Consonantism: the consonants

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Abstract

This chapter examines consonants in Slavic languages primarily from a synchronic perspective. I begin by reviewing the consonant inventories. The key properties of the inventories are secondary palatalization, a large inventory of coronal fricatives and affricates, and a voicing contrast in obstruents. In the remainder of the paper, I review four types of consonant patterns: palatalization, voicing, other local, and long-distance alternations. Palatalization is inherited from Proto-Slavic, but the contemporary Slavic languages differ in terms of undergoing segments, morphological triggers, and phonological conditioning. Slavic voicing alternations offer typological insight into the extent of cross-linguistic variation. The key differences are in final devoicing, directionality, and participation of sonorants. Slavic languages also exhibit limited place assimilation, dissimilation, and consonant decomposition. As for long-distance patterns, I review both assimilatory (sibilant consonant harmony) and dissimilatory (consonant co-occurrence restrictions) phenomena in two Slavic languages.

Keywords: inventories, palatalization, assimilation, voicing, consonant harmony, OCP

1 Introduction

This chapter reviews the consonantism in Slavic. The main focus is on the common consonantal segments, their sound patterns, and the role they have played in phonological theory.

Section 2 reviews the inventories of the 12 contemporary Slavic languages. As we will see, most Slavic languages have relatively large consonant inventories, which is related to three factors: (i) most Slavic languages contrast plain vs. palatalized consonants, (ii) many Slavic languages have two sets of posterior coronal fricatives, and (iii) obstruents contrast voicing.

The remaining sections look at alternations affecting consonants. Section 3 looks at palatalization, which is particularly extensive in Slavic (Bateman 2007). In particular, I review

velar palatalization (and related processes of velar fronting and iotization) as well as secondary palatalization. Section 4 examines two common laryngeal alternations: final devoicing and voicing assimilation. A typical Slavic language has final devoicing and regressive voicing assimilation within obstruent clusters, but there are languages without final devoicing and languages that allow clusters of voiced and voiceless obstruents. Section 5 examines other local processes affecting consonants, such as place assimilation, dissimilation, and decomposition. Finally, section 6 discusses patterns in which consonants affect one another at a distance. Consonant harmony is a pattern in which sibilants must agree in some property within a word; it is found in two Slavic languages. Consonant co-occurrence restrictions (described as the effect of the Obligatory Contour Principle, OCP) constitute the opposite: two instances of a segment (or a class of segments) cannot co-occur across a vowel or within a word.

2 Consonant inventories

Most contemporary Slavic languages have larger than average consonant inventories. This can be attributed to the inherited contrasts of the Proto-Slavic inventory as well as additional subsequent contrasts.

The Late Proto-Slavic consonant inventory distinguishes five places of articulation, voicing of obstruents and affricates in addition to stops and fricatives, and a range of sonorants (Table 1). Notable is the abundance of palatalized consonants and the asymmetries in fricatives: there is no voiceless labiodental fricative or voiced velar fricative. This inventory has 27 consonantal phonemes, which is considered to be moderately large among the languages of the world (Maddieson 2013).

On the whole, the contemporary Slavic languages have inherited the Proto-Slavic inventory contrasts, with changes mostly affecting the palatalized consonants. In fact, many contemporary languages have secondary palatalization of consonants which can affect almost all consonants (such as in Russian and Bulgarian). Table 2 summarizes the phoneme inventories across the 12

	Labial		Dental		Alveol.		Palatal		Velar	
Stop	p	b	t	d			t^{j}	d^{j}	k	g
Fricative		v	s	z	ʃ	ʒ	s^{j}	z^{j}	x	
Affricate				ʦ	ʤ	ʧ				
Nasal		m		n				n^{j}		
Rhotic				r				r^{j}		
Lateral				l				l^{j}		
Glide								j		

Table 1: Late Proto-Slavic consonant inventory (Schenker 1993:82; Sussex & Cubberley 2006:40).

contemporary standard Slavic languages. The segments are color-coded by frequency.[1] This table is meant to provide a general overview of what a typical Slavic consonant inventory looks like, despite the potential drawbacks of this approach, which minimizes the discrepancies among the existing descriptions and ignores dialectal variation. All languages distinguish three pairs of stops /p, b; t, d; k, g/, four fricatives /f, s, z, x/, the affricate /ʦ/, two nasals /m, n/ and the palatal glide /j/. These phonemes are mostly inherited from Proto-Slavic (although subject to sound change, see the following sections). Only /f/ was introduced predominantly through borrowing, though in some languages it also derives from **xv* or other groups, for example Macedonian [fati] 'grab' < **xvatiti*.

Most Slavic languages (except Czech, Macedonian, Bosnian-Croatian-Serbian or BCS, and Slovenian) distinguish secondary palatalization. Phonetically, secondary palatalization is realized with a raised or fronted tongue body (Kochetov 2002). Along with postalveolars, palatalized consonants arose in Proto-Slavic as a result of various phonological processes. The contemporary Slavic languages differ in terms of how many of the original contrasts they have maintained (Kochetov 2006; Kavitskaya 2009; Kavitskaya et al. 2009; Iskarous & Kavitskaya 2018). In fact,

[1]The inventories were coded based on available descriptions and complemented by the literature on secondary palatalization (Hall 2000; Kochetov 2002; Bateman 2007; Kochetov 2011; Kavitskaya et al. 2009; Iskarous & Kavitskaya 2018), sibilants (Żygis 2003; Padgett & Żygis 2007; Hamann 2004; Kochetov 2017) and the labiodental sonorant (Hall 2004; Petrova & Szentgyörgyi 2004; Padgett 2002). Marginal phonemes were included if treated as phonemes by these sources. When the differences were not resolvable, half-values were assigned. Examples include the variation between the trill and flap in Polish or between postalveolar and retroflex fricatives in Bosnian-Croatian-Serbian.

	Labial	Labio-dental	Dental/ Alveolo-	Post-alveol.	Retro-flex	Alveo. palat.	Palat.	Velar	Uvular	Glottal
Stop	p 12 b 12 pʲ 6 bʲ 6		t 12 d 12 tʲ 3 dʲ 3				c 4 ɟ 4	k 12 g 12 kʲ 4 gʲ 4		
Fricative		f 12 v 9 fʲ 3 vʲ 4	s 12 z 12 sʲ 4 zʲ 4	ʃ 8 ʒ 8 ʃʲ 1 ʒʲ 1	ʂ 4 ʐ 4	ɕ 2 ʑ 2		x 12 ɣ 1 xʲ 3 ɣʲ 1		h 2 ɦ 3
Affricate			ʦ 12 ʣ 5 ʦʲ 2 ʣʲ 1	ʧ 9 ʤ 7	ʦ 3 ʣ 2	ʨ 3 ʥ 2				
Nasal	m 12 mʲ 6		n 12 nʲ 6				ɲ 5			
Trill			r 9.5 rʲ 4						ʀ 1 ʀʲ 1	
Flap			ɾ 1 ɾ 1.5							
Lateral			l 12 lʲ 4				ʎ 3			
Approximant	w 3 wʲ 2	ʋ 3					j 12			

Frequency across Slavic languages	12	11	10	9	8	7	6	5	4	3	2	1

Table 2: Phoneme inventories of contemporary standard Slavic languages, colour coded by frequency (see legend). The approximants [w] and [wʲ] are labiovelar.

not all palatalized consonants are equally attested across Slavic: palatalized labial nasal and oral stops are found in more languages than palatalized velars and coronals, and palatalized coronal sonorants are fairly common. Cross-linguistically, palatalized rhotics are marked (Kavitskaya et al. 2009; Iskarous & Kavitskaya 2010; Hall & Hamann 2010; Howson 2018). Palatalized postalveolars are rare. The processes affecting secondary palatalization will be reviewed further in section 3.

Posterior sibilants differ phonetically and phonologically across the Slavic languages (Żygis 2003; Hamann 2004). While the majority of Slavic languages have postalveolar affricates and fricatives, some Slavic languages have retroflex fricatives and affricates (e.g. Lower Sorbian), others have both (Russian), while a third group displays significant dialectal variation (Polish, BCS). Lower Sorbian, Polish, and BCS also have an additional set of alveopalatal.

One striking difference among the Slavic languages is the status of /v-w-ʊ/, which can vary

phonetically from a voiced fricative to an approximant. Phonologically, this phoneme behaves like a sonorant in many Slavic languages (e.g. BCS, Belarusian, Ukrainian), in other Slavic languages it can behave as a fricative or sonorant depending on context (e.g. Czech, Slovak), or as an obstruent entirely (Polish). The voiced labiovelar sometimes assimilates in voicing, but other times it does not affect voicing assimilation. In many Slavic languages, the voiced labiodental has multiple allophones. For instance, in Ukrainian it is realized as [ʋ] in onsets, but as [w] in codas. The voiced labiovelar is further discussed in section 4.

In terms of obstruent voicing, most place and manner combinations have a voiced-voiceless pair, with some notable gaps: phonemic voiced velar fricatives are only found in Belarusian, and while all languages have a phonemic /ʦ/, only five have its voiced counterpart /ʣ/. In other languages, the missing voiced obstruents are allophones, appearing before voiced obstruents.

Among the rhotics, most Slavic languages are described as having the alveolar trill. Three languages have other rhotics: Slovenian has a flap (Šuštaršič et al. 1995), Upper Sorbian has a uvular trill (Howson 2018), and Czech has an additional trill-fricative [r̝] (Howson 2017). Overall, many Slavic languages show substantial positional, dialectal, and interspeaker variation in rhotics, which is sometimes mirrored in the descriptions of the standard varieties.

Not shown in the inventories above are the geminates, or long consonants. Most Slavic languages allow geminates across a morpheme boundary, where they can be variantly pronounced as singletons in casual speech. Perhaps the most extensive inventory of geminates is found in Russian. The Russian geminates arise due to morpheme concatenation (e.g. [vːos] ‘import’, [rɐsːkas] ‘story’) or morpheme-internally in loanwords ([bɐrokːə] ‘baroque’, [sumːə] ‘sum’). Dmitrieva (2017) demonstrates that the Russian geminates have systematically longer duration than singletons. Russian geminates display some of the cross-linguistically common properties, such as the rarity of sonorant geminates or geminates appearing next to another consonant. At the same time, Dmitrieva identified several language-specific idiosyncrasies, such as the relative robustness of word-initial and voiced-obstruent geminates. Geminates are also very common in Belarusian and Ukrainian because of the historical change Cj > $C^{j}C^{j}$, for example Ukrainian

[ʒɪtʲtʲa] ‘life’ < *ʒitje.

This concludes the overview of consonant inventories in Slavic languages. In the following section, we move on to the alternations affecting consonants.

3 Palatalization processes

One of the most striking properties of all contemporary Slavic languages is the various palatalization processes. Palatalization is defined as the pronunciation of consonants in the palatal or postalveolar, and more broadly in the coronal region (Bateman 2007; Kochetov 2011). This description encompasses both secondary articulation (e.g. k → kʲ) and change in place of articulation (e.g. k → ʧ).

To illustrate the phonological and morphological properties of palatalization, let us examine palatalization in BCS. The language involves several different palatalizations (de Bray 1980; Browne 1993; Morén 2006), which BCS inherited from Proto-Slavic. The first type of palatalization (1-a) applies to stem-final velars which become postalveolars before the vocative suffix. All three velars are affected (i), and the alternation changes the manner of two obstruents, but not of [x]. Voicing is maintained. The triggers of palatalization are specific suffixes which most commonly contain front vowels, as the vocative. However, not all suffixes that begin with a front vowel trigger palatalization (1-a-ii) and not all triggering suffixes have front vowels (iii). Thus, it is best to describe these triggers as morphological. Finally, velar palatalization is not fully productive and does not apply to all stem-final velars when followed by the triggering suffixes. In fact, sometimes palatalization applies variably (1-a-iv).

The second type of palatalization affects two alveolars which become postalveolars (1-b). In BCS, this alternation is also found with the vocative suffix (i) and the nominative plural *-ɔvi/-ɛvi* (ii). With the latter we can see that the velars are not affected. There are also a number of exceptions. Coronal palatalization is less productive in BCS and affects only a handful of suffixes.

(1) BCS palatalization patterns (Browne 1993; Morén 2006; prosody omitted)

a. Velar palatalization: {k, x, g} → {ʧ, ʃ, ʒ}

(i)	utʃɛnik	‘pupil’	utʃɛniʧ͡ɛ	‘pupil.VOC
	bɔg	‘god’	bɔʒ͡ɛ	‘god.VOC
	sirɔmax	‘poor man’	sirɔmaʃɛ	‘poor man.VOC’
(ii)	utʃɛnik	‘soldier’	utʃɛnik͡ɛ	‘soldier.ACC.PL
(iii)	pɛku	‘bake.3P.PL’	pɛʧ͡ɛm	‘bake.1P.SG’
	krug	‘circle’	kruʒ͡iti	‘circle.INF’
	nɔga	‘leg, foot’	nɔʒ͡urda	‘big ugly foot’
(iv)	ruka	‘hand, arm’	ruʧ͡itsa	‘small hand’
			ruk͡itsa	

b. Coronal palatalization: {ʦ, z} → {ʧ, ʒ}

(i)	striʦ	‘uncle’	striʧ͡ɛ	‘uncle.VOC
	knɛz	‘prince’	knɛʒ͡ɛ	‘prince.VOC
(ii)	striʦ	‘uncle’	striʧ͡ɛvi	‘uncle.NOM.PL
	vuk	‘wolf’	vuk͡ɔvi	‘wolf.NOM.PL
	vɔz	‘cart’	vɔz͡ɔvi	‘cart.NOM.PL

c. Velar fronting: {k, x, g} → {ʦ, s, z} — i

(i)	agnɔstik	‘agnostic’	agnɔsti ʦ͡i	‘agnostic.NOM.PL’
	bubrɛg	‘kindey’	bubrɛz͡i	‘kidney.NOM.PL’
	ɔrax	‘walnut’	ɔras͡i	‘walnut.NOM.PL’
(ii)	junak	‘hero’	junaʦ͡ima	‘hero.DAT/LOC/INSTR.PL’
	pɛku	‘roast.3P.PL’	pɛʦ͡ijax	‘roast.IMPERF’
	ruka	‘hand, arm’	ruʦ͡i	‘hand, arm.DAT/LOC’
(iii)	maʧ͡ka	‘cat’	maʧ͡k͡i	‘cat.DAT/LOC’
	milka	‘(name)’	milk͡i	‘(name).DAT/LOC’

The third type of palatalization also affects velars, but this time they turn into anterior coronals

(1-c-i). All suffixes that trigger velar fronting start with an [i], as shown in (ii). Velar fronting is not without exceptions: it can be blocked phonotactically (e.g. *[matʃtʃi] 'cat.DAT/LOC') and there are also lexically-conditioned exceptions such as personal names (1-c-iii).

The final palatalization alternation is BCS is iotation (2). Historically, iotation applied before [j], but in contemporary Slavic languages [j] is generally no longer present. The difference between the palatalizations in (1) and iotation is in the number of segments affected: iotation applies to most segments. As in velar palatalization, velars become postalveolars (2-a), while anterior coronals become posterior coronals (b). Notice the difference between stops, which become alveopalatal (t → tɕ), and fricatives/affricates, which become postalveolar (s → ʃ). Finally, labials do not palatalize: instead the palatal lateral [ʎ] is inserted.

(2) BCS Iotation (Browne 1993; Morén 2006)

a. Dorsals: {k, x, g} → {tʃ, ʃ, ʒ}

skakati	'to jump'	skatʃɛ	'jump.3p.sg'
tix	'quiet'	tiʃi	'quieter'

b. Coronals: {t, d, s, z, ʦ, n, l} → {tɕ, dʑ, ʃ, ʒ, tʃ, ɲ, ʎ}

ʋratiti	'to return'	ʋratɕɛn	'returned'
nɔsiti	'to carry'	nɔʃax	'carry.IMPERF'
batsiti	'to throw'	batʃɛn	'thrown'
xʋaliti	'to praise'	xʋaʎɛn	'praised'

c. Labials: ∅ → ʎ / {p, b, f, m, ʋ} —

glup	'stupid'	glupʎi	'more stupid'
ʎubiti	'to kiss, love'	ʎubʎɛn	'kissed, loved'
zaʃrafiti	'to tighten'	zaʃrafʎɛn	'tightened'
kraʋa	'cow'	kraʋʎi	'bovine'

The crucial difference between the palatalization patterns in (1) and iotation in (2) is that the set of triggering suffixes is different. Among all the palatalizations in BCS, only for velar fronting do

all triggering suffixes share a clear common property: they all begin with [i]. As regards iotation, most suffixes are front, but not all (e.g. [nɔʃax] ‘carry.IMPERF).

BCS inherited all four palatalizations from Proto-Slavic. This is why we also find palatalization in most other Slavic languages. Many of the patterns observed in BCS are similar to the ones found in the other languages, but there are also some key differences; I review these parallels in the remainder of this section.

First, each palatalization type is morphologically conditioned, and the set of triggering suffixes may all share a phonological property (e.g. front vowels). Palatalization may also interact with morphology in another way: the suffix may display allomorphy, including the choice of inflectional paradigm, that is conditioned by the stem-final consonant.

Second, the outcome of palatalization is conditioned by the segmental inventory of the language. Notable in BCS is the relationship between the postalveolar and alveopalatal affricates. A more complex case is Polish, which has more sibilants and five distinct palatalization processes (see Rubach 2011 for an accessible overview).

Third, most types of palatalization apply at morpheme boundaries. This type of alternation is termed a Derived Environment Effect (Kiparsky 1993; Burzio 2011). In the history of generative phonology, morphologically derived environments were treated together with phonologically derived environments, where an alternation applies only to a segment that is already derived by a different rule. A famous example of this type of is found in Polish, where /g/ palatalizes to [ʤ] and then spirantizes to [ʒ] in specific environments: /bɔg-ɛ/ → [bɔʒɛ] ’god-VOC. Underlying /ʤ/, however, does not undergo spirantization and surfaces faithfully. This type of pattern presents a substantial theoretical problem in rule- and constraint-based approaches.[2]

In some cases, however, palatalization is phonologically triggered, such as secondary palatalization in Polish and Russian. In Polish, secondary palatalization is triggered by [i, j] not only at morpheme boundaries but also within morphemes (e.g. [mʲit] ‘myth’) and across word

[2]Polish palatalization and its derivational properties are analyzed in Rubach (1984, 2000, 2003, 2017, 2019), Łubowicz (2002, 2016), and Gussmann (2007). Russian palatalization is analyzed in Padgett (2001, 2003, 2011), and Blumenfeld (2002).

boundaries ([dɔm] 'home' versus [dɔmʲ] *Iwana* 'Ivan's home; Rubach 2011).

Fourth, palatalization may be lexically restricted, which means that it does not apply to certain lexical items which meet the morphological and phonological requirements. Loanwords are a particularly likely source of exceptionality both in lacking expected palatalization (as in BCS) and showing a different set of facts. In Polish, for instance, secondary palatalization applies to postalveolars [ʃ, ʒ] but only in loanwords (e.g. [suʃʲi] 'sushi', [ʒʲigɔlak] 'gigolo'; see Gussmann 2007:§3.12). This sort of lexical exceptionality sometimes leads authors to conclude that a particular type of palatalization is no longer productive. In fact, Kapatsinski (2010) shows how velar palatalization in Russian has lost productivity before a subset of suffixes. In Slovenian, velar palatalization is highly variable, but Jurgec & Schertz (2020) show that native speakers favour palatalization in nonce stems when followed by palatalizing suffixes.

Fifth, palatalization is subject to phonological restrictions, as is common in other types of sound patterns. In BCS, palatalization is blocked by certain clusters. When palatalization is variable, BCS adheres to Guion's (1998) cross-linguistic generalization: /k/ palatalizes more often than the other two velars (Browne 1993). I return to this point in section 6.

4 Voicing alternations

All Slavic languages contrast two sets of obstruents: voiced and voiceless. Phonetically, voiced stops are produced with voicing during the closure. Voiceless obstruents are typically unaspirated, although [kʰ] is aspirated in Upper Sorbian (as an allophone of /x/; Šewc Schuster 1984:26–27)[3] and Slovenian (Srebot Rejec 1990); aspiration is not a factor in voicing alternations. The contrast between the two types of obstruents is not maintained in all contexts, and the neutralizing environments differ from language to language.

In word-final position, the voicing contrast is preserved in BCS and Ukrainian. All other Slavic languages display final devoicing, a process in which word-final obstruents are realized as voiceless. Standard Slovenian has final devoicing, but many dialects do not. Šmartno Slovenian

[3]Howson (2017) reports optional aspiration in other Upper Sorbian stops as well.

presents an intermediate situation (3). In Šmartno, the root-final contrasts are maintained before sonorant-initial suffixes, as in the instrumental singular. Obstruents devoice word-finally, as in the nominative. The key generalization applies in the high vowel cases, such as the genitive. Roots with mobile stress paradigms shift stress to the suffix, but roots with fixed paradigms do not and as a result the word-final high unstressed vowel deletes. The newly final obstruent fails to devoice (/ˈbrieɣ-i/ → [ˈbrieɣ], not *[ˈbriex]). The interaction of devoicing and vowel deletion is opaque rather than transparent, because devoicing does not apply to all word-final obstruents on the surface.

(3) Šmartno Slovenian opaque voicing (Jurgec 2019, vowel length omitted)

		MOBILE		FIXED		
		/prax/	/snieɣ/	/ˈsmiex/	/ˈbrieɣ/	
INSTR	/-m/	ˈpraxm̩	ˈsnieɣm̩	ˈsmiexm̩	ˈbrieɣm̩	
NOM	/-∅/	ˈprax	ˈsniex	ˈsmiex	ˈbriex	(final devoicing)
GEN	/-ˈi/	praˈxi	sneˈɣi	ˈsmiex	ˈbrieɣ	(no final devoicing)
		‘dust’	‘snow’	‘laughter’	‘coast’	

While the traditional phonological analyses of final devoicing posit full neutralization between final voiced and voiceless obstruents, phonetic work has shown that the neutralization is incomplete in many languages (Chen 1970; Dinnsen & Charles-Luce 1984; Port & O’Dell 1985; Warner et al. 2004). This means that while the contrast between voiced and voiceless obstruents is smaller than in presonorant positions, it is nevertheless still statistically significant in perception and production experiments. In this discussion, Russian has played an important role. Shrager (2012) and Kulikov (2012) demonstrate that voicing leaves traces in phonologically devoiced stops, Kharlamov (2014) shows that this phonetic effect is dependent on the task: minimal pairs and orthographic presentation of stimuli are more likely to result in neutralization being incomplete. Bishop et al. (2019) extend the findings to Bulgarian, where neutralization is also incomplete.

The second alternation that is common across Slavic languages is voicing assimilation. In most Slavic languages obstruent clusters must agree in voicing, with the rightmost obstruent determining the voicing of the entire cluster. This can be seen in the case of Russian prefixes (4). The presonorant position reveals the underlying voicing of the prefix-final obstruent, which can be either voiceless (a) or voiced (b). The distinction is neutralized before obstruents: all obstruents surface as voiceless before voiceless obstruents and voiced before voiced obstruents. This applies across morpheme boundaries, within morphemes, and across word boundaries—but not across pauses where final devoicing applies instead. Note that voicing assimilation is not inherently linked to final devoicing. For example, although BCS lacks final devoicing, it exhibits the same voicing assimilation patterns found in Russian.

(4) Russian voicing assimilation (Padgett 2012)

	Before a sonorant		Before a voiceless obstruent		Before a voiced obstruent	
a.	ˈs-jexətʲ	‘to ride down’	s-prɐˈsʲitʲ	‘to ask’	ˈz-dʲelətʲ	‘to do’
	ɐt-ˈjexətʲ	‘to ride off’	ɐt-stuˈpʲitʲ	‘to step back’	ɐd-ˈbrosʲitʲ	‘to throw aside’
b.	pəd-nʲiˈstʲi	‘to bring to’	pət-pʲiˈsaʲ	‘to sign’	pəd-ˈ zeʧʲ	‘to burn’
	iz-lɐˈgatʲ	‘to state’	is-klʲuˈʧʲatʲ	‘to exclude’	iz-ˈgnatʲ	‘to drive out’

Voicing assimilation in Russian is symmetrical: obstruents assimilate regardless of their underlying voicing. In contrast, Ukrainian shows asymmetrical assimilation, a fact that has played a key role in of our understanding of obstruent voicing typologies (Butska 1998; Lombardi 1999; Wetzels & Mascaró 2001). As shown in (5-a), Ukrainian allows word-final voiced obstruents and thus does not exhibit final devoicing. In obstruent clusters, voiceless obstruents become voiced (b), but voiced obstruents do not devoice (c): /liʒ̲ko/ → [liʒ̲ko], not *[liʃ̲ko].

(5) Ukrainian voicing assimilation (Butska 1998)

a. No final devoicing

ʋas	‘you.ACC.PL’	ʋaz	‘vase.GEN.PL’
plit	‘fence’	plid	‘fruit’

b. Regressive voicing assimilation

pros̲ɪtɪ	‘to request’	proz̲ʲba	‘a request’
boroṯɪ	‘to struggle’	borod̲ʲba	‘struggle’

c. No assimilation to voicelessness

liʒ̲ok	‘bed.GEN.PL’	liʒ̲ko	‘bed’
rid̲ɪtɪ	‘to rarefy’	rid̲ko	‘rarely’

Voicing of obstruents may also interact with sonorant voicing in several ways. First, in Polish (Rubach & Booij 1990; Rubach 1996) and Russian (Jakobson 1978; Hayes 1984; Kiparsky 1985; Petrova & Szentgyörgyi 2004; Rubach 2008b), it has been reported that at word boundaries, voicing assimilates even across sonorants (e.g. [ɐd mgl̲i] ‘from the haze’). Recent experimental studies have, however, revealed that sonorants are not transparent and that there is a contrast in the presonorant position in these cases (Strycharczuk 2012; Kulikov 2013).

Second, obstruents typically devoice word-finally if the following word starts in a sonorant. Slovak is the exception (along with Lower Sorbian and south-western Polish): word-final obstruents are voiced if the following word starts in a sonorant (6-a), even though morpheme-internally obstruent voicing is contrastive in pre-sonorant position (b).

(6) Slovak presonorant voicing at the end of the word (Blaho 2008)

a. Presonorant voicing across word boundaries

vɔjaka	‘soldier.GEN.SG’	vɔjag̲ idɛ	‘the soldier goes’
lɛsɛ	‘forest.LOC.SG’	lɛz̲ jɛ	‘the forest is’

b. Contrastive voicing before sonorant word-internally

mɔk̲raː	‘wet’	puz̲drɔ	‘case’
ṯlak	‘pressure’	d̲laɲ	‘palm’

Third, specific segments can behave exceptionally with respect to voicing assimilation. Shared among many Slavic languages is the labiovelar sonorant, which behaves like a sonorant in some

positions, but like an obstruent in others. This may have to do with its phonetic properties. For instance, Padgett (2002) suggests that Russian has a "narrow approximant" [ʋ̞] which explains its ambivalent behavior. In Slovenian, the labiovelar sonorant is realized simply as rounding on a consonant when not adjacent to a vowel: [ʷzeti] 'take' (Srebot Rejec 1981). To illustrate the unusual behaviour of the voiced labiovelar, consider Czech (7). The basic facts in Czech are identical to the ones in Russian (4): voicing assimilation applies regressively. The prefix /s-/ 'with' surfaces faithfully before a sonorant, but voices before a voiced obstruent (7-a). The prefix /z-/ 'from' again surfaces faithfully before a sonorant, but devoices before a voiceless obstruent (b).

(7) Czech regressive voicing assimilation (Hall 2003, 2004)

	Before a sonorant		Before a voiceless obstruent		Before a voiced obstruent	
a.	s̲lesem	'with a forest'	s̲polem	'with a field'	z̲domem	'with a house'
b.	z̲lesa	'from a forest'	s̲pole	'from a field'	z̲domu	'from a house'

Turning to [v], we see that it behaves like an obstruent when followed by a consonant: it is underlyingly voiced but becomes devoiced before voiceless obstruents (8-a-i). When [v] is rightmost in a cluster, it devoices after voiceless obstruents in some dialects, but in any case does not trigger voicing regressively (8-a-ii); [v] is voiced when following a voiced obstruent (iii). Another exceptional segment in Czech is the trill-fricative [r̝̊] which shows a different pattern: it devoices after voiceless obstruents (8-b). Across word-boundaries, the trill-fricative can trigger voicing, although there is some interspeaker variation (Palková 1997).

(8) Czech anomalous segments (Hall 2003, 2004)

a.	(i)	v̲lese	‘in a forest’
		f̲pole	‘in a field’
		v̲dom̡e	‘in a house’
	(ii)	tv̲o̲rit	‘in a field’
		tf̲o̲rit	
	(iii)	d̲vo̲rit	‘to court’
b.	(i)	pr̰i	‘near’
	(ii)	br̰ex	‘shore’

5 Other local interactions

In the languages of the world, the vast majority of alternations affecting consonants are local, meaning that a consonant is affected by an immediately adjacent segment. This is the case for palatalization and voicing assimilation discussed so far. In this section, I review other local alternations affecting consonants. I limit these discussions to those that are not clearly affected by the sonority restrictions on syllable structure. For instance, obstruent-sonorant complex onsets are much more common that the reverse, and some Slavic languages do not allow complex onsets consisting of a sonorant followed by an obstruent (Sonority Sequencing Principle; see Clements 1990 for a comprehensive history and overview). Syllable restrictions on consonant combinations are reviewed in the chapter on the syllable in this volume.

I begin with the place of articulation of nasals in consonant clusters, which is restricted in many Slavic languages. Consider the example from Polish in (9), where I omit that palatal nasal /ɲ/ for simplicity. We can see that an underlying /m/ is possible before stops regardless of their place of articulation. This is not the case for /n/, which assimilates to the same place of articulation as the following stop, even across word boundaries. For instance, [pan] ‘mister’ alternates with [pam] when followed by a word starting in a labial stop. Before fricatives, the situation is more complex, with nasal glides surfacing in some positions. Words with historical

nasal vowels have largely the same distribution as /n/.

(9) Polish nasal place assimilation (Czaykowska Higgins 1989, 1992; Padgett 1994)

Before stops	m		n		Ṽ	
labial	bɔmba	'bomb'	pam buk	'Lord God'	zɔmp	'tooth'
coronal	kɔmtur	'commander'	blɔnd	'blond'	zn̥ɔndu	'government'
dorsal	klamka	'doorknob'	baŋk	'bank'	vɛŋgʲɛl	'coal'
Before fricatives						
labial	trɪuw̃f	'triumph'	kɔɱflikt ∼ kɔw̃flikt	'conflict'	(no data)	
coronal	xamski	'boorish'	ʃansa ∼ ʃaw̃sa	'chance'	mɔw̃s̪	'husband'

Nasals are also involved in another alternation in Polish and Upper Sorbian. In the latter, shown in (10), the palatal nasal [ɲ] in the prevocalic (or syllable onset) position alternates with the sequence [jn] in the position before a consonant or end of the word (in the coda). Note that the sequence [jn] can also appear in the prevocalic position [kɔmbajnɪ], while the [ɲ] can never occur before a consonant or the end of word. Assuming an underlying /ɲ/, the motivation for decomposition into [jn] is the retention of palatality and nasality in the coda where [ɲ] is illicit (Rubach 2008a). Polish displays a similar pattern that is driven by segmental environment, not syllable structure: decomposition applies before stops and fricatives.[4]

(10) Upper Sorbian nasal decomposition (Rubach 2008a)

kamʲɛɲa	'stone.GEN.SG'	kamʲɛjn	'stone.NOM.SG'
kɔɲa	'horse.GEN.SG'	kojn	'horse.NOM.SG'
waɲa	'bathtub.NOM.SG'	wajnʧka	'small bathtub.NOM.SG'
kɔmbajnɪ	'threshing machine.NOM.PL'	kɔmbajn	'threshing machine.NOM.SG'

Next, several Slavic languages show dissimilation, a pattern in which one segment alternates when next to a similar segment. Consider Macedonian (11). Coronals (and [ɡ]) turn into labiodentals before the suffix *-ʧe*. The key generalization is that a non-labial becomes labial when

[4]Rubach (2008a) also describes this alternation for Slovenian, but there is no empirical basis for such an analysis in any variety of Slovenian.

next to a non-labial. This process is not fully general and applies only to this specific environment. In this sense dissimilation in Macedonian is similar to palatalization in BCS, applying in specific morphological environments. Other similar local consonant alternations are described in the chapter on phonologically conditioned alternations in this volume.

(11) Macedonian diminutive *-ʧe* dissimilation (Lunt 1952:17; Friedman 1993:259−260)

vɔz̲	'cart'	vɔf̲ʧɛ	'small cart'
vɔʃ̲ka	'louse'	vɔf̲ʧɛ	'small louse'
mɔs̲t	'bridge'	mɔf̲ʧɛ	'small bridge'
ʃamij̲a	'scarf'	ʃamif̲ʧɛ	'small scarf'

This concludes the short survey of the other local consonant patterns in Slavic languages. This survey is partial, as it leaves syllable-related restrictions to other parts of this volume.

6 Long-distance interactions

The alternations reviewed so far are local. For instance, the segments involved in voicing alternations are adjacent. At least two Slavic languages also involve long-distance interactions among consonants, which will be reviewed next.

The first long-distance interaction is consonant harmony (Hansson 2001, 2010; Rose & Walker 2004), which has been reported for Russian and Slovenian. Consonant harmony is a process in which consonants within a word must agree in some feature, such as voicing, minor place, or nasality. The most common type of consonant harmony is sibilant harmony. Most typically, a posterior sibilant (e.g. [ʒ, ʂ]) cannot co-occur with an anterior sibilant (e.g. [ʦ, z]). These restrictions may result in alternations but this is not necessarily so. Some are simply static restrictions on the shape of morphemes (or Morpheme Structure Constraints). Moreover, many cases of consonant harmony are strong tendencies rather than exceptionless generalizations (Arsenault & Kochetov 2011; Ozburn & Kochetov 2018).

In Russian, many words historically contained a sequence of an anterior and a posterior sibilant, but these were subsequently harmonized (e.g. [ˈʂɛrʂɨnʲ] 'hornet' from Old Russian

sʲʃenʲ). Kochetov & Radisic (2009) investigate whether there is a phonetic basis for such a pattern. They asked Russian speakers to repeat words containing different sibilants. In total, there were 18% of mispronunciations. Most of these were assimilatory, such as the target [sap ʃap] being pronounced as [ʃap ʃap]. Anterior sibilants more likely assimilate to posterior than vice versa, and plain sibilants more likely assimilate to palatalized than vice versa. While these experiments do not show that Russian has consonant harmony, they demonstrate a potential mechanism for the genesis of consonant harmony.

More systematic sibilant harmony is found in some varieties of Slovenian, particularly the western dialects. Even though Standard Slovenian does not display sibilant harmony, it is nevertheless encountered occasionally, as in (12). Note that the underlined sibilants alternate even though they neighbour the same segments. What causes this alternation? In the first column, we see that alveolar sibilants are not followed by another sibilant. When a postalveolar appears towards the end of the word as a result of velar palatalization—as in BCS (1)—the alveolars earlier in the word harmonize and become postalveolars (underlined). In short, an alveolar sibilant becomes postalveolar when followed by a postalveolar within the same word, even though it could be several segments away. This process is directional, as the reverse order is not restricted, as in [ʒeleznitsa].

(12) Sibilant harmony in Slovenian

slux	'hearing'	ʃliʃim	'hear.1P.SG'
razlika	'difference'	raʒlitʃitsa	'variant'
ʒeleznitsa	'railroad'	ʒeleʒnitʃki	'railroad.ADJ'

The individual dialects differ, and the pattern is in decline (e.g. Steenwijk 1992 for Resian). The key issue under discussion in the literature has been whether sibilant harmony can apply across consonants, and if so, whether a subset of consonants block it. Jurgec (2011) describes a variety in which only coronal stops block sibilant harmony, while Bon (2017) and Misic (2018) identified varieties with other kinds of blockers. Blocking is exceedingly rare in consonant harmony, so

these patterns have played a key role in the literature (see Hansson 2020 for a comprehensive review).

A consonant co-occurrence restriction is another type of long-distance interaction that we find in Slavic. In Russian, for instance, roots cannot consist of two homorganic consonants (Padgett 1992). In particular, roots with two labials, two dorsals, or two types of a subset of coronals are reported to be impossible or at least vastly underrepresented (13-a), but roots consisting of combinations of these groups co-occur freely (b).

(13) Russian roots (Padgett 1992)

a. Impossible or exceedingly rare

*map (two labials)

*kag (two dorsals)

*lor (two coronal sonorants)

*sʲoz (two coronal fricatives)

*dat (two coronal stops)

b. Commonly attested

grʲeb	‘dig’	brat	‘brother’
koz	‘goat’	tolk	‘explain’
poln	‘full’	sad	‘sit’
bod	‘awake’		

Similar OCP effects are also found elsewhere in Russian. Linzen et al. (2013) look at the variation in Russian prepositions, which can be pronounced with or without a vowel [sə mnozˌəstvəm] ∼ [s mnozˌəstvəm] ‘with a large amount’. Adjacent identical segments tend to be avoided, so the additional vowel is more common if the preposition contains the same consonant as the following word. There is a second, weaker generalization: non-adjacent identical consonants are also avoided. So, the extra vowel is more common if the second consonant of the noun is the same as the preposition (14).

(14) Non-local OCP in Russian prepositions (Linzen et al. 2013)

More common variant		Less common variant	
v̲ə dv̲ɐrets	'into the palace'	kə dvɐrtsu	'to the palace'
v̲ə dv̲ɐre	'into the yards'	sə dvɐrom	'from the yard'

Thus, the OCP effect is a driver of the vowel alternation in prepositions, resembling the overall tendency observed in the roots.

A similar restriction is found in Slovenian, where multiple non-adjacent posterior sibilants are dispreferred within a word—recall that the opposite is found in western dialects discussed above. The co-occurrence restriction can be seen when looking at palatalization. Much like in BCS (section 3), palatalization in Slovenian is found with specific suffixes which turn velars into postalveolars (15). As shown in Jurgec (2016), this process is variable, and the percentages below present the number of palatalized tokens in the corpus.

(15) Slovenian palatalization (Jurgec 2016)

STEM		NON-PAL.	PALATALIZED	%PAL	TOKENS	
barok	'baroque'	barok-ən	baroʧ-ən	99.8	10,466	'ADJ'
straŋk-a	'party'	straŋk-itsa	strantʃ-itsa	88.3	206	'DIM'
grax	'pea'	grax-ək	graʃ-ək	55.7	341	'DIM'
krok	'circle'	krog-əts	kroʒ-əts	9.0	4,804	'DIM'

When the stem contains a postalveolar, however, the palatalization rates are much lower. Often, palatalization is completely blocked (16).

(16) Palatalization blocked by a distant postalveolar (Jurgec 2016)

STEM		NON-PAL.	PALATALIZED	%PAL	TOKENS	
ʒag-a	'saw'	ʒag-ən	ʒaʒ-ən	0.0	15	'ADJ'
ʃʧɪrk-a	'daughter'	ʃʧɪrk-itsa	ʃʧɪrʧ-itsa	0.0	5,335	'DIM'
ʃpɛx	'fat'	ʃpɛx-ək	ʃpɛʃ-ək	0.0	18	'DIM'
ʧuk	'owl'	ʧuk-əts	ʧuʧ-əts	0.0	405	'DIM'

Jurgec & Schertz (2020) demonstrate that the speakers extend these generalizations to derived and non-derived nonce words: the acceptability of nonce words with two postalveolars is lower than other combinations of sounds, including two velars. The authors also found a separate identity avoidance effect, mirroring the Russian preposition facts.

Only in recent decades have long-distance interactions been a major focus of phonological research. It is likely that this research will uncover similar patterns in other Slavic languages.

7 Conclusions

This chapter provides an overview of the most common sound patterns involving consonants in Slavic. We have seen that the inventories of contemporary Slavic languages are quite similar, with the chief differences being in the number and realization of coronals and in the presence of palatalized consonants. Slavic languages display a great range of palatalizations, which involve either primary or secondary place, and which can be conditioned by various phonological, morphological, and lexical factors. Voicing alternations have received attention in the phonological literature and display key typological differences. Finally, this chapter reports on several long-distance interactions between consonants, including consonant harmony and the OCP.

Acknowledgments

I would like to thank two anonymous reviewers and the volume editors. I also received valuable feedback from Michael Friesner and Alexei Kochetov. This work was partially supported by the *Social Sciences and Humanities Research Council* Insight Development Grant "Interacting Consonants: An ultrasound investigation of consonant harmony" (file number 430-2019-00296).

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