Palatalization and consonant-vowel interactions

Basic facts and terminology

Basic facts: hard and soft consonants

The distinction between 'hard' and 'soft' consonants is traditional in both synchronic and diachronic phonology. Very broadly, 'soft' consonants are those that are produced by a process that involves front vowels or glides.

Two key processes are secondary palatalization, where a consonant becomes 'soft' before a front vowel (that may have disappeared later), and coalescence with a following *j*. In principle, any consonant can have a palatalized counterpart, but synchronically we find that we can roughly divide the Slavic languages into two groups:

- Northern (all of East Slavic, Polish, Sorbian) and (Eastern) Bulgarian: basically all consonants[1] have soft counterparts, usually realized as palatalized versions of the hard consonant.
  - In some languages (Polish, Belarusian, parts of Ukrainian), some soft coronals (especially sonorants) are palatal rather than palatalized anterior
  - A common secondary development is **enhancement** of the soft quality. A typical example is Polish and Belarusian: *t' d' s' z'* > [t͡ɕ d͡ʑ ɕ ʑ] and similar
- South Slavic other than (Eastern) Bulgarian, Czech and Slovak: no secondary palatalization contrast, but a distinctive series of palatals: /c ɟ ɲ ʎ/ (and the Czech *ř*) as the 'soft' versions of /t d n l r/

[1] With some complications around velars

Hard	Soft	Source	Example
t d n l	c ɟ ɲ ʎ	*Cj coalescence	Svk *žena* 'woman' ≠ *baňa* 'mine'
		Secondary palatalization	Cz *prst* 'finger' ≠ *prsť* 'soil'
			Cz *když* 'where' ≠ *divný* 'strange'
p b t d s z	pʲ bʲ tʲ dʲ sʲ zʲ	Secondary palatalization	Uk *pit* 'sweat' ≠ *myt'* 'moment'
n l	nʲ/ɲ lʲ/ʎ	Secondary palatalization	Uk *den'* 'day' ≠ *son* 'dream'
		*Cj coalescence	Uk *kin'* 'horse'

Basic facts: velar palatalizations

A special place belongs to posterior coronals *č ž š*, and in some languages the affricates *c dz*. Diachronically, they derive from palatalization processes.

Process	Change	Example	Gloss
First velar palatalization	k g x > č ž š / _i e ě ь	BCMS *muka* ~ *mučiti*	'torment' N ~ INF
	sj zj > š ž	Po *zwisać* ~ *wiszę*	'hang' INF ~ PRS.1SG
Cj coalescence		Ru *xod* ~ *xožu*	'walk' N ~ PRS.1SG
	tj dj > various outcomes	P *chód* ~ *chodzę*	
		BCMS *rod* ~ *rođen*	'kin, birth' ~ 'born'
		Bu *rod* ~ *rozhden*	
Second velar palatalization	k g x > c dz š/s	BCMS *ruka* ~ *ruci*	'hand' NOM ~ DAT

Since these segments usually derive from 'C + front vowel' or *Cj sequences, they share many behaviours with soft consonants. However, with few exceptions[2] they are phonetically 'hard' (not palatalized or palatal), and usually do not have soft counterparts. They also show some 'hard' phonological patterning, as we shall see.

[2] Notably *c'* <ц> in Ukrainian, [c ɟ] <ќ ѓ> in Macedonian, and *ć đ* in at least parts of BCMS.

Key alternations and examples

Surface palatalization   C → Cʲ, usually before a front vowel

(First) velar palatalization   k g/ɣ/ɦ x → č ž š, usually before a front vowel or *j*

Transitive palatalization   t d s z → T D š ž, before a historical *j* but often without a clear context synchronically

Labial iotation   ⊠ → lʲ/ʎ after labials, before a historical *j* but often without a clear context synchronically.

(Second) velar palatalization   k g/ɣ/ɦ x → c dz/z s/š in a very restricted number of contexts

> ⚠ Warning
>
> Transitive palatalization and labial iotation often occur in the same contexts as each other. Sometimes — but not always — you also see the first velar palatalization in those contexts, too, but 1VP can also

co-occur with Surface Palatalization.

Alternation	Example	Gloss
Surface palatalization	P *kosa* [s] ~ *kosić* [ɕ]	'scythe' ~ 'mow.INF'
	Ru *korm* ~ *kormit'* [mʲ]	'feed' N ~ INF
First velar palatalization	Ru *muka* ~ *mučit'*	'torment' N ~ INF
	BCMS *jak* ~ *jači*	'strong' POS ~ CMP
Transitive palatalization	P *kosa* [s] ~ *koszę* [ʂ]	'scythe' ~ 'mow.PRS.1SG'
	BCMS *ljut* ~ *ljući* [tɕ]	'angry' POS ~ CMP
	P *chód* [d] ~ *chodzę* [d͡z]	'walk' N ~ PRS.1SG
Labial iotation	Ru *korm* ~ *korml'u*	'feed' N ~ PRS.1SG
	BCMS *glup* ~ *gluplji*	'stupid' POS ~ CMP
Second velar palatalization	Bu *vълk* ~ *vълci*	'wolf' SG ~ PL
	P *rąka* ~ *ręce*	'hand' NOM ~ DAT

The problem of /y/ and velars

Many, but not all, present-day languages distiguish between [i] and a second non-back, non-round, high (or near-high) vowel, traditionally symbolized *y*.[3]

[3] Not IPA [y]!

> **💡 Further reading**
>
> A detailed overview of the realization and patterning of this vowel can be found in J. Ian Press. 1986. *Aspects of the phonology of the Slavonic languages: The vowel* y *and the consonantal correlation of palatalization* (Studies in Slavic and General Linguistics 7). Amsterdam: Rodopi.

In most languages that distinguish them in principle, [i] and [ɨ] are in complementary distribution:

- [i] after soft consonants and syllable-initially
- [ɨ] after hard consonants **including** the unpaired postalveolars *č ž c dz*

Sequence	Russian	Polish	Ukrainian
ti di	✗	marginal	✓
tʲi dʲi	✓	✓ (basically)	✓
tɨ dɨ	✓	✓	✓
ki gi	✗	✗	✗
kʲi gʲi	✓	✓	✓
kɨ gɨ	restricted	restricted	✓
tɛ dɛ	marginal	✓	✓

Sequence	Russian	Polish	Ukrainian
tʲɛ dʲɛ	✓	✓	restricted
kɛ gɛ	restricted	restricted	✓
kʲɛ gʲɛ	✓	✓	✗

Key:

- ✓ sequence allowed
- ✗ sequence disallowed
- Marginal: allowed but largely restricted to borrowings/newer lexicon
- Restricted: allowed only in certain phonological/morphophonological circumstances

Surface generalizations for Russian and Polish:

- Both [i] and [ɛ] prefer to follow soft consonants
- [ɨ] only follows hard consonants
- General tendency to neutralize [k g] ~ [kʲ gʲ] before [i ɨ ɛ] — but to maintain [t d] ~ [tʲ dʲ]

The analysis of /i/ and /y/

- Because of the largely complementary distribution of [i] and [ɨ], they were generally considered to be allophones of /i/ in structuralist phonology
- This is **central** to Jakobson,[4] is acknowledged by Trubetzkoy,[5] and remains the case in Halle[6]
- To state the distribution, we have to assume that /C/ and /Cʲ/ are phonemically distinct.

Table 5: Analysis of Russian [pɨl] 'ardour', [pʲil] 'drink.PST.SG.M', [pɨlʲ] 'dust'

Conso-nant	Word-final		Before /i/	
Hard		/pil/ [pɨl]		
Soft	/pilʲ/	[pɨlʲ]	/pʲil/	[pʲiɫ]

Consonant palatalization in generative phonology

What needs an account?

- Front vowels generally follow Cʲ
- C and Cʲ can contrast when there is no following front vowel
- There hard → soft alternations before front vowels

[4] Roman Jakobson. 1929. *Remarques sur l'évolution phonologique du russe comparée à celle des autres langues slaves* (Travaux du Cercle linguistique de Prague 2). Prague: Jednota československých matematiků a fyziků. Trans. as *Remarks on the phonological evolution of Russian in comparison with the other Slavic languages*. Trans. by Ronald F. Feldstein. Cambridge, MA & London: The MIT Press, 2018.

[5] Nikolai S. Trubetzkoy. 1934. *Das morphonologische System der russischen Sprache* (Travaux du Cercle linguistique de Prague 5.2). Prague: Jednota československých matematiků a fyziků.

[6] Morris Halle. 1959. *The sound pattern of Russian: A linguistic and acoustical investigation*. 's Gravenhage: Mouton.

- After surface hard consonants, we only find [ɨ]

The generative approach

> **❗ The foundational hypothesis of Slavic generative phonology**
>
> A large proportion of Slavic morphophonological patterns can be explained if soft consonants always derive from hard consonants followed by a front vowel

As we discussed yesterday, all kinds of alternations are produced by the single mechanism of **phonological rule**. On this basis, generative phonology can use morphophonological alternations to posit rules and 'unspool' them to recover **abstract** underlying representations.

Two kinds of /i/

Table 6: Some derivations of **mǫk-* 'torment' and **xod-* 'walk' in Russian and Polish

Language	Item	Infinitive suffix	Nominative plural
Russian	*xod*	*xodit'* [dʲi]	*xody* [dɨ]
	muka	*mučit'*	*muki* [kʲi]
Polish	*chód*	*chodzić* [d͡ʑi]	*chody* [dɨ]
	męka	*męczyć*	*męki* [kʲi]

Table 7: Synchronic derivation of the Russian forms

Rule	/xod-itʲ/	/muk-itʲ/	/xod-ɨ/	/muk-ɨ/
Velar palatalization		mučitʲ		
Post-velar fronting				muki
Surface palatalization	xodʲitʲ			mukʲi

What is going on?

On the face of it, the *č* in *mučit'* cannot derive from a rule turning *k* into *č* before [i], because forms like *muki* show that [kʲi] sequences are allowed. However, such surface sequences occur precisely in contexts where the vowel turns up as [ɨ] after hard consonants when those consonants are not velars. Conversely, the rule that looks like 1VP is triggered by vowels that trigger Surface Palatalization of preceding consonants.

Because of the different morphophonological behaviours, the two suffixes are analysed as containing two different underlying vowels:

- The infinitive has a real front vowel, which triggers assimilation of preceding consonants: Surface Palatalization for non-velars, 1VP for velars
- The nominative plural has a back vowel, which unsurprisingly does not trigger softening — unless a different rule (Post-Velar Fronting) makes it front. If it does end up front, it is able to trigger palatalization like any other front vowel

> **❗ Two key takeaways**
>
> - This is all **phonology**, and it works with **phonological** segments, which have real (phonetically non-trivial) feature specifications and all the rest. The vowels behave this way because they really are front or back, not because of an abstract 'morphophonemic' structure
> - The fact that this analysis closely tracks diachronic developments is neither surprising nor problematic: this is the system working exactly as intended.

A fun fact: the idea of Post-Velar Fronting has a deep Jakobsonian pedigree. The idea that *ky gy xy* developed to *ki gi xi* and then the front vowel palatalized the preceding velars is a centrepiece of Jakobson.[7] His explanation remained foundational in structuralist historical accounts, but this history seems to have been largely forgotten in generative analyses; one exception is Padgett.[8]

[7] Jakobson, *Remarques sur l'évolution phonologique du russe comparée à celle des autres langues slaves*.

[8] Jaye Padgett. 2003. Contrast and post-velar fronting in Russian. *Natural Language & Linguistic Theory* 21. 39–87.

Getting the complementary distribution

The analysis so far explains the fact that we have [C^{j}i] and [C$\dot{\text{i}}$] but not *[Ci]

- Underlying /C$\dot{\text{i}}$/ remains
- Underlying /Ci/ → [C^{j}i] by Surface Palatalization

There is still a problem with the Polish.

Table 8: Predicted derivation for Polish cognates

Rule	/xɔd-it^j/	/mɛNk-it^j/	/xɔd-ɨ/	/mɛNk-ɨ/
First Velar Palatalization		mɛNčit^j		
Post-Velar Fronting				mɛNki
Surface Palatalization	xɔd^{j}it^j	mɛNč^{j}it^j		mɛNk^{j}i
Minor rules	xɔd͡ʑit͡ɕ	mɛnč^{j}it͡ɕ		mɛŋk^{j}i
Predicted surface form	xɔd͡ʑit͡ɕ	mɛnč^{j}it͡ɕ	xɔdɨ	mɛŋk^{j}i

Rule	/xɔd-itʲ/	/mɛNk-itʲ/	/xɔd-ɨ/	/mɛNk-ɨ/
Actual surface form		mɛn͡t͡ʂit͜ɕ		

This is what I meant when I said that the velar palatalization products behave as soft in the phonology but end up being surface-hard. The *cz dż sz ż* series in Polish sound hard and also condition a following [ɨ], and we don't have an account of that yet.

The backness switch

Table 9: Better derivation for the Polish forms

Rule	/xɔd-itʲ/	/mɛNk-itʲ/	/xɔd-ɨ/	/mɛNk-ɨ/
First Velar Palatalization		mɛNčʲitʲ		
Post-Velar Fronting				mɛNki
Surface Palatalization	xɔdʲitʲ			mɛNkʲi
Postalveolar hardening		mɛnčitʲ		
Retraction		mɛnčɨtʲ		
Minor rules	xɔd͡ʑit͜ɕ	mɛn͡t͡ʂit͜ɕ	xɔdɨ	mɛŋkʲi

The product of 1VP is soft. When Surface Palatalization stops being relevant,[9] a Hardening rule applies and feeds retraction of [i] to [ɨ]

We now correctly derive surface [Cɨ], whether it from underlying /Cɨ/ or from another process where the consonant ends up hard for other reasons, but our derivations are getting really rather long.

> **ℹ What's the backness switch?**
>
> Note that underlying /kɨ/, with a back vowel (and a hard consonant), surface with a front vowel and a soft consonant, and underlying /ki/, with a front vowel, surfaces as [t͡ʂɨ], with a hard consonant and a back vowel. The term is due to Jerzy Rubach. 2000. Backness switch in Russian. *Phonology* 17(1). 39–64. http://www.jstor.org/stable/4420162

Further developments

Taking the system further

The basic recipe for analysing palatalization:

- Soft consonants come from following front vowels (or glides)

[9] The eagle-eyed will notice that Surface Palatalization fails before [ɛ]. Ask me about it if you're still wondering by the end!

- If a vowel has a softening effect, it must be underlyingly front
- If a vowel does not have a softening effect, it must be underlyingly back
- Rule ordering will keep us straight

Regressive palatalization revisited

Languages like Czech show coronal → palatal alternations before some, but not all, front vowels

Table 10: Softening and non-softening suffixes in Czech

Context	Non-palatalizing	Palatalizing
Morpheme-internal	*když* [di] 'where'	*divný* [ɟi] 'strange'
Adjective inflection	*pěkný* [ni] 'beautiful.NOM.SG.M'	*pěkní* [ɲi] 'beautiful.NOM.PL'
Nominal inflection	*hradem* [dɛ] 'city.INS.SG'	*hradě* [ɟɛ] 'city.LOC.SG'

This can be accounted for by positing back underlying vowels with subsequent fronting

Table 11: Analysis of Czech *i* vs *y*

Rule	/pjɛkn-ɨ:/	/pjɛkn-i:/
Palatalization		pjɛɲi:
Vowel fronting	pjɛkni:	

> **i Note**
>
> In general colloquial Czech, *y* is realized [ɛj]. Does this matter?

Tackling unexpected softness

Table 12: Some Russian verbs

Infinitive	PRS.1SG	Imperfective	Gloss
lʲez-tʲ	lʲez-u	-lʲezatʲ	'clamber'
grɨz-tʲ	grɨz-u	-grɨzatʲ	'gnaw'
žečʲ	žg-u	-žɨgatʲ	'burn'
ža-tʲ	žm-u	-žɨmatʲ	'press'

Infinitive	PRS.1SG	Imperfective	Gloss
ža-tʲ	žn-u	-žɨnatʲ	'reap'
mʲa-tʲ	mn-u	-mʲinatʲ	'knead'
ras-pʲa-tʲ	ras-pn-u	ras-pʲinatʲ	'crucify'

What's the deal with soft consonants before [a]? Three observations:

- Infinitive stems have the shape CVC or CV
- Imperfective stems always have the shape CVC-a
- Present stems are either CVC or CC
  - Cʲa occurs in items that CV- in the infinitive and CN- in the present

Table 13: Analysis of surface [Cʲa]

Rule	mIn-tʲ	mIn-u	mina-tʲ
Surface Palatalization	mʲIntʲ	mʲInu	mʲinatʲ
Nasal vowel formation	mʲĩtʲ		
Vowel deletion		mʲnu	
ĩ → a	mʲatʲ		
Softness assimilation		mnu	

- We posit that the root is CVC, with a final nasal
- The vowel is plausibly front
  - It triggers Surface Palatalization
  - It alternates with a real front vowel in the imperfective
- The back vowel in the infinitive only arises after Surface Palatalization

- Armed with this idea, we can tackle other cases of unexpected softness, even when there are no alternations
  - [mʲaso] 'meat' ← /minso/
  - [lʲubʲitʲ] 'love.INF' ← /leubitʲ/

Tackling unexpected hardness

- In Polish, some /e/-initial suffixes trigger Surface Palatalization of non-velars; they usually trigger 1VP or 2VP for the velars

Suffix	Non-velars	Velars
LOC.SG	pas-ie [ɕ] 'belt'	rzec-e [t͡s] 'river'
V stem	łys-ieć [ɕ] 'go bald'	droż-eć [z̧] 'become dearer'

- When they do not, they do trigger Surface Palatalization of velars

Suffix	Labials	Coronals	Velars
INS.SG	tłum-em 'crowd'	pas-em 'belt'	krok-iem [kʲ] 'step'
ADJ.DAT.SG.M	grub-emu 'fat'	bos-emu 'barefoot'	wielk-iemu [kʲ] 'big'
ADJ.GEN.SG.M	grub-ego	bos-ego	wielk-iego

In effect, Polish seems to provide ample evidence that just like there is a distinction between 'softening' and 'non-softening' versions of the high unrounded vowel (traditional *i* vs. *y*), there is an entirely parallel 'softening' and 'non-softening' version of the mid unrounded vowel. This leads us to postulate an underlyingly back /ɤ/ for the latter case.[10]

> 💡 **What about diachrony?**
>
> This kind of move is not so well supported by diachrony. Some of the non-palatalizing *e*'s are indeed historically back vowels that merged with **e* — more on Thursday. But most of the time, this case in Polish comes from contraction where the deleted vowel was back: **grubu-jemu > grubēmu*. What does this tell us about the diachronic argument in favour of the general approach?

How far can we go?

Our examples so far have been from two kinds of languages:

- Russian or Polish, where [i] and [ɨ] both exist on the surface, and the analysis consists in elaborate reshufflings of the distribution
- Czech or BCMS, where the hard-soft contrast exists as coronal vs. palatal and there is no surface [ɨ]. If we try, we can look for alternative analyses, for example by coalescence with [j]

Table 16: Possible analysis without underlying front-back contrasts

	Morpheme	Labials	Coronals	Velars	UR
Czech	INS.SG	dub-em 'oak'	hrad-em 'city'	rok-em 'year'	/-ɛm/
	LOC.SG	dub-ě [bj]	hrad-ě [ɟ]	roc-e [t͡s]	/-jɛ/
BCMS	ACC.SG	rib-u 'fish'	crt-u 'line'	drag-u 'bay'	/-u/
	INS.SG	krvlj-u [vʎ] 'blood'	smrću [t͡ɕ] 'death'		/-ju/

[10] Jerzy Rubach. 1984. *Cyclic and lexical phonology: The structure of Polish* (Studies in Generative Grammar 17). Berlin & New York: Mouton de Gruyter.

BCMS	NOM.SG.M	grub-i 'rough'	tvrd-i 'hard'	jak-i 'strong'	/-i/
	CMP	grublj-i [bʎ]	tvrđ-i [d͡ʑ]	jač-i [t͡ʃ]	/-ji/

Bulgarian plurals

Table 17: Two types of [i] in Bulgarian

Gender	Num-ber	Labials	Coronals	Velars	UR
Femi-nine	SG	riba 'fish'	rana 'wound'	dъga 'arc'	/-a/
	PL	ribi [b(ʲ?)]	rani [n(ʲ?)]	dъgi [gʲ]	/-ɨ/
Mascu-line	SG	zъb 'tooth'	elen 'deer'	vъlk 'wolf'	/-⊠/
	PL	zъbi [b(ʲ?)]	eleni [n(ʲ?)]	vъlci [t͡s]	/-i/

Bulgarian demonstrates at least two types of [i] suffix.[11] Their behaviour is typical in the sense that one does not trigger major place changes of velars, and the other one does (2VP in this case, but there also 1VP triggers). What happens to the other consonants, though?

Recall that the hard/soft distinction in Bulgarian is neutralized before [i ɛ]: velars are soft in this position (a neutralizing alternation) and the non-velars are 'semi-soft', traditionally interpreted as phonemically hard.

Scatton[12] explicitly appeals to the parallel with Russian in treating the 'less palatalizing' [i] as underlying /ɨ/ (with something like Post-Velar Fronting and Surface Palatalization of velars to get the pattern) and the 'more palatalizing' [i] as /i/ (with Velar Palatalization rules but nothing happening for other consonants). Bulgarian does not have surface [ɨ] at all!

Further, /ɨ/ and /i/ in this analysis have the exact same effects on preceding consonants. This means we likely have not 'Post-Velar Fronting' of /ɨ/ but actually **absolute neutralization** where /ɨ/ → [i] in all cases. In post-SPE generative phonology, this eventually became extremely problematic,[13] but these kinds of analysis remained current in generative approaches to Slavic.[14]

Summary

- The standard analysis of Slavic in early generative phonology assumes highly abstract representations and complicated derivations that largely reproduce diachrony

[11] In fact, more than two

[12] Ernest A. Scatton. 1975. *Bulgarian phonology*. Columbus, OH: Slavica Publishers.

[13] Paul Kiparsky. 1968. *How abstract is phonology?* Bloomington: Indiana University Linguistics Club.

[14] Edmund Gussmann. 1980. *Studies in abstract phonology* (Linguistic Inquiry Monograph 4). Cambridge, MA: MIT Press; Rubach, *Cyclic and lexical phonology*; Jerzy Rubach. 1993. *The lexical phonology of Slovak*. Oxford: Clarendon Press.

- The aim is to capture as many generalizations as possible within the phonological component
- The distinction between soft and hard consonants can be derived from the backness of following vowels in underlying representations
- This is seen as **economical**: storage is expensive, computation is cheap
- Conversely, differences in morphemes' behaviour with regard to palatalization are encoded in the featural make-up of their segments

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