

Russian Softening Explained: (Phonetics,) Phonology and Morphology Combined (Aug '05 draft)

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1. The Problem

(1) Alternations /s/ - /sʲ/ and /s/ - /ʃ/ in verb paradigms:

		A. Transitive softening:	B. Plain softening:
Present	1.sg	pʲiʃu	nʲosu
	2.sg	pʲiʃoʃ	nʲosʲoʃ
	3.sg	pʲiʃot	nʲosʲot
	1.pl	pʲiʃom	nʲosʲom
	2.pl	pʲiʃotʲe	nʲosʲotʲe
	3.pl	pʲiʃut	nʲosut
	Pass.part.	—	nʲosomyj
	Act.part.	pʲiʃuʃʲ:ij	nʲosuʃʲ:ij
	Gerund	pʲiʃa	nʲosʲa
Imper.	2.sg	pʲiʃi	nʲosʲi
	2.pl	pʲiʃitʲe	nʲosʲitʲe
Past	M.sg	pʲisal	nʲos
	F.sg	pʲisala	nʲosla
	N.Sg	pʲisalo	nʲoslo
	Pl	pʲisalʲi	nʲosʲi
	Pass.part.	pʲisan	nʲosʲon
	Act.part.	pʲisavʃij	nʲosʃij
	Gerund	pʲisav	nʲosʃi
Infinitive		pʲisatʲi ‘write’	nʲostʲi ‘carry’

Main questions:

- How can we characterize the relationships holding between the alternants?
- How can we characterize the environment conditioning the alternations?

2. Overview of Alternations

(2) Transitive Softening (exemplified by alternations in verb paradigms)¹

Target	Result	Infinitive	Present 1.sg	Gloss
g	□	dv ^j iga-t ^j	dv ^j i□-u	‘move’
d	□ (ǫ)	gloda-t ^j	glo□-u	‘gnaw’
		(strada-t ^j	straǫ -u	‘suffer’)
d ^j	□ (ǫ)	xod ^j i-t ^j	xo□-u	‘walk’
z	□	maza-t ^j	ma□-u	‘grease’
z ^j	□	voz ^j i-t ^j	vo□-u	‘transport’
s	š	p ^j isa-t ^j	p ^j iš-u	‘write’
s ^j	š	broš ^j i-t ^j	broš-u	‘throw’
x	š	ṁaxa-t ^j	maš-u	‘wave’
k	ṭš ^j	plaka-t ^j	platš ^j -u	‘weep’
t	ṭš ^j (š ^j ː)	pr ^j ata-t ^j	pr ^j atš ^j -u	‘hide’
		(kl ^j ev ^j eta-t ^j	kl ^j eveš ^j ː-u	‘slander’)
t ^j	ṭš ^j (š ^j ː)	krut ^j i-t ^j	krutš ^j -u	‘twist’
		(osvet ^j i-t ^j	osveš ^j ː-u	‘illuminate’)
sk	š ^j ː	iska-t ^j	iš ^j ː-u	‘seek’
st	š ^j ː	xl ^j esta-t ^j	xl ^j eš ^j ː-u	‘whip’
ʒg	ʒ ^j ː	brizga-t ^j	briʒ ^j ː-u	‘sprinkle’
b	bl ^j	kol ^j eba-t ^j	kolebl ^j -u	‘vacillate’
b ^j	bl ^j	l ^j ub ^j i-t ^j	l ^j ubl ^j -u	‘love’
v ^j	vl ^j	lov ^j i-t ^j	lovl ^j -u	‘catch’
m	ml ^j	dr ^j ema-t ^j	dr ^j eml ^j -u	‘slumber’
m ^j	ml ^j	korm ^j i-t ^j	korml ^j -u	‘feed’
p	pl ^j	kapa-t ^j	kapl ^j -u	‘drip’
p ^j	pl ^j	kup ^j i-t ^j	kupl ^j -u	‘buy’
f ^j	fl ^j	graf ^j i-t ^j	grافل ^j -u	‘rule (paper)’

Note that transitive softening is realized as a variety of manner and/or place changes, as well as the epenthesis of a palatalized lateral following labial consonants.

¹ The verbs in parentheses represent marginal patterns reflecting Church Slavic influence. We will not analyze the cases of transitive softening in consonant clusters.

(3) Plain Softening (exemplified by alternations in noun paradigms):

<u>Target</u>	<u>Result</u>	<u>Nom. sg.</u>	<u>Loc. sg.</u>	<u>Gloss</u>
k	c	sok	soc-e	‘juice’
g	ʃ	Bog	Boʃ-e	‘God’
x	ç	dux	duç-e	‘spirit’
t	tʲ	svʲet	svʲetʲ-e	‘light’
d	dʲ	god	godʲ-e	‘year’
s	sʲ	nos	nosʲ-e	‘nose’
z	zʲ	voz	vozʲ-u	‘cart’
r	rʲ	vor	vorʲ-e	‘thief’
l	lʲ	vol	volʲ-e	‘bullock’
n	nʲ	ton	tonʲ-e	‘tone’
p	pʲ	sʲerp	sʲerpʲ-e	‘sickle’
b	bʲ	sʲerb	sʲerbʲ-u	‘Serbian’
f	fʲ	mʲif	mʲifʲ-e	‘myth’
v	vʲ	klʲov	klʲovʲ-e	‘biting’
m	mʲ	som	somʲ-e	‘sheat-fish’

Note that plain softening seems to involve only the addition of a secondary place of articulation in most cases.

3. *Historical Background*

The transitive softening alternations are reflections of sound change from Proto-Slavic. These sound changes are relevant for all Slavic languages, but the reflexes in the various languages vary to some degree. The effect of analogy is also different in the various languages.

- (4) First palatalization: [k, g, x] → [tʃʲ, ʒ, ʂ]² / __ [front vowel]
- (5) Second palatalization: [k, g, x] → [ts, zʲ, sʲ] / __ [front vowel]
- (6) Third palatalization: [k, g, x] → [ts, zʲ, sʲ] / [front vowel] __
- (7) Iodization: C+[j] → C*, where C* represents product of
transitive softening specified in (3) above.

Thus, the first palatalization and the iodization produced the alternations that are known as transitive softening in present day Russian. The reflexes of the second and third palatalizations are not involved in alternations in Russian inflectional morphology, but are arguably still seen in a few derivational processes.

² Today’s “hard” (non-palatalized) /ʂ, ʒ, ts/ were originally “soft” (palatalized) segments that later underwent “depalatalization”. We interpret this as an earlier stage in the language in which these segments had a primary place as well as a secondary place, followed by a stage in which the original primary place was lost. Thus, what was a secondary place became a primary place.

Plain softening also has its origin in the Proto-Slavic iodization, which produced [lʲ, rʲ, nʲ] from [l, r, n]. The non-palatalized – palatalized alternation later spread to other segment classes.

4. Segment Inventories

Since phonological manner and place are both relevant to describing and explaining the softening alternations, we must first determine the contrastive segment inventory and the feature composition of each segment. It is clear in surveying the literature on the Russian sound system that this involves complex interactions between the phonetics and phonology, as well as consonants and vowels. Therefore, it is important to establish a clear division between phonetic (acoustic, articulatory, enhancing, gradient, etc.) and phonological (abstract, featural, categorical, etc.) phenomena related to palatalization. Although we do not presume to provide the definitive answer to the question of the divide between phonetics and phonology, we will provide a very explicit set of assumptions and rationales that will feed our overall analysis of the language.

The surface consonants of Standard Modern Russian are given in (8).

(8) Surface realization of contrastive consonants (simplified)

		Place							
		Labial		Alveolar		Post-alveolar		Palatal	Velar
		Primary	Secondary	Primary	Secondary	Primary	Secondary		
		Soft	Hard	Soft	Hard	Soft	Hard	Soft	Hard
Manner	Stop	[pʲ]	[pʲ]	[tʲ]	[tʲ]			[c]	[k]
		[bʲ]	[bʲ]	[dʲ]	[dʲ]			[j]	[g]
	Affricate				[tʃʲ]	[tʃʲ]			
	Fricative	[fʲ]	[fʲ]	[sʲ]	[sʲ]		[ʃʲ]	[ç]	[x]
		[vʲ]	[vʲ]	[zʲ]	[zʲ]		[ʒʲ]		
	Nasal	[mʲ]	[mʲ]	[nʲ]	[nʲ]				
	Lateral			[lʲ]	[lʲ]				
	Trill			[rʲ]	[rʲ]				

There are several things to note about this inventory. First, all consonants with a pre-palatal primary place of articulation are shown here with a secondary place of articulation. All labials and alveolars (except the affricate) come in velarized-palatalized pairs, and the post-alveolars are either velarized or palatalized. Although the presence of palatalization on the soft consonants is universally accepted, there is a fair amount of disagreement in the literature on the extent of velarization across the inventory of hard consonants. Timberlake (2004) claims that the labials are not velarized and that the alveolar and post-alveolars have varying degrees of velarization: alveolar stops are slightly velarized, alveolar fricatives are noticeably velarized, post-alveolar fricatives are strongly velarized, and liquids are velarized (especially the lateral)). In contrast, Kochetov (XX) claims that velarized consonants are “mainly labials”, the opposite of Timberlake’s claim. On the other hand, Ladefoged and Maddieson (XX) claim that only the lateral is velarized. Clearly there is variability in the robustness of velarization but not palatalization, and we take this as evidence of phonological palatalization and phonetic velarization. Therefore, we do not assign velarization a phonological feature in Modern Standard Russian. Throughout the rest of the discussion, we will assume that phonetic velarization is widespread throughout the inventory, as shown in (8), but acknowledge the possibility of a more limited distribution.

The second thing to note about the inventory is that palatals and velars do not come in velarized-palatalized pairs, but they seem to form soft-hard pairs nonetheless. However, the phonological

status of the palatals has also been the topic of much debate in the literature. They are extremely limited in their distribution in Modern Standard Russian: 1) absolutely prohibited in final position, 2) occurring before back vowels only in borrowings and limited native/dialectal words (one for some speakers - *tkať* ‘weave’ present tense [cɔ]), and 3) occurring regularly before [i] (to be discussed below). These restrictions combined with the absence of any velars or palatals before the mid front vowel (at least in the native vocabulary) leads us to the conclusion that the palatals are by and large the result of a regular phonetic fronting before front vowels (articulatory overlap).³ As we will see below, this assumption not only explains the distributional restrictions on both velars and palatals, but it also helps to distinguish between phonological and phonetic palatalization among other segments, thus providing an answer to part of the softening puzzle.

The third observation about the surface consonant inventory is that there is a post-alveolar affricate and a pair of post-alveolar fricatives, but no post-alveolar stops. This is something of a markedness paradox under many phonological theories since fricatives and affricates are thought to be more marked than stops. Therefore, the presence of a fricative and/or affricate at a given place of articulation might imply the presence of a stop at that place. We will show later that assuming that the phonetic affricate is really a phonological stop not only eliminates this paradox, but also helps to explain otherwise unexpected consonant alternations under transitive softening.

Finally, it is an interesting fact that hard consonants (except [tʲsʲ], [ʃʲ] and [Zʲ]) never surface before the mid front vowel [e] in the native vocabulary. We will account for this restriction via phonological assimilation.

Moving on to vowels, there are 11 different phonetic realizations depending on the segmental and prosodic context. We will present the stressed vowels here and return to the context-specific realizations and neutralizations below. There are six surface vowels found in Modern Standard Russian stressed syllables. These are shown in (9).

(9) Surface realization of stressed vowels (simplified)

		Place			
		Front	Central	Back	
Height	High	i	ɨ	u	Round
	Mid	e		o	
	Low		a		

There are several things to note about this inventory. First, there are three phonetic heights. Second, the low vowel does not contrast in place. Third, both back vowels are phonetically round. Fourth, the vowels are phonetically dispersed by both place and height. Finally, there is an important restriction on the occurrence of high vowels that has led to much disagreement in the literature as to how many contrastive vowels there are. Specifically, the high, unrounded vowels are in complementary distribution in the native vocabulary. The centralized vowel is only found following hard consonants in the native vocabulary and the non-centralized vowel is never found in this environment. This has led to what is called the “Moscow” approach of allowing for only five contrastive or phonemic vowels. In contrast, the presence of a limited number of proper name borrowings in which the central vowel is also found in initial position has led to the “Leningrad” approach of allowing for six contrastive vowels and near perfect neutralization. For reasons to be made clear below, we subscribe to the “Moscow” approach. For the moment we remain agnostic with respect to the exact nature of the “front unround” phoneme, but will return to this below.

³ We will revise this slightly later.

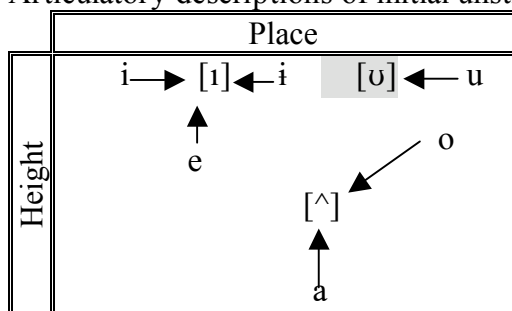
5. Segment Alternations and Interactions

To determine the feature specifications of each segment, we must look at both the set of contrasts given in (8) and (9) and the behavior of the segments within the phonological system. We begin here with the distribution of vowels.

Vowels

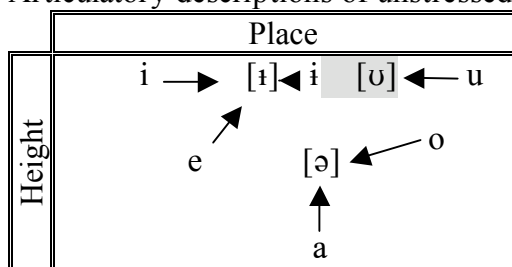
In unstressed syllables, the position of the vowel relative to the stressed syllable, as well as the place of articulation of the preceding consonant, play a role in the pattern of vowel reduction. In pre-tonic initial position, there are three reduced vowels, as shown in (10). Both phonetically front vowels reduce to high central-front, the phonetically high back round vowel reduces to high round central-back, and both the low and mid back vowel reduce to schwa⁴ (low central).

(10) Articulatory descriptions of initial unstressed vowels⁵



After non-palatalized consonants the situation is almost identical. The only differences are the realization of the high front vowel and the low central. Both are slightly more centralized.

(11) Articulatory descriptions of unstressed vowels following non-palatalized consonants⁶



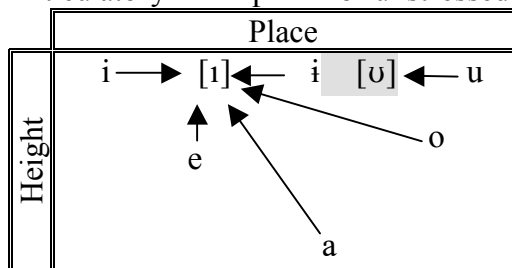
After palatalized consonants, the situation is quite different. In non-final position, all vowels that are not high round neutralize to high central-front. This means that the non-final post-palatalized vowel space consists of only two vowels at only one height. However, in final position, the low vowel becomes schwa, maintaining a two-way height distinction. This is shown in (12) and (13).

⁴ Many descriptions (e.g. Timberlake 2004) distinguish between [ʌ] (initial and first pre-tonic syllable) and [ə] (all other syllables). We ignore this as a phonetic effect resulting from predictable durational differences.

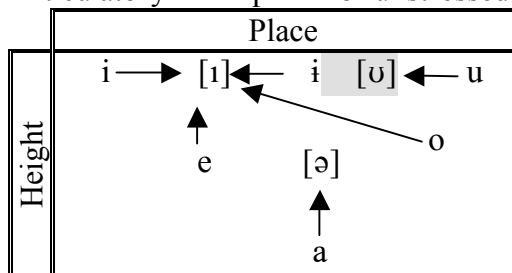
⁵ There may be some variation in the reduction pattern of the mid front vowel in initial position. However, we follow the description of Jones and Ward (1969) here.

⁶ The situation of the non-high vowels following the post-alveolar fricatives is quite complex. This is due to several historical facts that are beyond the scope of this paper.

(12) Articulatory descriptions of unstressed non-final vowels following palatalized consonants



(13) Articulatory descriptions of unstressed final vowels following palatalized consonants



To summarize, there are five contrastive vowels in stressed syllables and context-specific allophonic (phonetic) alternations of the high front vowel. There are only two or three vowels in unstressed syllables depending on the prosodic and segmental environment.

Consonants

As suggested in the introduction, alternations involving consonants can be quite complex in Modern Standard Russian. We will concentrate on the phenomenon known as “softening” in this paper, and will not address consonant cluster phenomena (feature assimilations or co-occurrence restrictions).

Non-palatal consonants occur freely in initial and final position. This can be seen in the following data, where non-palatalized labials, alveolars and velars are found in initial and final positions.

(X) Data

Palatalized consonants also occur freely in initial and final position, as can the post-alveolars.

(X) Data

There are just two general restrictions on the native vocabulary. First, most consonants palatalize before [e]. Second, palatals do not occur in final position or before a non-front vowel.

(X) Data

Since there are alternations between velars and post-alveolars (both plain and transitive softening) suggesting that the post-alveolars are the “palatalized” velars, we see that the distribution of all palatalized and non-palatalized segments is quite symmetrical. The restricted distribution of the palatals in the native vocabulary can be seen through the lens of cross-linguistic evidence suggesting that consonants before high front vowels are often either articulatorily palatalized or are perceived as palatalized. We claim that most palatals (i.e. fronted velars) are phonetically palatalized velars that are not phonologically palatalized. Given this phonetic palatalization of velars before high front vowels, we suggest that underlyingly plain non-velars are also phonetically palatalized before these vowels. Thus, Modern Standard Russian has a hybrid palatalization system. Palatalization is phonological in some contexts (e.g. contrastive and resulting from feature

assimilation with mid front vowels) but phonetic in other contexts (resulting from phonetic “assimilation” with high front vowels).

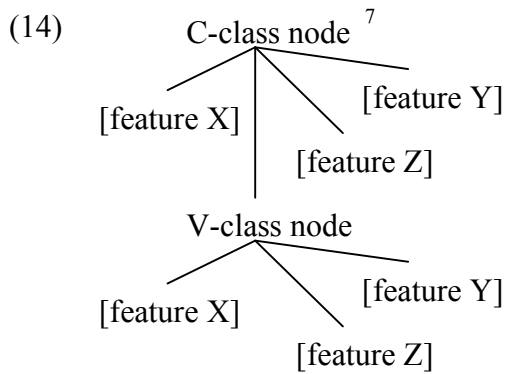
6. *Theoretical background (the Parallel Structures Model)*

The phonological analysis of the segment inventory, consonant-vowel interactions and consonant-vowel alternations in Modern Standard Russian will make use of the Parallel Structures Model of feature geometry (Morén 2003) and Optimality Theory (Prince and Smolensky 1993). Since the Parallel Structures Model is fairly new and may be unfamiliar to many readers, a review of its basic premises and how it works is given here.

There are currently many competing feature theories and models of segment-internal representations. Despite differences in detail, however, the general proposals are fairly uniform, each making minor modifications to the feature set of SPE (Chomsky and Halle 1968) and the geometry of Clements (1985) – with four notable exceptions. First, Clements (1991a) proposed an innovative unification of consonant and vowel place features, which greatly economizes the set of those features and helps to explain place harmony asymmetries. Second, Clements (1991b) proposed a set of vowel height features that makes a more direct connection between those features and degrees of constriction of the vocal tract. Third, Steriade (1993a, b, c, 1994) proposed that consonant manners are differentiated via different types of root nodes corresponding to different degrees of constriction of the vocal tract. Fourth, Particle Phonology (Schane 1984), Dependency Phonology (Anderson and Ewen 1987, van der Hulst 1989, 1999, etc.) and Element Theory (Harris and Lindsey 1995) differ radically from the SPE feature tradition in a number of ways - most notably, they assume that vowels and consonants make use of the same set of features/elements.

The Parallel Structures Model of feature geometry combines insights and pieces of each of these lines of research. It extends the mechanism of Clements’ place model to other areas of the phonology, unifies Clements’ constriction model and Steriade’s aperture model, and incorporates some of the segment-internal organization proposed in Particle Phonology, Dependency Phonology and Element Theory. In addition, it makes use of structural and featural economy to the greatest extent possible. The result is a feature theory that eliminates a large number of features from the grammar (including the major class features); provides a unified analysis for consonants, vowels, place and manner; and captures consonant-vowel interactions, alternations and harmony asymmetries in a natural and straightforward way.

According to the Parallel Structures Model, phonological segments are composed of a limited set of identical structures and a limited set of privative, articulator-based features. The form of the basic structure is essentially that proposed by Clements (1991a) and is shown in (14).

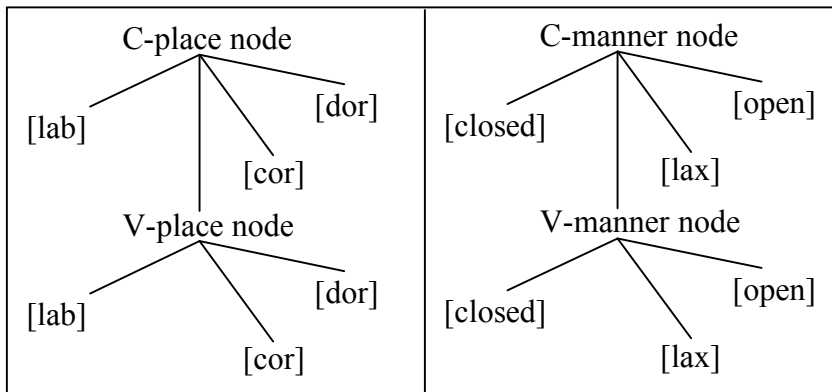


Minimally, there is a set of place and manner features that associate with identically configured place and manner class nodes, as shown in (15).

(15)

a. Place of Articulation

b. Manner of Articulation



The place features are currently in widespread use and will not be discussed. See Clements 1991a for a full discussion. The manner features are based on degrees of vocal tract constriction and relative articulator rigidity. Since the lax feature is irrelevant to Modern Standard Russian, it is not discussed here. See Morén (2003) for a general discussion of this feature. The manner features [open] and [closed] are demonstrated below.

The Parallel Structures Model also assumes that the grammar is economical/ parsimonious and that more complex structures are built from less complex structures. This is in keeping with some of the principles of Particle Phonology, Dependency Phonology and Element Theory, the Modified Contrastive Specification Model (Dresher and Rice 1993, Dresher *et al.* 1994), as well as other work of Avery and Rice (1989), Rice and Avery (1990) and Rice (1992), etc. One consequence of this is the prediction that languages can have simple segments that are featurally minimal - having only a manner feature or only a place feature.

To demonstrate how the Parallel Structures Model establishes minimal feature specification for a given contrastive inventory, let us assume the following very limited set of segments: [t, ʈ, s, l, ɹ, i, e, a]. Note that this set does not have any place contrasts, but differentiates among stops, lateral fricatives, fricatives, lateral approximants, rhotic approximants, high vowels, mid vowels and low vowels. In other words, it contrasts among three major classes (obstruents, sonorant consonants and

⁷ The use of “C” and “V” to indicate node type is a mnemonic device more than a statement about the phonological nature of the nodes. That is, vowels can have “C-node” features and consonants can have “V-node” features. In the lack of a contrast, all segments will have “C-node” features. However, if there is overt evidence in the language that consonants and vowels behave differently with respect to a particular feature, then the consonant has the “C-node” feature and the vowel has the “V-node” feature.

vowels), and within each of these major classes, there are manner and height distinctions. In addition, the mapping from a given feature specification to a phonetic realization of is determined on a language-by-language basis based on a combination of contrasts and behavior. Therefore, a given phonetic transcription (i.e. IPA symbol) can correspond to different feature specifications in different languages. Using the features in (15b), and building complex feature combinations from simpler feature combinations, we can describe this inventory as in (16).

(16) PSM feature specification for the target segment inventory

		C-manner [closed]	C-manner [open]	V-manner [closed]	V-manner [open]		
Stop	[t]	✓				Consonant	Obstruent
Lateral fric.	[ɬ]	✓	✓				
Fricative	[s]		✓				
Lateral approx.	[l]	✓		✓			
Rhotic approx.	[ɹ]		✓	✓			
High vowel	[i]			✓		Vowel	Sonorant
Mid vowel	[e]			✓	✓		
Low vowel	[a]				✓		

Note: shaded cells indicate simple manner feature specification.

There are a number of observations that are important here. As discussed in Morén (2003), the major classes are not defined in the Parallel Structures Model via separate major class features (e.g. [+/-sonorant]), but rather they are defined structurally via combinations of C-manner and/or V-manner features, as shown in (16). Consonants have a C-manner feature, while vowels do not, and sonorants have a V-manner feature, while obstruents do not. Sonorant consonants have both a C-manner and a V-manner feature. Second, “lateral” consonants are not defined via a distinct lateral feature, but rather as a combination of a C-manner[closed] and a more open gesture. Third, manner of articulation and vowel height are captured using the same set of articulator-based features distributed across two related class nodes. Fourth, relative markedness relationships among manners and heights are captured via relative structural complexity. That is, plain stops and plain fricatives are less marked than lateral fricatives because they each have only a single manner feature, whereas the lateral fricative has two. Similarly, high and low vowels are less marked than mid vowels because they each have only a single manner feature, whereas the mid vowels have two. Sonorant consonants are also more marked than either simple obstruents or simple vowels for the same reason.

To summarize, there has been much insightful work done on segmental features and geometry over the past few decades, and we continue to refine the feature sets and representations that we assume to be universal. However, there are still unresolved issues and many important questions to answer. Specifically, what is the full minimal set of universal features, and what are the ways in which they can combine to form all the segments found cross-linguistically? The Parallel Structures Model takes the insights and formalisms of several current feature theories and combines them into a new model in which parallel structures and feature sets are used wherever possible.

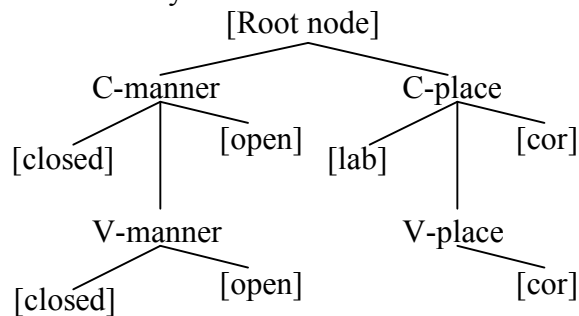
As we will see below, the assumption that more complex structures are built from less complex structures, and the assumption that consonants and vowels make use of the same features, will provide for a simple and straightforward analysis of the Modern Standard Russian segment inventory, segment alternations and consonant-vowel interactions.

7. *Applying the Parallel Structures Model to Modern Standard Russian*

With the basics of the Parallel Structures Model established, we can turn to the task of applying it to Modern Standard Russian.

If we ignore the nasals and laryngeal features, the feature geometric structure relevant to Russian is given in (17) and the proposed feature sets for individual segments are given in (18). Note that (18) displays a *very* symmetrical inventory in which every complex segment implies a minimally different simpler segment. This is in keeping with the assumptions of the Parallel Structures Model. Since this chart consists of many segments and complex feature combinations, each of these segments will be discussed in detail below.

(17) Standard Russian PSM Geometry



(18) Feature specifications for individual Standard Russian segments

			C-place		V-place	C-manner		V-manner	
			[lab]	[cor]	[cor]	[closed]	[open]	[closed]	[open]
Mannerless	/v/	[v ^v] [v ^l]	✓						
	/v ^j /	[v ^j]	✓		✓				
	/T/	[ts ^v]		✓					
	/ʃ/				✓				
Stop	/K/	[k] [c]				✓			
	/K ^j /	[tʃ ^j]			✓	✓			
	/p/	[p ^v] [p ^l]	✓			✓			
	/p ^j /	[p ^j]	✓		✓	✓			
	/t/	[t ^v] [t ^l]		✓		✓			
	/t ^j /	[t ^j]		✓	✓	✓			
Fricative	/X/	[x] [ç]					✓		
	/X ^j /	[ʃ ^v]			✓		✓		
	/f/	[f ^v] [f ^l]	✓				✓		
	/f ^j /	[f ^j]	✓		✓		✓		
	/s/	[s ^v] [s ^l]		✓			✓		
	/s ^j /	[s ^j]		✓	✓		✓		
Closed Approx.	/l/	[l ^v] [l ^l]				✓		✓	
	/l ^j /	[l ^j]			✓	✓		✓	
Open Approx.	/r/	[r ^v] [r ^l]					✓	✓	
	/r ^j /	[r ^j]			✓		✓	✓	
High	/i/	[i [€]][i [€]][i ^l][i ^l]						✓	
	/u/	[u [€]][u [€]]	✓					✓	
	/i/	[é][i ^l][i ^l]			✓			✓	
Mid	/o/	[o [€]]						✓	✓
Low	/a/	[a [€]][^][ə]							✓

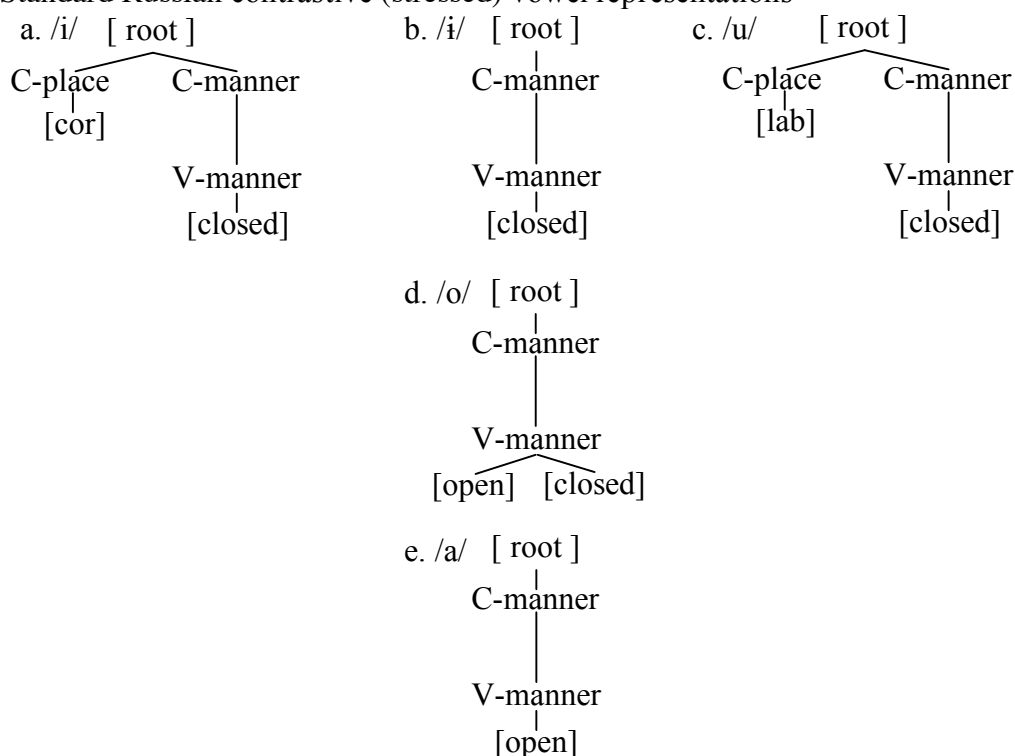
Notes: 1) Shaded cells indicate minimal (single feature) segments. 2) Symbols within slash brackets indicate phonological feature specification, while those within square brackets indicate phonetic realization. The two are not in a 1:1 relationship. 3) Some symbols within slash brackets diverge from the IPA because there is no IPA symbol that usually represents this (or similar) phonological feature specification. 4) Phonetic affricates are not phonological contour segments in this analysis - to be discussed.

Vowels

In the following, we will assume only five underlying phonological vowel qualities, which map onto 11 different phonetic realizations depending on segmental and prosodic context. Within a given environment, there are anywhere from two to six surface vowels. The phonetic realization of a phonological feature specification is determined by a combination of language-particular phonetics and more general phonetic dispersion principles. In the remainder of the paper, underlying phonological representations are marked with double slash brackets, surface phonological representations are marked with single slash brackets, and phonetic realizations are marked with square brackets. Indices are used to show correspondences among underlying representations, surface representations and phonetic entities when necessary to the discussion.

From an autosegmental perspective using the PSM, the five contrastive vowels of Modern Standard Russian may be represented as in (19). Note that there are three high vowels, one of which is placeless; and there is one mid and one low vowel, both of which are placeless.

(19) Standard Russian contrastive (stressed) vowel representations



In initial stressed position, these vowels surface with all phonological features intact, and they are realized as phonetically dispersed. The phonologically high coronal vowel is realized as phonetically “mid front” to distinguish it from the phonologically high placeless vowel. Note that the high placeless vowel is phonetically “fronted” to make it more perceptually distinct from the high round vowel. (20) shows the correspondences among orthographic, underlying, surface and phonetic representations in stressed initial position. (21) shows the feature composition of the individual segments.

(20) Stressed syllable-/word-initial

	//i/ 'i', 'y'	//í/ 'e'	//a/ 'a'	//o/ 'o'	//u/ 'u'
#	/í/ [i]	/í/ [e]	/á/ [a]	/ó/ [o]	/ú/ [u]

(21)

	//UR//			/SR/			[Phonetics]			
	V[cor]		V[lab]	V[cor]		V[lab]		Front	Central	Back/ Round
V[closed]	i ₂	í ₁	u ₅	í ₂	í ₁	ú ₅	High	i ₁		u ₅
V[closed]& V[open]		o ₄			ó ₄		Mid	e ₂		o ₄
V[open]		a ₃			á ₃		Low		a ₃	

In stressed syllables following underlyingly non-palatalized onsets, there are six surface vowels. These are also phonetically dispersed. The main vowel difference between this environment and

initial environment is in the phonetic realization of “high placeless” vowel. It surfaces as central following phonetically velarized (non-palatalized) segments. This centralization is seen here as a phonetic effect, not the result of phonological assimilation (contra Padgett (2001)). Underlying feature specification is maintained on the surface for vowels, as is shown in (23).

(22) Stressed, underlyingly non-palatalized onset

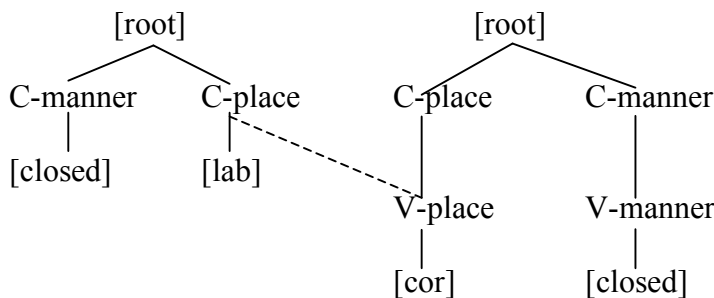
	//i// ‘i’, ‘y’	//i// ‘e’	//a// ‘a’	//o// ‘o’	//u// ‘u’
//p//	/p ^í / [p ^y i]	/p ^j i/ [p ^j e]	/p ^á / [p ^y a]	/p ^ó / [p ^y o]	/p ^ú / [p ^y u]
//t//	/t ^í / [t ^y i]	/t ^j i/ [t ^j e]	/t ^á / [t ^y a]	/t ^ó / [t ^y o]	/t ^ú / [t ^y u]
//K//	/K ^í / [ci]	/K ^j i/ [t ^j e]	/K ^á / [ka]	/K ^ó / [ko]	/K ^ú / [ku]
//X//	/X ^í / [çi]	/X ^j i/ [še]	/X ^á / [xa]	/X ^ó / [xo]	/X ^ú / [xu]
//T//	/T ^í / [ts ^y i]	/T ^j i/ [ts ^j e]	/T ^á / [ts ^y a]	/T ^ó / [ts ^y o]	/T ^ú / [ts ^y u]

(23)

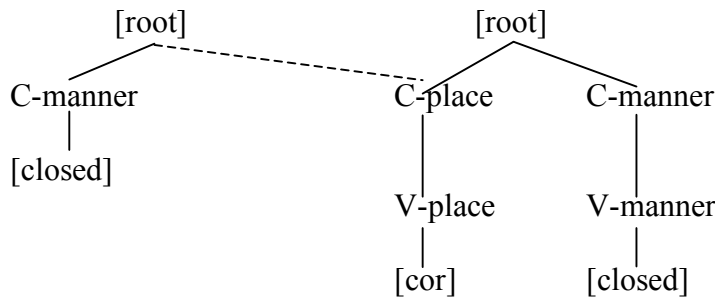
	//UR//			/SR/			[Phonetics]			
	V[cor]		V[lab]	V[cor]		V[lab]		Front	Central	Back/ Round
V[closed]	i ₂	i ₁	u ₅	í ₂	í ₁	ú ₅	High	i ₁	í ₁	u ₅
V[closed]& V[open]		o ₄			ó ₄		Mid	e ₂		o ₄
V[open]		a ₃			á ₃		Low		a ₃	

There are two related phenomena to note about this environment. First, there is palatalization of most consonants before the high coronal vowel. This suggests that the V-place[cor] feature assimilates in this context (excepting the creation of an illicit feature combination). Second, the velars become palatals before the high placeless vowel, but other consonants do not alternate. The lack of a change to post-alveolar and the lack of application to other segments suggest that velar fronting is phonetic, not phonological in nature. Phonological and phonetic “palatalization” scenarios are shown in (24) and (25), respectively.

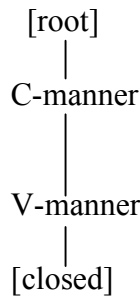
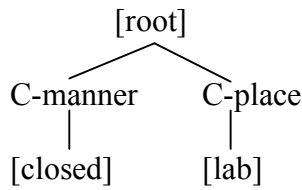
(24) a. //pi// --> /p^ji/ [p^je]



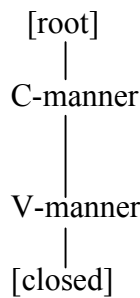
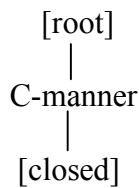
b. //Ki// --> /K^jí/ [tʃ^je]



(25) a. //pi// --> /p^yí/ [p^yi]



b. //Ki// --> /K^jí/ [ci]



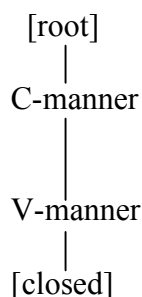
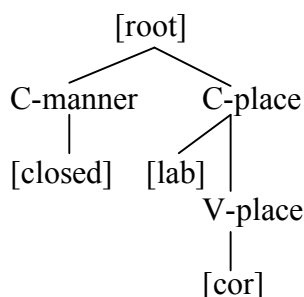
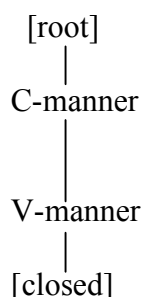
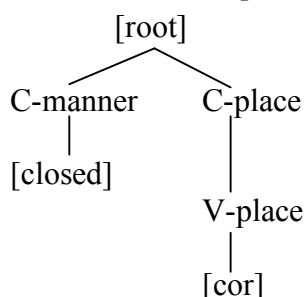
In stressed syllables following underlyingly palatalized onsets, there are also six surface vowels. These are also phonetically dispersed. The difference between this environment and that before underlyingly non-palatalized onsets is in the realization of the “high placeless” vowel. It surfaces as front following palatalized consonants that actually appear with phonetic fronting. We assume that this is a phonetic effect and that underlying vowel feature specifications are maintained on the surface. Interestingly, this leads to an asymmetry in the assimilation patterns of consonants and vowels. While stressed high coronal vowels cause preceding consonants to palatalize if possible, as shown in (22), palatalized consonants do not cause following high placeless vowels to become coronal.

(26) Stressed, palatalized onset

	//i// ‘i’, ‘y’	//í// ‘e’	//a// ‘a’	//ó// ‘o’	//u// ‘u’
//p ^j //	/p ^j í/ [p ^j i]	/p ^j í/ [p ^j e]	/p ^j á/ [p ^j a]	/p ^j ó/ [p ^j o]	/p ^j ú/ [p ^j u]
//t ^j //	/t ^j í/ [t ^j i]	/t ^j í/ [t ^j e]	/t ^j á/ [t ^j a]	/t ^j ó/ [t ^j o]	/t ^j ú/ [t ^j u]
//K ^j //	/K ^j í/ [tʃ ^j i]	/K ^j í/ [tʃ ^j e]	/K ^j á/ [tʃ ^j a]	/K ^j ó/ [tʃ ^j o]	/K ^j ú/ [tʃ ^j u]
//X ^j //	/X ^j í/ [ʃi]	/X ^j í/ [ʃe]	/X ^j á/ [ʃa]	/X ^j ó/ [ʃo]	/X ^j ú/ [ʃu]

(27)

	//UR//				/SR/			[Phonetics]			
	V[cor]		V[lab]		V[cor]		V[lab]		Front	Central	Back/ Round
V[closed]	i ₂	ĩ ₁	u ₅		í ₂	í ₁	ú ₅	High	i ₁	ĩ ₁	u ₅
V[closed]& V[open]		o ₄				ó ₄		Mid	e ₂		o ₄
V[open]		a ₃				á ₃		Low		a ₃	

(28) a. //p^ji// --> /p^jĩ/ [p^ji]b. //K^ji// --> /K^jĩ/ [tÉ^Sjĩ]

To summarize, stressed vowels never change their underlying feature specifications on the surface. The variation seen in the realization of the high placeless vowel is the result of phonetic dispersion and coarticulation effects (and perhaps perceptual enhancement strategies - see Padgett (2001)). That said, the high coronal vowel /ĩ/ [e] does spread its V-place[cor] feature to the preceding consonant if possible. This causes phonological palatalization of the preceding consonants, including the realization of underlying placeless consonants (i.e. phonetic velars) as post-alveolar. In contrast, the high placeless vowel /i/ causes phonetic fronting of the preceding placeless consonants (i.e. velars).

In initial unstressed syllables, there are three surface vowels. These are phonetically dispersed within a more limited (centralized) vowel space. Phonologically, the high non-round vowels neutralize to just high and the mid and low vowels neutralize to just low. The high round vowel does not phonologically change. In other words, an underlying coronal feature is lost on the surface, as is the high feature of the mid vowel.

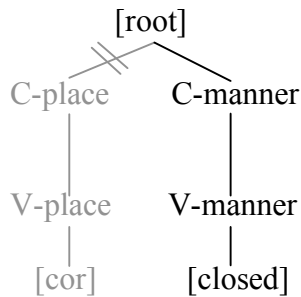
(29) Unstressed initial

	//ĩ// 'i', 'y'	//i// 'e'	//a// 'a'	//o// 'o'	//u// 'u'
#	/ĩ/ [ɪ]	/i/ [ɪ]	/a/ [ʌ]	/a/ [ʌ]	/u/ [ʊ]

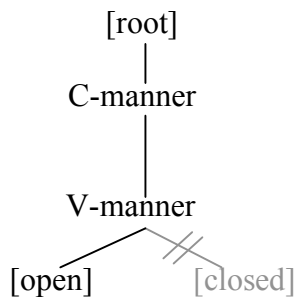
(30)

	//UR//			/SR/			[Phonetics]			
	V[cor]		V[lab]	V[cor]		V[lab]		Front	Central	Back/ Round
V[closed]	i ₂	i ₁	u ₅		i _{1,2}	u ₅	High	i _{1,2} u ₅		
V[closed]& V[open]		o ₄					Mid	Λ _{3,4}		
V[open]		a ₃			a _{3,4}		Low			

(31) a. //i// --> /i/ [#1] *[#e]



b. //o// --> /a/ [#Λ] *[#o]



In unstressed syllables following underlyingly non-palatalized onsets, there are four surface vowels, which are phonetically dispersed. The difference between this environment and initial environment is in the realization of “high placeless” vowel and the low placeless vowel. The former surfaces as central following non-palatalized consonants. As was discussed above for stressed syllables, this centralization is seen as a phonetic phenomenon. The latter surfaces as slightly more centralized.

(32) Unstressed, non-palatalized onset

	//i// ‘i’, ‘y’	//i// ‘e’	//a// ‘a’	//o// ‘o’	//u// ‘u’
//p//	/pi/ [pɪ]	/pi/ [pɪ]	/pa/ [pə]	/pa/ [pə]	/pu/ [pu]
//t//	/ti/ [tɪ]	/ti/ [tɪ]	/ta/ [tə]	/ta/ [tə]	/tu/ [tu]
//K//	/Ki/ [cɪ]	/Ki/ [cɪ]	/Ka/ [kə]	/Ka/ [kə]	/Ku/ [ku]
//X//	/Xi/ [çɪ]	/Xi/ [çɪ]	/Xa/ [xə]	/Xa/ [xə]	/Xu/ [xu]
//T//	/Ti/ [tsɪ]	/Ti/ [tsɪ]	/Ta/ [tsə]	/Ta/ [tsə]	/Tu/ [tsu]

(33)

	//UR//			/SR/			[Phonetics]			
	V[cor]		V[lab]	V[cor]		V[lab]		Front	Central	Back/ Round
V[closed]	i ₂	i ₁	u ₅		i _{1,2}	u ₅	High	1 _{1,2}	i _{1,2}	u ₅
V[closed]& V[open]		o ₄					Mid	ə _{3,4}		
V[open]		a ₃			a _{3,4}		Low			

In unstressed, non-final syllables following underlyingly palatalized onsets, there are two surface vowels. All phonologically non-labial vowels neutralize to high front. As shown in (36), the mid vowel loses its low feature, and the low vowel loses its low feature and epenthesizes a high feature. It is important to note the phonetic dispersion pattern here. [ɪ] is usually the phonetic realization of the placeless high vowel /i/ in those contexts where there is a contrast between it and the coronal high vowel /i/ (realized as [e]). The phonetic lowering of /i/ is due to the pressure to disperse the realization of the vowels across the vowel space. However, [ɪ] is the phonetic realization of the coronal high vowel /i/ when it is not in contrast with the placeless high vowel. Since the only pressure to disperse comes from the high round vowel, there is no phonetic lowering.

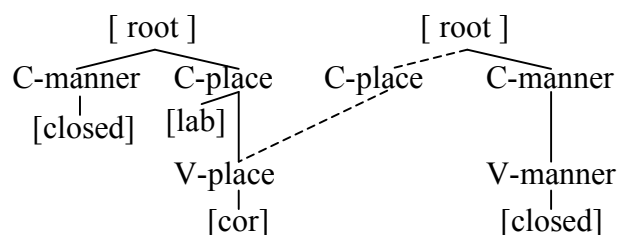
(34) Unstressed, non-final palatalized onset

	//i/ 'i', 'y'	//i/ 'e'	//a/ 'a'	//o/ 'o'	//u/ 'u'
//p ^j /	/p ^j i/ [p ^j ɪ]	/p ^j i/ [p ^j ɪ]	/p ^j i/ [p ^j ɪ]	/p ^j i/ [p ^j ɪ]	/p ^j u/ [p ^j u]
//t ^j /	/t ^j i/ [t ^j ɪ]	/t ^j i/ [t ^j ɪ]	/t ^j i/ [t ^j ɪ]	/t ^j i/ [t ^j ɪ]	/t ^j u/ [t ^j u]
//K ^j /	/K ^j i/ [t͡ɕ ^j ɪ]	/K ^j i/ [t͡ɕ ^j ɪ]	/K ^j i/ [t͡ɕ ^j ɪ]	/K ^j i/ [t͡ɕ ^j ɪ]	/K ^j u/ [t͡ɕ ^j u]
//X ^j /	/X ^j i/ [ɕɪ]	/X ^j i/ [ɕɪ]	/X ^j i/ [ɕɪ]	/X ^j i/ [ɕɪ]	/X ^j u/ [ɕu]

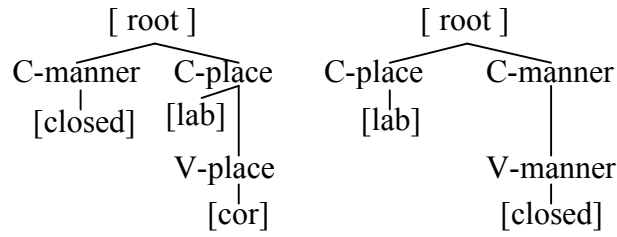
(35)

	//UR//			/SR/		[Phonetics]			
	V[cor]		V[lab]	V[cor]	V[lab]		Front	Central	Back/ Round
V[closed]	i ₂	i ₁	u ₅	i _{1,2,3,4}	u ₅	High	1 _{1,2,3,4}		u ₅
V[closed]& V[open]		o ₄				Mid			
V[open]		a ₃				Low			

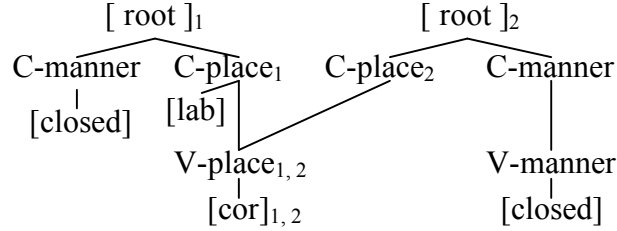
(36) Standard Russian non-final unstressed vowel neutralization with place assimilation

a. //p^ji/ --> /p^ji/ [p^jɪ]

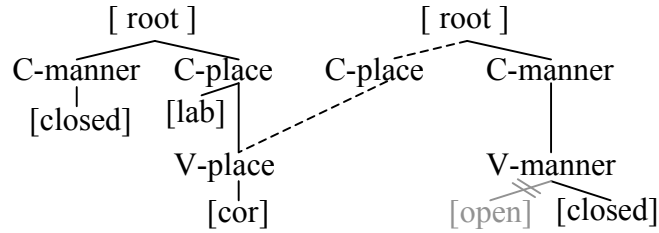
b. //p^ju// --> /p^ju/ [p^ju]



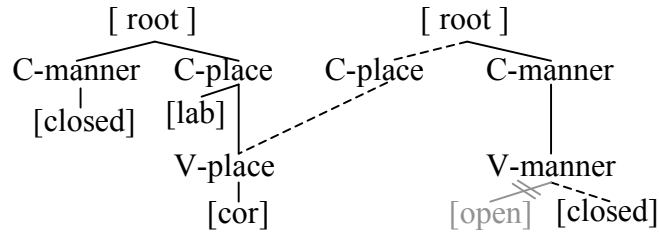
c. //p^ji// --> /p^ji/ [p^ji]



d. //p^jo// --> /p^ji/ [p^ji]



e. //p^ja// --> /p^ji/ [p^ji]



In unstressed, final syllables following underlyingly palatalized onsets, there are three surface vowels. All phonologically non-labial vowels neutralize to high front, except the low vowel. It remains phonologically low. This may be explained as a restriction against epenthesizing a high feature in this environment.

(37) Unstressed, final palatal onset

	//i// 'i', 'y'	//i// 'e'	//a// 'a'	//o// 'o'	//u// 'u'
//p ^j //	/p ^j i/ [p ^j i]	/p ^j i/ [p ^j i]	/p ^j i/ [p ^j ə]	/p ^j i/ [p ^j i]	/p ^j u/ [p ^j u]
//t ^j //	/t ^j i/ [t ^j i]	/t ^j i/ [t ^j i]	/t ^j i/ [t ^j ə]	/t ^j i/ [t ^j i]	/t ^j u/ [t ^j u]
//K ^j //	/K ^j i/ [t ^j i]	/K ^j i/ [t ^j i]	/K ^j i/ [t ^j ə]	/K ^j i/ [t ^j i]	/K ^j u/ [t ^j u]
//X ^j //	/X ^j i/ [ɕi]	/X ^j i/ [ɕi]	/X ^j i/ [ɕə]	/X ^j i/ [ɕi]	/X ^j u/ [ɕu]

(38)

	//UR//			/SR/			[Phonetics]			
	V[cor]		V[lab]	V[cor]		V[lab]		Front	Central	Back/ Round
V[closed]	i ₂	i ₁	u ₅	i _{1,2,4}		u ₅	High	i _{1,2,4} u ₅		
V[closed]& V[open]		o ₄					Mid	ə ₃		
V[open]		a ₃			a ₃		Low			

To summarize, unstressed vowels change their underlying feature specifications on the surface depending on their underlying nature and the context. When not following an underlyingly palatalized consonant, only three vowels can appear - /i/, /a/ and /u/. This neutralization can be seen as the inability of marked (structurally complex) segments from appearing in prosodically weak positions. The underlying V-place[cor] vowel loses its place feature, the underlying mid vowel loses its high feature, and the high labial vowel remains faithful because the labial feature is never lost in this language. When following an underlyingly palatalized consonant, vowel reduction is partially dependent on prosodic context. In non-final position, all vowels but the high labial vowel become high and coronal. This is due to place assimilation with the preceding palatalized consonant, and it entails the loss of a low feature for both the mid and low vowels and the epenthesis of a high feature for the low vowel. In final position, the low vowel escapes assimilation and remains low. Finally, pressures to phonetically disperse the vowels across the vowel space are constrained by the contrastive system (or context-specific sub-system) and phonological feature specification. This can lead to similar phonetic realization for different phonological structures found in different environments.

“Consonants”

The characterization and evaluation of consonants is slightly more difficult than that for vowels. This is due partially to the fact that consonants have traditionally been more prone to full feature specification in the literature than vowels have been, and partially to the fact that the Parallel Structures Model assumes that consonants and vowels can make use of the same features. This blurs the line between the two segment types. For our present purposes, consonants may be defined roughly as segments with a C-manner feature.

Stops and Fricatives

If we ignore laryngeal specifications, Modern Standard Russian has three pairs of stops (only C-manner[closed]) and three pairs of fricatives (only C-manner[open]). The two groups are exactly parallel, and each group is internally differentiated via primary place features (C-place) and/or secondary place features (V-place).

(39) Feature specifications for Modern Standard Russian phonological stops and fricatives

			C-place		V-place	C-manner		V-manner	
			[lab]	[cor]	[cor]	[closed]	[open]	[closed]	[open]
Stop	/K/	[k] [c]				✓			
	/Kʲ/	[t͡ʃʲ]			✓	✓			
	/p/	[pʷ][pʲ]	✓			✓			
	/pʲ/	[pʲ]	✓		✓	✓			
	/t/	[tʷ] [tʲ]		✓		✓			
	/tʲ/	[tʲ]		✓	✓	✓			
Fricative	/X/	[x] [ç]					✓		
	/Xʲ/	[ɣʷ]			✓		✓		
	/								
	/f/	[fʷ] [fʲ]	✓				✓		
	/fʲ/	[fʲ]	✓		✓		✓		
	/s/	[sʷ] [sʲ]		✓			✓		
	/sʲ/	[sʲ]		✓	✓		✓		

Note that [t͡ʃʷ] is discussed below.

There are two things that are especially noteworthy about this analysis. First, the velars are phonologically placeless. This makes them similar to those of related Standard Serbian (Morén 2004) and fits nicely with recent claims that velars are both acquired and produced early in Russian (Zharkova ???). Second, the post-alveolar affricate and fricative differ from the placeless stop and fricative (respectively) only by the addition of a V-place[cor] feature. This helps to explain why the native vocabulary does not have velars followed by the high coronal vowel (i.e. [e]) and the alternations of velars with post-alveolars under plain and transitive softening. This was shown in (24a) and (24b).

Approximants

Standard Russian has two pairs of approximants, which are characterized in the Parallel Structures Model by the presence of both a C-manner and a V-manner feature. These pairs are differentiated via the presence or absence of a secondary place feature, as shown in (40).

(40) Feature specifications for individual Standard Russian approximants

			C-place		V-place	C-manner		V-manner	
			[lab]	[cor]	[cor]	[closed]	[open]	[closed]	[open]
Closed Approx.	/l/	[lʷ]				✓		✓	
	/lʲ/	[lʲ]			✓	✓		✓	
Open Approx.	/r/	[rʷ]					✓	✓	
	/rʲ/	[rʲ]			✓		✓	✓	

Softening of approximants before mid front vowels is identical to that demonstrated for stops and fricatives and is not shown here.

“Mannerless” Segments

One of the claims of the Parallel Structures Model is that every complex segment implies a minimally different less complex segment. This leads to the prediction that a language that has both place and manner feature contrasts will have segments composed of only a single place feature and

only a single manner feature. In the discussion thus far, we have seen a variety of placeless segments (i.e. /i/, /o/, /a/, /K/, /X/, /l/, /r/).⁸ However, we analyze Modern Standard Russian as also having the mannerless segments shown in (41).

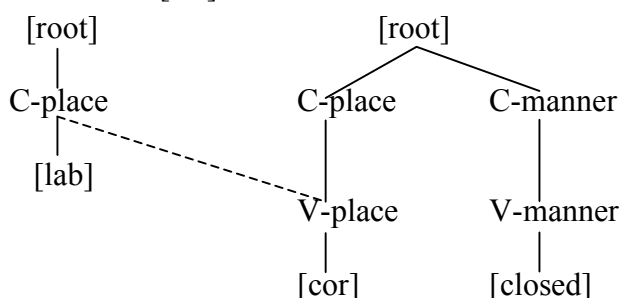
(41) Feature specifications for Modern Standard Russian mannerless segments

			C-place		V-place	C-manner		V-manner	
			[lab]	[cor]	[cor]	[closed]	[open]	[closed]	[open]
Mannerless	/v/	[v ^v]	✓						
	/vʲ/	[vʲ]	✓		✓				
	/T/	[ts ^v]		✓					
	/ʎ/				✓				

What is particularly interesting about these mannerless segments is that they are all treated as “marginal” in one way or another by the grammar. First, the labials are realized as voiced fricatives, but do not trigger voicing assimilation as do all other voiced obstruents. This has led to their categorization as sonorants⁹ by many linguists, but their phonetic voicing may be the result of vocal tract aerodynamics and the fact that these segments do not have a sufficient constriction to suppress spontaneous voicing. Second, the C-place[cor] (only) segment does not participate in laryngeal contrasts (unlike most obstruents), it does not undergo plain softening (unlike all other alveolar consonants), and it has certain limitations on its distribution - such as it cannot be verb-stem final (unlike most other obstruents). Finally, the V-place[cor] (only) segment is also quite interesting. We will show below that this segment is the trigger of many of the cases of morphological palatalization found in the verbal inflection system. Because it is mannerless, it cannot surface in nuclear position because of sonority requirements, and because it only has a vocalic feature, it cannot surface faithfully in margin positions either (onset or coda). Thus, this segment either merges with an adjacent segment (e.g. triggering palatalization) or it must epenthesize enough features to be licit in a given syllable position (e.g. labial iotization).

As (42) shows, the plain labial undergoes plain palatalization when followed by a mid front vowel within a morpheme, but the plain C-place[cor] segment does not. The lack of palatalization in the latter case is due to the fact that Modern Standard Russian does not allow a segment composed of just C-place[cor] and V-place[cor] features. This is unlike Standard Serbian, which does allow such a feature combination (Morén 2004).

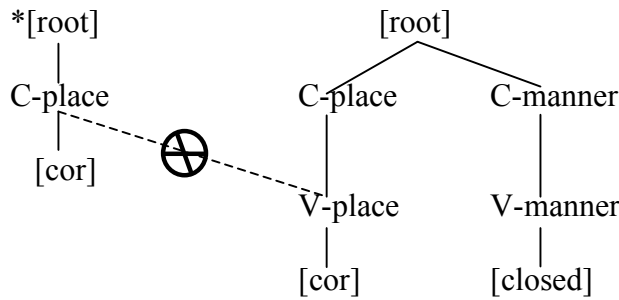
(42) a. //v// + //i// --> /vʲi/ [vʲe]



⁸ Note that placeless segments are the most susceptible to place change.

⁹ There may also be morphological evidence that this segment alternates with the high round vowel (e.g. stem ‘kova’ [kɔjú] 1sg versus [kəvátʲ] infinitive. This will not be discussed further here.

b. //T// + //i// --> /Tⁱ/ [ts^ve]



8. Transitive Softening

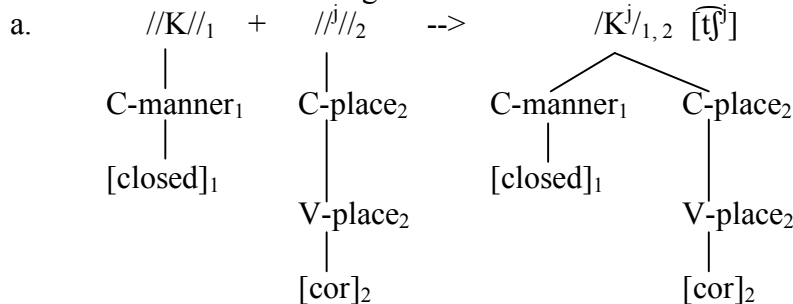
In the previous section, we used the Parallel Structures Model of feature geometry to account for the segment inventory of Standard Russian, as well as the vowel reduction patterns in unstressed syllables. In addition, we discussed plain softening of two types (i.e. phonetic - velars before /i/, and phonological - most segments before /i/) and the “marginal” behavior of a set of segments from a representational perspective. We can now move on to a phonological accounting of transitive softening. We will return to the morphological influence later.

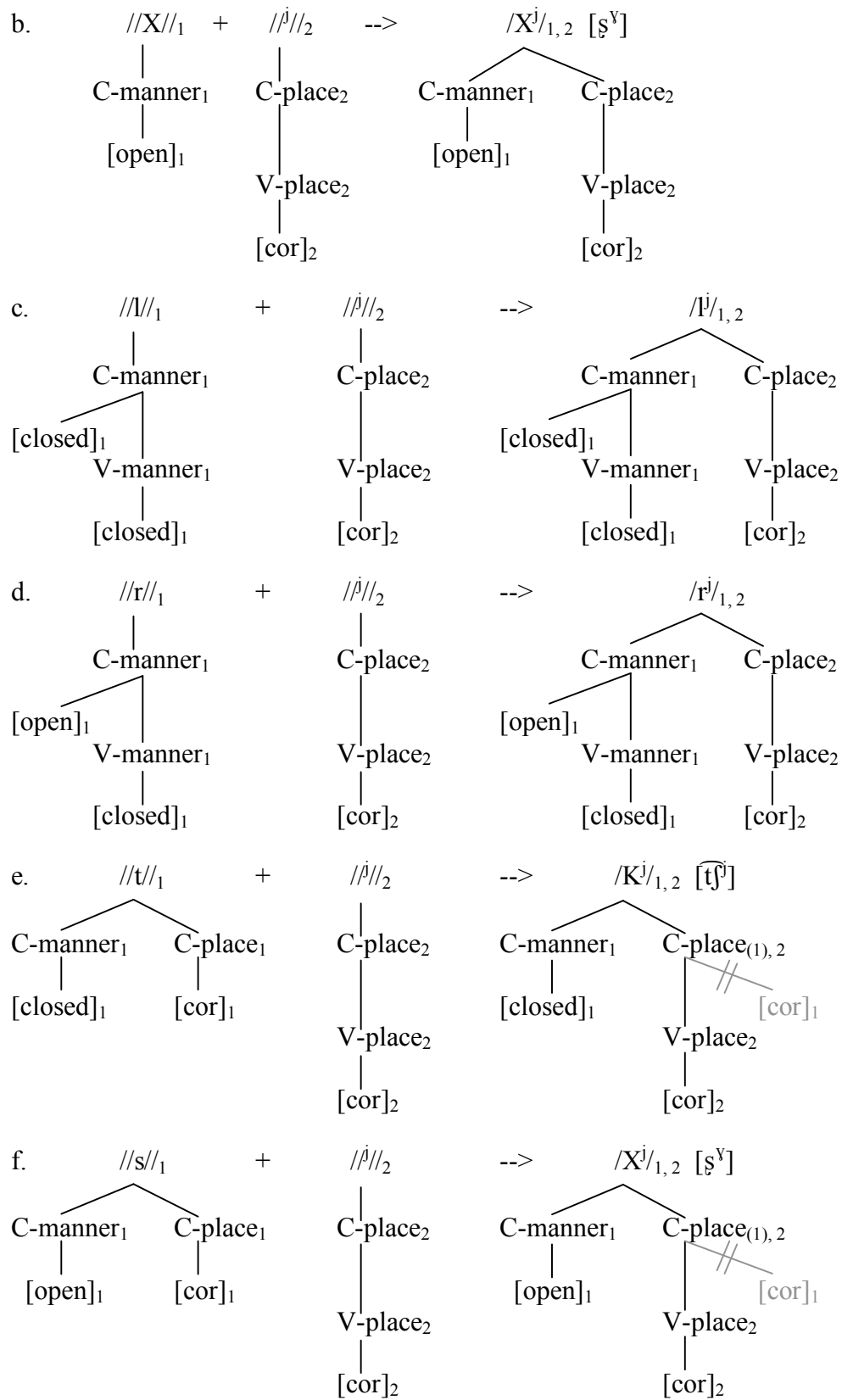
Recall that transitive softening differs from plain softening in one main respect. Phonological plain softening entails the simple addition of a secondary place of articulation, leaving all other aspects of the segment intact (except the placeless obstruents, which were discussed and will be addressed again below). In contrast, transitive softening entails a major place alternation (e.g. [s^v] ~ [ʃ^v]) or the realization of a palatalized lateral (e.g. [p^v] ~ [p^l]). In an analysis of Modern Standard Serbian, Morén (2004) accounts for similar transitive softening alternations via the interaction of a stem-final consonant and a following suffix-initial “iotizing” segment (mannerless V-place[cor]). We will make use of the same representational analysis here. However, since the Russian segment inventory has a different structure than that of Serbian, the results of iotization will often be different between the two languages.

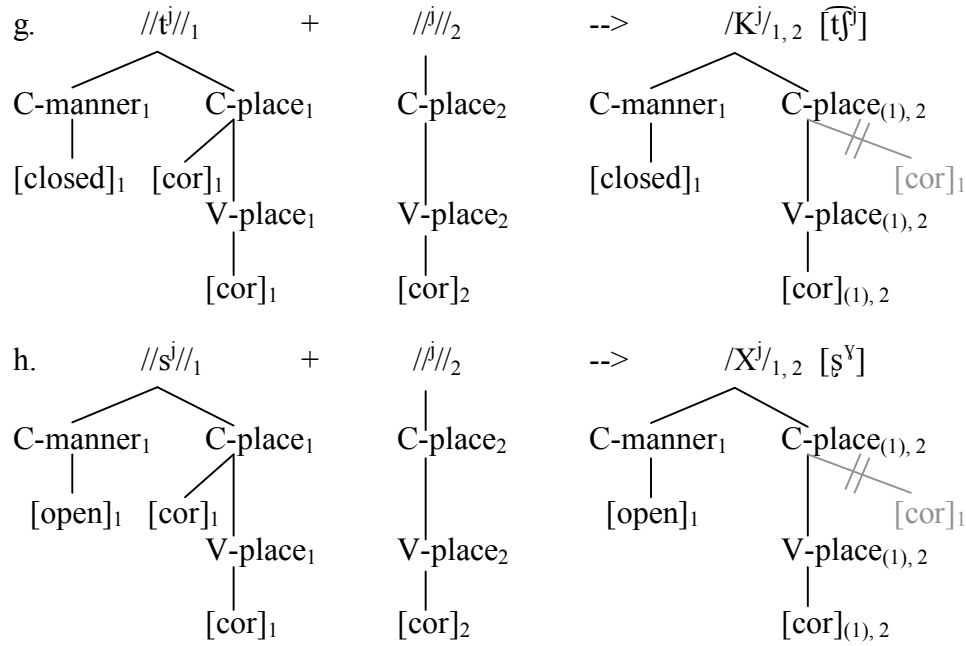
Non-labials

To make sense of transitive softening, we may view it as the merging of a V-place[cor] segment with the preceding segment if possible, as shown in (43). Note that this analysis unifies transitive softening with plain softening in that it also involves the V-place[cor] feature. In (43a) through (43d), we see the simple merger of two segments - creating a licit segment in this language that has faithful exponence to both original segments. However, (43d) through (43h) shows the merger of two segments with concurrent deletion of the C-place[cor] feature originally associated with the first segment. Note that the indices are to show the relationship between input and output structures.

(43) Non-labial transitive softening





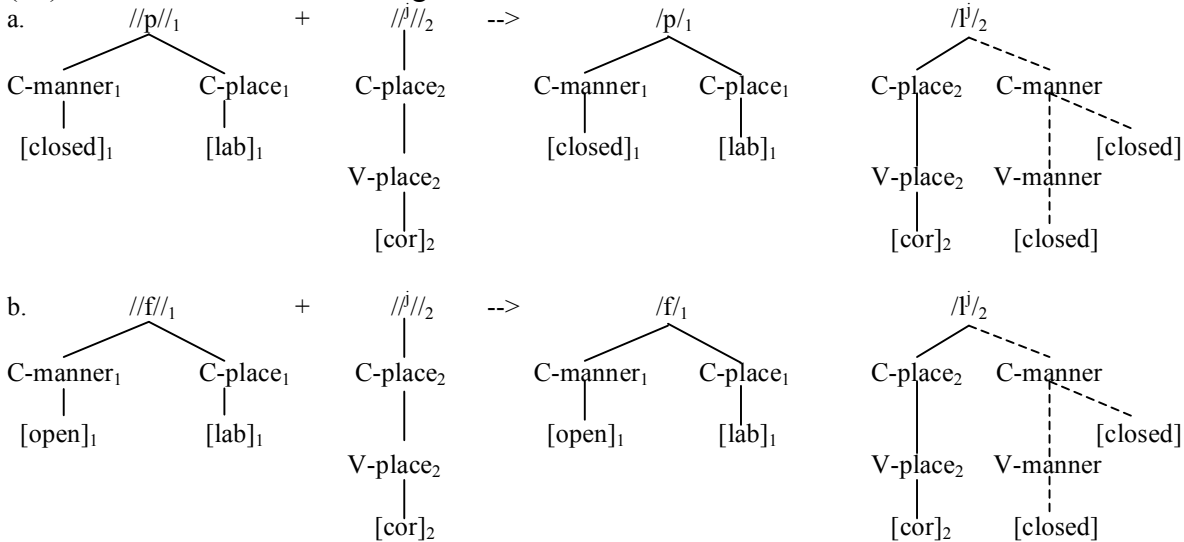


We can conceptualize the loss of the original C-place[cor] feature of the first segment in (43g) and (43h) from a violable-constraint perspective. That is, it is better to merge the two segments, maintain the V-place[cor] feature of the second segment, and not add a C-place[cor] feature to the second segment than it is to not delete the C-place[cor] feature. This will be demonstrated using Optimality Theory (Prince & Smolensky 1993) below.

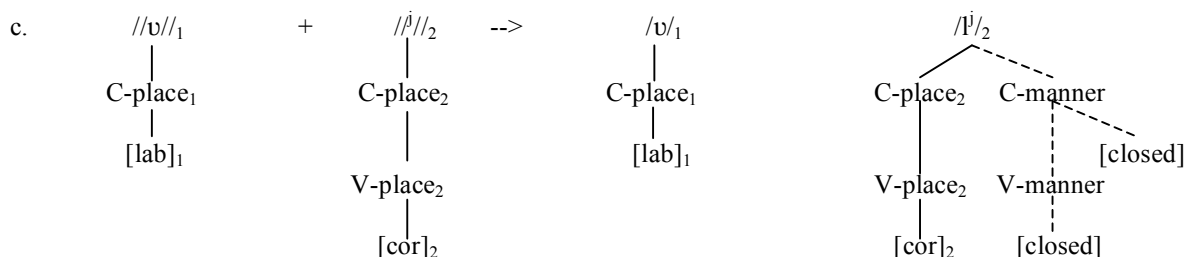
Labials

The phonological analysis of labial transitive softening given here is identical to that of Modern Standard Serbian (Morén 2004). The presence of a palatalized lateral following labials is readily explained as an interaction of violable constraints: 1) neither C-place[lab] nor V-place[cor] can be deleted, 2) the labial feature cannot be added to the iotizing segment, and 3) the least marked consonant allowed as the second member of onset clusters is a lateral¹⁰. The results of these conditions are shown in (44).

(44) Labial Transitive Softening



¹⁰ See Morén (2003) for a discussion of the relative markedness of sonorant consonants under the Parallel Structures Model.



9. Summary

Viewing the segmental phonology of Modern Standard Russian through the lens of the Parallel Structures Model of feature geometry allows us to capture the segment inventory, vowel reduction facts and consonant-vowel interaction facts in a straightforward way. The answer to our first main question about how to characterize the relationships holding between transitive and phonological plain softening alternates is that softening entails the addition of a V-place[cor] feature to a consonant. Plain softening involves only the addition of this feature. Non-labial transitive softening involves the addition of the feature and sometimes the concurrent deletion of an original place feature. Labial transitive softening is the result of feature epenthesis in response to the unavailability of merger due to feature incompatibility and restrictions on feature deletion and syllable structure.

10. Unresolved Issues

Although we have come a long way thus far in accounting for the complexities of the Modern Standard Russian phonetic and phonological system, there are several unresolved issues.

- Our second main question from section 1, “how can we characterize the environment conditioning the alternations?” has not been answered fully. As shown in (1), the same morpheme (e.g. 2.sg) sometimes triggers transitive softening and sometimes triggers plain softening. Although we can structurally describe the different types of softening via the representations presented above, it is unclear how one might ensure that the same morpheme can sometimes allow feature preservation under softening (plain) and other times trigger feature deletion under softening (transitive). One potential road to follow is to make use of the fact that in (1), the stem that undergoes transitive softening ends in a vowel that undergoes hiatus deletion on the surface, while the stem that undergoes plain softening does not have a deleted vowel.
- We need to provide a morphological analysis of the verb inflection paradigm (e.g. list morphemes, morpheme order, restrictions on concatenation, etc.) (or make use of paradigms).
- We need to provide an OT account of the segment inventory, as well as the various alternations. We will address this last issue first.

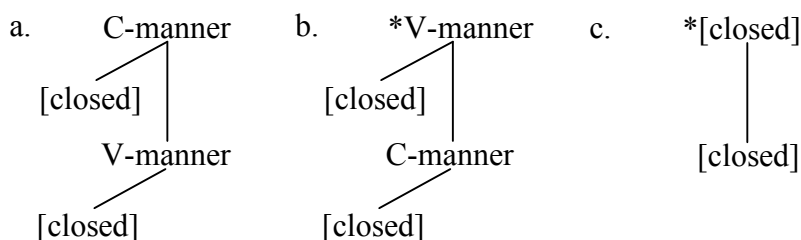
11. An OT analysis of the Modern Standard Russian segment inventory

Most OT analyses in the literature do not explicitly state the mechanism by which the segment inventories of languages are captured using constraints. Nor do they motivate the feature specifications that they assume for given segments. Rather, they simply assume a particular (usually fully-specified) feature set for given segments and use constraint interaction to account for specific phenomena without questioning the validity of those features and constraints for the rest of the language. While such analyses are certainly interesting and address particular theoretical and

empirical questions, it is also important to put analyses within the larger context of the grammar of that language. For this reason, we will provide an OT characterization of both the segment inventory and the consonant-vowel interactions/alternation that are the focus of this paper. As we will see, the constraints used to define the segment inventory also play an important role in accounting for other phonological phenomena.

Before providing an OT analysis of Modern Standard Russian, it is important to state some assumptions regarding features, segment-internal representations and featural markedness and faithfulness constraints. First, we assume the Parallel Structures Model features discussed above. Second, we assume that only the representations of the Parallel Structures Model are possible segment-internal structures. Therefore, universally illicit structures are impossible outputs of the Gen(erator) function and are thus absent from the candidate set. This is an explicit statement about the nature of Gen and the grammar, in which Gen, not the constraint ranking, ensures that only particular representations are universally available. It reduces the set of re-rankable constraints and limits the typological predictions made by re-rankable constraints. It also reduces the workload of the Eval(uator) function and makes for a more learnable grammar by eliminating the need for learners to reject universally unavailable structures or consider universally untenable constraint rankings during the acquisition process. Finally, this makes an explicit statement about the division of labor between segment-internal representations and constraints. The representations regulate the possible relationships among segment-internal elements while the constraint ranking determines which representations occur in a given context in a specific language. Some examples of possible and impossible structures are given in (45).

(45) Examples of possible and impossible structures



Third, we assume a Correspondence Theory (McCarthy and Prince 1995) version of faithfulness constraints, but one in which features are treated as autosegments, not attributes. Thus, we use MAX(imality) and DEP(endency) constraints rather than IDENT(ity) constraints. Fourth, the feature markedness and faithfulness constraints make reference to both class node and feature specification. Examples are given in (46) and (47) for some simple features.

- (46) a. ***C-manner[closed]** - the C-manner[closed] configuration is prohibited.
b. ***V-manner[closed]** - the V-manner[closed] configuration is prohibited.

- (47) a. **MAXC-manner[closed]** - Every C-manner[closed] in the input has a correspondent in the output (do not delete).
b. **MAXV-manner[closed]** - Every V-manner[closed] in the input has a correspondent in the output (do not delete).
c. **DEPC-manner[closed]** - Every C-manner[closed] in the output has a correspondent in the input (do not epenthesize).
d. **DEPV-manner[closed]** - Every V-manner[closed] in the output has a correspondent in the input (do not epenthesize).

Finally, there are a number of possible ways to formalize constraints against feature co-occurrence. We assume a conjunction of individual feature constraints of the type given in (49).

- (48) Local Conjunction¹¹ (Smolensky 1997) - The local conjunction of C1 and C2 in domain D, C1 & C2, is violated when there is some domain of type D in which both C1 and C2 are violated.
- (49) ***C-manner[closed]&*V-manner[closed]** - the local conjunction of *C-manner[closed] and *V-manner[closed] is violated when both *C-manner[closed] and *V-manner[closed] are violated by the same segment.

With essential assumptions made, we can move on to the analysis of Modern Standard Russian. Recall from the representational analysis of this language provided above that this language has seven segments composed of only a single feature - three segments are mannerless and four segments are placeless. Using the standard OT strategy of ranking markedness constraints below faithfulness constraints to yield a contrast, the following constraint rankings yield these first order contrastive segments.

- (50)
- | | | |
|---|-----|--------------------|
| a. MAXC-place[lab] >> *C-place[lab] | /v/ | [v ^v] |
| b. MAXC-place[cor] >> *C-place[cor] | /T/ | [ts ^v] |
| d. MAXV-place[cor] >> *V-place[cor] | /j/ | |
| e. MAXC-manner[closed] >> *C-manner[closed] | /K/ | [k] [c] |
| f. MAXC-manner[open] >> *C-manner[open] | /X/ | [x] [ç] |
| g. MAXV-manner[closed] >> *V-manner[closed] | /i/ | [i] [i] [ɪ] [ɪ] |
| h. MAXV-manner[open] >> *V-manner[open] | /a/ | [a] [ʌ] [ə] |

The tableaux in (51) and (52) demonstrate how this provides the correct results for the velar fricative and the high vowel. In both tableaux, the feature deletion in candidate (b) is ruled out by the higher-ranked faithfulness constraint.

(51)

//C-manner[open]//		MAX	
		C-manner[open]	*C-manner[open]
-->	a. C-manner[open] /X/		*
	b. / / ---	*!	

(52)

//V-manner[closed]//		MAX	
		V-manner[closed]	*V-manner[closed]
-->	a. V-manner[closed] /i/		*
	b. / / ---	*!	

In contrast, segments composed of only the features not used in this language (e.g. C-place[phar]) are prohibited because the relevant markedness constraint outranks the related faithfulness constraint, as shown in (53). This means that the pharyngeal C-place never surfaces in this language.

(53)

//C-place[phar]//		*C-place[phar]	MAXC-place[phar]
	a. C-place[phar]	*!	
-->	b. / /		*

¹¹ Local conjunction is an operation by which constraints applying to a specific domain (the segment in this case) are combined such that the conjoined constraint is violated if and only if all its members are violated.

If we assume that more complex structures are necessarily built up of less complex structures, then the only combinations of features allowed in this language are those making use of the seven features in (50). Combining two of the relevant markedness constraints at a time, we get $7C2 = 7!/(2!(7-2)!) = 21$ second order constraints. This entails 21 logically possible segments composed of two features. Of these, only 12 are actually used in this language. The allowable combinations of two features are the result of the constraint rankings in (54). Tableau (55) demonstrates how a high round vowel results from the ranking in (54j). In contrast, tableaux (56) and (57) show how a low round vowel is not allowed even though both the round feature and the low feature are allowed independently (see (50)).

(54) a. MAXC-place[lab], MAXV-place[cor] >> *C-place[lab]&*V-place[cor]	/v ^j /	[v ^j]
b. MAXV-place[cor], MAXC-manner[closed] >> *V-place[cor]&*C-manner[closed]	/K ^j /	[t̪ ^j]
c. MAXC-place[lab], MAXC-manner[closed] >> *C-place[lab]&*C-manner[closed]	/p/	[p ^y] [p ^j]
d. MAXC-place[cor], MAXC-manner[closed] >> *C-place[cor]&*C-manner[closed]	/t/	[t ^y] [t ^j]
e. MAXV-place[cor], MAXC-manner[open] >> *V-place[cor]&*C-manner[open]	/X ^j /	[s ^y]
f. MAXC-place[lab], MAXC-manner[open] >> *C-place[lab]&*C-manner[open]	/f/	[f ^y] [f ^j]
g. MAXC-place[cor], MAXC-manner[open] >> *C-place[cor]&*C-manner[open]	/s/	[s ^y] [s ^j]
h. MAXC-manner[closed], MAXV-manner[closed] >> *C-manner[closed]&*V-manner[closed]	/l/	[l ^y] [l ^j]
i. MAXC-manner[open], MAXV-manner[closed] >> *C-manner[open]&*V-manner[closed]	/r/	[r ^y] [r ^j]
j. MAXC-place[lab], MAXV-manner[closed] >> *C-place[lab]&*V-manner[closed]	/u/	[u]
k. MAXV-place[cor], MAXV-manner[closed] >> *V-place[cor]&*V-manner[closed]	/i/	[e] [ɪ]
l. MAXV-manner[closed], MAXV-manner[open] >> *V-manner[closed]&*V-manner[open]	/o/	[o]

(55)

//C-place[lab] V-manner[closed]//	//u//	MAX C-place [lab]	MAX V-manner [closed]	*C-place [lab]& *V-manner [closed]	*C-place [lab]	*V-manner [closed]
--> a. C-place[lab] V-manner[closed]	/u/			*	*	*
b. C-place[lab]	/v/		*!		*	
c. V-manner[closed]	/i/	*!				*
d. ---	[]	*!	*!			

(56)

//C-place[lab] V-manner[open]//		*C-place[lab]& *V-manner[open]	MAX C-place[lab]	*C-place[lab]
a. C-place[lab] V-manner[open]		*!		*
--> b. C-place[lab]	/v/			*
c. V-manner[open]	/a/		*!	
d. ---	[]		*!	

(57)

/C-place[lab] V-manner[open]/		*C-place[lab]& *V-manner[open]	MAX V-manner[open]	*V-manner[open]
a. C-place[lab] V-manner[open]		*!		*
b. C-place[lab]	/v/		*!	
--> c. V-manner[open]	/a/			*
d. ---	[]		*!	

Note that there is no evidence at this point with which to decide the relative ranking of either the two faithfulness constraints, MAXC-place[lab] and MAXV-manner[open], or the two markedness constraints, *C-place[lab] and *V-manner[open]. Therefore, a single input containing both features, C-place[lab]V-manner[open], could result in either /v/ or /a/. However, we will see below that faithfulness to the labial feature is very highly ranked in this language, therefore, we might expect candidate (b) to win.

Combining three markedness constraints at a time using local conjunction, we get $7C3=7!/3!(7-3)!=35$ third order constraints. Of these, only six are used in this language. Note that these are all consonants with V-place[cor]. Tableau (59) shows the evaluation of the palatalized lateral.

(58) a. MAXC-manner[closed], MAXV-place[cor], MAXC-place[lab] >>		
*C-manner[closed]&*V-place[cor]&*C-place[lab]	/p ^j /	[p ^j]
b. MAXC-manner[closed], MAXV-place[cor], MAXC-place[cor] >>		
*C-manner[closed]&*V-place[cor]&*C-place[cor]	/t ^j /	[t ^j]
c. MAXC-manner[open], MAXV-place[cor], MAXC-place[lab] >>		
*C-manner[open]&*V-place[cor]&*C-place[lab]	/f ^j /	[f ^j]
d. MAXC-manner[open], MAXV-place[cor], MAXC-place[cor] >>		
*C-manner[open]&*V-place[cor]&*C-place[cor]	/s ^j /	[s ^j]
e. MAXC-manner[closed], MAXV-place[cor], MAXV-manner[closed] >>		
*C-manner[closed]&*V-place[cor]&*V-manner[closed]	/l ^j /	[l ^j]

f. MAXC-manner[open], MAXV-place[cor], MAXV-manner[closed] >>
 *C-manner[open]&*V-place[cor]&*V-manner[closed] /r^j/ [r^j]

(59)

//C-manner[closed] V-manner[closed] V-place[cor]//	//l ^j //	MAX C-manner [closed]	MAX V- manner [closed]	MAX V-place [cor]	*C-manner[closed]& *V-manner[closed]& *V-place[cor]
--> a. C-manner[closed] V-manner[closed] V-place[cor]	/l ^j /				*
b. C-manner[closed] V-manner[closed]	/l/			*!	
c. V-manner[closed] V-place[cor]	/i/	*!			
d. C-manner[closed] V-place[cor]	/K ^j /		*!		

There are no violations of the fourth order constraints composed of the seven constraints under investigation in this study. Therefore, corresponding representations do not surface. To summarize, the constraint ranking necessary to account for the segment of Modern Standard Russian under investigation here is given in (60).

(60) General Standard Russian segment inventory ranking (to be revised below)

Unviolated feature markedness constraints	{	all n th >3 order markedness constraints, all unviolated third order markedness constraints, all unviolated second order markedness constraints, all unviolated first order markedness constraints >>
Faithfulness constraints against feature deletion		MAXC-place[lab], MAXC-place[cor], MAXV-place[cor], MAXC-manner[closed], MAXC-manner[open], MAXV-manner[closed], MAXV-manner[open] >>
Violated 3rd order feature markedness constraints		*C-manner[closed]&*V-manner[closed]&*V-place[cor], *C-manner[open]&*V-manner[closed]&*V-place[cor], *C-manner[closed]&*C-place[lab]&*V-place[cor], *C-manner[closed]&*C-place[cor]&*V-place[cor], *C-manner[open]&*C-place[lab]&*V-place[cor], *C-manner[open]&*C-place[cor]&*V-place[cor], *C-place[lab]&*V-place[cor], *C-place[lab]&*C-manner[closed], *C-place[cor]&*C-manner[closed], *V-place[cor]&*C-manner[closed], *C-place[cor]&*C-manner[open], *C-place[lab]&*C-manner[open], *V-place[cor]&*C-manner[open], *C-manner[closed]&*V-manner[closed], *C-manner[open]&*V-manner[closed], *V-manner[open]&*V-manner[closed], *C-place[lab]&*V-manner[closed], *V-place[cor]&*V-manner[closed], *C-place[lab], *C-place[cor], *V-place[cor], *C-manner[closed], *C-manner[open], *V-manner[closed], *V-manner[open]
Violated 2nd order feature markedness constraints		
Violated 1st order feature markedness constraints	{	

12. An OT analysis of the vowel distribution

Given the general account of the contrastive segment inventory, we must now provide an analysis of the distribution of vowels and the patterns of vowel reduction since consonant-vowel assimilation (a part of the reduction pattern) plays a crucial role in morphologically conditioned softening. Therefore, it is important to have an analysis of the interactions within morphemes so we have a core constraint ranking with which the morphology can interact. As we will see, the constraints making up the contrastive inventory interact with positional faithfulness constraints (Beckman 1995) and markedness constraints requiring feature sharing.

As we saw in section X, surface vowels are not always faithful to their underlying feature specification. Thus, the ranking given in (60) is not quite accurate. We must actually specify that at least some of the faithfulness constraints on features are sensitive to prosodic position. If we look only at non-assimilatory environments, the feature that is only found in stressed vowels is V-place[cor]. Thus, we can split the faithfulness constraints against losing this feature into a general constraint and a constraint specific to the head mora of a head syllable of a foot. These are given in (61) and (62).

- (61) **MAXLinkV-place[cor]** - Every V-place[cor] associated with a vowel in the input is associated with that vowel in the output.
- (62) **MAXLinkV_{head}V-place[cor]** - Every V-place[cor] associated with a vowel in the input is associated with that vowel in the output if the vowel is the head of a foot.

In addition, we know from section X that the mid vowel only occurs in stressed syllables. In non-assimilating environments, it reduces to a low vowel by deleting the high feature. Thus, we must have two constraints on the V-manner[closed] feature.

- (63) **MAXLinkV-manner[closed]** - Every V-manner[closed] associated with a vowel in the input is associated with that vowel in the output.
- (64) **MAXLinkV_{head}V-manner[closed]** - Every V-manner[closed] associated with a vowel in the input is associated with that vowel in the output if the vowel is the head of a foot.

We know that the high, low central and high rounded vowels are allowed in all non-assimilatory environments, thus the rankings in (65) through (67). These were shown in (XXg), (XXh) and (XXl).

- (65) //vi// --> /vi/ MAXV-manner[closed] >> *V-manner[closed]
- (66) //va// --> /va/ MAXV-manner[open] >> *V-manner[open]
- (67) //vu// --> /vu/ MAXV-manner[closed], MAXC-place[lab] >>
 *V-manner[closed]&*C-place[lab]

Because underlying mid vowels neutralize to low, not high, in non-assimilating unstressed position, the ranking in (68) must hold. Similarly, high front vowels neutralize to high, not coronal. Note that the rankings in (68) and (69) are a modification of those given in (50) and (54). Tableaux (70) and (71) demonstrate the mid vowel and high front vowel reductions, respectively.

(68) //vo// --> /va/ MAXV-manner[open], *V-manner[closed]&*V-manner[open] >>
MAXV-manner[closed]

(69) //vi// --> /vi/ MAXV-manner[closed], *V-manner[closed]&*V-place[cor] >>
MAXV-place[cor]

(70)

//C-place[lab] V-manner[closed]& V-manner[open]//	//vo//	*V-manner[closed]& *V-manner[open]	MAX V-manner [open]	MAX V-manner [closed]
a. C-place[lab] V-manner[closed]& V-manner[open]	/vo/	*!		
b. C-place[lab] V-manner[closed]	/vi/		*!	
--> c. C-place[lab] V-manner[open]	/va/			*

(71)

//C-place[lab] V-manner[closed]& V-place[cor]//	//vi//	*V-manner[closed]& *V-place[cor]	MAX V-manner [closed]	MAX V-place [cor]
a. C-place[lab] V-place[cor]& V-manner[closed]	/vi/ ¹²	*!		
b. C-place[lab] V-place[cor]	/v ^j /		*!	
--> c. C-place[lab] V-manner[closed]	/vi/			*

Because underlying high front and mid vowels do not neutralize in stressed position, the rankings in (72) and (73) must hold.

(72) //vi// --> /vⁱ/ MAX_{head}V-place[cor], MAXV-manner[closed] >>
*V-manner[closed]&*V-place[cor]

(73) //vo// --> /v^o/ MAX_{head}V-manner[closed], MAXV-manner[open] >>
*V-manner[closed]&*V-manner[open]

(74)

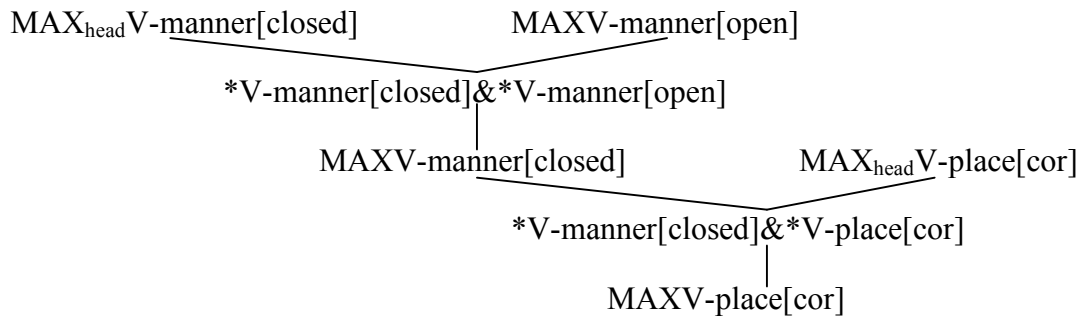
//C-place[lab] V-manner[closed]& V-place[cor]//	//vi//	MAX _{head} V-manner [cor]	MAX V-manner [closed]	*V- manner[closed]& *V-place[cor]
--> a. C-place[lab] V-place[cor]& V-manner[closed]	/v ⁱ /			*
b. C-place[lab] V-place[cor]	/v ^j /		*!	
c. C-place[lab] V-manner[closed]	/v ⁱ /	*!		

¹² This environment would also entail consonant palatalization, which we abstract away from here.

(75)

//C-place[lab] V-manner[closed]& V-manner[open]//			MAX _{head} V-manner [closed]	MAX V-manner [open]	*V-manner[closed]& *V-manner[open]
--> a.	C-place[lab] V-manner[closed]& V-manner[open]	/v ^o /			*
b.	C-place[lab] V-manner[closed]	/v ⁱ /		*!	
c.	C-place[lab] V-manner[open]	/v ^a /	*!		

(76) Summary ranking of non-assimilatory reduction



After palatalized consonants, the situation is quite different due to place assimilation. In non-final position, all unstressed vowels that are not high round neutralize to high front. That means that the non-final post-palatalized vowel space consists of only two vowels at only one height. All vowels are high and they are either V-place[cor] or C-place[lab]. Recall the discussion of role of phonetic dispersion in the realization of vowels in an environment of limited contrasts given in section X.

(77) **AGREE[feature]** - Onsets and nuclei must agree in a particular feature.¹³(78) //v^ji// --> /v^ji/ [v^ji] AGREE V-place[cor] >> *V-manner[closed]&*V-place[cor]

(79)

//C-place[lab]& V-manner[closed]// V-place[cor]		//v ^j i//	AGREE V-place[cor]	*V-manner[closed] &*V-place[cor]
a.	C-place[lab]& V-manner[closed] V-place[cor]	/v ^j i/	*!	
--> b.	C-place[lab]& V-manner[closed]& V-place[cor] V-place[cor]	/v ^j i/		*

(80) //v^jo// --> /v^ji/ [v^ji] AGREE V-place[cor] >> MAX V-manner[open]

(81)

//C-place[lab]& V-manner[closed]& V-place[cor] V-manner[open]//		//v ^j o//	AGREE V-place [cor]	MAX V-manner [open]
a.	C-place[lab]& V-manner[closed]& V-place[cor] V-manner[open]	/v ^j o/	*!	
--> b.	C-place[lab]& V-manner[closed]& V-place[cor] V-place[cor]	/v ^j i/		*

¹³ There is much debate in the literature regarding what constraints ensure assimilation. We remain agnostic here and use AGREE for convenience.

(82) //v^ja// --> /v^ji/ [v^ji] AGREEV-place[cor] >> DEPV-manner[closed]

(83)

//C-place[lab]& V-manner[open]// V-place[cor]		//v ^j a//	AGREE V-place [cor]	DEP V-manner [closed]
a.	C-place[lab]& V-manner[open] V-place[cor]	/v ^j a/	*!	
--> b.	C-place[lab]& V-manner[closed]& V-place[cor] V-place[cor]	/v ^j i/		*

(84) //v^ju// --> /v^ju/ [v^ju] MAX_{onset} V-place[cor] >> AGREEV-place[cor]
MAXC-place[lab] >> AGREEV-place[cor]
*V-manner[closed]&*C-place[lab]&*V-place[cor] >>
AGREEV-place[cor]

(85)

//C-place[lab]& C-place[lab]& V-place[cor] V-manner[closed]//		//v ^j u//	MAX _{onset} V-place[cor]	AGREE V-place [cor]
--> a.	C-place[lab]& C-place[lab]& V-place[cor] V-manner[closed]	/v ^j u/		*
b.	C-place[lab] C-place[lab]& V-manner[closed]	/vu/	*!	

(86)

//C-place[lab]& C-place[lab]& V-place[cor] V-manner[closed]//		//v ^j u//	MAX C-place[lab]	AGREE V-place [cor]
--> a.	C-place[lab]& C-place[lab]& V-place[cor] V-manner[closed]	/v ^j u/		*
b.	V-place[cor] V-manner[closed]& V-place[cor]	/v ^j i/	*!	

(87)

//C-place[lab]& C-place[lab]& V-place[cor] V-manner[closed]//		//v ^j u//	C-place[lab]& V-manner[closed]& V-place[cor]	AGREE V-place [cor]
--> a.	C-place[lab]& C-place[lab]& V-place[cor] V-manner[closed]	/v ^j u/		*
b.	C-place[lab]& C-place[lab]& V-place[cor] V-manner[closed]& V-place[cor]	/v ^j y/	*!	

Stressed vowels in this environment do not assimilate in place to the preceding palatalized consonant. Therefore, there must be a faithfulness constraint against adding the V-place[cor] feature to a stressed vowel. This is shown in (89) for an underlyingly high placeless vowel.

(88) **DEPLink_{head}V-place[cor]** - Every V-place[cor] associated with a vowel in the output is associated with that vowel in the input if the vowel is the head of a foot.

(89) //v^ji// --> /v^ji/ [v^ji] */v^ji/ [v^je] DEPLink_{head}V-place[cor] >> AGREEV-place[cor]

(90)

//C-place[lab]& V-manner[closed]// V-place[cor]	//v ^j i//	DEP _{head} V-place[cor]	AGREE V-place[cor]
--> a. C-place[lab]& V-manner[closed] V-place[cor]	/v ^j i/		*
b. C-place[lab]& V-manner[closed]& V-place[cor] V-place[cor]	/v ^j i/	*!	

Recall that in unstressed final position, the low vowel becomes schwa, maintaining a two-way height distinction. The constraint ranking would be the same as for non-final position following palatalized consonants, except that adding a high vowel feature in final position is not allowed.

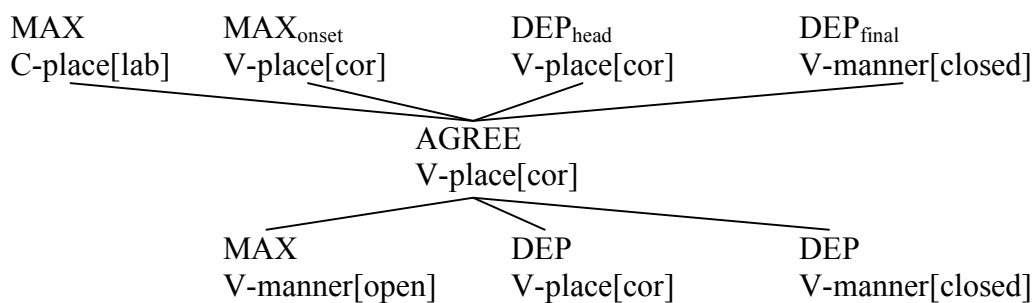
(91) **DEPLink_{final}V-manner[closed]** - Every V-manner[closed] associated with a vowel in the output is associated with that vowel in the input if the vowel is in the final syllable.

(92) //v^ja// --> /v^ja#/ [v^jə#] DEPLink_{final}V-manner[closed] >> AGREEV-place[cor]

(93)

//C-place[lab]& V-manner[open]// V-place[cor]	//v ^j a//	DEP _{final} V-manner [closed]	AGREE V-place [cor]	DEP V-manner [closed]
--> a. C-place[lab]& V-manner[open] V-place[cor]	/v ^j a/		*	
b. C-place[lab]& V-manner[closed]& V-place[cor] V-place[cor]	/v ^j i/	*!		*

(94) Summary ranking of assimilatory reduction¹⁴



To summarize, the non-assimilatory vowel patterns are the result of ranking markedness constraints against particular features (and combinations) with respect to related general and positional faithfulness constraints. The assimilatory vowel patterns involve the addition of a markedness constraint ensuring that onsets and nuclei share the V-place[cor] feature, as well as an additional set of positional faithfulness constraints.

¹⁴ DEPV-place[cor] and DEPV-manner[closed] are listed here by hypothesis. We assume that positional faithfulness constraints imply general faithfulness constraints.

13. An OT analysis of the consonant distribution

Recall that all consonants (ignoring laryngeal features) may appear in both initial and final position, except when there is place assimilation between a stressed high coronal vowel [e] and the preceding onset. However, the high coronal stressed vowel palatalizes the preceding consonant if such assimilation would not create an illicit segment. This occurs with all consonants except that composed of only C-place[cor], /t/ [ts^v]. The non-assimilatory distribution is straightforwardly accounted for via the ranking in (61), and the assimilation is accounted for by ranking AGREEV-place[cor] above all co-occurrence restrictions against licit consonants with V-place[cor]. The ranking is given in (95) and is demonstrated for the mannerless labial consonant in (96) and the placeless stop in (97).

(95) General Standard Russian pre-[e] palatalization ranking

- *C-place[cor]&*V-place[cor]
>>
AGREEV-place[cor]
>>
- *C-manner[closed]&*V-manner[closed]&*V-place[cor],
*C-manner[open]&*V-manner[closed]&*V-place[cor],
*C-manner[closed]&*C-place[lab]&*V-place[cor],
*C-manner[closed]&*C-place[cor]&*V-place[cor],
*C-manner[open]&*C-place[lab]&*V-place[cor],
*C-manner[open]&*C-place[cor]&*V-place[cor],
*C-place[lab]&*V-place[cor],
*V-place[cor]&*C-manner[closed],
*V-place[cor]&*C-manner[open],
*V-place[cor]&*V-manner[closed]

(96)

//C-place[lab] V-manner[closed]& V-place[cor]//			AGREE V-place[cor]	*C-place[lab]&*V-place[cor]
a.	C-place[lab]	V-place[cor]& V-manner[closed]	/v ⁱ / [ve]	*!
--> b.	C-place[lab]& V-place[cor]	V-place[cor]& V-manner[closed]	/v ^j i/ [v ^j e]	*

(97)

//C-manner[closed] V-manner[closed]& V-place[cor]//			AGREE V-place[cor]	*C-place[lab]&*V-place[cor]
a.	C-manner[closed]	V-place[cor]& V-manner[closed]	/K ⁱ / [ce]	*!
--> b.	C-manner[closed]& V-place[cor]	V-place[cor]& V-manner[closed]	/K ^j i/ [[t ^j e]	*

(98)

//C-place[cor] V-manner[closed]& V-place[cor]//			*C-place[cor]&*V-place[cor]	AGREE V-place[cor]
--> a.	C-place[cor]	V-place[cor]& V-manner[closed]	/T ⁱ / [ts ^v e]	*
b.	C-place[cor]& V-place[cor]	V-place[cor]& V-manner[closed]	/T ^j i/ [[ts ^j e]	*!

To summarize the consonant distribution, all consonants are allowed in both initial and final position because of the ranking of featural faithfulness constraints above markedness constraints against particular features and feature co-occurrence. The only restrictions we find have to do with assimilation. All consonants that can assimilate in V-place[cor] with the following stressed high front vowel (i.e. /i/ [e]) do. In the case of non-velars, this entails phonological palatalization. In the case of velars, which are placeless in this analysis, this entails the addition of a primary place of articulation and realization as post-alveolars. The only segment that does not undergo palatalization in this environment is the alveolar affricate. This is because of a restriction against a segment composed of only two coronal features.

14. *Morpho-phonological Softening*

15. *Velars Revisited*

Recall that the velars in the Modern Standard Russian native vocabulary always surface as post-alveolar when palatalized, and that palatals only occur before the high placeless vowel. We accounted for these facts by claiming that the native velars are phonologically placeless and that the high placeless vowel conditions phonetic, not phonological assimilation. However, we see exceptional behavior in the non-native vocabulary of some speakers. Non-native velars do not become palatal before the high placeless vowel, they become palatal before the high front vowel, and there are palatals before non-front vowels.

(99) Data

To explain these facts, we propose that Modern Standard Russian has two sets of “velars” - those that are placeless and those that have a C-place[dor] feature. The placeless velars are historically native and the dorsal velars were introduced via language contact.

(100) Feature specifications for individual Standard Russian segments

			C-place	V-place		C-manner
			[dor]	[cor]	[closed]	[open]
Non-native	/k/	[k]	✓			
	/kʲ/	[c]	✓	✓		
	/x/	[x]	✓			✓
	/xʲ/	[ç]	✓	✓		✓
Native	/K/	[k] [c]			✓	
	/Kʲ/	[tʃʲ]		✓	✓	
	/X/	[x] [ç]				✓
	/Xʲ/	[ʂʲ]		✓		✓

These non-native velars are marginal in that they are relatively rare in the language, as one might expect from borrowed elements, but they are becoming more prevalent. Although palatalized dorsals (palatals) are still not found in post-vocalic final position.

To account for the presence of the non-native dorsal velars in Modern Standard Russian, we must rank a set of featural co-occurrence constraints referring to C-place[dor] below its corresponding faithfulness constraint, as shown in (101).

(101) Modern Standard Russian non-native dorsal ranking

MAXC-place[dor]
>>
*C-manner[open]&*C-place[dor]&*V-place[cor],
*C-manner[open]&*C-place[dor],
*C-place[dor]&*V-place[cor],
*C-place[dor]

16. **Conclusions**

17. **General Vision for the Paper**

- Given the data for the phonological patterns and the assumptions of the PSM, we arrive at a fairly straightforward analysis of the phonological system of Standard Russian:
 - Vowel inventory - including vowel reduction/Leningrad~Moscow School
 - Consonant inventory
 - Phonological feature specification and phonetic realization are not 1:1
 - Phonetic dispersion, coarticulation, perceptual enhancement
 - Only /í/ [e] causes phonological plain softening
 - /í/ [i] [i] cause phonetic plain softening of some consonants
 - Non-front vowels do not affect consonants
 - Velars (placeless consonants) show the same result in both plain softening and transitive softening environments because they are phonologically identical for these segments
- The claim of the PSM that more complex --> less complex leads to four main consequences:
 - Placeless vowels and consonants that behave as classes with respect to place assimilation
 - “Odd” alternation patterns (e.g. manner changes that accompany place changes) are captured via an abstract relationship between phonetics and phonological representation
 - Predicts the existence of the “iotizing” segment that can be used in the morphology to trigger softening
 - Can naturally account for the presence of a soft lateral after labials in transitive softening contexts
- Using phonetic enhancement (articulatory) and dispersion (perceptual), we tease apart those phenomena that should be explained via phonetics or phonology

18. **Phonological Issues to be Resolved?**

There is a depressing lack of data here. All the phonetic/phonological patterns should be given with real word-forms. These should include the Cyrillic, Romanized, phonetic transcriptions (including vowel reduction) and possibly the underlying representations (without vowel reduction).

19. *Morphological Issues to be Resolved?*

Discuss the exact environments in which the various types of softening take place:

- Morpheme-internal (phonological) softening
- Plain softening across morpheme boundaries
- Transitive softening across morpheme boundaries (including the various alternating allophones)
- Word class restrictions on the types of softening
- Affix class restrictions on the types of softening
- General discussion about the nature of the morphology involved in softening (inflectional, derivational, inflecting, agglutinating, etc.)
- Discussion and formal description of the types of “morphemes” we will be using, including some restrictions/implications
- List the morphemes/morphological constraints we are using
- Demonstrate the analysis on simple examples
- Demonstrate the analysis on complex examples (e.g. labials)

20. *Grammatical Consistency*

We should show and discuss how the analysis we provide for morpho-phonological softening is consistent with the analysis of the rest of the morphological, phonological and phonetic grammar.