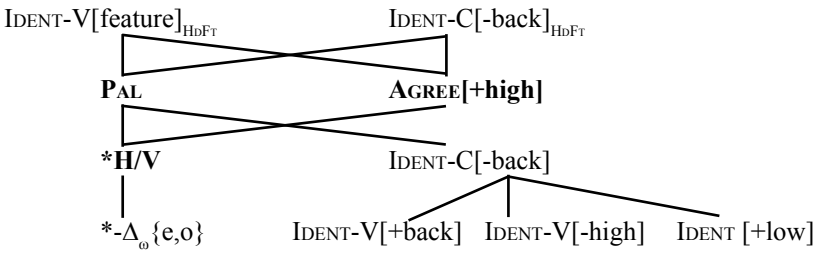
The preceding sections have considered neutralisation patterns attested after palatalised consonants in different East Slavic dialects. Given that palatalised consonants are defined as [-back] and [+high], the presence of either [e]-reduction or [i]-reduction in a given dialect has been analysed to derive from the relative ranking of the markedness constraints PAL, AGREE[+high] and *H/V. Figure 5 shows ranking schemata which generate different types of vowel neutralisation after palatalised consonants (the constraints whose re-rankings produce different types of reduction are set in bold type). As can be seen in Fig. 5, [e]-reduction is triggered by PAL ranked above *H/V, while [i]-reduction is derived when both PAL and AGREE[+high] outrank *H/V. The opposite scenario,

with *H/V dominating PAL and AGREE[+high], yields [ja]-reduction. This system neutralises non-high vowels to [a], after palatalised and velarised consonants alike. In the next section we turn to more complex patterns of reduction, in which not only preceding, but also the following consonants affect the quality of unstressed vowels.

[e]-reduction



[i]-reduction



[ja]-reduction

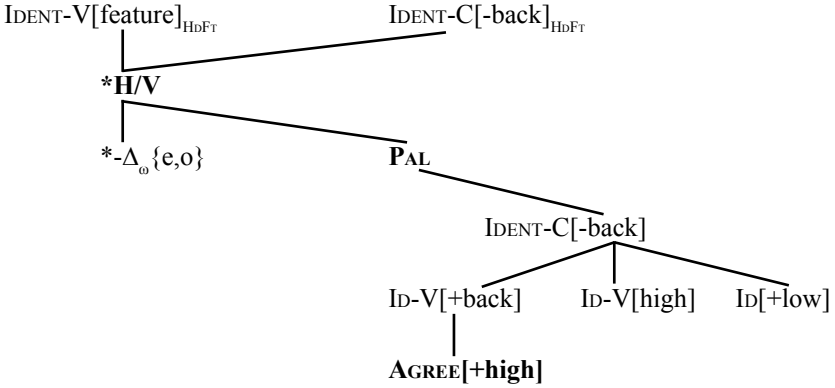


Figure 5. *Reduction patterns after palatalised consonants*

3. Feature assimilation in *C^{j}VC^{j}* contexts

There are dialects within the southern Russian and the eastern parts of the central Russian dialectal area (Tula, Penza, Tambov and Marij-El regions) with a mixed type of vowel reduction: non-high vowels neutralise to [a] before non-palatalised consonants and to [i] or [e] before palatalised consonants (e.g., Kasatkin, 2005: 43; Požarickaja, 2005: 59). This pattern, referred to as moderate *jakan'e* ([ja]-reduction) in the traditional literature, is attested in the context of preceding soft consonants in systems which exhibit [a]-reduction after non-palatalised consonants. Thus, neutralisation of the immediately pretonic non-high vowels in [a] is the predominant pattern in dialects with moderate [ja]-reduction, and the reduction to [i]/[e] is a contextually conditioned process, triggered by the presence of a palatalised consonant in the onset of the following stressed syllable. The illustrative data is provided below.

(18) *Moderate [ja]-reduction*

a. Tonic vowel

njos [ˈnʲos] 'carry' (masc. past)
les [ˈlʲes] 'forest'
pjat' [ˈpʲatʲ] 'five'
rek [ˈrʲek] 'river' (gen. pl.)
prjal [ˈprʲal] 'spin' (masc. past)
vzgljad [ˈvzglʲat] 'a look'[11]

b. Pretonic [a] before a hard consonant

nesla [nʲaˈsla] 'carry' (fem. past)
lesu [ˈlʲasu] 'forest' (loc. sg.)
pjatak [pʲaˈtak] 'five-rouble note'
reka [rʲaˈka] 'river' (nom. sg.)
prjala [prʲaˈla] 'spin' (fem. past)
gljažu [glʲaˈžu] 'look' (1st pers. sg. pres.)

c. Pretonic [i]/[e] before a soft consonant

	[i]-reduction dialects	*[e]-reduction dialects*
nesi 'carry' (imp.)	[nʲiˈsʲi]	[nʲeˈsʲi]
lesina 'piece of wood'	[lʲiˈsʲina]	[lʲeˈsʲina]
pjati 'five' (gen.)	[pʲiˈtʲi]	[pʲeˈtʲi]
reki 'river' (gen. sg.)	[rʲiˈkʲi]	[rʲeˈkʲi]
prjadjot 'spin' (3rd pers. sg. pres.)	[prʲiˈdʲot]	[prʲeˈdʲot]
gljadjat 'look' (3rd pers. pl. pres.)	[glʲiˈdʲat]	[glʲeˈdʲat]

[11] The velar plosive [g] is spirantised to [ɣ] in the sorthern Russian dialects.

The comparison of the forms in (18a) and (18b) shows that non-high vowels lower to [a] in the immediately pretonic position before a non-palatalised consonant in the stressed syllable. When the following consonant is palatalised (18c), the non-high vowels neutralise either into [e] or [i]. Crosswhite (2001) analyses the reduction to [e] and [i] by means of a phonotactic constraint requiring a vowel flanked by two palatalised consonants to be front:

(19) $C^j\_C^j$/[+front]: A vowel may not occur between two palatalised consonants unless it is [+front] (Crosswhite, 2001: 93).

The choice between [e] or [i] in a given dialect is made by the mutual ranking of the two constraints, LIC-NONPERIPH/STRESS and MAX[-high], defined below:

(20) a. LIC-NONPERIPH/STRESS: A nonperipheral vowel may not occur in the output unless under stress (Crosswhite, 2001: 83).
b. MAX[-high]: no deletion of [-high] (Crosswhite, 2001: 16).

High-ranked LIC-NONPERIPH/STRESS eliminates unstressed mid vowels, whereas $C^j\_C^j$/[+front] induces the fronting of a back vowel. Both constraints outrank MAX[-high] in dialects exhibiting [i]–raising before soft consonants. The operation of LICNONPERIPH/STRESS and $C^j\_C^j$/[+front] is illustrated in Tableau (21), which shows the evaluation of the word *pjati* [$p^ji\,'t^ji$] 'five' (gen.). The nominative form *pjat'* [$'p^jat^j$] demonstrates that the vowel in question comes from the underlying //a//.

(21) *Moderate [ja]-reduction in: dialects with [i]-reduction (Crosswhite, 2001)*

//p^jat^j+'i//	$C^j\_C^j$/[+front]	LIC-NONPERIPH/STRESS	MAX[-high]
⇒ a. $p^ji\,'t^ji$			*
b. $p^ja\,'t^ji$	*!		
c. $p^je\,'t^ji$		*!	

The reduction to [e] is generated by the reverse ranking of the constraints LICNONPERIPH/STRESS and MAX[-high]. In this scenario, [e]-reduction (candidate (22a) in Tableau (22) below) is the optimal output because [e], unlike [i], preserves the underlying [-high] specification.

(22) *Moderate [ja]-reduction: dialects with [e]-reduction (Crosswhite, 2001)*

//pʲatʲ+ˈi//	Cʲ_Cʲ/[+front]	Max[-high]	Lic-Nonperiph/Stress
⇒ a. pʲeˈtʲi			*
b. pʲaˈtʲi	*!		
c. pʲiˈtʲi		*!	

Given that the basic architecture of OT aims at minimising the number of constraints, employing one constraint Cʲ_Cʲ/[+front] to drive fronting in systems with [e]-reduction and [i]-reduction is a desirable move. However, while Crosswhite's model is successful in analysing systems with moderate [ja]-reduction, it cannot adequately account for the data attested in dialects with moderate [e]-reduction. In these dialects, non-high vowels preceded by soft consonants are reduced to [e] before hard consonants and to [i] before soft consonants (Kasatkin, 2005: 43). Such a pattern is attested in Čuxloma, spoken in the northern Russian dialect area in the region of Kostroma (Kasatkin, 1999). Čuxloma has the Žizdra pattern of reduction after hard consonants, with non-high vowels neutralising in [a] before stressed non-low vowels and in [ə] before the stressed vowel [a]. After a soft consonant, the choice among [a], [e] or [i] is conditioned by the quality of the following consonant and the vowel in the stressed syllable. If the consonant is hard, [a] is found before the non-low vowels, and [e] before the low vowel [a]. The high vowel [i] is attested before soft consonants, irrespective of the quality of the stressed vowel. This is illustrated by the examples in (23) below, taken from Kasatkin (1999: 417-420).

(23) *Čuxloma reduction*

a. *CʲVC*

i. [a] before non-low vowels

privezut	[prʲɪvʲaˈzut]	'bring' (3rd pers. pl. future)
počemu	[pəčʲaˈmu]	'why'
derutsja	[dʲaˈruts͡ːə]	'fight' (3rd pers. pl.)
vsego	[fˢsʲaˈvo]	'whole' (gen. sg.)
segodnja	[sʲaˈvodʲnʲə]	'today'

ii. [e] before low vowels

xlebaj	[xlʲeˈbaɻ]	'drink' (imp. sg.)
včerašnego	[fčʲeˈrašnʲɪvə]	'yesterday' (adj., gen. sg.)
pobrela	[pəbrʲeˈla]	'ramble' (past. fem.)
vosemnadcat'	[vəsʲeˈmnat͡sːətʲ]	'eighteen'

b. *CʲVCʲ*
[i] in all positions

telaty	[tʲiˈlʲatɪ]	‘calves’
venčalis’	[vʲinʲˈčʲalʲɪsʲ]	‘marry’ (3rd pers. pl. past)
zverej	[zʲvʲiˈrʲeˌj]	‘animal’ (gen. pl.)
verxom	[vʲirʲˈxom]	‘astride’
rebjatiški	[rʲɪbʲiˈtʲiškʲɪ]	‘children’

The pattern of moderate [e]-reduction, instantiated by Čuxloma, is interesting because it shows that both [e] (23aii) and [i] (23b) can constitute the outcome of reduction in the *CʲV* context, which proves that the occurrence of either [e] or [i] is not always a matter of dialectal variation, as in the moderate [a]-reduction systems discussed above. Crosswhite (2001) suggests the following constraint to analyse [e]-reduction taking place after soft consonants:

(24) Cʲ/[+front]: In unstressed syllables, a palatalised consonant must be followed by a [+front] vowel (Crosswhite, 2001: 77).

In Čuxloma, a palatalised consonant is followed by a front vowel in *Cʲi* as well as in *Cʲe*, so both sequences satisfy Cʲ/[+front]. However, *Cʲe* contains a mid vowel, which is banned from unstressed syllables by Lic-Nonperiph/Stress. In turn, the raising to [i] in *Cʲi* sequences is assumed to be blocked by a high-ranked Max[-high] (Crosswhite, 2001: 89). The two processes are incompatible in this model: [e]-reduction compels Max[-high] to outrank Lic-Nonperiph/Stress, whereas [i]-reduction requires the opposite ranking. The evaluation of the words *pjatak* [pʲeˈtak] ‘five-rouble note’ and *pjati* [pʲiˈtʲi] ‘five’ (gen.) in (25) below serves to illustrate the point.

(25) *Moderate [e]-reduction: Crosswhite’s approach*

i. //pʲatʲ+ˈak//	Cʲ/[+front]	Cʲ_Cʲ/[+front]	Max[-high]	Lic-Nonperiph/Stress
⇒ a. pʲeˈtak				*
b. pʲiˈtak			*!	
c. pʲaˈtak	*!			
ii. //pʲatʲ+ˈi//	Cʲ /[+front]	Cʲ_Cʲ/[+front]	Max[-high]	Lic-Nonperiph/Stress
⇐ a. pʲeˈtʲi				*
☹ b. pʲiˈtʲi			*!	
c. pʲaˈtʲi	*!	*		

It can be seen that the markedness constraints C^{j}/[+front] and C^{j}_C^{j}/[+front] are satisfied by both [p^{j}e] and [p^{j}i], so the choice between the two options is passed onto MAX[-high] and LICNONPERIPH/STRESS. The ranking MAX[-high] >> LICNONPERIPH/STRESS generates the correct output [p^{j}eˈtak] in (25i) but gives preference to a wrong candidate *[p^{j}eˈt^{j}i] in (25ii). The reverse ranking, LICNONPERIPH/STRESS >> MAX[-high], is equally problematic as it rightly chooses the form [p^{j}iˈt^{j}i] but fails in the case of *[p^{j}iˈtak].

To conclude, the analysis assuming that both [i]-reduction and [e]-reduction are driven by a constraint against back vowels in the contexts of soft consonants (C^{j}_C^{j}/[+front]), coupled with a constraint prohibiting unstressed mid vowels (LIC-NONPERIPH/STRESS), fails to account for systems with moderate [e]-reduction. The main problem of this approach stems from its inability to distinguish two separate triggers for [i]-reduction and [e]-reduction. However, the ranking paradox discussed above indicates that these processes do not constitute two different strategies which are used by different dialects to avoid disagreement in backness between vowels and adjacent consonants. Rather, the fact that [i]-reduction and [e]-reduction co-occur within one system suggests that they respond to different types of markedness requirements.

Let us recall from the preceding sections that [e]-reduction and [i]-reduction are widely attested in different East Slavic dialects in the contest of the preceding palatalised consonant in the unstressed *C^{j}V* sequences. It has been argued in Section 2 of this chapter that [e]-reduction is driven by the constraint PAL requiring agreement in backness, while [i]-reduction is triggered by the constraint AGREE[+high] mandating agreement in height. The data furnished by the dialects with moderate [a]-reduction and [e]-reduction suggest that similar mechanisms are at work in the *VC^{j}* and *VC* sequences. In particular, [i]-reduction taking place before soft consonants can be viewed as a regressive assimilation in height between a vowel and a following consonant. However, none of the East Slavic dialects exhibits raising before soft consonants when the unstressed vowel is preceded by a non-palatalised consonant, e.g. *parit'* [paˈr^{j}it^{j}] 'float', *vode* [vaˈd^{j}e] 'water' (dat. sg.), or when it occurs in an onsetless syllable, e.g. *oni* [aˈn^{j}i] 'they'; the pronunciations such as *[pɨˈr^{j}it^{j}], *[vɨˈd^{j}e], and *[ɨˈn^{j}i]/*[iˈn^{j}i] are never attested. Therefore, the constraint compelling the raising of non-high vowel has to refer not only to the following, but also to the preceding segment, as in (26) below:

(26) AGREE-C^{j}VC^{j}[+high]: A vowel occurring between two palatalised consonants must be [+high].

Further evidence for the constraint AGREE-C^{j}VC^{j}[+high] is furnished by the process of [e]-raising, which occurs in Polish child phonology. Łukaszewicz & Opalińska (2006) report two [e]-raising effects in the speech of a Polish child (aged 3;0-3;8): a gradient change of //ɛ// to [ɛ$_{\uparrow}$] in the vicinity of a single palatal consonant (a similar phenomenon is attested in adult Polish), and a categorical change to [i] between palatal or palatalised consonants, which is not present in adult Polish, e.g. *biel* [b^{j}jɛ$_{\uparrow}$l] 'white' – *bielić* [b^{j}il^{j}it͡ɕ] 'whiten', *dzielę* [d͡ʑɛ$_{\uparrow}$lɛ] 'I divide' – *dzielić* [d͡ʑil^{j}it͡ɕ] 'to divide'. The categorical change of //ɛ// to [i] between palatal or palatalised consonants in child Polish parallels the raising of non-high vowels attested in East Slavic dialects with moderate reduction. Both processes constitute an assimilation in height and can be analysed by means of the constraint AGREE-C^{j}VC^{j}[+high].

Tableau (27) below demonstrates how the analysis including the constraint AGREE-C^{j}VC^{j}[+high] generates correct outputs for the words *pjatak* [p^{j}eˈtak] 'five-rouble note' and *pjati* [p^{j}iˈt^{j}i] 'five' (gen.) in dialects with moderate [e]-reduction.

(27) *Moderate [e]-reduction*

i. //p^{j}at+ˈak//	PAL	AGREE-C^{j}VC^{j}[+high]	IDENT-V[-high]	IDENT-V[+low]
⇒ a. p^{j}eˈtak				*
b. p^{j}iˈtak			*	*!
c. p^{j}aˈtak	*!			
ii. //p^{j}at^{j}+ˈi//	**PAL**	**AGREE-C^{j}VC^{j}[+high]**	**IDENT-V[-high]**	**IDENT-V[+low]**
⇒ a. p^{j}iˈt^{j}i			*	*
b. p^{j}eˈt^{j}i		*!		*
c. p^{j}aˈt^{j}i	*!			

The crucial difference between Crosswhite's (2001) approach illustrated in (25) above and the present model is that the analysis in (27) provides a means of distinguishing between the outputs containing the high and the non-high vowels. Tableau (27ii) shows that, while both [p^{j}iˈt^{j}i] (27iia) and [p^{j}eˈt^{j}i] (27iib) satisfy PAL, the latter does not conform to the requirements of AGREE-C^{j}VC^{j}[+high] because it contains a [-high] vowel followed by a [+high] consonant.

AGREE-C^{j}VC^{j}[+high] is mute in (27i) since the pretonic vowel in //p^{j}aˈtak// occurs before a non-palatalised consonant, which is not specified for [+high]. In this case, the winner is determined by the lower-ranked faithfulness constraints: candidate (27ia) wins because it preserves the underlying [-high] specification.

The constraint AGREE-C^{j}VC^{j}[+high] is also operative in dialects with moderate [ja]-reduction. As illustrated by the data in (18) at the beginning of this section, moderate [ja]-reduction consists in the raising and fronting of the immediately pretonic non-high vowels in the *C^{j}VC^{j}* context and lowering to [a] elsewhere. The tone-based approach to vowel reduction advocated in this book assumes that pretonic reduction to [a] is motivated by High tone, which prefers to dock on low (most sonorous) vowels. Let us recall that the association of High tone with vowels of different sonority profiles is regulated by the constraints of the *H/V family. These constraints are undominated in dialects with the so called strong [ja]-reduction (as in Standard Belarusian), where all pretonic mid vowels are lowered to [a], irrespective of the consonantal context. In dialects with moderate [ja]-reduction, lowering to [a] is blocked if the pretonic vowel is flanked by soft consonants: instead of the expected [a], the vowel in question surfaces as [i] or [e], *cf. nesu* [n^{j}aˈsu] ‘carry’ (1st pers. sg.) *vs. nesi* [n^{j}iˈs^{j}i] id. (imp.). The change to [i] is driven by AGREE-C^{j}VC^{j}[+high] forcing the assimilation in height between the vowel and the adjacent soft consonants, as in the dialects with moderate [e]-reduction discussed above.

The operation of the constraint system generating moderate [ja]-reduction is illustrated in (28). The Tableau in (28i) shows the evaluation of the word *reka* [r^{j}aˈka] id. (nom. sg.), in which the underlying mid vowel //e// (*cf. rek* [ˈr^{j}ek] ‘river’ (gen. pl.)) surfaces as [a] in the pretonic syllable. The change to [a] takes place under duress of *H/e,o, which gives preference to candidate (28ia) with a low vowel in the pretonic syllable. The ranking *H/e,o >> PAL ensures that candidate (28ia) wins despite containing a marked configuration of a [-back] consonant followed by a [+back] vowel. In *reke* [r^{j}iˈk^{j}e] id. (dat. sg.) in (28i), the pretonic vowel is followed by a soft consonant, so the change to [a] in candidate (28iib) is blocked due to the markedness constraint AGREE-C^{j}VC^{j}[+high]. This constraint also rules out the faithful contender (28iib) and chooses candidate (28iia), in which a soft consonant is preceded by a high vowel.

(28) *Moderate [ja]-reduction, [i]-reduction*

i. //rʲek+ˈa//	AGREECʲVCʲ [+high]	*H/i,u	*H/e,o	*H/a	PAL	IDENT-V [-high]	IDENT [-low]
⇒ a. rʲaˈka				**	*		*
b. rʲeˈka			*!	*			
c. rʲiˈka		*!		*		*	
ii. //rʲek+ˈe//	AGREE-CʲVCʲ [+high]	*H/i,u	*H/e,o	*H/a	PAL	IDENT-V [-high]	Ident [-low]
⇒ a. rʲiˈkʲe		*	*			*	
b. rʲaˈkʲe	*!		*	*	*		*
c. rʲeˈkʲe	*!		**				

As mentioned previously, non-low vowels neutralise in favour of [e] when followed by a soft consonant in a number of dialects with moderate [ja]-reduction, e.g. *pjatak* [pʲaˈtak] 'five-rouble note' – *pjati* [pʲeˈtʲi] 'five' (gen.) (for further illustration, see data in (18c) at the beginning of this section). This process mirrors [e]-reduction occurring in the unstressed *CʲV* sequences described earlier in this chapter (in Section 2.1), e.g. *čas* [ˈčʲas] 'hour' (nom. sg.) – *časa* [čʲeˈsa] id. (gen. sg.). In both cases, a pretonic vowel assimilates in backness to an adjacent consonant, the difference between the two patterns consisting in the direction of assimilation: the trigger is located in the preceding consonant in [čʲeˈsa] and in the following consonant in [pʲeˈtʲi]. At first blush, then, it would seem that the latter change instantiates a case of backness assimilation between a vowel and the immediately following consonant. However, dialects showing moderate [ja]-reduction after palatalised consonants also exhibit [a]-reduction after hard consonants and in word-initial positions, e.g. *kon'* [ˈkonʲ] 'horse' (nom. sg.) – *konja* [kaˈnʲa] id. (gen. sg.), *on* [ˈon] 'he' – *oni* [aˈnʲi] 'they', where lowering to [a] takes place irrespective of the quality (or the presence) of the following consonant. If the consonant following the pretonic vowel were to trigger fronting in these words, we would expect to attest forms such //konʲ+ˈa// *[kʲeˈnʲa] and //on+ˈi// *[eˈni], similar to //pʲatʲ+ˈi// [pʲeˈtʲi]. Therefore, the constraint driving

fronting needs to make reference to the consonants at both sides of the vowel. The relevant constraint is stated in (29) below.

(29) AGREE-C^{j}VC^{j}[-back]: A vowel occurring between two palatalised consonants must be [-back].

Besides the switch in backness, the change of //a// to [e] in words such as [p^{j}e't^{j}i] involves raising to a less sonorous vowel. Let us recall that dialects with moderate [ja]-reduction lower non-high vowels in all pretonic positions except before palatalised consonant (*cf.* the data in (18)). It has been argued in this book that reduction to [a] is triggered by High tone, favouring low vowels in immediately pretonic positions. On this view, moderate [ja]-reduction is modelled by ranking AGREE-C^{j}VC^{j}[-back] above the *H/V constraints, thus ensuring that AGREE-C^{j}VC^{j}[-back] overrides the pressure exerted by High tone. This is illustrated by Tableau (30) which shows the evaluation of the words *peti* [p^{j}e't^{j}i] 'five' (gen.) and *pjatak* [p^{j}a'tak] 'five-rouble note' in dialects exhibiting [e]-reduction in the context of palatalised consonants and [a]-reduction elsewhere.

(30) *Moderate [ja]-reduction, [e]-reduction*

i. //p^{j}at^{j}+'i//	AGREE-C^{j}VC^{j} [-back]	*H/i,u	*H/e,o	*H/a	PAL	IDENT-V[+back]
⇒ a. L H p^{j}e't^{j}i		*	*			*
b. L H p^{j}i't^{j}i		**!				*
c. L H p^{j}a't^{j}i	*!	*		*	*	
ii. //p^{j}at+'ak//	**AGREE-C^{j}VC^{j} [-back]**	***H/i,u**	***H/e,o**	***H/a**	**Pal**	**IDENT-V[+back]**
⇒ a. L H p^{j}a'tak				**	*	
b. L H p^{j}i'tak	*!	*		*		*
c. L H p^{j}e'tak	*!		*	*		*

In (30)i, AGREE-C^{j}VC^{j}[-back] excludes candidate (30ic) because it retains the back vowel [a] before a palatalised consonant. The remaining candidates

(30ia) and (30ib) fare equally well on AGREE-C^{j}VC^{j}[-back], so the choice in favour of (30ia) is made by the lower-ranked *H/i,u. In (30ii), the pretonic vowel is followed by a non-palatalised consonant, so in this case, the back vowel [a] in (30iia) is the most optimal output, both from the perspective of AGREE-C^{j}VC^{j}[-back] as well as *H/i,u and *H/e,o.

To conclude, the data discussed in this section demonstrate that East Slavic dialects show backness agreement not only between consonants and the following vowels, but also in the environments in which a vowel in the immediately pretonic position is flanked on both sides by palatalised consonants. It has been suggested that both [e]-reduction and [i]-reduction instantiate two distinct assimilation processes: reduction to [e] is the result of backness assimilation, while the reduction to [i] is the effect of the assimilation in height. The mechanisms deriving [e]-reduction and [i]-reduction in the *C^{j}VC^{j}* contexts parallel the ones responsible for the palatalisation and raising in consonant-vowel sequences. The presence of palatalised consonants in both *C^{j}V* and *C^{j}VC^{j}* contexts inhibits tone-induced vowel lowering attested after hard consonants in many East Slavic dialects. In the next section we turn to one more context in which the consonantal neighbourhood obscures the effect of the underlying tone.

4. Reduction after hard stridents

4.1. Introduction

In most Russian dialects, as well as in the standard variety, stridents [š], [ž], and [t͡s] are phonetically hard and, unlike other hard consonants, do not have palatalised counterparts (Avanesov, 1984; Kasatkin, 2005). Given this fact, hard stridents are expected to pattern together with other hard consonants with respect to vowel reduction. However, [a]-reduction is blocked after hard stridents in the majority of Russian dialects, where, instead of lowering, non-high vowels exhibit raising to [i] when preceded by the consonants [š], [ž], or [t͡s]. For instance, dialects with moderate [ja]-reduction use a high vowel after a hard strident and a low vowel after other hard consonants. The examples in (31) demonstrate that hard stridents in (31a) pattern together with soft consonant (31c) and not with hard consonants (31b).

(31) *Hard stridents in dialects with moderate [ja]-reduction*
(data from Kasatkin, 2005: 50)

a. pšeno [pšaˈno] ‘millet’	–	pšenica [pšɨˈnʲɨt͡sə] ‘wheat’
žena [žaˈna] ‘wife’	–	ženix [žɨˈnʲix] ‘bridegroom’
cena [t͡saˈna] ‘price’	–	cene [t͡sɨˈnʲe] id. (dat. sg.)
žara [žaˈra] ‘heat’	–	žare [žɨˈrʲe] id. (dat. sg.)
b. nesu [nʲaˈsu] ‘I carry’	–	nisi [nʲiˈsʲi] id. (imp.)
lesok [lʲaˈsok] ‘forest’ (dim.)	–	lesnik [lʲiˈsʲnʲk] ‘forester’
c. voda [vaˈda] ‘water’	–	vode [vaˈdʲe] id. (dat. sg.)
trava [traˈva] ‘grass’	–	trave [traˈvʲe] id. (dat. sg.)

The data in (31) is not problematic if one assumes that hard stridents are underlyingly soft and become hard at a later derivational level, after the neutralisation of vowels has taken effect. An analyses along these lines has been proposed for Standard Russian by Halle (1959), Lightner (1972) and Rubach (2000). The basic idea is that hard stridents group together with soft consonants because both are [-back] when non-high vowels undergo pretonic reduction. However, while this analysis explains the presence of a high vowel in (31a) above, it actually fails to account for neutralisation patterns attested after hard consonants in Standard Russian. Unlike in the pattern presented in (31), consonants [š], [ž], and [t͡s] do not behave consistently with respect to vowel reduction in Standard Russian. As illustrated in (32) below, the pretonic vowel can surfaces either as [a] (32a) or as [ɨ] in a similar consonantal environment (32b).

(32) *Hard stridents in Standard Russian*
(data from Avanesov, 1984)

a. *šar* [ˈšar] ‘ball’	–	šary [šaˈrɨ] id. (nom. pl.)
šok [ˈšok] ‘shock’	–	šokirovat’ [šaˈkʲirəvətʲ] ‘to shock’
b. žalost’ [ˈžaləstʲ] ‘pity’	–	žalet’ [žɨˈlʲetʲ] ‘to pity’
šjepot [ˈšopət] ‘a whisper’	–	šeptat’ [šɨpˈtatʲ] ‘to whisper’

The fact that non-high vowels are raised in (32b) but not in (32a) is problematic on the assumption that stridents are phonologically soft consonants. The following section develops an alternative analysis, in which hard sibilants are argued to be underlyingly hard and neutralisation to [a] in (32a) is assumed to constitute the default pattern. The discussion in this section draws heavily on Mołczanow (2015).

4.2. Basic generalisations

As mentioned previously, consonants [š], [ž], and [t͡s] exhibit inconsistent behaviour with respect to vowel reduction in Standard Russian. This pattern is interesting because the outcome of reduction depends not only on the quality of the adjacent consonant, but also on the input quality of the vowel undergoing reduction. The underlying vowel //a// surfaces as [a] after hard stridents in the immediately pretonic position, which is illustrated in (33).

(33) šar [ˈšar] 'ball' (nom. sg.) – šary [šaˈrɨ] id. (nom. pl.)
žar [ˈžar] 'feaver' – žara [žaˈra] 'heat'
car' [ˈt͡sarʲ] 'tsar' (nom. sg.) – carja [t͡saˈrʲa] (gen. sg.)

Hard stridents were historically soft and, similar to other soft consonants, caused vowel raising. The vowel //a// was still raised to [ɨ] after [š] and [ž] in the old Moscow pronunciation, e.g. *žara* [žɨˈra] 'heat', *šary* [šɨˈrɨ] 'balls'. However, Standard Russian has [a] in these positions and Avanesov (1984: 93) explicitly warns against the pronunciation with [ɨ]. However, a handful of words have retained [ɨ] in immediately pretonic positions after hard stridents; the complete list is provided below.

(34) *žalet'* [žɨˈlʲetʲ] 'to pity' and derivatives; oblique plural forms of the word *lošad'* [ˈlošətʲ] 'horse': *lošadej* [ləšɨˈdʲeɻ] (gen. pl.), *lošadjam* [ləšɨˈdʲam] (dat. pl.), etc.; *ržanoj* [ržɨˈnoɻ] 'rye' (adj.); oblique forms of the numerals *dvadcat'* 'twenty' and *tridcat'* 'thirty': *dvadcati* [dvət͡sɨˈtʲi] (gen.), *tridcati* [trɪt͡sɨˈtʲi] (gen.).

The pronunciation of pretonic [ɨ] in the words in (34) above constitutes a prescriptive norm, which is not always followed. Shapiro (1968) reports that most speakers fail to observe this rule and pronounce [a] after hard stridents. This is confirmed by Avanesov & Ožegov (1959: 671), who note that "the frequently occurring pronunciation [ša], [ža], [t͡sa] is incorrect in these words" (translation is mine).

The low vowel [a] is usually found after hard stridents in the immediately pretonic position in borrowings (35a). Only four words, shown in (35b), have [ɨ] in this position (Avanesov, 1984: 93).[12]

[12] Borrowings which are not fully assimilated into the Russian phonological system may be exempt from vowel neutralisation, e.g., the word *šosse* 'highway' can be pronounced either [šoˈsɛ] or [šaˈsɛ].

(35) a. *šofjor* [ša'fʲor] 'driver', *šotlandec* [ša'tlandʲɪt͡s] 'Scot', *žokej* [ža'kʲeɻ] 'jockey', *žongljor* [žan'glʲor] 'juggler'
b. *žaket* [žɨ'kʲet] 'jacket', *žasmin* [žɨ'smʲin] 'jasmine', *žavel'* [žɨ'vʲelʲ] 'bleach', *bešamel'* [bʲɪšɨ'mʲelʲ] 'bechamel'

Unlike //a//, the front mid vowel //e// is raised to [ɨ] after [š], [ž], and [t͡s]. Some examples are given in (36).

(36) šest' ['šɛsʲtʲ] 'six' – šestoj [šɨ'stoɻ] 'sixth',
žemčjug ['žɛmčʲuk] 'pearl' (masc.) – žemčjužyna [žɨm'čʲužɨnə] (fem.),
ceny ['t͡sɛnɨ] 'price' (nom. pl.) – cena [t͡sɨ'na] (nom. sg.)

The sound spelled with the letter 'e' in words not showing alternations is pronounced [ɨ], e.g. *šeršavyj* [šɨr'šavɨɻ] 'rough', *žeton* [žɨ'ton] 'jetton', *žemannyj* [žɨ'mannɨɻ] 'affected'.

The mid vowel [o] alternates with both [a] and [ɨ] after hard stridents, as exemplified in (37a) and (37b), respectively.

(37) a. šok ['šok] 'shock' – šokirovat' [ša'kʲirəvətʲ] 'to shock'
b. šjopot ['šopət] 'a whisper' – šeptat' [šɨp'tatʲ] 'to whisper'
žjony ['žonɨ] 'wife' (nom. pl.) – žena [žɨ'na] (nom. sg.)

To sum up, the outcome of reduction after hard consonant is determined to a large extent by the quality of the input vowel. The underlying vowel //a//, except for a handful of exceptions in (35b), predominantly surfaces as [a] after hard stridents. The mid vowel //e// is consistently realised as [ɨ], and //o// appears to reduce to both [a] and [ɨ].

4.3. Analysis

Given the fact that hard stridents, similarly to other velarised consonants, are not [+high] and [-back], they are not expected to trigger vowel raising and to block tone-induced lowering in the immediately pretonic syllable. However, only the behaviour of the underlying vowel //a// is in line with these predictions. In contrast, the mid vowel //e// is raised to [ɨ] after hard stridents, as in *šest'* ['šɛsʲtʲ] 'six' (nom.) – *šesti* [šɨ'stʲi] 'six' (gen.), whereas //o//, exhibits either

raising or lowering after hard stridents, e.g. *šjepot* [ˈšopət] 'a whisper' – *šeptat'* [šɨpˈtatʲ] 'to whisper', *šok* [ˈšok] 'a shock' – *šokirovat'* [šaˈkʲirəvətʲ] 'to shock'.

First, let us consider the alternation [o] – [ɨ], as in [ˈšopət] – [šɨpˈtatʲ]. Historically, the vowel [o] found after hard sibilants is the result of a process which changed stressed *e* into *o* before hard consonants.[13] In effect, morphologically related forms may exhibit the alternation [o] – [e] – [ɨ], shown in (38).

(38) *Vowel alternations after hard stridents*

a. [o]
šjopot [ˈšopət] 'whisper'
žjony [ˈžonɨ] 'wife' (nom. pl.)

b. [e]
šepčeš [ˈšɛpčʲɪš] 'whisper' (2nd pers. sg.)[14]
ženskij [ˈžɛnskʲɪi̯] 'female'

c. [ɨ]
šeptat' [šɨpˈtatʲ] 'whisper' (inf.)
žena [žɨˈna] 'wife' (nom. sg.)

In some cases, only the alternation [o] – [ɨ] is present, without the form in which the vowel [ɛ] occurs under stress before a soft consonant, e.g. *šjolk* [šolk] 'silk' (nom. sg.) – *šelka* [šɨlˈka] 'silk' (nom. pl.).

Following Crosswhite (2001), I assume that the alternation [o] – [e] is conditioned morphologically and the forms such as *šjolk* [šolk] 'silk' (nom. sg.) and *šelka* [šɨlˈka] 'silk' (nom. pl.) come from two different allomorphs, //šolk// and //šɛlk//, respectively.[15] In this conception, the unstressed vowel [ɨ] in words such as *šelka* [šɨlˈka] 'silk' (nom. pl.) and *šeptat'* [šɨpˈtatʲ] 'to whisper' is derived from //ɛ//. Consequently, there are no cases of the raising of //o// to [ɨ] or [i] as only //ɛ// is raised to [ɨ], whereas //o// can only be lowered to [a].

The next question to ask is why //e// should be raised in the context of hard sibilants. The present model assumes that [i]-reduction is driven by the markedness constraint AGREE[+high] requiring [+high] soft consonants to be

[13] Note that the difference between the original vowel [o] and the one which is historically derived from //e// is reflected in orthography: the former is spelled with the letter *o* and the latter with *e* or ë.

[14] The consonants [p] in *šepčeš* and [n] in *ženskij* used to be soft because they were followed by a front vowel, which was subsequently deleted.

[15] For an alternative view, see Melvold (1990) and Plapp (1996), who assume that the stressed vowel [o] preceded by a palatalised consonant is synchronically derived from the underlying front mid vowel //e//.

followed by high vowels. As hard stridents, like other hard consonants, are not specified for the feature [+high], the constraint AGREE[+high] is not violated when [š], [ž], and [t͡s] are followed by non-high vowels. The problem disappears if one assumes, together with Halle (1959), Lightner (1972) and Rubach (2000a), that stridents are underlyingly soft in Russian. Consequently, //ɛ// is raised to [ɨ] because [š], [ž], and [t͡s] are [+high] and [-back] in the underlying representation. It was pointed out above that this solution is unacceptable. First, the vowel //a// would raise to [i] after [š], [ž], and [t͡s] if hard stridents were underlyingly soft. Recall that the low vowel //a// changes to [i] after soft consonants, e.g. *čjas* [ˈčʲas] 'hour' (nom. sg.) – *čjasa* [čʲiˈsa] (gen. sg.). However, //a// does not raise after [š], [ž], and [t͡s], e.g. *šary* [šaˈrɨ] 'ball' (nom. pl.), *žara* [žaˈra] 'heat', *carja* [t͡saˈrʲa] 'tsar' (gen. sg.).

Furthermore, the vowel //o// which is not historically derived from //e// lowers both after velarised consonants and after hard stridents, for instance, *kot* [ˈkot] 'cat' (nom. sg.) – *kota* [kaˈta] (gen. sg.), *šok* [ˈšok] 'a shock' – *šokirovat'* [šaˈkʲirəvətʲ] 'to shock'. The parallel behaviour of hard stridents and velarised consonants would be unexplainable if hard stridents were underlyingly soft.

To recapitulate, hard stridents act as soft consonants before the front vowel //e// and as hard consonants when followed by the back vowels //o// and //a//. This contradictory behaviour is accounted for if evaluation of candidates is carried out in two steps, as assumed in Derivational OT (Kiparsky, 1997, 2000; Rubach, 1997, *et seq*.; Bermúdez-Otero, 1999, 2003). I suggest that the sibilants [š], [ž], and [t͡s] are hard in the underlying representation and only get palatalised when followed by a front vowel. The soft stridents lose palatalisation at a subsequent derivational level due to the constraint HARD-C, which assures that [š], [ž], and [t͡s] are hard in the output of the derivation (Rubach, 2000a: 59).[16]

(39) HARD-C: a. *t͡sʲ: Anterior affricates cannot be [-back].
b. *šʲ žʲ: Non-anterior coronal continuants cannot be [-back].

HARD-C is low-ranked at the first level, which allows stridents to get palatalised in the context of front vowels. This is illustrated by the evaluation of the word *šesti* [šɨˈstʲi] 'six' (gen.). shown in (40).

[16] The difference between the present model and Rubach's (2000a) analysis is that Rubach assumes that hard stridents are soft in the underlying representation.

(40) *Reduction of //ɛ// after hard stridents: Level 1*

H //šɛˈstʲi //	Agree [+high]	Pal	Id-V[-back]	Hard-C	Id-C[+back]	*H/i,u	*H/ɛ,ɔ
L H ⇒ a. šʲɪˈstʲi				*	*	**	
L H b. šʲɛˈstʲi	*!			*	*	*	*
L H c. šɛˈstʲi		*!				*	*
L H d. šaˈstʲi			*!			*	

The faithful candidate (40c) is excluded by Pal because it contains a sequence of a hard consonant followed by a front vowel. The palatalisation of the strident in (40b) satisfies Pal but violates Agree[+high], because //šj//, which is [+high], is followed by a non-high vowel. As hard consonants are not specified for height, Agree[+high] is mute in (40c) and (40d). Candidate (40d) satisfies both markedness constraints but fatally violates Ident-V[back]. The optimal candidate (40a) runs afoul of a host of lower ranked constraints. Yet it comes out victorious because the raising to [i] leads to a considerable improvement in markedness.

At level two, Hard-C is re-ranked above the markedness constraints Agree[+high] and Pal, which jointly drive raising at level 1. The input to level 2 is the optimal output from level 1. The evaluation is shown in (41).

(41) *Reduction of //ɛ// after hard stridents: Level 2*

L H /šʲɪˈstʲi/	Hard-C	Pal	Id-V[-back]	Id-V[+high]	Id-C[-back]	*H/ɛ,ɔ
L H ⇒ a. šɪˈstʲɪ			*		*	
L H b. šʲɪˈstʲɪ	*!					
L H c. šɪˈstʲɪ		*!			*	
L H d. šɛˈstʲɪ		*!			*	*
L H e. šaˈstʲɪ			*	*!	*	

Let us note that only minimal re-ranking of HARD-C between two levels is sufficient to ensure the correct output. The promoted HARD-C excludes the soft strident in candidate (41b). The optimal candidate (41a) retains the high vowel, which is retracted to [ɨ] after the hard strident in order to comply with PAL. Candidate (41e) and the winner (41a) tie on the high-ranked IDENT-V[-back]. The choice in favour of candidate (41a) is made by another faithfulness constraint, IDENT-V[+high].

The lowering of the vowel /o/ after hard stridents is generated at level 1, as illustrated in Tableau (42). For compactness, only the first two syllables of the word *šokirovat'* [šaˈkʲirəvətʲ] 'to shock' are shown.

(42) *Reduction of //o// after hard stridents: Level 1*

H //šoˈkʲi //	AGREE [+high]	PAL	HARD-C	*H/i,u	*H/e,o	*H/ɛ,ɔ	*H/a	ID-V[-low]
⇒ a. L H šaˈkʲɪ				*			*	*
b. L H šoˈkʲi				*	*!			
c. L H šɛˈkʲɪ		*!		*		*		
d. L H šɨˈkʲɪ				**!				
e. L H šʲɛˈkʲɪ	*!		*	*		*		
f. L H šʲɪˈkʲɪ			*	**!	*	*	*	

The optimal candidate (42a) exhibits vowel lowering which serves to maximise the sonority of a vowel linked to a High tone. Other conceivable changes (candidates (42c-f) are ruled out because their violations of faithfulness do not lead to the improvement in markedness. As the strident /š/ is hard in the optimal output at level 1, the re-ranking of HARD-C does not affect the evaluation at level 2 and the optimal candidate from level 1 also wins at level 2.

To summarise, it has been demonstrated in this section that the reduction pattern found after hard stridents is not exceptional and that hard stridents behave like other hard consonants with respect to vowel reduction. In particular,

the change of //o// to [a] in words such as *šok* [ˈšok] 'a shock' – *šokirovat'* [šaˈkʲirəvətʲ] 'to shock' is brought about by the need to increase the sonority of immediately pretonic vowels. Similarly, //a// is realised as [a] after hard stridents in the majority of cases, which is predicted by the analysis developed here. There exists a handful of words in which //a// is raised to [i] after hard sibilants, for example *lošadej* [ləšiˈdʲeɻ] 'horse' (gen. pl.), *cf. lošadka* [ləˈšatkə] (dim.). Let us note that the low vowel //a// was regularly raised after hard stridents in Old Moscow pronunciation and the words which have retained the high vowel in the standard language are the lexicalised remnants of the old norm. Their exceptional status is confirmed by the increasing tendency to pronounce these words with [a] (Shapiro, 1968).

Furthermore, it has been shown that the cases of the alternation of [o] with [i], as in *žjony* [ˈžonɨ] 'wife' (nom. pl.) – *žena* [žɨˈna] (nom. sg.), do not constitute counterevidence to the present theory because the forms with the reduced vowel [i] come from the allomorphs containing the front vowel //e// in the immediately pretonic position. However, the raising of //e// to [i] after the hard stridents is not expected given that [š], [ž], and [t͡s] are [+back] consonants not specified for the feature [+high]. Let us note that the front mid vowel //e// has a palatalising effect on all consonants except [š], [ž], and [t͡s]. The idea behind the present analysis is that hard stridents are also palatalised when followed by //e//, but lose their palatalisation on the surface. Contrary to previous models which postulated that [š], [ž], and [t͡s] are soft underlyingly (Halle, 1959; Lightner, 1972; Rubach, 2000a), it is assumed here that hard sibilants acquire palatalisation only before front vowels. This assumption allows us to explain why //a// is exempt from raising after [š], [ž], and [t͡s]. It is noteworthy that the variation in the reduction pattern (raising *vs.* lowering) is only found with the low vowel //a//, whereas there are no cases where the mid vowel //e// would exceptionally lower to [a] after hard stridents. This fact finds a straightforward explanation in the present model because palatalisation before //e// is regular in native words and, hence, we do not expect to find forms in which //e// would fail to palatalise the preceding hard consonant. Raising, in turn, takes place whenever an unstressed vowel is preceded by a palatalised [+high] consonant.[17]

[17] Interestingly, Rubach (2000: 60) observes that unassimilated borrowings which lack palatalisation before //e// also do not exhibit reduction to [i].

5. Conclusion

This chapter has considered contexts in which tone-induced lowering is blocked due to the presence of a palatalised consonant. In most cases, palatalised consonants induce fronting and raising of the following unstressed vowels. However, a number of East Slavic dialects exhibit a pattern in which not only the preceding, but also the following consonants affect the quality of unstressed vowels. It has been argued that the processes operating in the vicinity of palatalised consonants are triggered by the features [+high] and [-back] which are present both in vowels and in consonants. While [+high] and [-back] constitute definitional properties of high and front vowels, these features also serve to define secondary place of articulation in palatalised consonants, and so vowel fronting and raising are triggered by the constraints requiring agreement in backness and/or height between a consonant and a following vowel, or between a vowel and both the preceding and the following consonant.

Furthermore, it has been argued that hard stridents pattern together with other hard consonants with respect to vowel reduction. An apparently exceptional raising of //e// after hard consonants has been analysed in terms of derivational OT, the basic assumption being that underlyingly hard stridents are palatalised when followed by //e//, and subsequently lose their palatalisation on the surface. This account allows us to explain why //a// does not undergo raising after hard stridents.

7. Alternative accounts of East Slavic vowel reduction

Three basic facts have to be addressed by any account of East Slavic vowel reduction. The first fact has to do with the quality of the reduced vowels in palatalised and non-palatalised contexts. The second fact is related to different types of reduction occurring in unstressed syllables: extreme reduction in atonic contexts and moderate reduction in immediately pretonic positions. The third fact concerns the systems is which the quality of the reduced vowel is dependent on the quality of the vowel under stress. In this chapter, I show how these issues have been dealt with in some of the previous models of vowel reduction and compare them with the approach presented in this book.

1. The quality of reduced vowels

Vowel reduction has been extensively studied within most phonological theories, and, most recently, within the framework of Optimality Theory (van Oostendorp, 1995; Alderete, 1995; Crosswhite, 2001; de Lacy, 2006; Iosad, 2012; among many others). Most analyses focus on the first fact mentioned above, their main objective being to explain distinct vowel inventories found in different prosodic and segmental contexts.

Crosswhite (2001) suggests that reduction to peripheral vowels in immediately pretonic positions is perceptually-driven, whereas centralization in atonic syllables is articulatory-driven. Reduction in pretonic syllables serves to enhance contrast: peripheral vowels are more salient and, hence, easier to perceive in prosodically weak positions. In turn, reduction in atonic contexts is analysed as prominence reduction and is assumed to result from a production-based target undershoot. As rightly pointed out by Harris (2005), the drawback of this model is that it employs two formally distinct mechanisms (acoustically-driven *vs.* articulatory-driven reduction) to account for the phenomenon of vowel reduction.

In contrast, non-functional accounts view vowel reduction as a process not grounded in phonetics. A recent proposal in terms of a substance-free phonology by Iosad (2012) builds an analysis of Russian vowel reduction based on a representational model. In this approach, [a]-reduction consists in

a loss of a privative feature [closed] and an addition of the feature [open]. By referring to just one feature, it has an advantage over accounts using feature conjunction. Nevertheless, the analysis prohibiting the feature [closed] in prosodically weak positions is a restatement of a descriptive generalisation about the non-occurrence of mid vowels in unstressed syllables. Moreover, it can equally well generate the opposite system, in which *u* reduces to *o*, and it does not provide an explanation why mid vowels, and not high or low vowels, are targets of reduction.

This problem does not arise in the markedness-based approach, in which the reduction of //o//, //e// to [a], [i] is taken to reflect the fact that mid vowels are typologically more marked than high and low vowels (Maddieson, 1984). Within the paradigm of Optimality Theory, this is analysed employing the constraint *MID ('No mid vowels') (e.g., Alderete, 1995; Mołczanow, 2007). However, the change of //o// to [a] is attested in systems which also exhibit the raising of //a// to [e] after palatalised consonants (as discussed in Section 2.1, Chapter 6). In effect, models explicitly banning mid vowels from prosodically weak positions are bound to stipulate that mid back vowels but not mid front vowels are subject to a constraint against unstressed mid vowels in East Slavic dialects with [a]-reduction and [e]-reduction.

An attractive alternative to markedness approaches is offered by the element-based theory (e.g., Harris, 1994, 2005), in which the avoidance of unstressed mid vowels is modelled in terms of the reduction in segmental complexity. In this approach, the corner vowels *a, i, u* are represented with the single resonance elements A, I, and U, whereas the melodic make-up of the mid vowels *ɔ* and *ɛ* is characterised with the two expressions, {U,A} and {I,A}. Vowel reduction then consists in the elimination of one (or all) of the elements. For instance, the change of *o* to *a* is viewed as the loss of the element {U}, and the reduction to schwa, which is a common process cross-linguistically, is analysed as the loss of all the resonance elements.

However, all the models banning mid vowels from prosodically weak positions (whether based on contrast enhancement, markedness, or element complexity) fail in cases where mid vowels are not the targets but the outcomes of reduction. A pattern in which unstressed //a// and //o// are neutralised into [e] after palatalised consonants and into [o] after non-palatalised consonants is attested in a number of East Slavic dialects, including northern Russian dialects, south-western dialects, and northern Ukrainian dialects (Nazarova, 1961;

Vajtovič, 1968; Jakobson, 1971; Al'muxamedova & Kul'šaripova, 1980; Kasatkin, 2005; Požarickaja, 2005; Bethin, 2012a). Some examples from the northern Russian dialects are provided below; the data come from Kasatkin (2005: 41), Požarickaja, (2005: 46), and Al'muxamedova & Kul'šaripova (1980: 17-18).

(1) *Northern Russian dialects with [o]-reduction and [e]-reduction*

a. *Pretonic [e] after soft consonants*

rjady [rʲeˈdɨ] 'row' (nom. pl.)	*cf.*	rjad [ˈrʲat] id. (nom. sg.)
nesu [nʲeˈsu] 'carry' (1st pers. pres. sg.)		njos [ˈnʲos] id. (3rd pers. past masc.)
pjatak [pʲeˈtak] 'five-rouble note'		pjat' [ˈpʲatʲ] 'five'

b. *Pretonic [o] after hard consonants*

starik [stoˈrʲik] 'old man' (nom. pl.)	*cf.*	star [ˈstar] 'old' (short form)
sady [soˈdɨ] 'garden' (nom. pl.)		sad [ˈsat] id. (nom. sg.)
stoly [stoˈlɨ] 'table' (nom. pl.)		stol [ˈstol] id. (nom. sg.)

Systems exhibiting [e]-reduction and [o]-reduction, as in (1) above, are problematic from the perspective of both the markedness-based and the element-based models banning mid vowels from prosodically weak positions. First, raising to the mid vowels creates more marked segments, thus defying the main assumption of the markedness-based approaches, in which vowel reduction is equated with the reduction in markedness. Second, the existence of such patterns demonstrates that not all cases of neutralisation lead to the decrease in the segmental complexity, as assumed in the element-based theory. It was mentioned earlier in this section that [a] is represented with the element 'A', while [o] is defined by the combination of the elements 'A' and 'U', so the change from *a* to *o* increases segment's complexity. Similarly, the raising from *a* to *e* is implemented through the addition of the element 'I', rendering the outcome of reduction more complex than its unreduced counterpart.

As regards [e]-reduction, it might be objected that the neutralisation of non-high vowels into [e] in (1a) does not constitute reduction as such, but is due solely to the palatalisation of the preceding consonant. In terms of the Element Theory, this can be achieved through the spreading of the element I, which is independently present in palatalised consonants. The same result can be obtained using the OT constraint C^{j}/[+front] ('In unstressed syllables, a palatalised consonant must be followed by a [+front] vowel', Crosswhite, 2001: 77), or PAL ('A consonant and a following vowel agree in backness', Rubach, 2003: 216). A special status of [e]-raising as an independent process is supported by the fact that it is often attested in the absence of [o]-raising

(i.e., in the dialects which preserve the full set of vowels in unstressed positions after non-palatalised consonants).[1] Yet, as shown by the data in (1) above, there exist systems in which [e]-raising is accompanied by [o]-raising, the latter change taking place after hard (velarised) consonants. As the secondary articulation of velarisation is represented with the particle @ in the Element Theory (*cf.* Harris, 1994: 119), its spreading cannot be responsible for the switch of *a* {A} to *o* {AU}. The same problem arises in the feature-based theories, which define velarisation either with the feature [+back],[2] as in the Halle-Sagey model (Sagey, 1986; Halle, 1992), or with the privative feature [dorsal], as in the Clements-Hume model of feature geometry (Clements, 1985; Clements & Hume, 1995) or the Parallel Structures Model (Morén, 2003).[3] As both *a* and *o* are specified for the feature [+back] in the Halle-Sagey model, and for [dorsal] in the Clements-Hume model, the addition of neither [+back] nor [dorsal] can derive the raising of //a// to [o]. Therefore, while [e]-raising can be analysed in terms of the coarticulation with the preceding consonant, this explanation is not available in the case of the raising of //a// to [o].[4] The present model analyses raising of the low vowel //a// in terms of prominence reduction. It is assumed that High tone is not active in the dialects not exhibiting [a]-reduction in the immediately pretonic position. Consequently, such dialects are predicted either to lack phonological reduction altogether or to exhibit one-degree reduction. As discussed in Section 3, Chapter 3, phonological reduction in positions not affected by the lexical tone is analysed, after de Lacy (2006), by means of the constraint families regulating the sonority level of prosodic heads and non-heads. On this view, vowel raising is driven by the constraint *-Δ_{ω}{a}, which prohibits highly sonorous low vowels in prosodically recessive positions. This analysis explains the asymmetry in the distribution of [e]-reduction and [o]-reduction: if a given dialect raises //a// after hard consonants, it also raises it after soft consonants, but not the other way round. That is, the high-ranked *-Δ_{ω}{a} drives both [e]-raising and [o]-raising, whereas PAL only triggers the raising of //a// to [e] after palatalised consonants. It is predicted then that a system with a high-ranked *-Δ_{ω}{a} will raise //a// both after palatalised and non-palatalised consonants (to [o] and [e], respectively), while a system with a high-ranked PAL will only exhibit [e]-raising.

[1] Interestingly, the opposite pattern, with [o]-raising but no [e]-raising is rare (*cf.* Bethin, 2012a: 3).

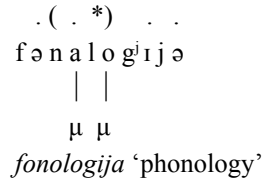
[2] The use of the feature [+back] to define velarisation is discussed Section 2.2, Chapter 6.

[3] The Parallel Structures Model (Morén, 2003) has been employed in the Iosad's (2012) analysis of Russian vowel reduction.

[4] Bethin (2012a) suggests a phonetically-based explanation, in which both [e]-raising and [o]-raising are argued to be motivated by the extended onset-nucleus transitions and the close transitions from a vowel into a following consonant.

2. Two-degree reduction

The second fact, concerning the asymmetry between immediately pretonic and atonic positions, has been either marginalised or not addressed at all in the previous accounts of vowel reduction. In some models, extreme reduction is denied a phonological status and is claimed to be a phonetic effect of reduced duration (Barnes, 2006, 2007; Iosad, 2012). On this view, the outcomes of extreme and moderate reductions are distinct due to differences in the phonetic realisation of the same vowel in durationally impoverished contexts. Another approach to extreme reduction states that syllables showing extreme reduction are extrametrical (Crosswhite, 2001). That is, they are not incorporated into the foot, but linked directly to the phonological word (PW) node. Given this assumption, the next question to ask is how, and why, this structural distinction (footed *vs.* stray syllables) relates to position's ability to undergo reduction. Crosswhite (2001) answers this question by assuming that two-pattern reduction (extreme *vs.* moderate) is due to the iambic footing. The moderate reduction affects vowels in a foot-dependent position, while unfooted vowels undergo extreme reduction. Furthermore, Crosswhite hypothesizes that reduced vowels occurring in stray syllables are nonmoraic. The prosodic structure of the word *fonologija* 'phonology' shown in (2) serves to illustrate the point.

(2)


fonologija 'phonology'

This approach raises several objections. On the theoretical side, it is not clear how moraless vowels could function as syllable peaks. In autosegmental phonology (Goldsmith, 1976, 1990), the structure wherein a vocalic melody is not linked to a mora has been reserved for glides. To distinguish nonmoraic vocalic segments from consonants, which are inherently moraless, and from glides, which lose their moras in the process of gliding, Crosswhite re-introduces the SPE feature [±syllabic]. This, however, forfeits the basic insight of autosegmental phonology that syllabicity is predictable and, therefore, need not be encoded in the underlying representation.

Furthermore, there is no independent evidence that would support iambic foot structure in Russian. Postulating iambs to account for different

degrees of reduction, Crosswhite (2001) refers to Halle and Vergnaud (1987) and Alderete (1995) and, in addition, adduces the argument of phonetic duration: "Phonetically, the vowels within the foot are durationally different from vowels outside of the foot: the unfooted vowels are shorter than footed vowels" (Crosswhite, 2001: 72). It should be noted that Halle & Vergnaud (1987) based their assumption of iambic structure on the leftward stress movement, which takes place when an underlying stressed yer fails to vocalize.[5] However, their argument is undermined by the fact that also rightward stress shifts are attested after the deletion of a stressed yer.[6] In turn, Alderete (1995) argues for the iambic foot as follows: "Taking the pattern of rising amplitude over the pre-tonic syllable as the guide to the metrical structure (Hamilton, 1980; Jones, 1923), let us assume that the pre-tonic and stressed syllables together support an iambic foot in Russian" (Alderete, 1995: 12). However, neither increased duration nor the rising pitch of the immediately pretonic syllable can constitute a legitimate ground for iambic feet. Quite the opposite, it has been observed in the literature that there is a tendency in the world's languages to maximise length distinctions within iambic feet. According to the Iambic-Trochaic Law (Hayes, 1985), elements contrasting in duration naturally form groupings with final prominence. In linguistic context, this implies that feet are iambic if they contain durational contrast and trochaic if they lack one (for discussion, see Hyde, 2011). In Russian, however, the differences in duration between tonic and immediately pretonic syllables are only evident when a given word bears phrasal stress, whereas in non-focus positions immediately pretonic vowels are equal to or exceed the duration of the vowels in the stressed syllable (Knjazev, 2006: 50). Assuming that Russian feet are iambic, it is predicted that extreme reduction should occur in foot-dependent position in order to enhance quantity contrasts, which does not happen. So in the absence of the evidence other than vowel reduction, the argument is circular: Russian iambs are motivated by vowel reduction; vowel reduction, in turn, is explained by reference to iambic foot structure.

Moreover, the analysis assuming iambic structure to be the source of two-degree reduction makes wrong predictions. Specifically, it claims that a vowel in a foot-dependent position is less likely to reduce than vowels in other positions. Therefore, trochaic languages should exhibit a parallel asymmetry in the position's propensity to reduction in that vowels in post-stressed syllables should be more resistant to reduction. Counterevidence comes from Dutch,

[5] In Slavic linguistics, yers refer to vowels which are involved in vowel-zero alternations.

[6] Later, Halle and other authors have suggested that Russian has a trochaic foot structure (Idsardi, 1992; Halle & Idsardi, 1995; Halle, 1997).

which is a trochaic language (Booij, 1995). In Dutch, whether a given vowel can reduce to schwa depends on the position within a word and on the speech register (Kager, 1989; van Oostendorp, 1995). This is illustrated by different pronunciations of the word *fonologie* 'phonology'.

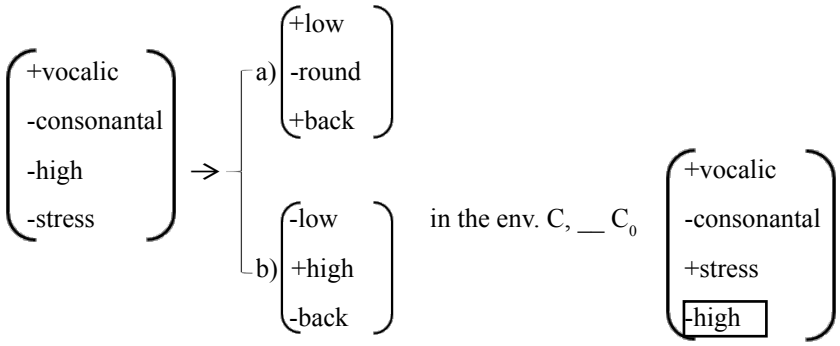
(3) (. *)
(* .) . (*)
a. [f ò n o l o ɣ í] *formal register*
b. [f ò n ə l o ɣ í] *informal register*
c. [f ò n ə l ə ɣ í] *very informal register*
d. *[f ò n o l ə ɣ í]

As shown above, there is a distinction between the two types of unstressed positions: in the informal register, only the vowel in a foot-dependent position reduces, while a stray vowel in the third syllable remains intact (3b). In the very informal register, both unstressed vowels reduce. Interestingly, it is not possible to have reduction in the third syllable without reduction in the second syllable (3d). So, contrary to the prediction made by Crosswhite's analysis, a vowel in a foot-dependent position is more likely to reduce than in other non-prominent positions. In view these facts, it is difficult to maintain that the special status of immediately pretonic syllables with respect to vowel reduction is due to iambic parsing.

3. Dissimilative reduction

Previous accounts have analysed dissimilative vowel reduction either as dissimilation in quality (Halle, 1965; Davis, 1970; Nelson, 1974; Suzuki, 1998) or in quantity (Broch, 1916; Kurylo, 1928; Vojtovič, 1972a; Belaja, 1974; Timberlake, 1993; Crosswhite, 2000, 2001; Kasatkina, 2005). Analyses attributing dissimilative reduction to the influence of the quality of the following stressed vowels have originated within the generative tradition. The common feature of these accounts is that they establish a direct link between the quality of the pretonic and tonic vowels. Halle (1965) presents the following formalisation of dissimilative [ja]-reduction (note: 'C,' represents a soft consonant and 'C_0' stands for zero or more consonants).

(4) *Dissimilative [ja]-reduction (Halle, 1965: 106)*[7]



The rule in (4) derives the Don type of dissimilative [ja]-reduction. Other types (Obojan', Sudža, Ščigry, Kidusovo, Novoselki, and Žizdra) are obtained by replacing the circled feature [-high] by one of the values of the features [±high], [±low], [±round] and [±back].

The statement of the dissimilation rule in (4) allows for an elegant description of a number of dissimilation patterns because the dialectal differences are accounted for by means of a change of a single feature in the structural description of the rule. Yet, this analysis suffers from several drawbacks. On a general level, it does not provide a link between the change and the context in which it occurs. The raising to [i] after palatalised consonants can be triggered by any feature, and there is no relation between the feature triggering the change and outcome of reduction. Furthermore, the analysis in (4) generates only seven reduction patterns out of twelve reported in the literature, and, as pointed out by Davis (1970: 367), it does not explain why some patterns are more closely related to each other, e.g. this analysis fails to capture the fact that Ščigry is closer to Sudža than to Obojan'.

Beginning with Broch (1916), many researchers have viewed dissimilative patterns in terms of quantitative dissimilation (Kurylo, 1928; Vojtovič, 1972a; Belaja, 1974; Timberlake, 1993; Crosswhite, 2000, 2001; Kasatkina, 2005). Within Optimality Theory, this idea is formalised by Crosswhite (2000, 2001), who proposes that the pretonic vowel is non-moraic when followed by the long (bimoraic) vowel [a], and monomoraic when followed by non-low (monomoraic) vowels, schematically $CV'Ca_{\mu\mu}$ *vs.* $CV_{\mu}'Cu_{\mu}$. The different dissimilative patterns are generated by positing limitations on which vowels

[7] Halle (1965) employs the terms *diffuse*, *compact*, *flat*, and *grave* to refer to the vocalic features *high*, *low*, *round*, and *back*. For ease of reference, I use the latter in (4) and below.

can be bimoraic in a given dialect. The analysis relying on quantity dissimilation is problematic because it requires stating a three-way length contrast in vowels: nonmoraic, monomoraic and bimoraic. There is no empirical basis for this theoretical distinction as none of the East Slavic dialects exhibits a lexical length contrast.

Another objection against theories based both on quality and quantity dissimilation is related to the fact that dissimilation only affects vowels occurring in the disyllabic domain of the tonic and the pretonic syllables. The fact that not all adjacent vowels are subject to dissimilation has been explained in previous analyses in terms of iambic footing. However, it was argued in Section 2 above that metrical parsing alone cannot be responsible for the special status of the pretonic position, and attributing the differences in reduction between pretonic and atonic positions to iambic footing constitutes a circular argument. In the analysis presented in this book, I have argued that reduction in immediately pretonic positions is conditioned by High tone and is not directly derivable from the metrical footing. Though the leftward spreading of the High tone is constrained by the boundary of an iambic foot, this fact does not constitute evidence for iambic parsing, as it is possible to achieve the association of H with the immediately pretonic syllable using a constraint requiring the alignment of High tone with the left edge of the word (*cf.* Mołczanow, 2015).

8. Concluding remarks

This study has set out to design a theoretical model which would account for the cross-linguistically attested patterns of the interaction between vocalic sonority and tone. The model of the tone-sonority interaction has been developed within the framework of Optimality Theory (Prince & Smolensky, 1993/2004; McCarthy & Prince, 1995). The present book argues that tone can interact directly with vowel quality without mediating factors such as syllable structure or duration. The basic assumption is that tonally prominent units co-occur with prominent segments. In terms of Optimality Theory, this generalisation is expressed by a family of markedness constraints *H/V and *M/V, which are derived by harmonic alignment of two natural linguistic scales, the tonal scale and the sonority scale.

The proposed constraints are used in the analysis of vowel neutralisations found in immediately pretonic positions in Standard Russian and in different East Slavic dialects. A characteristic trait of these systems is that they exhibit two degrees of vowel reduction: moderate reduction is found in immediately pretonic positions, while extreme reduction is found in atonic positions. Previous accounts have unanimously agreed that different degrees of reduction are due to iambic foot structure, with moderate reduction taking place in the syllable parsed into the iambic foot, and extreme reduction occurring in unparsed syllables. However, there is no evidence other than the asymmetric behaviour of vowels with respect to reduction that would support iambic foot structure. In view of this, the argument is overtly circular: iambs are motivated by vowel reduction; vowel reduction, in turn, is explained by reference to iambic foot structure.

Drawing on the insight originally expressed by Bethin (2006), this book has developed an alternative model in which pretonic reduction to [a] is a direct consequence of the shift of the tonal prominence (High tone) from the stressed syllable to the immediately preceding syllable. Neutralisation of non-high vowels to [a] is driven by a family of functionally grounded markedness constraints *H/V requiring High tone to be realised on the most sonorous vowel [a]. The location of High tone determines whether a given system exhibits non-dissimilative or dissimilative reduction type. In the former, High tone is linked to both the tonic and the immediately pretonic syllables. In the latter, High

tone docks on the tonic syllable if it contains a low sonorous vowel, otherwise, tone shifts to the pretonic position. Additionally, it has been demonstrated that the pressure to maximize sonority of high-toned vowels can be overruled by the harmonic processes affecting vowels in the immediately pretonic and tonic syllables. The influence of High tone is also supressed in the presence of palatalised consonants. It has been argued in Chapters 5 and 6 that all these cases can be accounted for in an elegant way in terms of the agreement in the features [+high], [back] and [+low]. The present model is conceptually parsimonious in that it provides a common denominator (tone) for such diverse processes as lengthening, non-dissimilative reduction, and different types of dissimilative reduction attested in the pretonic position across East Slavic.

The central claim of this book is that, synchronically, abstract tone interacts with segmental quality and quantity without the mediation of phonetic pitch. Historically, however, it is likely that phonological tone was expressed through phonetic pitch, and segmental and suprasegmental adaptations occurred in response to the requirements of the rising pitch contour. As argued in Chapter 4, these adaptations could have been grounded in both articulation and perception. As the results of acoustic studies do not provide conclusive evidence for the presence of contrastive pitch contours in the East Slavic dialects in question, it is plausible that the transparent link in the form of the F_0 excursion has been lost in the present-day dialects, and the underlying tonal contrast has developed into productive alternations in quality and length. It might be objected that the positing of the phonological tonal contrast which is not realised as pitch contrast phonetically serves a purely diacritic purpose. However, alternative analyses relying on quantity dissimilation face the same problem (e.g., Broch, 1916; Vojtovič, 1972a; Crosswhite, 2000, 2001; Kasatkina, 2005). For instance, an OT analysis developed by Crosswhite (2000, 2001) assumes an abstract distinction in vocalic duration (zero mora – one mora – two moras) which is not employed to express a lexical contrast and serves simply to identify the locations of different types of neutralisations.

The proposed theory of tone-vowel interactions carries a series of implications for the typology. While the Low tone is predicted not to interact with segmental sonority, it is expected that High tone should co-occur with lower vowels and Mid tone should be associated with higher vowels. As discussed in Section 3, Chapter 2, these predictions are borne out by the attested cases of tone-sonority interactions. The present model also predicts that there should be no languages with High tone favouring high vowels and/or Mid tone favouring

low vowels. However, there are systems in which high tone is correlated with higher vowels. For instance, Becker and Jurgec (to appear) report a synchronic interaction of tone with vowel quality in Slovenian, where High tone co-occurs with tense vowels and Low tone with lax vowels. This pattern is not predicted by the present analysis. However, experimental studies reveal a phonetic affinity between High tones and high vowels: higher vowels have higher fundamental frequency than lower vowels (Ladefoged, 1968; Ohala, 1973). It might then be the case that there is a constraint which forces high tones to be associated to high vowels. This type of constraint, *H[-ATR -low], has been postulated by Becker and Jurgec (to appear) to account for the Slovenian data.

Finally, it should be noted that the constraints *H/V and *M/V also predict the existence of tonal systems in which High tone would seek out low vowels and Mid tone would dock on high vowels. Such languages have not been documented in the literature. Needless to say, more empirical research on tonal and pitch-accent languages is needed to validate the theory presented in this book.

To conclude, it is hoped that the present study has shed new light on a number of theoretical and descriptive issues and produced a more explanatory and coherent description of the complex vowel patterns attested in East Slavic. The future research shall demonstrate whether (and how) the theory of tone-sonority interaction developed here can be implemented in the analyses of tone-related phenomena in other languages.

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