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Russian Consonant-Vowel Interactions and Derivational Opacity¹

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1. Background: derivational opacity

In Russian, [e] sometimes alternates with [o] (see for example Townsend 1968; Hart 1996). Compare the forms in (1)a-b.²

(1)	a.	p ^h et ^h	‘to bake’	b.	p ^h ok	‘he baked’
		jel ^h	‘fir tree’		jolka	‘New Year tree’
		s ^h el ^h sk ^h ij	‘rural’		s ^h ola	‘villages’

In rule-based terms, these alternations motivate the generalization /e/ → [o] / __ C^v: “/e/ is backed to [o] before a velarized (non-palatalized) consonant”. However, sometimes [e] does *not* appear where expected according to this rule:

(2)	sn ^h eg	‘snow’	*sn ^h og
	d ^h elo	‘business’	*d ^h olo
	m ^h esto	‘place’	*m ^h osto

It is no mystery from an historical viewpoint why the words in (2) behave differently. The vowel [e] in those words was once different from that in words like p^het^h. This vowel, which Historical Slavists transcribe

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² Transcriptions throughout ignore some irrelevant detail such as vowel reduction.

as “ě” (in Cyrillic, “Ѣ”), was likely either between [e] and [i] in quality or else a sort of diphthong, perhaps [ie].³

This historical fact suggests a neat derivational account of the synchronic Russian facts, one pursued for example by Lightner (1969) and Matushansky (2002). As shown in (3), we might posit the phoneme /ě/ distinct from /e/. Only /e/ is subject to the backing rule seen above. A later rule neutralizes /ě/ to [e]. These derivations also assume that palatalization is derived in all of the forms by an early rule.

(3)

	/seʲskʲij/	/sela/	/dělo/
C → Cʲ / __ [V,-bk]	sʲeʲskʲij	sʲela	dʲělo
e → o / __ Cʲ	--	sʲola	--
ě → e	--	--	dʲelo
	[sʲeʲskʲij]	[sʲola]	[dʲelo]

The derivations in (3) are derivationally opaque, in two ways. First, the /e/-backing rule counterbleeds the first rule of palatalization. Second, the /ě/ → [e] rule counterfeeds /e/-backing.

Before proceeding let us clarify what counts in this discussion as “derivational opacity”. I exclude as “opaque” cases in which one can reasonably attribute exceptional properties of a form to related *surface* forms. A well known source of output-to-output effects like this is paradigm uniformity, illustrated in (4) with forms of the verb ‘go’. In verbs of this class, the second-plural form shows overapplication of the /e/-backing rule, since the following consonant is palatalized. This can be understood as forced by conformity with other members of the paradigm.⁴

³ Another source of eCʲ is borrowings, including Old Church Slavonic forms that were not subject to e-backing. Compare the cognate forms [nʲoba] ‘roof of the mouth’ (historically native) and [nʲebo] ‘sky, heaven’ (Old Church Slavonic).

⁴ Since the second-plural vowel in question never alternates with [e] in contemporary Russian, it is likely reanalyzed as /o/ today. I treat it as /e/ underlyingly, as it was historically, only for the sake of the point. The same holds for the example [pʲosʲik] below.

(4)	Sg.	Pl.	
	1 st	idu	id ^h om
	2 nd	id ^h oʃ	id ^h o ^h t ^h e *id ^h e ^h t ^h e
	3 rd	id ^h ot	idut

Another well known source of output-to-output effects are the “cyclic” relationships between base forms like [p^hos] ‘dog’ and forms morphologically derived from them like [p^hos^hik] ‘dog (dim.)’. In the latter form /e/-backing has once again overapplied, and this might be attributed to the influence of the base form, an “output-output” faithfulness effect (Benua 1997).⁵

In contrast to these cases where apparent opacity might be attributed to other surface forms, by ‘opaque’ I mean phenomena that seem to require reference to *abstract intermediate* representations. The forms boxed in (3) are both derivationally intermediate, and abstract in the sense of having no existence as output forms. Forms like [d^helo] ‘business’ (*d^holo), which disrespect /e/-backing, cannot be rescued by reference to any related surface form.

Some phonological frameworks have denied derivational opacity. These include the theory of Natural Generative Phonology (Hooper [Bybee] 1976), Declarative Phonology (Scobbie 1991; Coleman 1996), and what we might call “classic” Optimality Theory (Prince & Smolensky 1993 [2004]). In contrast, rule-based approaches in the tradition of SPE (Chomsky & Halle 1968) embrace derivational opacity. And despite the fundamentally parallelist thrust of Optimality Theory (OT), that theory has seen a host of proposals to account for opacity. These include Stratal OT (Kiparsky 1998; 2000; Itô & Mester 2001), Sympathy (McCarthy 1999), OT-CC (McCarthy 2008), and Targeted Constraints (Wilson 2001), among others.

⁵ A third potential kind of “influential surface form”, not often enough considered, is the variant pronunciation (Kawahara 2002).

Indeed, today few within OT seem to question the validity of opacity (but see, e.g., Mielke et al. 2003; Sanders 2003; Green 2004), probably because of the apparently overwhelming evidence for it. As Vaux (2008) puts it, “Opaque interactions between phonological processes occur in all known natural languages”. It is true that facts that linguists can *describe* with derivational opacity are widespread (though I haven’t checked all known languages). But apparent cases of opacity can often, perhaps always, be explained *without* positing opacity. Doing so in some cases might come at a cost that is unacceptable to some. But as arguments are made on one side of the debate or the other based on theory-internal criteria or elegance, the central question that ought to be asked – Is derivational opacity psychologically real? – continues to be little asked, because we are unfortunately in a poor position to answer it.

This article is likewise in no position to answer it. But its goal is to ask what the cost is of denying derivational opacity, and to answer the question concretely for a few apparent cases of opacity in Russian: i) the [e]~[o] alternation, ii) the famous behavior of [v] w.r.t. voicing, and iii) so-called “backness switch” (Rubach 2000). A general strategy here will be to see to what extent alleged opacity can be eliminated by calling on aspects of the grammar that are *independently necessary*. Those aspects of the grammar include at least phonetics, morphology, and the lexicon.

As background for the discussion, (5) presents the consonantal phonemes of Russian. All consonants are either “soft” (palatalized) or “hard” (velarized); within either of these categories, the degree of softness or hardness depends on the phonetic context. Velarization will be shown below only when relevant. The vowels assumed are /i,e,a,o,u/.

(5)	p ^y	p ^j	t ^y	t ^j		k ^y	k ^j	
	b ^y	b ^j	d ^y	d ^j		g ^y	g ^j	
	f ^y	f ^j	s ^y	s ^j	ʂ ^y	ʃ ^j :	x ^y	x ^j
	v ^y	v ^j	z ^y	z ^j	z _l ^y			
			ts ^y			tʃ ^j		
	m ^y	m ^j	n ^y	n ^j				
			l ^y	l ^j				
			r ^y	r ^j	j			

2. Phonetically informed phonology: Russian [v]

Some instances of apparent opacity can be avoided, with significant explanatory gain, by incorporating more or better phonetic notions into phonological theory. Here I briefly review a case involving voicing assimilation and Russian [v]. For details of the argument see (Padgett 2002).

Though Russian has a very general process of voicing assimilation among obstruents, the phoneme [v] behaves oddly. On the one hand it fails to trigger voicing assimilation – like a sonorant. As (6) shows, obstruents actually contrast in voicing before [v].

- (6)
- | | | | | |
|----|--------------------------------------|------------------|---------------------------------------|--------------------|
| a. | tv ^j er ^j | 'Tver' | dv ^j er ^j | 'door' |
| | sv ^j erx | 'above' | zv ^j er ^j | 'wild animal' |
| b. | ot-v ^j est ^j i | 'to lead away' | pod-v ^j est ^j i | 'to lead up' |
| c. | ot vas | 'from you (pl.)' | pod vam ^j i | 'under you (pl.)' |
| | s vam ^j i | 'with you (pl.)' | iz vas | 'out of you (pl.)' |

But as (7)a-b shows, [v] does undergo assimilation – like an obstruent.

- (7)
- | | | | | |
|----|------------------------------------|---------------------|---------|--------------|
| a. | korovok | 'cow (dim.gen.pl.)' | korofka | 'cow (dim.)' |
| | lavok | 'bench (gen.pl.)' | lafka | 'bench' |
| b. | v r ^j ek ^j e | 'in the river' | | |
| | v gorod ^j e | 'in the city' | | |
| | f sup ^j e | 'in the soup' | | |

[v] also devoices word-finally, like an obstruent:

- (8)
- | | | | |
|-----------------------------------|----------------|----------------------------------|---------|
| prava | 'right (fem.)' | praf | (masc.) |
| l ^h ubv ^j i | 'love (gen.)' | l ^h ubof ^h | (nom.) |
| krov ^j i | 'blood (gen.)' | krof ^h | (nom.) |

In a well known derivational account for the behavior of [v] (Hayes 1984; Kiparsky 1985, and many others), [v] is underlyingly [w]. Like any sonorant it fails to trigger assimilation, though it crucially undergoes. A late rule obstruentizes /w/. As Padgett (2002) shows, if this is opacity then it is true opacity, untreatable by reference to other surface forms or even by reference to levels in the sense of Kiparsky (1985; 2000).

(9)	/tw ^j er ^j /	/praw/	/pod w ^s em ^j i/
Final devoicing	tw ^j er ^h	praw	—
Voice assimilation	—	—	pot w ^s em ^j i
w-strengthening	tw ^j er ^j	praf	pot fs ^j em ^j i
Sonorant revoicing	tv ^j er ^j	—	—
	[tw ^j er ^j]	[praf]	[pot fs ^j em ^j i]
	'Tver'	'right'	'underneath everyone'

The alternative advocated in Padgett (2002) is to acknowledge that [v] has, *on the surface*, properties of both obstruents and sonorants. In particular, the phonetic properties of [v] motivate its characterization as a 'narrow approximant' [ɹ], understood as [+sonorant, -wide], where [-wide] segments are stops, nasals, fricatives, and narrow approximants including [ɹ], and [+wide] segments are liquids, glides, and vowels. It is not obstruents but [-wide, -nasal] segments, including [ɹ], that are subject to devoicing and voicing assimilation. However, like other sonorants [ɹ] constitutes an environment before which voicing contrasts are perceptually salient; in other words, it does not "trigger" assimilation. For aerodynamic reasons dubbed "Catford's generalization", a devoiced [ɹ] is equivalent to [f].

These phonetic properties motivating the characterization of [ɹ] as a narrow approximant are (obviously) *surface* properties. Incorporating the extra detail into phonology (in the form of the novel feature [wide])

allows us to give a surface account of the behavior of [ʊ]. As Padgett (2002) argues, the surface account is actually superior to the opaque account in explanatory power.

3. The lexicon: e ~ o

It is uncontroversial that phonological generalizations die, but can leave relics in the lexicon. Sanders (2003) provides a formal mechanism by which this can happen, within OT: *strong lexicon optimization*. We explore here how this works by applying it to Russian /e/-backing.

Let us begin by illustrating the workings of lexicon optimization (Prince & Smolensky 1993 [2004]). We recast the /e/-backing rule as a constraint *eCʸ, “[e] cannot be followed by a [+back] consonant”. This constraint interacts with Ident(bk), which requires that corresponding input-output segments agree in [back]. Assuming that this faithfulness constraint is outranked by *eCʸ, we predict output [o] as in (10), whether we assume that /e/ is underlying or /o/ is underlying.

(10) jolka ‘fir/New Year tree’

	/jel + ka/	*eCʸ	Ident(bk)
a.	jelka	*!	
b.	☞ jolka		*

	/jol + ka/	*eCʸ	Ident(bk)
a.	jelka	*!	*
b.	☞ jolka		

As the ‘tableau des tableaux’ (Itô et al. 1995) in (11) shows, input /o/ provides the more harmonic derivation. According to lexicon optimization, the underlying representation /jol-ka/ is chosen.

(11) ‘Tableau des tableaux’

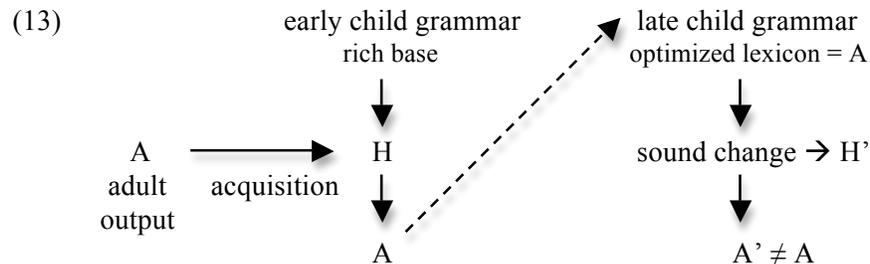
			*eCʸ	Ident(bk)
a.	☞ /jolka/	jolka		
b.	/jelka/	jolka		*!

What happens when there are alternations, however, as in (1)? Tableau (12) shows the derivation of *jelʲ* ‘fir’, related to *jolka* above. Because it ends in a palatalized consonant, the constraint **eCʲ* is vacuously satisfied and the faithful output is chosen. Lexicon optimization, focusing only on this form, would obviously choose /*jelʲ*/ as underlying. We have a seeming conflict: is it /*jol-*/ or /*jelʲ*/? Prince and Smolensky assume that lexicon optimization is overridden by a requirement that there be only one underlying form for a morpheme. Presumably that form should be /*jelʲ-*/ for the case at hand, since *jol-* can be derived by /*e*-backing.

(12) *jelʲ* ‘fir’

	/ <i>jelʲ</i> /	<i>*eCʲ</i>	Ident(bk)
a.	<i>jelʲ</i>		
b.	<i>jolʲ</i>		*!

But suppose it isn’t true that there must be one underlying form of a morpheme? Sanders (2003) makes two assumptions in particular. First, lexicon optimization is *strong*, meaning that we store alternants of a morpheme independently. Second, sound change can follow lexicon optimization. To understand the latter idea, consider the diagram in (13). Sanders makes a distinction between an “early” and a “late” child grammar. In the early grammar the learner employs a rich base: any form is a legitimate input (see Prince and Smolensky 1993 [2004]). The learner forms her grammar H, a ranking of constraints, based on the forms encountered through adult outputs A. The goal is to mimic A.



In the late grammar, the learner has optimized inputs by lexicon optimization, indicated by the dashed line in the diagram. Sanders assumes that sound change – a change in the learner’s grammar from H to H’ – can occur after this point. This will alter some of the forms in A, resulting in a new set of outputs A’ which is not identical to the adult forms encountered.

To see how this works, and what consequences it has if lexicon optimization is strong, consider again the forms *jelʲ* and *jolka*. Let us begin with the stage in Russian history before /ě/ neutralized to [e]. The tableau in (14) shows derivations of both forms, assuming the input has /e/ in both cases (as it indeed did historically). The /e/-backing process applies, ensured by the ranking $*eC^y \gg \text{Ident}(\text{bk})$. Since there is no merger of /ě/ to [e] (see the following tableau), we also assume the ranking $\text{Ident}(\text{hi}) \gg *ě$. In this *early* child grammar, /jelʲ + ka/ surfaces as [jolka] due to /e/-backing. (I assume that /lʲ/ is depalatalized for reasons not shown.) The form /jelʲ/ surfaces unchanged. Lexicon optimization chooses the outputs [jolka] and [jelʲ] as inputs respectively.

(14) *Early grammar + Strong Lexicon Optimization*

	/jelʲ + ka/	*eC ^y	Id(hi)	Id(bk)	*ě		By SLO:
a.	jelka	*!				→	/jol-ka/
b.	jolka			*			
c.	jělka		*!		*		
	/jelʲ/	*eC ^y	Id(hi)	Id(bk)	*ě		By SLO:
a.	jelʲ					→	/jelʲ/
b.	jolʲ			*!			
c.	jěl		*!		*		

But this is *strong* lexicon optimization: alternants of a form are stored independently. This assumption that alternants of a morpheme are independently stored, even for predictable alternations like this, is obviously a departure from the standard assumption in generative phonology. Notice that strong lexicon optimization does *not* mean that /e/-backing is not active. Given the ranking $*eC^V \gg \text{Ident}(bk)$, it *is* active. This means, for example, that borrowed or new words will undergo the process. Even so, predictably altered forms are stored by strong lexicon optimization.

Now consider a hypothetical input /jěł+ka/. It vacuously satisfies $*eC^V$, and since $\text{Ident}(hi)$ outranks $*ě$ (at this point in Russian history), it surfaces faithfully. By strong lexicon optimization it is stored as /jěł+ka/:

(15) *Early grammar + Strong Lexicon Optimization*

	/jěł + ka/	$*eC^V$	$\text{Id}(hi)$	$\text{Id}(bk)$	$*ě$	By SLO: /jěł-ka/
a.	jelka	*!	*!			
b.	jolka		*!	*		
c.	jělka				*	

Contrast this early child grammar with a *late* child grammar in which sound changes have occurred: /e/-backing is no longer active ($\text{Ident}(bk) \gg *eC^V$), and /ě/ now merges to [e] ($*ě \gg \text{Ident}(hi)$). Crucially, the forms entertained as inputs are now only those stored by strong lexicon optimization in the early grammar. In the case of hypothetical /jěł+ka/, the vowel has now lowered to [e], as shown in (16). By reapplication of strong lexicon optimization, the form /jel-ka/ is now stored as the input.

(16) *Late grammar with lexically optimized /jěł+ka/*

	/jěł + ka/	$*ě$	$\text{Id}(bk)$	$*eC^V$	$\text{Id}(hi)$	By SLO: /jel-ka/
a.	jelka			*	*	
b.	jolka		*!		*	
c.	jělka	*!				

The previously stored /jelʲ/ and /jolka/ have rather pedestrian derivations at this point:

(17) *Late grammar with lexically optimized /jelʲ/ ~ /jolka/*

	/jol + ka/	*ě	Id(bk)	*eCʸ	Id(hi)		By SLO:
a.	jelka		*!	*		→	/jol-ka/
b.	jolka						
c.	jělka	*!	*!		*		
	/jelʲ/	*ě	Id(bk)	*eCʸ	Id(hi)		By SLO:
a.	jelʲ					→	/jelʲ/
b.	jolʲ		*!				
c.	jěl	*!			*		

However, strong lexicon optimization has had a profound effect on the look of the language. To see this, consider what things would have been like had [jolka] still been /jelka/ underlyingly – the form expected if predictable alternates are stored with the same underlying representation. As (18) shows, the new grammar would have chosen [jelka] as the surface form, instead of attested [jolka].

(18)

	/jel + ka/	*ě	Id(bk)	*eCʸ	Id(hi)		By SLO:
a.	jelka			*		→	/jel-ka/
b.	jolka		*!				
c.	jělka	*!			*		

In this world, there would be no vowel alternation in [jelʲ] vs. [jelka]. The other, hypothetical, form [jelka] (< /jěl-ka/) would be

indistinguishable in behavior from this form, and there would be no question of derivational opacity.

What the account with strong lexicon optimization derives is different: there is a vowel alternation in [je^{l̥}] vs. [jolka], and this distinguishes forms like this from those having [ě] historically. But this is true *even though /e/-backing is no longer active* (Ident(bk) >> *eC^Y). The alternation survives, but only because the alternant forms are independently stored in the lexicon. The upshot of this account is that the alternations seen in (1), between forms like p^{l̥}et^{l̥} ~ p^{l̥}ok, je^{l̥} ~ jolka, and s^{l̥}el^{l̥}sk^{l̥}ij ~ s^{l̥}ola, involve *suppletion*.

This strong lexicon optimization account relies on a stage of learning (the early grammar) in which suppletive allomorphs are stored (e.g., /je^{l̥}/, /jolka/), but the generalization that relates them (/e/ → [o] / __ C^Y) is living. Isn't this inconsistent? The answer is 'no'. The idea that we list forms that are predictable by rule is a commonplace in morphology, for example. Still, the idea that suppletion is involved in predictable alternations, not just in e.g., *go/went*, is difficult for generative phonologists to contemplate (but compare the account of semi-predictable alternations in Hooper [Bybee] 1976). The question should be approached as an empirical one. Current psycholinguistic evidence suggests that, at least at the surface, we store a great many *exemplars* of a particular form (Goldinger 1996; Johnson 1997, and much following work.). This says nothing directly about underlying forms. But it does undermine any general presumption that lexical minimization is sacrosanct.

To conclude this section, note that the very different accounts of Russian [v] and [e]~[o] make the right *different* predictions about their respective behaviors. On the one hand, the explanation for the 'opacity' of Russian [v] is *phonetic*, the behavior is *exceptionless*, and it *generalizes to borrowings*. On the other, the explanation for [e]~[o] is *lexical*, the "generalization" admits of a great many exceptions (see (2)), and it does *not* generalize to borrowings. For explanations calling on derivational opacity, these distinct properties require *separate stipulation*.

4. Morphology: “backness switch”

Descriptions of Russian often note palatalization before front vowels, as in (19).

(19)	Dim.	Loc.	Gloss	
	stol	sto ^l ik	sto ^l e	‘table’
	dom	dom ^l ik	dom ^l e	‘house’
	šar	šar ^l ik	šar ^l e	‘ball’
	zont	zont ^l ik	zont ^l e	‘umbrella’

However, we also find “retraction” of /i/, a change to something we transcribe as /i̯/ for the time being, after hard consonants:

(20)		Plural /-i/	
	stol	stoli̯	‘table’
	šar	šari̯	‘ball’
	zont	zonti̯	‘umbrella’

Taken together these facts present a puzzle. The combination of hard consonant plus /i/ surfaces either as [C^ji] *or* as [Ci̯]. What’s going on? Given the facts so far, we might decide that Russian has distinct vowel phonemes /i/ and /i̯/. The plural is simply /-i̯/, there is no retraction, and naturally only front vowels cause palatalization.

Whatever we think about the plural as /-i̯/, retraction is real. We find it applying not only within words but across them as well, as in (21)a. Retraction does not apply when the consonant in question is palatalized, (21)b. (This holds for the plural as well, see (28) below.) Retraction also occurs after prepositions and prefixes, (22). In cases such as (21)- (22), the vowel in question is uncontroversially /i/: as we will see below, [i] and [i̯] are in complementary distribution, and [i] is clearly “elsewhere” in distribution.

- (21) a. /brat ivana/ → brat ivana 'Ivan's brother'
 b. /zʲatʲ ivana/ → zʲatʲ ivana 'Ivan's son-in-law'
- (22) /v italʲiju/ → v italʲiju 'to Italy'
 cf. italʲija 'Italy'
 /ot + igratʲ/ → otigratʲ 'to win back'
 cf. igratʲ 'to play'

This is yet another problem of Russian phonology (among many) that can be approached as a case of derivational opacity. Working within a stratal- or levels-based approach to OT, Rubach (2000) gives such an analysis. Though we will focus on Rubach's analysis here, two other stratal OT approaches to these facts are Blumenfeld (2003) and Gribanova (2006, 2009), and rule-based approaches, also opaque, are offered by Halle and Matushanky (2002), and Matushansky (2002).⁶

To begin with, Rubach's analysis makes use of the two constraints shown in (23), as well as markedness constraints against [i] and [ɨ]. The first constraint in (23) ensures that a consonant is palatalized before [i] and velarized before [ɨ] or [u].

- (23) Pal-i: A consonant and a following high vowel agree in backness
- ID-C_[+bk]: Input [+back] on consonants must be preserved as output [+back] on consonants

The analysis works as shown in (24), for a stem ending in a hard (non-palatalized) consonant and a suffix beginning with /i/. Since the velarization (= [+back] specification) of non-palatalized consonants now matters, it is shown. The undominated ranking of Pal-i rules out

⁶ Iosad and Morén-Duolljá (2009) is a recent discussion sharing our main conclusions that 1) the facts treated in this section do not require opacity, and 2) Russian has little or no purely phonological palatalization.

candidates (b-c), where the CV sequence disagrees in backness. Of the remaining two candidates, (d) is optimal because of the preference for [i] over [ɨ]. So given a hard consonant and an incompatible /i/-initial suffix, the latter wins.

(24)

	stol ^v + ik	Pal-i	*ɨ	*i	ID-C _[+bk]
a.	stol ^v ik		*!		
b.	stol ^v ik	*!		*	
c.	stol ^ɨ ik	*!	*!		*
d.	stol ⁱ k			*	*

It is clear that if the plural were /-i/, then we would derive the same result for plurals rather than the retraction seen in (20). Rubach therefore assumes that the plural is /-i/. He also includes the following undominated constraint:

(25) ID-V_[+back]: Input [+back] on vowels must be preserved as output [+back] on vowels

With these elements in place, the plural is accounted for, as shown in (26).⁷ Though markedness prefers [i] over [ɨ], as seen above, the higher ranking of ID-V_[+bk] protects *input* /i/. Candidate (a) wins because the consonant and vowel agree in [back] also.

⁷ Rubach's tableau for this case leaves *ɨ among the undominated constraints, but for the analysis to work it must be subordinated as shown.

(26)

	stol ^v + i	ID-V _[+bk]	Pal-i	*i	*i	ID-C _[+bk]
a.	stol ^v i			*		
b.	stol ^v i	*!	*!		*	
c.	stol ^j i		*!	*		*
d.	stol ^j i	*!			*	*

When a stem ends in a palatalized consonant, the plural is [i], as in /gvozd^j + i/ → [gvozd^ji] ‘nails’. The ranking above would predict *[gvozd^vi], because of the high ranking of ID-V_[+bk]. Rubach introduces another constraint protecting input palatalization:

(27) ID-C_[-bk]: Input [-back] on consonants must be preserved as output [-back] on consonants

With this constraint undominated, the correct form is derived, as (28) shows.⁸ The input /gvozd^j + i/ will also lead to output (d).

(28)

	gvozd ^j + i	ID-C _[-bk]	Pal-i	ID-V _[+bk]	*i	*i	ID-C _[+bk]
a.	gvozd ^v i	*!			*		
b.	gvozd ^v i	*!	*!	*		*	
c.	gvozd ^j i		*!		*		
d.	gvozd ^j i			*		*	

Rubach’s analysis can be summed up as follows. First, all optimal forms satisfy Pal-i. The other top priority is to protect input C^j; when this is not an issue, protect the input [+back] of V; when neither of these is an

⁸ Rubach’s tableau for this case leaves ID-V_[+bk] among the undominated constraints, but for the analysis to work it must be subordinated as shown.

issue, prefer [i]. The analysis requires that we distinguish /i/ and /i/ as phonemes, and the plural is /-i/.

Recall the retraction of /i/ we find between words, including after prepositions and prefixes (see (21)-(22)). The account seen so far won't work for these data, as (29) shows. (Undominated Pal-i is now assumed and not shown.) The problem is that the two high-ranking faithfulness constraints protect only palatalized consonants and back vowels; but these inputs have neither.

(29)

	brat ^v ivana	ID-C _[-bk]	ID-V _[+bk]	*i	*i	ID-C _[+bk]
a. ☹	brat ^v ivana			*!		
b. ☹	brat ^ɟ ivana				*	*!

Rubach argues that the account seen up to now is just the first stratum of a two-stratum derivation. The cases involving assimilation across words, or from preposition/prefix to word/stem (resp.), are handled at the second stratum. Rubach suggests that the two strata are lexical and postlexical ones. What's different at the second stratum is that formerly low-ranking ID-C_[+bk] now outranks *i. At this later level, it matters more to protect input velarization:

(30)

	brat ^v ivana	ID-C _[-bk]	ID-V _[+bk]	ID-C _[+bk]	*i	*i
a. ☹	brat ^v ivana				*	
b.	brat ^ɟ ivana			*!		*

This new ranking works for input stem-final C^ɟ too:

(31)

	$z^j at^j ivana$	ID-C _[-bk]	ID-V _[+bk]	ID-C _[+bk]	*i	*i
a.	$z^j at^y ivana$	*!			*	
b.	$z^j at^j ivana$					*

Rubach sees a potential problem for his account: prefixes and prepositions can trigger retraction (see (22)). But they can themselves *undergo* palatalization. An example of the latter is the prefix/preposition *pri-*, as in [$pr^j i obam^j e$] ‘under Obama’, where we see palatalization of the [r] before [i]. If prefixes and prepositions are introduced at the level where retraction happens, why don’t we get $*[pr^y i obam^j e]$? Alternatively, if they are introduced at Stratum 1, why do we get $[ot^y i grat^j]$ instead of $*[ot^j i grat^j]$ (see (22))?⁹

Rubach assumes that prefixes and prepositions are present in both strata. At Stratum 1, $/pr^y i-/$ undergoes palatalization, as shown in (32).

(32) Stratum 1

	$pr^y i obam^j e$	ID-C _[-bk]	ID-V _[+bk]	*i	*i	ID-C _[+bk]
a.	$pr^y i obam^j e$			*!*		
b.	$pr^j i obam^j e$				**	*

To *prevent* palatalization of prefix/preposition-final consonants at Stratum 1, Rubach calls on the famous Russian *jer*. Independent evidence supports the existence of the abstract *jer* vowel at the end of certain prepositions like *ot* ‘from’ shown here:

⁹ Rubach assumes that the prefix is underlyingly $/pr^y i-/$. If it is $/pr^j i-/$ (or even $/pr^i i-/$), it is not clear there is any problem here.

(33) Stratum 1

	ot ^Y O ivana	ID-C _[-bk]	ID-V _[+bk]	*i	*i	ID-C _[+bk]
a.	ot ^Y O ivana			*!		
b.	ot ^Y O ivana				*	
c.	ot ^j O ivana			*!		*
d.	ot ^j O ivana				*	*!

At Stratum 2 the jer disappears, and the consonant causes retraction as it should:

(34) Stratum 2

	ot ^Y O ivana	ID-C _[-bk]	ID-V _[+bk]	ID-C _[+bk]	*i	*i
a.	ot ^Y ivana				*	
b.	ot ^j ivana			*!		*

There are a number of worries for this overall account of Russian palatalization and retraction.

First, prepositions cannot be included in Stratum 1 (the lexical level), because they are syntactically independent (Padgett 2002; Gribanova 2009). Just as in English, a preposition can precede, and prosodically attach to, words of any class, such as an adjective as in [[ot v^je^li^ko^go]_{Pwd} slona] ‘from great elephant’. In other words, its position is determined by the syntax, not by the lexical morphology. Gribanova (2006; 2009) discusses more problems for Rubach’s level ordering assumptions.

Second, the use of a jer to prevent palatalization in /ot igrat^j/ cannot extend to the prefixes /sv^jerx-/ or /super-/, which demonstrably lack any final jer. But these cause retraction too (Matushansky 2002): /sv^jerx^Y-int^jer^jesnaja/ → [sv^jerx^Y-int^jer^jesnaja] ‘super-interesting’.

Third, at least one Russian suffix causes *depalatalization*. Compare the forms in (35)a to the derived ones in (35)b. If this suffix is introduced in Stratum 1, then such forms should behave like /gvoz^d + i/ →

[gvozdʲi], giving *[gusʲinʲa]. Having said this, this is the only suffix that seems to trigger depalatalization, and it is not productive.

- (35) a. gusʲ ‘goose’ b. gusinʲa ‘female goose’
 sudarʲ ‘sir’ sudarinʲa ‘madam’

A fourth, more serious, drawback of this account is that it gives entirely disjoint explanations for occurrences of [ɨ] within vs. across words. Within words, in cases such as /stol + i/ → [stoli] ‘tables, the explanation is that the plural is underlying /-i/ to begin with. The same needs to be said for other suffixes that behave as the plural does (see (39) below). Across words, as in /brat ivana/ → [brat ivana] ‘Ivan’s brother’, the explanation is that we have active retraction of /i/ to [ɨ].

Fifth, Rubach’s account for lexical [ɨ] requires positing both /i/ and /ɨ/ as phonemes. As is well known, though, they are in complementary distribution. The sound [ɨ] occurs after velarized consonants, as in [bʲɨtʲ] ‘to be’ and [vʲ ɨtaʲɨju] ‘to Italy’; it is [i] elsewhere: after palatalized consonants, as in [bʲitʲ] ‘to beat’, phrase-initially, as in [ivan] ‘Ivan’, and after vowels, as in [pro-igratʲ] ‘to lose’. Because of this perfect complementarity, the ‘Moscow school’ of Russian phonology traditionally holds that [ɨ] is an allophone of /i/. The famously opposed ‘Leningrad school’ insists that /ɨ/ is a phoneme distinct from /i/. Perhaps without doing justice to the discussion, one might sum up the Leningrad argument like this: /ɨ/ just “feels like” a phoneme. This argument has more going for it than it seems to, as we will see.

Excursus: against “ɨ”

In previous work (Padgett 2001), I have argued that not only does Russian lack the phoneme /ɨ/, it lacks the *phone* [ɨ]. In fact, “ɨ” is nothing

before /e/; instead consonants are always palatalized. But there are compelling reasons to accept [C^ye] as a part of core Russian phonology, as Blumenfeld (2003) does. First, though it does not occur inside words natively, it does occur “natively” in phrasal contexts, e.g., [k^y etomu] ‘to that’. Notice the perfect parallel to “retraction” of /i/ in the same context. It is not retraction of a vowel in either case, it is simply velarization of the consonant before front vowels. Second, [C^ye] occurs in native Russian abbreviations like НЭП (NEP) [n^yep] (for ‘New Economic Policy’). It also occurs in the names of most Russian letters: [a, b^ye, v^ye, g^ye...] for “а, б, в, г...”. Third, there are many borrowed but everyday words having the sequence, e.g., [kaf^ye], [t^yennis], [b^yeta], etc. Finally, Russians frequently pronounce non-native [Ce], as in English “basically”, as [C^ye]. Why should this be if [C^ye] is not part of Russian core phonology?

Acknowledging the fully-integrated reality of [C^ye] in Russian phonology, in combination with what has been said about “ɨ”, leads to a surprising conclusion. The palatalization vs. velarization contrast exists before *all* vowels (contrary to what is often claimed):

(38) C^ji C^yi (= Cɨ) C^ju C^yu
 C^je C^ye C^jo C^yo
 C^ja C^ya

It is therefore incorrect to say (as people often do) that Russian generally palatalizes consonants before front vowels! This statement is falsified by the everyday occurrence of [C^yi] and [C^ye].¹²

¹² A reviewer asks why, then, Russian frequently palatalizes consonants before [i] in loans, e.g. [b^ji^ly k^liⁿton] for “Bill Clinton”. This occurs not because Russian must palatalize before [i], but because Russian has no choice but to categorize a loan [Ci] as *either* [C^ji] *or* [C^yi], since only these are licit sequences in the language. (I.e., Russian

But then when *do* [i] and [e] cause palatalization? The answer is, in *certain derived environments*. This brings us back to the discussion of Russian “backness switch”.

End excursus on “i”

Let us summarize the environments in Russian where we see “retraction”:

(39) Environments of “retraction”

Across words /bratʲ ivana/ → bratʲ ivana ‘Ivan’s brother’

After preps/prefixes /vʲ italʲiju/ → vʲ italʲiju ‘to Italy’

Some suffixes: Plural	stolʲ-i	‘tables’	cf. stolʲ
Genitive	vʲerʲ-i	‘faith	vʲera
Adj.	vʲerʲ-n-ij	‘faithful’	
gusʲ-inʲa	‘female goose’	cf. gusʲ	‘goose’
malʲ-iʂ	‘small child’	malʲ	‘little’

In our terms, the forms above are actually [bratʲ ivana], [stolʲi], [malʲiʂ], etc. Let us construct an analysis of the “backness switch” facts with this new understanding of Russian phonology. First, I assume the

must palatalize *or* velarize before [i].) Which is chosen is likely to depend on matters like convention or how the loan is perceived by Russians. Loans having [Cʲi] also exist, e.g. [kʲirgʲiz] ‘Kirghiz’; the source (a Turkic language) has a high back unrounded vowel without palatalization. And velarization before [e] in loans is frequent; it seems likely this is because, while (loan) [Ci] is perceptually very similar to (native) [Cʲi], (loan) [Ce] is not so similar to (native) [Cʲe]. This difference by vowel is informally depicted in (37); this loan fact might mean that [Ce] should lie even closer to [Cʲe] than that diagram suggests.

constraints shown in (40). The constraint Pal is the same as Rubach's, with the name simplified. The faithfulness constraint itself is simplified compared to Rubach: ID-C_[bk] is bidirectional (I-O and O-I) and applies to either feature value.

(40) Pal A consonant and a following high vowel agree in backness

ID-C_[bk] Corresponding input and output consonants agree in [back]

I assume that high-ranking constraints on contrast, not shown, require a consonant to be either palatalized or velarized on the surface in Russian. I also assume that an undominated *i rules out [i] from Russian entirely, and I do not entertain this vowel. The first, key, fact about Russian is that a consonant's input [back] specification is normally preserved, motivating the ranking of ID-C_[bk] over *C^j and *C^v. Given richness of the base, an input consonant might lack a [back] specification. I treat velarization as the default in such cases, handled by ranking *C^j over *C^v. This latter point is illustrated in (41).

(41)

	brat	ID-C _[bk]	*C ^j	*C ^v
a.	brat ^v	*	*!	
b.	brat ^j	*		*

Consonantal faithfulness also wins out over Pal, as shown in (42)i-iii. This is the “postlexical” environment in which retraction is said to occur after a non-palatalized consonant, though not after a palatalized one. In our terms, nothing interesting is happening here! Consonantal backness is simply maintained (or velarization is inserted by default, (42)ii). As (42)ii shows, *C^j must also outrank Pal. The analysis works the same way for prepositions.

(42)

i.

	brat ^y ivana	ID-C _[bk]	*C ^j	*C ^y	Pal
a. 	brat ^y ivana			*	*
b.	brat ^j ivana	*!	*		

ii.

	brat ivana	ID-C _[bk]	*C ^j	*C ^y	Pal
a. 	brat ^y ivana	*		*	*
b.	brat ^j ivana	*	*!		

iii.

	put ^j ivana	ID-C _[bk]	*C ^j	*C ^y	Pal
a.	put ^y ivana	*!		*	*
b. 	put ^j ivana		*		

Things are the same also within words, in the “retraction” environments, shown below. Unspecified inputs are now omitted for brevity.

(43)

i.

	ot ^y -igrat ^j	ID-C _[bk]	*C ^j	*C ^y	Pal
a. 	ot ^y -igrat ^j			*	*
b.	ot ^j -igrat ^j	*!	*		

ii.

	stol ^y -i	ID-C _[bk]	*C ^j	*C ^y	Pal
a. 	stol ^y -i			*	*
b.	stol ^j -i	*!	*		

iii.

	gvozdʲ-i	ID-C _[bk]	*C ^j	*C ^v	Pal
a.	gvozdʲ-i	*!		*	*
b.	☞ gvozdʲ-i		*		

As foreshadowed in (38), there are simply no general rules of palatalization or retraction (or velarization) in Russian. Hence the simplicity of the account.

What about the real palatalizing environments? These involve only certain – though not a few – suffixes, such as those shown in (44). In other words, palatalization in Russian is exclusively *morphologically governed*.

- (44) /xod-it/ → xodʲit ‘walk (3rd sg.)’ cf. xod ‘motion’
 /pʲos-ik/ → pʲosʲik ‘dog (dim.)’ pʲos ‘dog’
 /ruk-e/ → rukʲe ‘hand (prep.)’ ruk ‘hands (gen.)’

To handle these cases, I assume that suffixes like /-ik/ are associated with a morpheme-specific version of the Pal constraint, Pal_A. The idea of morpheme-specific constraints is independently well motivated in phonology, as argued by Pater (2000; 2009), Ito and Mester (1999), and Fukazawa (1999), among others. (45)i-iii show the effect of this morpheme-specific constraint, assuming it dominates ID-C_[bk].

(45) i.

	stolʲ-ik _A	Pal _A	ID-C _[bk]	*C ^j	*C ^v	Pal
a.	stolʲ-ik	*!			*	*
b.	☞ stolʲ-ik		*	*		

ii.

	stol-ik _A	Pal _A	ID-C _[bk]	*C ^j	*C ^y	Pal
a.	stol ^y -ik	*!	*		*	*
b. 	stol ^j -ik		*	*		

iii.

	gvozd ^j -ik _A	Pal _A	ID-C _[bk]	*C ^j	*C ^y	Pal
a.	gvozd ^y -ik	*!	*		*	*
b. 	gvozd ^j -ik			*		

When we employ morpheme-specific constraints, we must stipulate which affixes belong to the relevant class (here, “A”). This is analogous to the need, with a stratal model, to say which affixes are Stratum 1 or Stratum 2 affixes.

Compared to previous accounts of “backness switch”, including that of Rubach (2000), this account has a number of advantages.

First, it explains the “complementary distribution” of palatalizing vs. non-palatalizing environments. Even in Rubach’s account, palatalization and “retraction” never occur in the same place, in any serial order. This complementarity follows from the account very simply: the phonology always protects a consonant’s input backness, *unless* the vowel belongs to an “A” class (palatalizing) suffix.

Second, it provides a *unified* account of “retraction”. What the plural, and other suffixes (see (39)) have in common with the “postlexical” cases is simply that they all obey the default imperative of Russian phonology, which is to preserve consonantal backness. In our terms, the bifurcation in the account is elsewhere, between all these cases and the cases in which palatalization happens. But this bifurcation is based on a well motivated distinction between general and morpheme-specific constraints.

Third, this account does not require reference to a non-existent [i], not to mention /i/.

Fourth, it encounters no problem with prefixes like /sv^jerx-/, or /super-/. This is because “retraction” does not depend on a final jer.

Finally, the analysis involves no derivational opacity and can be handled by a single, parallel evaluation.

Before concluding, let us consider again the case, involving only an unproductive suffix, of morphologically governed *depalatalization*. Recall the alternation [gus^j] ‘goose’ vs. [gusin^ja] ‘female goose’ (see (35)). In our terms this is /gus^j + in^ja/ → [gus^vin^ja]. One conceivable account of such forms is to appeal to a morpheme-specific constraint against palatalized consonants, *C^j, as shown in (46).

(46)

	gus ^j -in ^j a _B	Pal _A	*C ^j _B	ID-C _[bk]	*C ^j	*C ^v	Pal
a.	gus ^v -in ^j a			*		*	*
b.	gus ^j -in ^j a		*!		*		

There is a problem in such cases, though.¹³ It has been claimed that morpheme-specific constraints apply only “locally”: a triggering morpheme M cannot have phonological effects on a form that are arbitrarily distant from M (see Pater 2009 and references therein). Pater discusses this issue in detail, and proposes that a constraint C_A can apply only when the structural description of C includes some portion of the triggering morpheme of class A. For example, Pal_A rules out *[stol^v-ik] because, not only do the relevant consonant and vowel disagree in backness, but the vowel (contained in the structural description) is part of the exponent of the suffix *-ik* of class A. Things are different in the case of the proposed analysis of [gus^v-in^ja]. The constraint *C^j_B penalizes (46)b due to a palatalized segment, [s^j], belonging exclusively to the stem. What rules out nonexistent long-distance depalatalization in such cases?

One way to solve the problem with [gus^v-in^ja] would be to attribute to morphemes of class B a floating [+back] feature, and to replace *C^j_B with a constraint that forces this feature to link to the stem-final

¹³ I am grateful to Maria Gouskova for bringing this issue to my attention, and for suggesting the floating feature approach discussed below.

consonant (see Lieber 1987 on floating features for morphological mutations; and Wolf 2006 for a recent elaboration of this general idea in OT). Since the floating [+back] feature is part of the exponent of the class B morpheme, this approach would preserve Pater's approach to locality of constraint application. A floating feature approach to Russian palatalization is just what is advocated by Iosad and Morén-Duolljá (2009). As those authors point out, the floating feature idea generalizes to the many other suffixes in Russian, not discussed here, that trigger various sorts of palatalizations and mutations even when they lack a surface front vowel trigger.¹⁴ Alternatively, facts such as these may require a re-thinking of the precise locality requirements of suffixes with special phonology. I leave this as an open question.

5. Conclusion

Given the many facts cited on behalf of derivational opacity, the case for it can seem compelling. But there are always alternatives to opacity worth exploring. In at least some cases, they have better independent motivation. As I have argued here, these alternatives can call on phonetics, the lexicon, and morphology (in the form of morpheme-specific constraints).

Whatever one's views on opacity, Russian is fertile territory for the debate.

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¹⁴ Iosad and Morén-Duolljá go further, even treating the cases of palatalization discussed in this section via floating features.

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