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*Backness switch in Russian**

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Russian exhibits several different types of palatalisation. These are exemplified in (1), where we look at voiceless stops and affricates.

(1) a. *Velar Palatalisation*[1] (velars change into postalveolars): $k \rightarrow \check{c}$
ruk+a 'hand (FEM NOM SG)' – ruč+išč+a (AUG NOM SG), ruč+en'k+a (DIM NOM SG)

b. *Affricate Palatalisation* (affricates become postalveolar): $ts \rightarrow \check{c}$
konets 'end' – konč+i+t' 'to finish'
otets 'father' – otč+estv+o 'patronymic'

c. *Iotation* (many disparate changes of consonants):[2] $t \rightarrow \check{c}$
šut 'joker' – šuč+u 'I joke'

d. *Surface Palatalisation* (consonants become [−back, +high]): $t \rightarrow t'$
xvost 'tail' – xvost+ik [t'] (DIM), xvost+e [t'] (LOC SG)
brat 'brother' – brat+j+a [t'] 'brothers (COLL)'

A coherent analysis of these disparate effects is a formidable task, but one process seems to be easy: Surface Palatalisation is a straightforward spreading change. This change is particularly simple in the context of *i* and *j* since not only the feature [−back] but also the feature [+high] is spread from the triggering context onto the input consonant. In the following, I will restrict the scope of analysis to this simple case. That is, I will look at Surface Palatalisation applying in the context of *i* and *j*. I will demonstrate that standard Optimality Theory (henceforth OT: Prince & Smolensky 1993, McCarthy & Prince 1995), with its insistence on parallel evaluation, cannot offer an adequate analysis of Surface Palatalisation. I will suggest that standard OT needs to be modified and to admit the

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[1] For a recent analysis of Velar Palatalisation, see Plapp (1996).

[2] From a synchronic point of view, Iotation is an extremely opaque process, because its trigger, the *j*, is present neither in the underlying representation nor in the surface representation. Thus, synchronically, the effects of Iotation are probably best treated as instances of allomorphy, as originally suggested by Spencer (1986).

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possibility of a level distinction (a derivational step) in the evaluation of output forms.[3]

This paper is organised as follows. §1 introduces the basic generalisations. It looks at the interaction between consonants and high vowels, showing that, on the one hand, /i/ affects consonants (Palatalisation: C→ C') and, on the other hand, consonants affect /i/ and /ɨ/ (Retraction: /i/ → /ɨ/ and Fronting: /ɨ/ → /i/, respectively). §2 presents an OT analysis of Palatalisation, Retraction and Fronting, arguing that these disparate processes are in fact a single generalisation. The generalisation is that consonants and vowels must agree in backness, so either consonants and vowels are made [−back] (Palatalisation and Fronting, respectively) or vowels are made [+back] (Retraction). I call these two strategies a backness switch, and demonstrate that, contrary to appearances, they can be reconciled if we adopt the insight of Lexical Phonology that lexical and postlexical operations may have different effects due to a change of focus, which is expressed formally by the reordering of generalisations (Kiparsky 1982, Halle & Mohanan 1985, Booij & Rubach 1987). In the instance at hand, the focus is on [−back] at the lexical level and on [+back] at the postlexical level. The analysis of backness switch in §2 is then contrasted with the OT handling of the same or similar problems in the past literature (§3). It is shown that the earlier analysis in terms of syllable domains is descriptively incorrect and must be rejected. A further claim is that the problem can be solved neither by Output–Output Theory nor by Sympathy Theory. §4 refines the analysis by introducing Palatalisation-j, a generalisation that has never been observed in the generative literature on Russian to date (§4.1), and by looking at Hardening (§4.2), which strengthens the conclusions of §2. §5 is a summary of the main results. We begin with the presentation of the facts and the basic generalisations in the section that follows below.

1 Basic generalisations

Russian is a typical language in the sense that it draws a distinction between [−back] and [+back] vowels, which include [i e] and [ɨ u o a], respectively. Less typical is the fact that backness is also a parameter for consonants, which are either [−back] (palatalised) or [+back] (velarised). This means that there are no 'plain' consonants. That is, every consonant is articulated with one of the following two tongue-body positions: forward movement and raising towards the hard palate (palatalisation) or backward movement and raising towards the velum (velarisation). These

[3] Some early work in OT permitted a derivational step (serial evaluation) between morphologically defined domains, in particular between prefixes and stems (McCarthy & Prince 1993). However, this stance was later abandoned, in spite of some papers that argued for the distinction between the word level and the sentence level (see, for example, Booij 1997). Current work in OT, especially McCarthy (1999), rejects any form of serialism. The belief is that all arguments for serial OT have been made invalid by Sympathy Theory. This is not so, as this paper will show.

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are the so-called secondary articulation effects, because the gesture performed by the tongue body is simultaneous with but independent of the primary gesture that is responsible for determining the place of articulation. For example, the primary gesture for *m* is the closure of the lips, hence the place of articulation is bilabial. The secondary gesture is executed by the tongue body, which is raised and moved forwards or backwards, with the consequence being that we have either [m'] (palatalised bilabial nasal) or [m^{ɣ}] (velarised bilabial nasal), where the apostrophe means palatalisation and the superscript [ɣ] denotes velarisation.

The palatalised–velarised distinction, which is characterised in traditional grammars as a distinction between soft and hard consonants, has been known about Russian for more than a hundred years (Sweet 1879, Broch 1911, Halle 1959). The soft series includes [p' b' m' f' v' t' d' s' z' r' l' n' č' k' g' x']. All other consonants are hard: [p^{ɣ} b^{ɣ} m^{ɣ} f^{ɣ} v^{ɣ} t^{ɣ} d^{ɣ} s^{ɣ} z^{ɣ} ts^{ɣ} r^{ɣ} n^{ɣ} l^{ɣ} š^{ɣ} ž^{ɣ} k^{ɣ} g^{ɣ} x^{ɣ}].[4] It is the occurrence of [±back] in consonants[5] and vowels that is the source of the three basic generalisations: Palatalisation, Fronting and Retraction. These generalisations are illustrated below by looking at a sample of representative alternations.

Front vowels and [j] trigger Palatalisation.

(2) *Palatalisation*

otve<u>t</u>[6] [t^{ɣ}] 'answer'	otve<u>t</u>+i+t' [t'] 'to answer'
vo<u>z</u> [z^{ɣ}] 'cart'	vo<u>z</u>+i+t' [z'] 'carry'
golo<u>s</u> [s^{ɣ}] 'voice'	golo<u>s</u>+in+a [s'] (DIM)
sto<u>l</u> [l^{ɣ}] 'table'	sto<u>l</u>+ik [l'] (DIM)
du<u>b</u> [b^{ɣ}] 'oak'	du<u>b</u>+ik [b'] (DIM)
sest<u>r</u>+a [r^{ɣ}] 'sister'	sest<u>r</u>+ic+a [r'] (DIM)
že<u>n</u>+a [n^{ɣ}] 'wife'	že<u>n</u>+i+t' [n'] 'marry'
no<u>g</u>+a [g^{ɣ}] 'leg'	dvu+no<u>g</u>+ij [g'] 'two legged'[7]

[4] With [k g x], velarisation is the primary place of articulation. When palatalised, the velars are fronted and become [−back].

[5] The soft/hard distinction is true not only of surface forms but also of underlying representations. That is, soft consonants, with the exception of [x'], are underlying segments because they can occur in environments that do not warrant Palatalisation; for example, *z'at'* 'son-in-law', *n'uxat'* 'smell', *r'umka* 'glass', *b'ust* 'breasts', *l'uk* 'manhole cover', *krov'* 'blood', *sem'* 'seven', *ek'u* 'ecu', *G'ul'čtaj* (name of a cinema) and others. (Underlying palatalised velars are limited to loanwords.) There is a partial asymmetry between the soft and the hard series: *č'*, a palatalised voiceless affricate, is always soft while *ts š ž* are always hard. See §4.2 for an analysis. Also, note that velarisation is not distinctive underlyingly. I think the best way of looking at this problem is to assume that velarisation as a secondary articulation effect is underspecified in the underlying representation, and that it is enforced by a constraint at the first lexical level (see note 27). For the clarity of presentation, I will continue with the practice of transcribing hard consonants as velarised underlyingly.

[6] The transliteration used in this paper is close to the phonetic transcription. Palatalisation, marked by an apostrophe, is indicated in contexts other than before front vowels. Note also that *x* stands for [x], a voiceless velar fricative, and *y* for [ɨ], a high back unrounded vowel.

[7] A reviewer points out to me that the *ij* suffix derives from the underlying *oj*. In general, Russian, unlike Ukrainian, has no [ɨ] after velars, which is accounted for by a separate constraint that I am not discussing here.

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ti$\underline{x}$ [x$^{\text{v}}$] 'silent'	ti$\underline{x}$+ij [x'] 'silent (INFL)'
kolo$\underline{s}$ [s$^{\text{v}}$] 'ear of corn'	kolo$\underline{s}$+j+a [s'] 'ears of corn (COLL)'
ofitse$\underline{r}$ [r$^{\text{v}}$] 'officer'	ofitse$\underline{r}$+j+o [r'] 'officers (PEJOR)'
ba$\underline{b}$+a [b$^{\text{v}}$] 'woman' (PEJOR)	ba$\underline{b}$+j+o [b'] 'women (COLL)'

Schematically, the generalisation can be stated as follows:

(3) *Palatalisation*

$$C \rightarrow \begin{bmatrix} C \\ -back \end{bmatrix} / __ \; i/j$$

The data in (4) below make two points. First, an underlying //ɨ//[8] surfaces as [ɨ] after a hard consonant (4a). Second, if the consonant is soft, the //ɨ// fronts to [i] (4b). Our example is the nominative plural ending //ɨ//.[9]

(4)

NOM SG	NOM PL	
a. *Hard* C+//ɨ//		
šut	šut+y [t$^{\text{v}}$ɨ]	'joker'
nos	nos+y [s$^{\text{v}}$ɨ]	'nose'
zub	zub+y [b$^{\text{v}}$ɨ]	'tooth'
stol	stol+y [l$^{\text{v}}$ɨ]	'table'
zakon	zakon+y [n$^{\text{v}}$ɨ]	'law'
b. *Soft* C+//ɨ//		
gost'	gost+i [t'i]	'guest'
los'	los+i [s'i]	'moose'
golub'	golub+i [b'i]	'pigeon'
nol'	nol+i [l'i]	'zero'
slovar'	slovar+i [r'i]	'dictionary'

The standard analysis is to assume that the underlying //ɨ// exemplified in (4a) is fronted to [i] after a soft consonant.[10]

(5) *Fronting*

$$ɨ \rightarrow i / \begin{bmatrix} C \\ -back \end{bmatrix} __$$

[8] I use double slashes for underlying representations, single slashes for intermediate representations and square brackets for phonetic representations.

[9] In surface terms, the nominative plural ending [i] occurs after palatalised stems while [ɨ] occurs after hard stems. This complementary distribution of [i] and [ɨ] is standardly analysed as stemming from the underlying //ɨ// that is fronted to [i] after [−back] segments. One reason is that the nominative plural ending contrasts with affixes such as *-ist* in that it does not trigger Palatalisation; compare *golos* [s$^{\text{v}}$] 'voice' – *golos+y* [s$^{\text{v}}$] (NOM PL) with *Marks* [s$^{\text{v}}$] – *Marks+ist* [s'] 'Marxist'. Let us add that *-ist* does not have an alternant with [ɨ]. See Rubach (1984) for an analysis of the nominative plural ending in Polish.

[10] There has been a long debate in the literature of the past one hundred years or so whether [ɨ] and [i] are phonemes or allophones. There is little doubt that the former rather than the latter is true. For a review of the problem and a number of compelling arguments for the phonemic status of //ɨ//, see Plapp (1996).

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Finally, //i// is retracted to [ɨ] after a hard consonant. This happens at the juncture between the prefix and the stem (6a), and between two words which may (6b) but need not (6c) constitute a clitic phrase, that is, a phrase involving a preposition (Avanesov 1968).

(6) *Retraction*

a. iskat' 'look for' – *perfective forms*: raz + yskat'[11] [zʸɨ], ob + yskat' [bʸɨ], ot + yskat' [tʸɨ], s + yskat' [sʸɨ], pod + yskat' [dʸɨ], iz + yskat' [zʸɨ]
igrat' 'play' – *perfective forms*: s + ygrat' [sʸɨ], raz + ygrat' [zʸɨ], ot + ygrats'a [tʸɨ], ob + ygrat' [bʸɨ], pod + ygrat' [dʸɨ]

b. ot̲ i̲nstituta [tʸ ɨ] 'from the institute', k̲ i̲nvalidu [kʸ ɨ] 'to the invalid', pod̲ i̲zboj [dʸ ɨ] 'under the room', s̲ i̲gloj [sʸ ɨ] 'with the needle'

c. brat̲ id'ot [tʸ ɨ] 'my brother is going', mal'čik̲ i̲grajet [kʸ ɨ] 'a boy is playing', dom̲ i̲skustva [mʸ ɨ] 'art gallery', golos̲ I̲vana [sʸ ɨ] 'Ivan's voice'

Needless to say, Retraction does not occur after a soft consonant. Such consonants exist independently of Palatalisation, that is, they are palatalised in the underlying representation since, for example, they occur word-finally, as in (7).

(7)	gost'	'guest'	gost' i̲z Moskvy [t' i]	'a guest from Moscow'
	bukvar'	'dictionary'	bukvar' I̲vana [r' i]	'Ivan's dictionary'
	rol'	'role'	rol' i̲nstituta [l' i]	'the role of the institute'
	los'	'moose'	los' i̲d'ot [s' i]	'the moose is going'

The alternations in (6) are standardly analysed as instances of Retraction, which is motivated by the fact that the [i] variants occur in isolation: *iskat'* 'look for', *institut* 'institute', *Ivan* 'Ivan', *iz* 'from' and so forth. Since consonants are velarised in Russian, Retraction is no less of an assimilation than Fronting (5) is.

(8) *Retraction*

$$i \rightarrow ɨ \,/\, \begin{bmatrix} C \\ +back \end{bmatrix} —$$

The coexistence of Palatalisation, Fronting and Retraction presents quite a challenge for a phonological analysis. This is illustrated, among other things, by the phrase *ot instituta* 'from the institute', which is standardly analysed as derivable from the underlying representation //otʸ

[11] In prefix–stem words, the *i* is shown in the spelling by the letter *y*, which denotes [ɨ].

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in$^{\text{ʏ}}$s$^{\text{ʏ}}$t$^{\text{ʏ}}$it$^{\text{ʏ}}$ut$^{\text{ʏ}}$a//.[12] The first occurrence of //t$^{\text{ʏ}}$ i// is subject to Retraction, while the second occurrence of //t$^{\text{ʏ}}$i// undergoes Palatalisation: [ot$^{\text{ʏ}}$ in$^{\text{ʏ}}$s$^{\text{ʏ}}$t'it$^{\text{ʏ}}$ut$^{\text{ʏ}}$a]. How can these facts be analysed in Optimality Theory? It is this question that we address in the next section.

2 OT analysis

We begin with a summary of various consonant–vowel configurations and the changes that these configurations induce. Taking the voiceless dental stop as an example, we obtain the following schema. (The glide /j/ is discussed later.)

(9) a. t$^{\text{ʏ}}$i → t'i examples in (2)
b. t'i → t'i examples in (4b)
c. t$^{\text{ʏ}}$ɨ → t$^{\text{ʏ}}$ɨ (*no change*) examples in (4a)
d. t$^{\text{ʏ}}$i → t$^{\text{ʏ}}$ɨ examples in (6)
e. t'i → t'i (*no change*) examples in (7)

An overarching generalisation is that consonants and vowels agree in backness. An OT treatment of this generalisation is due to Zubritskaya (1995), who suggests the following constraint:

(10) CV Link: In CV all features linked to a vowel must also be linked to a consonant.

Now, with the credit having been given, in what follows I will depart in significant ways from Zubritskaya's analysis. I will suggest an alternative analysis, which crucially bears on the modification of the OT assumption about parallel derivation.[13] In §3, I will show that Zubritskaya's account is in fact incorrect.

The agreement of consonants and vowels in backness cannot be plausibly accounted for in terms of a single constraint. Rather, we have a set of constraints which differ in scope, much as classical rules differ in their degree of generality. Thus there is a difference between the backness agreement of consonants and high vowels and the backness agreement of consonants and mid vowels. Viewed from the perspective of Palatalisation, this difference manifests itself as an asymmetry in the ability of front vowels to palatalise consonants. The implicational generalisation is that a language that palatalises consonants before mid vowels will also palatalise consonants before high vowels, but the reverse is not true (see Chen 1973). The matter is highly complicated and cannot be adequately discussed

[12] The basic generalisations are due to Halle (1959) and Lightner (1965, 1972).

[13] Zubritskaya (1995) assumes a completely different feature theory from the standard one that I follow here. In particular, she uses monovalent [coronal] and [dorsal] to characterise both front vowels and palatalised consonants. This leaves her with no option of defining [ɨ] and velarised consonants as back segments. One evident loss of insight is immediately clear: there is no way in this system of expressing Retraction as an assimilatory process on a par with Palatalisation.

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here, so let us merely point to two examples and add some subtlety to the generalisation just stated.

In Ukrainian, consonants are palatalised before [i] but not before [e] (Bilodid 1969). Similarly, Polish Surface Palatalisation, a postlexical generalisation, affects consonants before *i* and *j* but not before *e* (Rubach 1984).

(11) a. *Ukrainian*
syn [n] 'son' (NOM SG) – syn + iv [n'] (GEN PL) *vs.* syn + e [n] (VOC SG)

b. *Polish*
głos Ireny [s' i] 'Irene's voice', głos Janka [s' j] 'John's voice' *vs.* głos Ewy [s e] 'Eve's voice'

In fact, Russian is a language that palatalises consonants before high vowels and glides (the data in (2)) as well as before the mid vowel *e*. The latter environment has crept surreptitiously into some of our earlier examples. For instance, in *otvetit'* 'answer', we have palatalisation not only on the *t* but also on the *v*: [at^{v}v'et'it']. Similarly, the *s* is palatalised not only in *golos* + *in* + *a* 'voice (DIM)' but also in *golos* + *e* 'voice (LOG SG)'. There is a distinction, however. While Palatalisation may have exceptions (Avanesov 1968, Holden 1976), my inspection of the data shows that all exceptions occur only in the environment of *e* and none are found in the environment of *i*. This is best illustrated by words which have both *i* and *e*. The examples in (12), from Avensov (1968), have been confirmed by my Russian consultants.

(12) tenisist 'tennis player' [t^{v}en'is'is^{v}t^{v}]
xrizantema 'chrysanthemum' [x^{v}r'iz^{v}an^{v}t^{v}em^{v}a]
sintetika 'acrylic material' [s'in^{v}t^{v}et'ik^{v}a]

We conclude that the backness agreement between consonants and high vowels is different from the backness agreement between consonants and mid vowels. In what follows, we limit our discussion to consonants followed by high vowels. The relevant constraint is PALATALISATION-i:[14]

(13) PALATALISATION-i (PAL-i)
A consonant and a following high vowel agree in backness.

In terms of the melodic tier, PAL-i looks at the Root nodes and thus does not distinguish between real vowels (nuclear Root nodes, here *i*) and glides (Root nodes occurring in syllable margins, here *j*), which is exactly what is required by the data in (2).

Returning to the schema in (9), we are now in a position to account for the changes in (9a–c). PAL-i is the only new constraint. All other

[14] I retain the traditional name 'Palatalisation', even though (13) extends to the assimilation of both consonants to vowels (classical Palatalisation) and vowels to consonants (classical Fronting and Retraction).

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constraints are the familiar input–output faithfulness constraints of McCarthy & Prince (1995) and the inventory markedness constraints of Prince & Smolensky (1993). The constraints relevant at this stage are summarised in (14).

(14) a. IDENT-$C_{[+back]}$
Input [+back] on consonants must be preserved as output [+back] on consonants.

b. IDENT-$C_{[-back]}$
Input [−back] on consonants must be preserved as output [−back] on consonants.

c. IDENT-$V_{[+back]}$
Input [+back] on vowels must be preserved as output [+back] on vowels.

d. *ü: don't be a high front rounded vowel.

e. *ɨ: don't be a high back unrounded vowel.

f. *i: don't be a high front unrounded vowel.

Palatalisation, //t^{γ}// → [t'] is a violation of (14a) because a hard consonant is turned into a soft consonant. Since this is the desired effect, PAL-i must outrank IDENT-$C_{[+back]}$. Furthermore, PAL-i in //t^{γ}i// → [t'i] strings should not be satisfied by retracting the vowel: *//t^{γ}i// → [t^{γ}ɨ]. This follows from the ranking *ɨ ≫ *i, which is expected, because [i] is universally a less marked segment than [ɨ].[15] We summarise this reasoning in (15).

(15)

//t^{γ}+i//	PAL-i	*ɨ	*i	ID-$C_{[+bk]}$
☞ a. t'+i			*	*
b. t^{γ}+ɨ		*!		
c. t^{γ}+i	*!		*	

The surfacing of //t^{γ}ɨ// as [t^{γ}ɨ] shows that [ɨ] is preferred to [i] when it comes from the underlying //ɨ//. This is a straightforward instance of faithfulness that is enforced by the high ranking of IDENT-$V_{[+back]}$.

(16)

//t^{γ}+ɨ//	PAL-i	ID-$V_{[+bk]}$	*ɨ	*i	ID-$C_{[+bk]}$
☞ a. t^{γ}+ɨ			*		
b. t'+i		*		*!	*
c. t^{γ}+i	*	*!		*	

The fronting of //t'ɨ// to [t'i] in (9b) shows that underlying soft

[15] As pointed out by Zubritskaya (1995), this markedness relationship accounts for the absence of [ɨ] word-initially in the citation form where it is not in the purview of PAL-i (Zubritskaya's CV LINK). The lexical gap that Russian has no word-initial [ɨ] is best treated in terms of underspecification.

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consonants are never sacrificed in order to obey the [+back] faithfulness on vowels. This is guaranteed by IDENT-$C_{[-back]}$.[16]

(17)

//t'+i//	ID-$C_{[-bk]}$	PAL-i	ID-$V_{[+bk]}$	*i	*i	ID-$C_{[+bk]}$
☞ a. t'+i			*		*	
b. t^{v}+i	*			*!		
c. t'+i		*		*!		

The fronting effect shown in (17) should not extend to the rounded vowel *u* because *put'*+*u*, the accusative singular of *put'* //p^{v}ut'// 'journey', should not surface as *[p^{v}ut'+ü], with the front rounded vowel [ü]. This is easily prevented by assuming that *ü is an undominated constraint.[17]

Finally, for completeness, we look at one further configuration: an underlying soft consonant followed by *i*, as in *put' is Moskvy* 'a journey from Moscow'.[18]

(18)

//t'+i//	ID-$C_{[-bk]}$	PAL-i	ID-$V_{[+bk]}$	*i	*i	ID-$C_{[+bk]}$
☞ a. t'+i					*	
b. t^{v}+i	*!			*		
c. t'+i		*!		*		

The overall picture that has emerged from (15)–(18) is as follows. Underlying //t^{v}+i// and //t'+i// have fully faithfully optimal outputs because they are a perfect fit from the perspective of PAL-i: there is no disagreement in backness between the consonant and the vowel. Where such a disagreement occurs, that is, in //t^{v}+i// and //t'+i//, the resolution of the conflict is always in favour of [−back], regardless of whether this would impinge on the faithfulness of the consonant (//t^{v}// → [t']) or the vowel (//i// → [i]). This strategy is contradicted by (9d), //t^{v}i// → [t^{v}i], exemplified in (6). How can this reversal be accounted for? The answer is simple if we permit a derivational step.

Observe that the strings analysed in (15)–(18) share a morphological property: they are all words. Let us therefore assume that words are

[16] This constraint could but need not be ranked above IDENT-$V_{[+back]}$.

[17] Phonetically, back vowels are fronted if they occur in the environment of a palatalised consonant, especially between palatalised consonants, as in *t'ul'* 'tulle', *p'at'* 'five' and *t'ot'a* 'aunt'. This allophonic process is gradient and varies from dialect to dialect and from speaker to speaker. Avanesov (1968) explains that the fronted *u* is centralised. However, in the colloquial pronunciation of some selected lexical items which carry emotional meaning, the fronted *u* is 'a central vowel or even a front vowel' (1968: 42); for example, *čut'-čut'* 'a little bit'. Assuming that we want to build this fronting into the phonological system and that we need to account for the extreme case of [ü] in *čut'-čut'*, the analysis is to rank the C' – C' fronting constraint above the markedness constraint prohibiting [ü].

[18] PAL-i requires agreement in backness and is satisfied regardless of whether the agreement comes from spreading or not. The latter situation is found when the consonant and the vowel happen to have the same value for backness in the underlying representation, as in this example and in the configuration considered in (16).

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analysed at level 1. Level 2 adds further structure: it looks not only at words (see §4.2) but also at clitic phrases and other combinations of words. That is, level 2 is much like the postlexical level in Lexical Phonology.[19] The distinction between levels 1 and 2, while grounded in morphology, has a beneficial effect for the understanding of phonology, because a reranking of constraints becomes possible. All that is required is a simple move: at level 2 IDENT-$C_{[+back]}$ is upgraded to the echelon of high-ranking constraints.[20] Specifically, it is ranked either equal to or above *i. The effect is that the retraction of the vowel rather than the palatalisation of the consonant becomes optimal. In (19) we look at the evaluation of *brat Ivana* 'Ivan's brother'. The outputs of level 1, here the unchanged /bʸrʸatʸ/ and /ivʸanʸa/, are now a phrase, and this phrase constitutes an input to level 2. That is, the phrase is an 'underlying representation' for level 2 evaluation: /bʸrʸatʸ ivʸanʸa/ → [bʸrʸatʸ ɨvʸanʸa].

(19)

level 2 /tʸ i/	ID-$C_{[+bk]}$	ID-$C_{[-bk]}$	PAL-i	ID-$V_{[+bk]}$	*ɨ	*i
☞ a. tʸ ɨ					*	
b. t' i	*					*!
c. tʸ i			*			*!

When a soft consonant and [i] become adjacent in a phrase at level 2, there is no incentive to alter representations, because PAL-i is satisfied. Consequently, /pʸut' ivʸanʸa/ *put' Ivana* 'Ivan's journey', is both the input and the optimal output. The evaluation is the same as the word-internal evaluation of //t'+i// shown in (18).[21]

An apparent complication arises with prefixes. Prefix-final consonants remain unpalatalised and trigger Retraction, for example, *raz+yskat'* 'look for (PERFECTIVE)' and *s+ygrat'* 'play (PERFECTIVE)':

(20) rʸazʸ+isʸkʸat' → rʸazʸ+ɨsʸkʸat' (*not* *rʸaz'+isʸkʸat')
sʸ+igʸrʸat' → sʸ+ɨgʸrʸat' (*not* *s'+igʸrʸat')

However, prefix-internal consonants palatalise, for example, *pri+gotovit'* 'prepare': //pʸrʸi// → [pʸr'i]. This suggests that prefixes are in the purview of level 1 evaluation. How can we reconcile Palatalisation and Retraction in prefixes? The answer lies in further details of Russian phonology.

Prefixes which in the surface representation end in a hard consonant (hence those that cause Retraction) are derived from underlying representations that have a prefix-final back vowel. This is shown by alternations.

[19] This line of thinking is in keeping with Kiparsky's (1997) work, whose goal is to reconcile OT with Lexical Phonology.

[20] Note that at level 2 (postlexical level) IDENT-$C_{[+back]}$ and IDENT-$C_{[-back]}$ are ranked together. While OT has no evaluation metric to prefer the same ranking of two related constraints that differ just in the plus and minus value, the intuition is that such ranking is natural. Since this natural ranking is found at the postlexical level but not at the lexical level, the postlexical level comes across as less marked than the lexical level. Thanks to Bill Idsardi for drawing my attention to this point.

[21] Since [ɨ] does not occur word-initially (see note 15), the configurations /tʸ ɨ/ and /t' ɨ/ are not inputs at level 2.

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For example, the prefixes *raz* and *s* of *raz+yskat'* and *s+ygrat'*, respectively, appear as *razo* and *so* in *razo+brat'* 'take apart' and *so+brat'* 'collect'. These vowels alternating with zero are called yers in Slavic phonology, and they are represented as floating segments, that is, as segments without a mora or an X-slot.[22] The underlying representations of *raz/razo* and *s/so* are therefore //r$^{\text{ʏ}}$az$^{\text{ʏ}}$O// and //s$^{\text{ʏ}}$O//, respectively, where O denotes a floater (here the back yer *o*). Now the strategy of accounting for the absence of palatalisation is clear.[23] At level 1 the yer //O// is present in the output, so the prefix-final consonants are not adjacent to the vowel *i*: /r$^{\text{ʏ}}$az$^{\text{ʏ}}$O+is$^{\text{ʏ}}$k$^{\text{ʏ}}$at'/ and /s$^{\text{ʏ}}$O+ig$^{\text{ʏ}}$r$^{\text{ʏ}}$at'/. The result is that Palatalisation is blocked. At level 2 floaters are not permitted since this level is the final phonological output representation. Consequently, unvocalised yers are deleted and hence the prefix-final consonant is adjacent to the stem-initial vowel *i*.[24] With Retraction being the dominant strategy at level 2, the candidates [r$^{\text{ʏ}}$az'+is$^{\text{ʏ}}$k$^{\text{ʏ}}$at'] and [s'+ig$^{\text{ʏ}}$r$^{\text{ʏ}}$at'] lose to the candidates [r$^{\text{ʏ}}$az$^{\text{ʏ}}$+is$^{\text{ʏ}}$k$^{\text{ʏ}}$at'] and [s$^{\text{ʏ}}$+ig$^{\text{ʏ}}$r$^{\text{ʏ}}$at'] in the same way as the candidate [t'i] loses to the candidate [t$^{\text{ʏ}}$i] in tableau (19). Prefix-internally, as in *pri* of *pri+gotovit'* 'prepare', the optimal output of level 1 is [p$^{\text{ʏ}}$r'i], with a palatalised *r*. The string [p$^{\text{ʏ}}$r'i] does not violate PAL-i when it enters level 2, because [r'] and [i] agree in backness. The level 2 evaluation is then the same as that for //t'i// given in (18).

The behaviour of prefixes strengthens our argument for level distinction. The reason is that the pattern of Palatalisation *vs.* Retraction shown in prefixes requires an intermediate stage at which the underlying back yer //O// occurs in the output representation and thus blocks Palatalisation. At level 2 the yer is deleted but then Palatalisation has already lost force. Bill Idsardi points out to me that this analysis is further strengthened by the fact that the front yer //E// results in Palatalisation not only when //E// is vocalised as [e] but also when //E// cannot vocalise and deletes. For example, the dark *l* of *komsomol* [l$^{\text{ʏ}}$] 'komsomol [youth organisation in the Soviet Union]' is palatalised to [l'] in the derived noun meaning 'member of komsomol', which is formed by adding //Ets'//.[25] Palatalisation is found not only in the nominative

[22] The representation of the yers as well as their pattern of vocalisation *vs.* deletion has received extensive coverage in the literature, beginning with Lightner (1965, 1972), who introduced the idea of yers into the phonology of modern Slavic languages. A number of further studies made use of this idea in a variety of ways, see especially Rubach (1986), Kenstowicz & Rubach (1987), Halle & Vergnaud (1987) and Melvold (1990). Yearley (1995) has offered an OT analysis of this problem.

[23] Thanks to Bill Idsardi for drawing my attention to this strategy.

[24] The pattern of retention and deletion of unvocalised yers at level 1 and level 2, respectively, can be accounted for in terms of $\text{PARSE}_{\text{seg}}$ (parse segments into syllables) and MAX_{seg} (don't delete segments). At level 1, $\text{MAX}_{\text{seg}} \gg \text{PARSE}_{\text{seg}}$ keeps the unvocalised yers in place since it is worse to delete a segment than to have an unparsed segment. (Recall that yers cannot be parsed because they are moraless vowels.) At level 2, the constraints are reranked: $\text{PARSE}_{\text{seg}} \gg \text{MAX}_{\text{seg}}$. The consequence is that unparsed segments (here unvocalised yers) are deleted.

[25] At the underlying level, the *ts* is soft; see §4.2 and note 41.

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singular, where the yer is vocalised and surfaces as [e], but also in the inflected forms, where the yer does not vocalise: *komsomol+ets* [l'] (NOM SG) and *komsomol'+ts+a* [l'] (GEN SG). The occurrence of [l'] in *komsomol'+ts+a* (GEN SG) is unproblematic if yers are not deleted at level 1 since then the level 1 output representation still has the surface-covert front vowel that triggers Palatalisation: /k^{y}om^{y}s^{y}om^{y}ol'+Ets'+a/. The yer //E//, like the yer //O// in *raz+yskat'* and *s+ygrat'* cited earlier, deletes at level 2 and we obtain the correct output form [k^{y}om^{y}s^{y}om^{y}ol'+ts^{y}+a].[26]

In sum, the distinction between level 1 and level 2 gains additional support from the behaviour of the yers. This behaviour is of two types: back yers block Palatalisation (*raz+yskat'* and *s+ygrat'*), while front yers trigger it (*komsomol'+ts+a* (GEN SG)). These effects are understandable if we can access the representation at level 1 showing the structure prior to the surface representation in which the yers are not present.

Pulling together the facts analysed in this section, we conclude that the conflicts between Palatalisation, Fronting and Retraction are resolved in a straightforward way by recognising that the analysis proceeds in two steps and that we have an intermediate derivational level (word level) between the underlying representation and the final output representation.[27] This conclusion is unacceptable from the point of view of standard OT, whose founding principle is that all evaluation is done in parallel and that there cannot be any derivational steps calling for the reranking of constraints. The consequences of this tenet are reviewed in the following section.

3 Parallel evaluation

When faced with derivational difficulties, the strategy of standard OT is to add new constraints. This is manifested most prominently in three ways. First, we might add a constraint that restricts the troublesome generalisation to a prosodic domain (Zubritskaya's 1995 analysis). Second, we might invoke surface analogy and claim the evaluation is governed by a special output–output constraint which requires faithfulness to an independently existing word, a position that is represented most prominently by Benua (1997). Third, we might analogise to a hypothetical output form, the 'failed candidate' of Sympathy Theory (McCarthy 1999). This account requires that we add a special sympathetic faithfulness constraint. We review each of these strategies below and conclude that none of them is correct.

[26] Phonetically, the *ts* is hard; see §4.2.

[27] The behaviour of prefixes *vis-à-vis* the process of Yer Vocalisation suggests that there is a level prior to our level 1 (word level). The point is that the vocalisation of the yer in the prefix depends on whether the yer has vocalised in the stem (Pesetsky 1979). This earlier level would thus need to encompass roots and suffixes but not prefixes, a suggestion made originally by Halle & Vergnaud (1987). Since, in spite of the progress made by Yearley (1995), it is unclear how Yer Vocalisation should be handled in OT, investigation of the stem level is a matter of future research.

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Zubritskaya's (1995) solution to the internal conflicts described in §2 is to add a special constraint that restricts the palatalisation of consonants to the domain of the syllable.

(21) ALIGN (coronal, syllable left)

A coronal feature dominated by a vocalic Root node must be aligned with the left edge of the syllable.

Notice that in the system of features adopted by Zubritskaya, [coronal] is the palatalisation feature; that is, it corresponds to our [−back].

Since Russian, like other Slavic languages, does not permit syllabification across word boundaries and at prefix–stem juncture, (21) has the desired effect of banning the palatalisation of consonants in (6). Thus, it is predicted, correctly, that *otvet Ivana* 'Ivan's answer' cannot have [t' i] as the optimal output because such an output would violate (21). Consequently, Zubritskaya's CV LINK, cited in (10), induces vowel retraction, and we have [t$^{\text{ɣ}}$ i], which is correct. In contrast, stem-internal *t*+*i* constitutes a syllable; hence (21) is satisfied in the candidate [t'+i], which is correct for *otvet*+*i*+*t'* 'to answer': //t$^{\text{ɣ}}$+i// → [t'+i].

This analysis is unsatisfactory on both general and descriptive grounds. From the general perspective, the problem is that it forfeits the OT insight that the palatalisation of consonants and the retraction of vowels are governed by the same constraint (Zubritskaya's CV LINK or our PAL-i). The analysis that postulates a special constraint for the palatalisation of consonants loses sting because the OT scenario of CV interactions does not diverge significantly from the classic analysis in which Palatalisation and Retraction are separate rules.

From the descriptive perspective, ALIGN (21) is simply incorrect. It predicts, wrongly, that consonantal prepositions undergo Palatalisation, when, in fact, they induce Retraction.

(22)	k Ivanu	'to Ivan'	[k$^{\text{ɣ}}$ i], *not* *[k' i]
	s Ivanom	'with Ivan'	[s$^{\text{ɣ}}$ i], *not* *[s' i]
	v Ivane	'in Ivan'	[v$^{\text{ɣ}}$ i], *not* *[v' i]

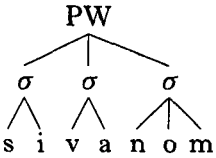
The point is that prepositions made up of a single consonant are syllabified into the onset of the following word because otherwise they could not be syllabified at all. This syllabification is thus different from the one exhibited by words (prepositions or other words) that contain a vowel, such as *ot* in *ot Ivana* 'from Ivan' or *bez* in *bez Ivana* 'without Ivan'. In these instances the consonant of the preposition can syllabify into the coda, which is exactly what happens; *ot.i.va.na* and *bez.i.va.na*.[28]

[28] As mentioned earlier, Slavic languages are typologically different from Romance languages in that they do not permit resyllabification from the coda into the onset across word boundaries (see Rubach, in press). In this regard, native speakers are unanimous in their intuitions about syllabification. The generalisation that word boundaries are respected in syllabification extends also to prepositions. The absence of Final Devoicing in prepositions has to do with the fact that prepositions function as clitics and do not have the status of phonological words. See Booij & Rubach (1987) for an analysis of such cases.

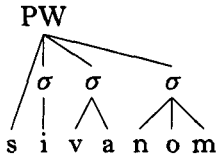
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The crucial question about (22) is the following: is it necessary for the prepositions *s*, *v* and *k* to syllabify into the onset, or could we rather assume that they are prosodified directly under a higher node such as that of the phonological word? That is, is (23a) a necessary structure or would (23b) be also acceptable?

(23) a.



b.



Zubritskaya's analysis can yield the correct result (//i// → [i] rather than //s^{v}// → [s']) only if (23b) is right.

There are three types of evidence that argue against (23b) and for (23a): first, Strict Layering, second, Vowel Insertion, and, third, *j*-triggered palatalisation in onsets.

The representation in (23b) violates Strict Layering (Selkirk 1980, Nespor & Vogel 1986), which requires, among other things, that consonants must be parsed into syllables and not directly into phonological words, that is, the prosodic hierarchy must be obeyed.[29] While constraint violation, such as the violation of Strict Layering in (23b), is certainly admissible in OT, it still is the case that (23a), which fully obeys the prosodic hierarchy, is better than (23b), which violates it.

Vowel Insertion,[30] our second argument against (23b), calls for inspecting additional data. In (24) we look at vowel–zero alternations in prepositions.

(24) a.	s oknom	'with the window'	v okne	'in the window'
	s tonom	'with the tone'	v malčike	'in the boy'
	s xvostom	'with the tail'	v zdorovje	'in the health'
b.	s sestroj	'with the sister'	v vode	'in the water'
	s samol'otom	'with the aeroplane'	v Voroneže	'in Voronež'
c.	so straxom	'with the fear'	vo vlasti	'in the power'
	so stolom	'with the table'	vo vremja	'in the times'
	so sxizmoj	'with the schism'	vo vdove	'in the widow'

[29] I have ignored the option that the *s* could be parsed into a foot rather than into the phonological word in (23b). Whichever is done, the argument remains the same.

[30] Given that Slavic languages have yers and that yers are floating melodic segments, Vowel Insertion is better regarded as a process of yer vocalisation. Then, Vowel Insertion is an insertion of a mora or an X-slot, depending on the skeletal theory that is assumed.

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The observation is that the vocalic forms *so* and *vo* occur if the next word begins with a consonant cluster whose initial consonant is identical to that of the preposition:[31] *s straxom* → *so straxom vs. s sestroj* (no cluster) and *s xvostom* (no identity of the consonants). That is, the strategy is to avoid **ss*C- and **vv*C- by inserting a vowel.

Inspection of further data reveals that vowel insertion is sensitive to syllable structure rather than to the linear sequence of consonants in a cluster. This is shown by the fact that the vowel is not inserted when the consonant of the preposition can syllabify into the coda.

(25)	bez straxa	'without the fear'	iz straxa	'from the fear'
	bez stola	'without the table'	iz stola	'from the table'
	bez sxizmy	'without the schism'	iz sxizmy	'from the schism'

The generalisations established for the prepositions carry over to the behaviour of prefixes.

(26) a.	s+xodit'	'come down'	v+pisat'	'write into'
b.	s+sor	'quarrel'	v+vedenije	'introduction'
c.	so+stavit'	'put together'	vo+vlekat'	'pull in'

As was the case with the prepositions, there is no vowel insertion if the consonant of the prefix has a chance to syllabify into the coda: *ras+strel'at'* 'shoot'.

Pulling together all these observations, we obtain the following picture. Russian, like other Slavic languages, admits onsets of obstruents with no regard to sonority distinctions between fricatives and stops. Therefore, *kto* 'who', *vdova* 'widow' and *vz'at'* 'take' all have well-formed onsets. This generalisation extends to the treatment of prefixes and prepositions. Consequently, *s* and *v* are in the onset of the examples in (26a) and (24a); for instance, *s xvostom* 'with the tail'. Geminate onsets are also tolerated, hence *ss-* in *s+sor* 'quarrel' and *s sestroj* 'with the sister' in (26b) and (24b), respectively. What is not tolerated is geminates in a complex onset: *[ssC-] and *[vvC-]. This constraint, call it Geminate Onset, induces vowel insertion: //ssC// → [sosC] and //vvC// → [vovC]. Vowel insertion is thus an effect of the tension between the need to parse segments into syllables and the restrictions mandated by Geminate Onset. Inserting a vowel is the last resort, an option that is not exercised if a consonant can be syllabified into the coda. This option is available for prefixes and prepositions that have a vowel and hence are able to erect a syllable: *ras.stre.lat'* 'shoot' and *bez.sto.la* 'without the table'.

The scenario for vowel insertion just outlined is valid only if we assume the representation in (23a) and not the one in (23b). That is, the *s* in *s Ivanom* 'with Ivan' and *s+ygrat'* 'play (PERFECTIVE)' must be in the onset (23a) and not in an appendix to the word node (23b). If the latter were

[31] Voice distinction plays no role, so we find the vocalic forms also in *so zdorovjem* 'with the health' and *vo frake* 'in tails'.

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true, then all the examples in (24) and (26) would have the same prosodic structure, and Geminate Onset would be muted on these strings. Consequently, it would not be possible to account for vowel insertion.

The third argument for the representation in (23a) derives from Avanesov's (1968) observation (confirmed and expanded in my fieldwork) that the consonant of the prefix or the preposition is palatalised before *j* in (27a) but not in (27b).

(27)	a.	s+jezd [s'j]	'congress'
		v+jexat' [v'j]	'enter'
		s juga [s'j]	'from the south'
		v Jalte [v'j]	'in Yalta'
		k Jeltsinu [k'j]	'to Yeltsin'
	b.	ot+jexat' [t$^{\text{v}}$j]	'go away'
		pod+jexat' [d$^{\text{v}}$j]	'come up'
		bez Jeltsina [z$^{\text{v}}$j]	'without Yeltsin'
		ot Jeltsina [t$^{\text{v}}$j]	'from Yeltsin'
		golos Jeltsina [s$^{\text{v}}$j]	'Yeltsin's voice'
		pidžak Jeltsina [k$^{\text{v}}$j]	'Yeltsin's jacket'

The patalisation in (27a) and its absence in (27b) are understandable when we look at syllable structure. If the prefix/preposition has a vowel of its own (27b), then the generalisation that Russian syllabification respects prefix and word junctures is adhered to: the consonant syllabifies into the coda of the prefix/preposition rather than into the onset of the stem. This syllabification pattern coincides with the absence of palatalisation, suggesting that the palatalisation before *j* does not occur across syllable boundaries. Given this observation, the presence of palatalisation in (27a) indicates that the consonant must be in the onset, which is what we would expect, because *s*, *v* and *k* do not have a vowel of their own. We pursue this analysis further in the following section. The only essential point now is that the palatalisation before *j* argues for the representation in (23a) and against the representation in (23b).

Finally, let us note that two arguments, Patalalisation and Vowel Insertion, converge in phrases such as *so s+jezdom* 'with the congress' and *vo v+jezde* 'in the entrance'. The prefixal *s* and *v* in these words must be in the onset for two reasons. First, they palatalise before *j* and, second, they trigger vowel insertion in the preposition: *s* → *so* and *v* → *vo*, and, as remarked earlier, Vowel Insertion is triggered by complex onsets.

To summarise, we have adduced three different arguments showing that the consonantal prefixes and prepositions syllabify into the onset of the following stem or word: *s+ygrat'* [s$^{\text{v}}$ɨ.g$^{\text{v}}$r$^{\text{v}}$at'] 'play' and *s Ivanom* [s$^{\text{v}}$ɨ.v$^{\text{v}}$a.n$^{\text{v}}$om$^{\text{v}}$] 'with Ivan'. But then Zubritskaya's (1995) analysis cannot be maintained, because ALIGN (21), the constraint responsible for palatalisation, cannot distinguish between *golos+in+a* 'voice (DIM)', which shows the palatalisation of the consonant, and *s+ygrat'* as well as *s Ivanom*, which show the retraction of the vowel.

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In our analysis, this distinction is unproblematic. As explained in §2, Palatalisation occurs at the word level (level 1) and Retraction elsewhere, that is, at level 2. But this analysis is unacceptable in standard OT because it involves a derivational step (two levels) and is thus at odds with the premise that all evaluation must be done in parallel. The assumption of standard OT is that instances calling for derivationalism are apparent and that they can be analysed in some other ways. These other ways are afforded, most significantly, by Output–Output Theory and/or by Sympathy Theory.

Output–Output Theory, represented most prominently by Benua (1997), handles troublesome alternations by introducing output–output faithfulness constraints. The idea is that these constraints enforce analogy to the surface alternant that has the desired property. For example, in order to block the palatalisation of /sʸ/ in *s Ivanom* and obtain [sʸɨ] rather than [s'i], we invoke an output–output constraint that enforces the hardness of consonants. To achieve this goal, we need to assume that *s Ivanom* has a base to which we can analogise. An associated assumption is that the base is an independently occurring word. This is unproblematic in the case of major lexical categories and perhaps also in the case of prepositions. However, difficulties appear when we look at prefixes; for example, *raz* in *raz+yskat'* 'look for'. Since prefixes do not occur as independent words,[32] evidence must be drawn from words which have the unpalatalised consonant of the prefix. But the list of such words is extremely long; for example, *ras+strelat'* 'shoot', *raz+ubedit'* 'dissuade', *raz+rezat'* 'cut', *ras+poznavat'* 'recognise', *ras+kovat'* 'unshoe', *raz+mestit'* 'deploy', *ras+pisat'* 'write much', *raz+dumat'* 'change one's mind' and others. So, which of these words functions as the base for *raz+yskat'*? There is no way of making a principled choice. More generally, why should, for instance, *ras+strelat'* 'shoot' function as the base for *raz+yskat'* 'look for'? These words are semantically unrelated.

Even if we disregard problems with the base, the difficulty is that Output–Output Theory cannot offer a workable scenario for the consonant palatalisation effects *vs.* the vowel retraction effects of PAL-i. The reason is that these operations are incompatible for any form of parallel evaluation. Thus, if we assume that in *otvet Ivana* 'Ivan's answer' *otvet* is the base and invokes an output–output IDENT-$C_{[+back]}$ constraint in order to enforce Retraction, then *otvet Ivana* is taken care of and [tʸɨ] is the optimal output, which is correct. However, then, by the same token, *otvet+i+t'* 'to answer', a verb derived from *otvet* 'answer', should also have [tʸɨ] in the optimal output, but this is not the case. The correct surface form is [t'i].

Sympathy Theory (McCarthy 1999) avoids the difficulties encountered by Output–Output Theory with the selection of the base. Such a selection is made in a principled way by a constraint that we appoint as a selector.

[32] Appealing to phonological rather than morphological words will not help. As argued above and in §4.1 below, consonantal prefixes *s* and *v* are actually in the onset of the stem syllable.

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However, the incompatibility problem of [t^{y}i] in *otvet Ivana* and [t'i] in *otvet*+*i*+*t'* is the same as in Output–Output Theory. No matter which candidate is selected as the sympathetic base for a sympathetic faithfulness constraint, we cannot obtain both results: the retraction of the vowel in *otvet Ivana* and the palatalisation of the consonant in *otvet*+*i*+*t'*. We will always derive one but not the other result: either [t^{y}i] or [t'i], but this is incorrect.

We conclude that Output–Output Theory and Sympathy Theory are unable to account for the attested facts. The correct solution is the one suggested in §2: there is a derivational step in the evaluation of PAL-i effects.

4 Refinements

There are two outstanding problems in our analysis. First, counter to the prediction made by IDENT-C$_{[+back]}$ ≫ PAL-i (§2), palatalisation is possible at level 2: it is the palatalisation before *j*. Second, as mentioned in §1, the stridents [ts^{y} š^{y} ž^{y}] show an asymmetry in the sense that they are the only consonants in Russian which do not have palatalised correspondents *[ts' š' ž'].[33] These two problems are addressed in §§4.1 and 4.2, respectively.

4.1 PALATALISATION-j

Level 2 contrasts in (27), such as hard [k^{y}] in *pidžak Jeltsina* 'Yeltsin's jacket' and palatalised [k'] in *k Jeltsinu* 'to Yeltsin', cannot be accounted for by PAL-i. The reason is that IDENT-C$_{[+back]}$ crucially dominates PAL-i at level 2 in order to obtain Retraction in (6): the [i] in, for example, *k invalidu* 'to the invalid'. The palatalisation of /k^{y}/ to [k'] in *k Jeltsinu* 'to Yeltsin' must therefore be enforced by a separate constraint. As observed in the preceding section, this palatalisation occurs if a consonant and *j* are in the onset.

(28) PALATALISATION-j (PAL-j)

A consonant and a glide in the onset must agree in backness.[34]

[33] Actually, Russian has palatalised *š ž*, but these are always long, i.e. [š':] and [ž':], and they are an effect of assimilation plus closure deletion in clusters with affricates (Avanesov 1968). The relevant constraints are undominated in Russian and will not be discussed here (see Zubritskaya 1995 for an analysis). The point is that [š':] and [ž':] are not an effect of PAL-i.

[34] PAL-j as an onset constraint is exceptionless since C*j* in phrases, such as *pidžak Jeltsina* 'Yeltsin's jacket', and in prefix plus stem structures, such as *pod*+*jexat'* 'come up', is not within the purview of PAL-j. The reason is that the consonant and the *j* are heterosyllabic in these contexts. Stem-internally, C*j* strings are always syllabified into the onset and the consonant is invariably palatalised, exactly as predicted by PAL-j. This observation extends in an exceptionless manner also to words that have the hard sign ⟨ъ⟩ before *j* in the spelling (Kit Wertz, personal communication): *adjutant* 'aide-de-camp', *adjunktura* 'adjuncture', *konjunktura* 'economic situation', *injunktiv* 'injunctive', *konjunktiv* 'conjunctive', *disjunktivnyj*

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The fact that PAL-i and PAL-j are separate constraints is obvious from the point of view of Slavic languages. The reason is that these languages are known to have had the process called Iotation, which operated before *j* but not before *i* or *e*. The effects of this process are scattered throughout the verbal morphology of all Slavic languages today.

The restriction of PAL-j to onsets is natural because the distinction between [i] and [j] is arguably a matter of syllabification. The [j] is an //i// that has been put into the onset or the coda rather than into the nucleus.[35] Consequently, to identify [j], we must refer to the syllable tier anyway. As a matter of fact, PAL-j could be generalised to the syllable margin, an onset or a coda, and no harm would be done. The point is that the coda *j*'s are always postvocalic, never postconsonantal, so a generalised version of PAL-j would always be vacuous when the *j* is in the coda. While generalising PAL-j to the syllable margin is technically possible, there seems to be little point in doing this, so we will assume PAL-j in the version given in (28).

The operation of PAL-j is visible at level 2 because its effects are then different from those of PAL-i (the palatalisation of consonants *vs.* the retraction of vowels).[36] These effects suggest that the level 2 ranking is PAL-j ≫ IDENT-$C_{[+back]}$, PAL-i (recall the discussion in §2).[37] The phrase *k*

'disjunctive' and *konjugatsija* 'conjugation'. My native-speaker consultants, as well as the literature (Jones 1923, Panov 1967), agree on this assertion. The hard sign in the spelling is meaningless in the sense that it does not indicate the absence of palatalisation in these words. Probably, the reason why *adjutant* 'aide-de-camp' and the other words in the list are written with the hard sign is a matter of the etymological judgement on the part of the prescriptive grammarians that *ad, in, dis* and *con* are prefixes in Latin. However, my fieldwork shows that native speakers of Russian do not perceive them as prefixes and, consequently, they palatalise the consonant before *j*.

[35] In answer to the question asked by a reviewer, let me clarify that the representation of [j] as a melodic [i] does not entail that *i* and *j* cannot be contrastive. All it says is that [i] and [j] are not distinct in terms of features. Rather, the distinction is made by syllable structure: [i] is a nucleus and [j] is a syllable margin. In this theory, unpredictable contrast between *i* and *j* is expressed by partly prespecifying syllable structure in the underlying representation.

[36] Counter to the suggestion of a reviewer, PAL-j and PAL-i should not be collapsed into a single constraint. The reasons are not only diachronic (recall the discussion of Iotation above). PAL-i, which encompasses both *i* and *j* (these are non-distinct at the melodic tier), is not restricted to onsets, because it causes Retraction across word boundaries and thus operates across syllable boundaries. If PAL-j does not exist as a constraint, then postlexical palatalisation before *j* is effected by PAL-i and, consequently, it is not restricted to onsets. But this is evidently incorrect since heterosyllabic C*j* has a hard consonant; for example, [t^{y}] in *ot+jexat'* 'go away' and *ot Jeltsina* 'from Yeltsin', even though *t* and *j* are segmentally adjacent at level 2. In order not to palatalise the *t* in these examples, PAL-i must be dominated by IDENT-$C_{[+back]}$, but then we cannot derive palatalised consonants in (27a). See our analysis below.

[37] Some speakers do not have palatalisation before *j* at prefix and word junctures. Thus, the *s* can be hard in the onsets of *s+jezd* 'congress' and *s Jeltsinym* 'with Yeltsin'. This dialect is easily analysed by assuming the ranking: IDENT-$C_{[+back]}$ ≫ PAL-j.

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Jeltsinu 'to Yeltsin' is therefore evaluated as follows. In (29) we look at the initial syllable and limit the evaluation to the three relevant constraints.

(29)

level 2 /k^{y} je/	PAL-j	ID-C$_{[+bk]}$	PAL-i
☞ a. (k'je)$_{\sigma}$		*	
b. (k^{y}je)$_{\sigma}$	*!		*

In fact, there seems to be one further strong contender that we have not considered: [k^{y}we], which would incur no violations in (29). Excluding this candidate presents no difficulty: Russian does not have phonetic [w] at all. That is, the melodic segment /u/ can only surface as a nucleus, never as a syllable margin, no matter whether it would be in the onset or in the coda. This generalisation is expressed by a segment markedness constraint (Prince & Smolensky 1993).

(30) *M$_{u}$: [u] cannot occur in the syllable margin

Now the absence of surface [w] follows from the fact that *M$_{u}$ is an undominated constraint in Russian.[38]

We summarise our discussion in (31) by looking at the level 2 evaluation of the relevant syllables in *bok Ivana* 'Ivan's side' (31a) and *bok Jeltsina* 'Yeltsin's side' (31b).

(31)

a. *level* 2 /b^{y}ok^{y} i/	*M$_{u}$	PAL-j	ID-C$_{[+bk]}$	PAL-i	*i̯	*i
☞ (b^{y}ok^{y})$_{\sigma}$ (i̯)$_{\sigma}$					*	
(b^{y}ok')$_{\sigma}$ (i)$_{\sigma}$			*			*!
(b^{y}ok^{y})$_{\sigma}$ (i)$_{\sigma}$				*		*!
b. *level* 2 /b^{y}ok^{y} je/						
☞ (b^{y}ok^{y})$_{\sigma}$ (je)$_{\sigma}$				*		
(b^{y}ok')$_{\sigma}$ (je)$_{\sigma}$			*!			
(b^{y}ok^{y})$_{\sigma}$ (we)$_{\sigma}$	*!					

The interesting point about (31b) is that we have found an argument for the ranking of IDENT-C$_{[+back]}$ above PAL-i that was missing in our earlier discussion. The correct output violates PAL-i because the consonant and the vowel do not agree in backness. (Recall that [j] is [i] at the melodic tier.) This is interesting since our earlier examples were unable to unveil the fact that PAL-i can be violated in the optimal candidate.

[38] A reviewer reminds me of the fact that Russian [v] derives from underlying //w//. The glide is motivated by alternations with *j* (see Flier 1972) and by the fact that it behaves as a sonorant with respect to Voice Assimilation (see, for example, Jakobson 1948, Lightner 1967, Coats & Harshenin 1971, Halle 1973, Hayes 1984 and Petrova 1997). The fact that *v* acts a glide but is an obstruent in the surface representation strengthens my contention that derivational steps need to be permitted in OT.

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Finally, let us point out that PAL-j is mute on the candidates in (31b), because the consonant and the *j* are in different syllables. A further potential candidate, $(bo)_{\sigma}$ $(kje)_{\sigma}$, would activate PAL-j, but it could never be the winner. As pointed out on several earlier occasions, Russian does not permit syllabification across word and prefix junctures. This generalisation can be violated only in the instances in which a consonant could not be syllabified at all. The instances in point are the monoconsonantal prepositions and prefixes that we discussed at length in the preceding section.

4.2 Hard stridents

There are three reasons for looking at hard stridents. First, we need to account for the asymmetry mentioned in §1: all consonants in Russian are paired symmetrically with regard to [±back], that is, they are either palatalised or velarised, but *ts š ž* are only velarised and never palatalised (but see note 33). Second, the behaviour of hard stridents provides an argument for level distinction and thus strengthens our conclusion in §2. Third, hard stridents demonstrate that level 2 phonology is not limited to the inspection of constituent edges but has repercussions for word-internal structures. This shows that level 2 is truly derivational and cannot be reduced to assigning morphological domains to particular constraints.

The observation that *ts š ž* are hard rather than soft is expressed in OT in terms of segment inventory constraints. Schematically:

(32) a. *ts': Anterior affricates cannot be [−back].[39]
b. *š' ž': Non-anterior coronal continuants cannot be [−back].[40]

Let us call the constraints in (32) HARD-C and, to simplify matters, let us refer to them collectively as if they were one constraint.

HARD-C is an effect of a historical process in the Slavic languages which affected surface stridents and led to the loss of overt palatalisation on selected consonants. The fall-out of this hardening is different in different Slavic languages. In Russian, the hardening affected *ts š ž* but not *č*, which is always soft. In Ukrainian, on the other hand, [ts'] has remained soft while [š' ž' č' dž'] have hardened to [$š^{v}$ $ž^{v}$ $č^{v}$ $dž^{v}$].

Hardened consonants still act as soft in the grammar of Russian and, consequently, are regarded by all authors as underlyingly soft. This view, originally due to Halle (1959) and Lightner (1965, 1972), is motivated by evidence from both morphology and phonology.

In terms of morphological class, nouns in *š* and *ž* belong to the soft rather than to the hard declension. This has consequences for word-formation rules that assign inflectional endings. For example, the mas-

[39] The voiced affricate *dz* does not exist as an underlying segment in Russian. When it appears in the surface representation, it is invariably an effect of Voice Assimilation acting on *ts*.

[40] As mentioned earlier, *č* is always soft, so this constraint refers only to continuants.

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culine genitive plural endings of hard and soft stems are different: *-ov* and *-ej*, respectively as in *kot* [t^{y}] 'cat' – *kot*+*ov vs. test'* [t'] 'father-in-law' – *test*+*ej* [t'+ej] and *kl'uč* [č'] 'key' – *kl'uč*+*ej* [č'+ej]. The hardened stridents act as soft consonants in the sense that they take *-ej* rather than *-ov* in the genitive plural: *nož* 'knife' – *nož*+*ej* [ž^{y}+ej] and *duš* 'shower' – *duš*+*ej* [š^{y}+ej]. This behaviour is automatically accounted for if the stridents are soft in the underlying representation.[41]

Phonologically, *ts š ž* behave in two contradictory ways: sometimes they act as soft consonants and sometimes as hard consonants, and their behaviour is systematic rather than haphazard. How is this possible? We clarify the details below.

Russian has a vowel-reduction process affecting non-high vowels. The facts are well known (see, for example, Avanesov 1968 and Jones 1923): *e*, *o* and *a* reduce to [i] in syllables with a soft onset (*ikanie*) and to *a* elsewhere (*akanie*).[42] In (33) the accent means that the vowel is stressed.

(33) a. *Ikanie*

e→i	dél+o 'matter' – del+á [d'il^{y}á] (PL)
	lés 'forest' – les+ók [l'is^{y}ók^{y}] (DIM)
o→i	s'ól+a 'villages' – s'ol+ó [s'il^{y}ó] 'village'
	jóž 'hedgehog' – jož+á [již^{y}á] (GEN SG)
a→i	p'át' 'five' – p'at'+órk+a [p'it'ór^{y}k^{y}a] 'five (COLL)'
	čár+y 'charms' – očaróvan [ač'ir^{y}óv^{y}an^{y}] 'charmed (SHORT FORM)'

b. *Akanie*

dóm 'house' – domóv [d^{y}am^{y}óf^{y}] (GEN PL)
prós'+b+a 'request' – pros+í+t' [p^{y}r^{y}as'ít'] 'to request'
kón' 'horse' – kon'+á [k^{y}an'á] (GEN SG)
sól' 'salt' – sol+í+t' [s^{y}al'ít'] 'to salt'

Ikanie is an assimilation in backness and height (Halle 1959, Lightner 1965, 1972). The [−back, +high] features are spread from the onset to the vowel, as shown in (33a). An interesting confirmation of this generalisation comes from borrowings which defy Palatalisation. Such borrowings also defy *ikanie*. For example, *neseser* 'briefcase' is pronounced [n^{y}es^{y}és^{y}er^{y}] rather than *[n^{y}is^{y}és^{y}er^{y}] (Avanesov 1968).

Given these generalisations, the reader might be surprised to find that both *ikanie* and Retraction occur after the phonetically hard consonants in (34).

[41] One argument for the phonological softness of *ts* derives from the process of Backing (see Lightner 1969), whereby *e* is realised as *o* if it occurs before a hard consonant in a stressed syllable. (Thanks to Bill Idsardi for drawing my attention to this argument.) Thus, the stressed syllable has [o] in *t'ažól*+*yj* [ol^{y}] 'heavy' because the lateral is velarised. If the consonant after the stressed vowel is soft, then Backing does not apply, hence we have [e] in *t'ažél*+*e* [el'] 'heavier'. The affricate behaves as a soft segment *vis-à-vis* Backing: we have *otéts* 'father' and not **ot'óts*.

[42] The reduced vowels are lax and their exact quality depends on the distance from the stressed syllable. I will not address these facts here, but see Avanesov (1968) and Jones (1923).

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(34)	šólk [šʸólˡkʸ] 'silk'	šolk + á [šʸɨlˡkʸá] (NOM PL)
	šópot [šʸópʸatʸ] 'whisper'	šept + á + t' [šʸɨpʸtʸát'] 'to whisper'
	šés't' [šʸés't'] 'six'	šes't' + órk + a [šʸɨs't'órˡkʸa] 'six (COLL)'
	žólt + yj [žʸólˡtʸɨj] 'yellow'	žolt + é + t' [žʸɨlˡt'ét'] 'become yellow'
	žón [žʸónʸ] 'wife (GEN PL)'	žon + á [žʸɨnʸá] (NOM SG)
	žémčug [žʸémʸč'ukʸ] 'pearl'	žemčug + á [žʸɨmʸč'ugʸá] (NOM SG)
	tsél + yj [tsʸélˡɨj] 'whole (MASC NOM SG)'	tsel + á [tsʸɨlˡá] (FEM NOM SG)
	tséx [tsʸéxʸ] 'union'	tsex + á [tsʸɨxʸá] (NOM PL)

If the stridents in (34) are hard, then it is not understandable why the reduced vowels are raised: //o e// → [ɨ]. Rather, we would expect *akanie*, which happens in non-palatalised contexts, as shown in (33b). The paradox is that in order to have *ikanie* //š ž ts// must be [−back], but then how is it possible for Retraction to occur? Recall that Retraction, /i/ → [ɨ], applies after [+back] consonants (§2).

The paradox is easily solved if we admit a derivational step. The stridents are underlyingly soft, that is [−back], and they remain soft in the optimal output at level 1. This assumption, which has been standard for years (Halle 1959, Lightner 1965, 1972), permits us to make sense of the morphological facts mentioned earlier (the distribution of inflectional suffixes). It also accounts for *ikanie* in (34). With soft //š' ž' ts'// and the HARD-C constraint being below IDENT-$C_{[-back]}$, the optimal output of *šolk + á* 'silk' (NOM PL) is /š'ilʸkʸá/ at level 1. This output is the 'underlying representation' for level 2 evaluation. The reranking of HARD-C above IDENT-$C_{[-back]}$, which is in keeping with the general strategy of hardening at this level (see §2), accounts for the desired final representation [šʸɨlˡkʸá], as we show in (35).

(35)

level 2 /š'i/	HARD-C	ID-$C_{[-bk]}$	PAL-i	*ɨ	*i
☞ a. šʸɨ		*		*	
b. š'i	*!				*
c. šʸi		*	*		*!
d. š'ɨ	*!		*	*	

Let us point out further that Retraction due to HARD-C occurs also in contexts that have nothing to do with *ikanie*. Retraction is a strategy for assimilating borrowings (36a) and for achieving the agreement in backness in sentence phonology (36b).

(36) a.	pacient	[pʸatsʸɨenʸtʸ]	'patient'
	Chirac	[šʸɨrʸakʸ]	(name)
b.	otec Ivana	[at'etsʸ ɨvʸanʸa]	'Ivan's father'
	nož Ivana	[nʸošʸ ɨvʸanʸa]	'Ivan's knife'

Ikanie and the data in (36a) show that HARD-C has an effect word-internally. On the other hand, the facts in (36b) indicate that it works also

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at word junctures. These effects are optimal at level 2, which means that level 2 is much like the postlexical level in Lexical Phonology: it is open to phonological processes in both word-internal and word-external domains. This is an important observation, because it shows that level 2 is a derivational step in the classical understanding of the term.[43]

Finally, HARD-C shows that PAL-j is a violable constraint.[44] The ranking HARD-C ≫ PAL-j accounts for the fact that *š ž ts* are hard in clusters with [j]: *šju* [šʸj] 'I sew', *ružjo* [žʸj] 'gun' and *Zürich* [tsʸj] (Jones 1923).

5 Conclusion

OT, with its assumption that constraints are universal, offers a different perspective on Palatalisation from that available in the standard rule approach. To put it figuratively, it cuts the cake horizontally into several layers rather than vertically into language-specific chunks. Thus, instead of having a general rule of Palatalisation before front vowels and glides, we have a set of constraints: PAL-j, PAL-i and PAL-e.[45] This change of perspective, which is motivated by the fact that not all languages showing Palatalisation show it in all contexts (recall the discussion of Russian *vs.* Ukrainian in §2), has beneficial effects for the understanding of Russian phonology. First, the palatalisation of consonants before the melodic *i*, the fronting of //ɨ// to [i] after palatalised consonants and the retraction of //i// to [ɨ] after hard consonants, which are treated as three separate

[43] A reviewer asks whether *ikanie* and *akanie* have tangible effects at level 2. The answer is affirmative with regard to prepositions when they surface as stressless in prepositional phrases, as in *bez stolá* 'without the table' and *pod stolóm* 'under the table'. Both of these effects can be obtained without postulating an additional derivational step within postlexical phonology. *Akanie* is a general vowel-reduction process that prohibits unreduced vowels in stressless syllables. *Ikanie* is sensitive not only to the absence of stress but also to the presence of a palatalised consonant. Since palatalisation is effected at level 1, *bez* 'without' is /b'ezʸ/ at the input to level 2 (PAL-e). If /b'ezʸ/ is unstressed, *ikanie* enforces reduction: [b'izʸ]. (There are no examples of prepositions with the phonologically soft stridents *ts š ž* that would have to 'wait' for postlexical *ikanie* before they could harden.) Let us add that *ikanie* does not operate across word boundaries, which means that IDENT-$V_{[+back]}$ is high-ranking. This observation fits well with the generalisation that level 2 is the domain of Retraction and not of Palatalisation. Thus, front vowels, specifically /i/, are affected (Retraction) while back vowels remain intact, even when they occur after a palatalised consonant, as does the word-initial vowel of *Olega* in *mat' Olega* 'Oleg's mother'.

[44] HARD-C itself is also violable; see note 33.

[45] In answer to a reviewer's question, let me clarify that I view these constraints as progressively broader generalisations. That is, while the palatalisation effects of PAL-j hold only for the context of *j*, the palatalisation effects of PAL-i hold for the context of both *i* and *j*. Similarly, PAL-e includes not only the context of *e* but also the context of *i* and *j*. Finally, PAL-æ, which is not operative in Russian because Russian has no [æ], refers to all vocalic segments and thus includes *æ*, *e*, *i* and *j*. This understanding of palatalisation constraints is similar to the *SPE* (Chomsky & Halle 1968) concept of rule generalisation. It is in keeping with the ways in which constraints are stated in OT, where one generic constraint may have several specific expansions. Whether this view of the relationships that hold between Palatalisation constraints is correct a matter for future research.

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generalisations in classical generative phonology, are now seen as surface effects of a single constraint: PAL-i. Second, the distinction between PAL-i and PAL-e highlights the fact that all exceptions to Palatalisation involving consonants are instances of *e* as a trigger. This generalisation does not come to light in the classical generative treatment of Palatalisation, which states the environment as [−consonantal, −back], and thus obscures the distinction between *i* and *e* as separate triggers.

With regard to OT itself, this paper shows that the principle of parallel evaluation is incorrect (Idsardi 1997). We conclude that OT must be modified to permit a derivational step: level 1, which is a word level, and level 2, which is postlexical and hence unrestricted in terms of morphological domains. The distinction of these two levels is new to OT but not to phonological theory in general. The latter has exploited this and similar distinctions with good results ever since it became a field of scientific inquiry.

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