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Opaque Softening: A Usage-Based Approach

While phonological opacity has been subject to intense debate in Optimality Theory (OT, Prince and Smolensky 1993/2004), this problem has not received much attention within cognitive linguistics. In the present article I explore counterbleeding opacity in Russian softening alternations, i.e. cases where a consonant is softened although the environment that conditions softening is not attested on the surface. The contribution of the analysis can be summarized as follows. First, it is argued that the Usage-Based Model of Langacker (1991, 1999; see also Kumashiro 2000) provides a principled account of phonological opacity in terms of what I call second-order schemas. Secondly, it is proposed that the interaction between the schemas can be accommodated in the model; the selection of the correct target of the softening alternations follows from the general cognitive principle of "conceptual overlap" (Langacker 1999). Third, it is pointed out that a usage-based approach is restrictive in that it does not involve any ad hoc devices designed for the sole purpose of accounting for phonological opacity. On the contrary, all the machinery involved has a general cognitive motivation. While this study deals with a single phenomenon in one language, it has implications of general theoretical interest. The proposed analysis suggests that phonological opacity can be reduced to relations between morphological forms—an implication that deserves to be further tested against data from other languages.

The present paper consists of four sections. After a presentation of the softening patterns in section 1, we turn to a discussion of rules versus second-order schemas with regard to opacity in section 2. Section 3 addresses schema interaction, before the contribution of the paper is summarized in section 4.

1. Plain and Transitive Softening

The term "softening" is traditionally applied in Russian linguistics to two sets of alternations that are referred to as "plain" and "transitive softening". While the alternations involve the majority of the consonant system,

I shall restrict myself to lingual (i.e. non-labial) obstruents, which suffice to illustrate the problem under scrutiny in this study. An overview of plain softening is given in (1). Although the focus of this paper is on verbs, the examples involve the nominative and locative cases of nouns, which are more instructive since only a subset of the alternations is found in conjugation. For each alternation I distinguish between a "standard" and a "target", where the latter is the alternant that shows softening. The alternations in (1) are of two types. In (1a) we have alternations between non-palatalized and palatalized segments. The alternation thus involves the addition of a palatal secondary place of articulation. The alternations in (1b) are between velar and palatal consonants, so instead of adding a secondary place of articulation, this type of softening entails a shift of the primary place of articulation.[1]

(1) a. Plain softening: alveolar standards

Standard	Target	Nominative	Locative	Gloss
t	t^j	sv^jet	sv^jet^j-e	'light'
d	d^j	god	god^j-e	'year'
s	s^j	nos	nos^j-e	'nose'
z	z^j	voz	voz^j-e	'cart'
r	r^j	vor	vor^j-e	'thief'
l	l^j	vol	vol^j-e	'ox'
n	n^j	ton	ton^j-e	'tone'

b. Plain softening: velar standards

Standard	Target	Nominative	Locative	Gloss
k	c	sok	soc-e	'juice'
g	ɟ	jug	juɟ-e	'south'
x	ç	dux	duç-e	'spirit'

An overview of transitive softening for lingual obstruents is given in (2). In alternations of this type, the target is a post-alveolar fricative or

[1] In order to avoid irrelevant complications due to e.g. vowel reduction, the examples in this paper are given in phonemic, rather than phonetic transcription. For phonemic transcription, IPA symbols are used. When the sound shape of the examples is not relevant for the argument, I use transliterated orthography (italics).

affricate, which may or may not be palatalized. The overview is somewhat simplified in that certain peripheral patterns of Church Slavic origin are omitted, since they have no bearing on the argument.

(2) Transitive softening:

Standard	Target	Infinitive	1.sg present	Gloss
g	z̨	dvʲiga-tʲ	dvʲiz̨-u	'move'
d	z̨	gloda-tʲ	gloz̨-u	'gnaw'
dʲ	z̨	xoɖʲi-tʲ	xoz̨-u	'walk'
z	z̨	maza-tʲ	maz̨-u	'grease'
zʲ	z̨	vozʲi-tʲ	voz̨-u	'transport'
s	ş	pʲisa-tʲ	pʲiş-u	'write'
sʲ	ş	brosʲi-tʲ	broş-u	'throw'
x	ş	maxa-tʲ	maş-u	'wave'
k	tʃʲ	plaka-tʲ	platʃʲ-u	'weep'
t	tʃʲ	prʲata-tʲ	prʲatʃʲ-u	'hide'
tJ	tʃʲ	krutʲi-tʲ	krutʃʲ-u	'twist'
sk	ʃʲː	iska-tʲ	iʃʲː-u	'seek'
st	ʃʲː	xlʲesta-tʲ	xlʲeʃʲː-u	'whip'
zg	ʒʲː	brizga-tʲ	briʒʲː-u	'sprinkle'

In Russian verbs, softening takes place in the root-final consonant in certain inflected forms so as to define the three types given in Table 1.[2] As can be seen from the table, verbs of type A display softening throughout the present tense and imperative subparadigms. Type B also shows transitive softening, but in a much smaller part of the paradigm. In type C we have plain, not transitive softening, which is attested in yet another part of the paradigm.

[2] In cases where according to the Russian Academy Grammar (Švedova (ed.) 1980) a form is not available in the paradigms of the example verbs, the relevant forms for alternative verbs are given in parentheses in the table.

		A: ‘smear’	B: ‘walk’	C: ‘wait’
Present	1.sg	maz̩-u	xoz̩-u	z̩d-u
	2.sg	maz̩-oṣ	xodʲ-iṣ	z̩dʲ-oṣ
	3.sg	maz̩-ot	xodʲ-it	z̩dʲ-ot
	1.pl	maz̩-om	xodʲ-im	z̩dʲ-om
	2.pl	maz̩-otʲe	xodʲ-itʲe	z̩dʲ-otʲe
	3.pl	maz̩-ut	xodʲ-at	z̩d-ut
	Pass.part.	(kolʲeblʲ-omij)	(vodʲ-imij)	(vʲod-omij)
	Act.part.	maz̩-uʃʲːij	xodʲ-aʃʲːij	z̩d-uʃʲːij
	Gerund	(plʲaṣ̩-a)	xodʲ-a	(vʲodʲ-a)
Imper.	2.sg	maz̩	xodʲ-i	z̩dʲ-i
	2.pl	maz̩-tʲe	xodʲ-itʲe	z̩dʲ-itʲe
Past	M.sg	maza-l	xodʲ-il	z̩da-l
	F.sg	maza-la	xodʲ-ila	z̩da-la
	N.Sg	maza-lo	xodʲ-i-lo	z̩da-lo
	Pl	maza-lʲi	xodʲi-lʲi	z̩da-lʲi
	Pass.part.	maza-n	(rʲaz̩-on)	z̩da-n
	Act.part.	maza-vṣ̩ij	xodʲi-vṣ̩ij	z̩da-vṣ̩ij
	Gerund	maza-v	xodʲi-v/xodʲ-a	z̩da-v
Infinitive		maza-tʲ	xodʲi-tʲ	z̩da-tʲ

Table 1: Transitive (shaded) and plain softening (framed) in Russian conjugation

We can predict which of the three types a verb belongs to on the basis of the shape of the stem. In most cases, the derivational suffix that is added to the root in order to form a verbal stem provides sufficient information, but in some cases additional phonological information is necessary. The relationship between the shape of the stem and the softening pattern is given in (3). In the following, I shall focus on verbs with the derivational suffix /a/. As can be seen from the boldfaced lines in (3), these verbs normally belong to type A, but are in type C if the stem is monosyllabic or the root ends in /r/ or /n/.

(3) Type A:

Derivational suffix /a/	**(*mazat'* 'smear')**
Derivational suffix /o/	(*kolot'* 'chop')
Type B:	
Derivational suffix /i/	(*xodit'* 'walk')
Derivational suffix /e/	(*videt'* 'see')
Type C:	
Derivational suffix /nu/	(*kriknut'* 'cry')
Derivational suffix Ø (no suffix)	(*vesti* 'lead')
Derivational suffix /a/ (monosyll. stems)	**(*ždat'* 'wait')**
Derivational suffix /a/ (root in /r/ or /n/)	**(*stonat'* 'moan')**

2. Opacity: Rules versus Second-order Schemas

While the relationship between derivational suffix and softening may seem straightforward in (3), there is an additional complication: opacity. As a first approximation, consider the verb *mazat'* 'smear' in Table 1. While the derivational suffix /a/ is crucial in order to predict the softening pattern, the suffix does not occur in the forms which display softening. The suffix is attested in the past tense and infinitive, but not in the present tense and imperative, which are the subparadigms with softening. In other words, the question arises as to how softening can be triggered by something that is not there.

This question receives a straightforward answer in serialist frameworks, i.e. frameworks where the phonological output is derived through a series of ordered, procedural rules applying to abstract underlying representations. The simple derivation of the first singular present tense form /mazu̯/ of *mazat'* in (4) is instructive:

(4)

Underlying representation:	maza+u
Softening (z → z̨/ _ a+V)	maz̨a+u
Truncation (V → Ø/ _ +V)	maz̨+u
Output:	maz̨+u

In the 1960s and 1970s several rule-based analyses of softening in Russian were couched in the framework of Chomsky and Halle (1968).

Examples include Halle (1963) and Lightner (1967 and 1972). While the simplified derivation in (4) does not correspond exactly to any of these analyses, it is sufficiently precise to illustrate the problem under scrutiny. I assume an underlying representation containing the root followed by the derivational suffix /a/ and the inflectional ending /u/. I represent the boundary between the stem and the inflectional ending as a + sign. Two rules are required in ordered to produce the correct output from this underlying representation. First, we need a softening rule that replaces the root-final /z/ by /ʐ/. The precise formalization of this rule does not bear on the argument; for present purposes it is sufficient to note that the rule applies before /a/ when it is followed by an inflectional ending beginning in a vowel. After the softening rule has applied, a rule that eliminates hiatus across the boundary between stems and inflectional endings removes the /a/. A rule of this type was first proposed in Jakobson's (1948) seminal analysis of Russian conjugation, and is commonly referred to as "truncation" since it shortens the stem. The interaction of the two rules is an example of counterbleeding opacity. The truncation rule *bleeds* the softening rule in that it removes the vowel suffix that is necessary for softening to apply. It *counter*bleeds softening in that it is ordered after softening and therefore does not prevent softening from applying. The result of this rule interaction is that softening occurs although the derivational suffix that triggers it is not found in the surface form. In this sense the rule interaction is *opaque* (Kiparsky 1973).

As shown in (4), counterbleeding opacity can be handled straightforwardly in serialist models, since one can first apply the rule in the relevant environment, and then have a later rule wipe out the environment. However, it is well known from the literature on Optimality Theory that opacity is a problem for parallelist models, where the output is not created through the application of a series of ordered, procedural rules, but rather evaluated against the various structures in the grammar all at once. While much energy has been invested in order to overcome this problem in Optimality Theory (e.g. Bye 2002, Goldrick 2000, McCarthy 1999, 2003, 2005), it has received little attention in cognitive linguistics. Nevertheless, it is clear that opacity presents a challenge for the Usage-Based Model also, which like OT does not allow for procedural rules applying in sequence. This follows from a fundamental restriction in the model:

(5) Content requirement:
The only structures permitted in the grammar of a language [...] are (1) phonological, semantic or symbolic structures that actually occur in linguistic expressions; (2) schemas for such structures; and (3) categorizing relationships involving the elements in (1) and (2). (Langacker 1987: 53f.)

The content requirement implies that all schemas be schemas over structures actually occurring in utterances. It follows from this that the crucial /a/ suffix cannot be part of a schema for the forms with softening, since it is not attested on the surface in these forms. In this way, the content requirement precludes reference to abstract underlying representations. Moreover, schemas are static representations that cannot be ordered sequentially, so there is no way we can let the /a/ suffix trigger softening and then later delete it. The question therefore arises as to whether and how one can account for the opacity in Russian softening in the Usage-Based Model.

The approach I shall explore in the following involves what I shall refer to as "second-order schemas". To the best of my knowledge this term has not been coined before; however, schemas of this sort have been employed *inter alia* in Nesset (2005) and Tuggy (2005), and I would like to suggest that they facilitate an account of opacity in examples of the type outlined above. The derivational suffix /a/ conditioning softening is not attested in the present tense or imperative forms, and therefore cannot be part of schemas over these forms. However, the derivational suffix does occur in the past tense and the infinitive. It is possible for speakers of Russian to compare past tense forms like *mazal* '(he) smeared' and *pisal* '(he) wrote' with the corresponding present tense forms *mažu* '(I) smear' and *pišu* '(I) write'. Since the past and present tense forms of each verb are similar, but not identical, such a comparison would involve establishing between them a categorization relationship of the type Langacker (1987) refers to as "extension". In the lower portion of Figure 1, I give a schema for the relevant forms of each verb. Each schema is represented as a box. The boxes for the past and present tense forms of each verb are connected by means of extension relations represented as dashed arrows. The arrows have heads at both ends, indicating that comparison can go in both directions. The question as to whether the past or the pre-

sent tense is more basic than the other will not be explored, as it does not bear on the argument. It is possible that speakers form schemas over the extension relations, i.e. that they notice that the same relationships recur in the grammar. I represent this by including the schemas for the past and present as well as the extension relationship connecting them in a box. I will refer to schemas of this type as "second-order" since they consist of two schemas that are connected by an extension relationship.

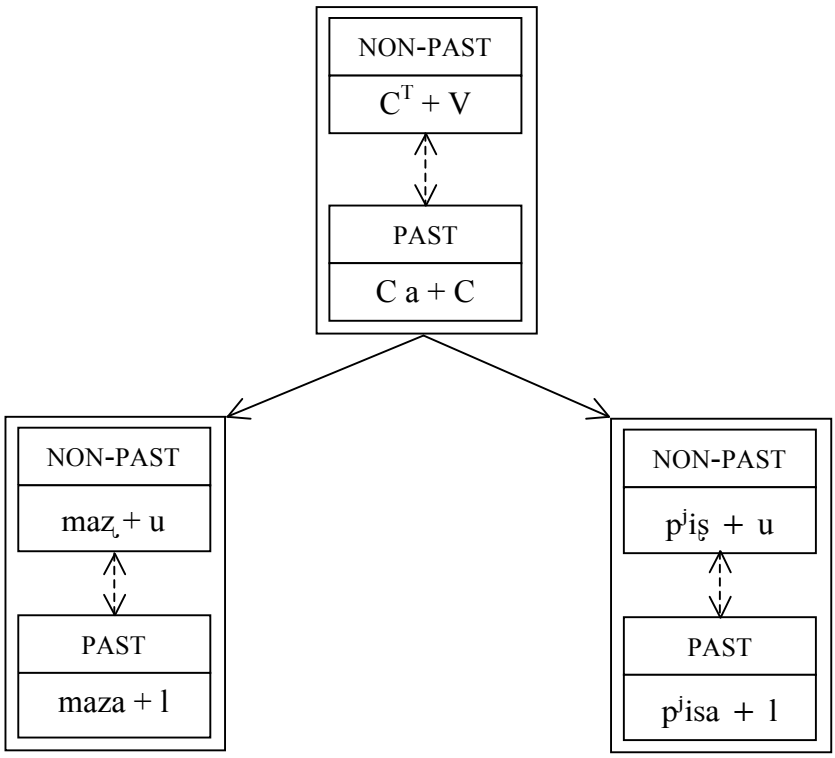

Figure 1: Opacity as second-order schemas

The schemas in the lower portion of Figure 1 are fully compatible with the schema in the top portion and are therefore connected to it by means of categorization relationships of the type Langacker (1987) calls instantiation and represents as solid arrows. For descriptive convenience I use the notation C^T for a consonant that shows transitive softening while a plain C stands for a consonant that does not undergo softening. While the substance behind the symbol C^T is an interesting issue in itself, I shall not

go into detail, as the problem has no bearing on the opacity issue under scrutiny in the present paper. The + sign representing the morphological boundary between the stem and the inflectional ending is followed by a C(onsonant) in the past tense, and a V(owel) in the present tense since past tense endings begin with vowels, while the past tense has consonant initial endings. The label PAST represents all the past tense forms, while NON-PAST is used as a cover term for the present tense and the imperative.

What the topmost schema in Figure 1 tells us is that verbs with the suffix /a/ immediately before the inflectional ending in the past tense have transitive softening in the non-past (i.e. the imperative and the present tense) forms. This is exactly the generalization we want to make; it connects the occurrence of transitive softening to the derivational suffix /a/ and the present tense and imperative subparadigms. Clearly, therefore, the opacity problem of softening in Russian conjugation can be solved in the Usage-Based Model by means of second-order schemas.

It is instructive to compare the usage-based approach to the opacity problem with the rule-based analysis sketched in (4). Recall that the essence of the problem is that the derivational suffix that conditions softening is absent in the forms that actually display softening. The rule-based analysis solves the problem by assuming the suffix to be present in the underlying representation and then deleted after it has triggered softening. The usage-based approach, on the other hand, relates the occurrence of the /a/ suffix to softening by connecting the schemas for the non-past forms, which display softening, to the past tense forms where the /a/ suffix is attested. Notice that the usage-based account is morphological in nature; the schemas involve phonological information combined with properties like “past” and “non-past” that characterize parts of the inflectional paradigm. The usage-based approach has clear parallels to two strategies for dealing with opacity in Optimality Theory, viz. output-output faithfulness (Benua 1997) and optimal paradigms (McCarthy 2005), which both capitalize on relationships between surface forms. Whether phonological opacity in general can be reduced to relations between morphological forms is a question that is beyond the scope of the present study.

It is important to notice that the usage-based approach is very restrictive. It does not involve any ad hoc devices that are specially designed to account for opacity, and all the devices involved (schemas and categorization relations) are independently motivated from cognitive psychology (Langacker 1999:93f.). Again, comparison to a rule-based analysis is revealing. There are no restrictions on what an underlying representation may look like, and there is also no way to impose such restrictions in a non-arbitrary way. Instead of relating the occurrence of softening directly to the derivational suffix, it would, for instance, be possible to assume some dummy segment preceding /a/, say /j/, which would cause softening before it would delete and never surface anywhere in the relevant verb paradigms. In fact, this analysis is very similar to an account proposed by Lightner (1972:104 and 150). While a detailed discussion of this analysis is beyond the scope of the present paper, it clearly illustrates the restrictiveness of the Usage-Based Model. The content requirement in (5) rules out reference to non-surfacing segments, since such segments cannot be part of schemas over actually occurring utterances

3. Schema interaction

In section 2, we saw that second-order schemas facilitate an account of transitive softening in verbs with the /a/ suffix. Recall from (3) in section 1, however, that some verbs with this suffix show different softening patterns. Our analysis is not complete before we have provided schemas for such verbs and shown how the schemas interact. These issues will be addressed in the following with special reference to monosyllabic verbs.

Figure 2 models a situation where a speaker wonders how to form the first singular present tense of the verb *ždat'* 'wait'. S/he considers three alternatives, which I refer to as "candidates" and represent as rectangles with rounded corners. The left candidate involves transitive softening, the middle plain softening, while the candidate to the right does not display softening at all. In order to select a candidate, the speaker compares them to the schemas in his or her grammar. Figure 2 contains three schemas that are relevant for verbs with the /a/ suffix. The leftmost schema is the schema discussed at length in the previous section; it captures the generalization that verbs with this derivational suffix default to type A. However, as mentioned in (3) verbs with the /a/ suffix belong to

type C if the stem is monosyllabic. The schema in the middle in Figure 2 captures the softening pattern in monosyllabic verbs. For descriptive convenience I represent the monosyllabic stems as $_{1\sigma}$[CC since they have a consonant cluster in the beginning. As can be seen from Table 1, type C verbs show plain softening in the second and third singular and the first and second plural.[3] These forms do not constitute a natural class. Neither with regard to inflectional features nor to the shape of the endings is there a simple way to characterize all the relevant forms while at the same time excluding the remaining forms in the paradigm. For this reason the most specific schema we can advance for these forms is the one in the middle in Figure 2, which relates plain softening (represented as C^j) to non-past forms with vowel-initial endings, i.e. to all present tense and imperative forms in the paradigm. Since this is too inclusive, we need an additional schema preventing softening from applying in the forms that do not have softening. It is possible to state a simple generalization about these forms: softening is blocked in forms where the inflectional ending begins in /u/. This generalization is captured in the rightmost schema in Figure 2, which explicates that forms with /u/-initial endings are preceded by a non-soft consonant represented as C. It may be worth noting that this schema has some phonetic motivation in that softening is blocked before a back vowel.

The question now arises as to how these schemas interact, i.e. on what basis the speaker selects a winning candidate. According to Langacker (1999), what he refers to as "degree of conceptual overlap" is relevant.[4] This principle is related to the so-called "Elsewhere Condition" in generative grammar (Kiparsky 1982), but it is important to notice that it is not restricted to linguistics, but pertains to cognition in general (Langacker 1999:105f.). The more features a candidate shares with the schemas in the grammar, the easier it is to activate the relevant schemas, and the better are the chances for the candidate to be selected. It follows from this that the candidate is selected as the winner if it instantiates the

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[3] Type C verbs also display softening in the present tense (imperfective) gerund, but this form is not available in the paradigm of *ždat'* 'wait', as shown in Table 1.

[4] Langacker (1999) also considers a second factor, inherent ease of activation, but since this factor is not decisive in the examples explored in this paper, I will not address it here. For some discussion, however, see Nesset (in press:5f.).

most specific schema(s) in the grammar; these are the schemas that contain the most information, and are therefore easiest to activate.

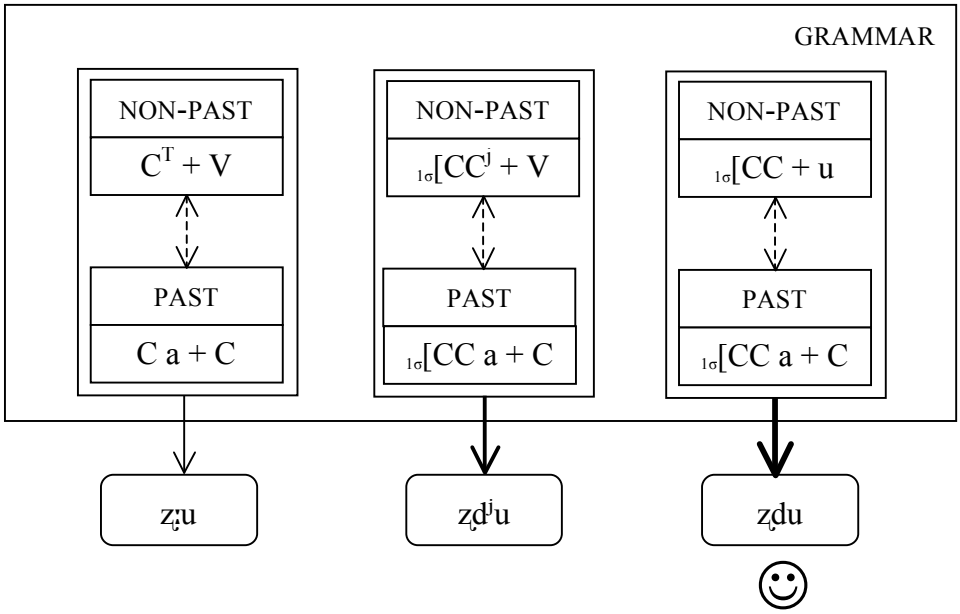

Figure 2: Schema interaction for type C verbs

The leftmost candidate in Figure 2 is fully compatible with the schema to the left, since it displays transitive softening and otherwise meets the description in the schema. The relationship of full compatibility, i.e. "instantiation" in Langacker's (1987) terminology, is represented as a solid arrow pointing at the candidate. The middle candidate is an instantiation of the schema in the middle. This schema is more specific than the schema to the left in that it states that the stem is monosyllabic and begins with a consonant cluster. Therefore the candidate shows a higher degree of conceptual overlap, which I represent as a thicker instantiation arrow. The candidate to the right, which is compatible with the rightmost schema, shows an even higher degree of conceptual overlap in that this schema also specifies that the inflectional ending begins with a vowel. As the candidate to the right involves the highest degree of conceptual overlap, the model predicts this candidate to be the winner. This prediction is borne out by fact, insofar as the first singular present tense of *ždat'* is

/zḍu/. For the convenience of the reader, the winning candidate is supplied with a smiling face.

4. Conclusions and implications

In conclusion, three points need to be mentioned. First, I have proposed that counterbleeding opacity can be accounted for in terms of what I call second-order schemas, i.e. schemas consisting of two schemas that are connected by extension relations. Secondly, we have seen that the Usage-Based Model facilitates a principled account of the interaction of second-order schemas in that the correct candidate is selected on the basis of the principle of conceptual overlap. Third, it has been emphasized that the usage-based approach to opacity is restrictive. The proposed analysis does not involve any ad hoc machinery; all the devices employed in the analysis reflect well-known principles in cognition.

In the case discussed in the present paper, counterbleeding opacity reduces to a relationship between morphological forms. The implication that phonological opacity boils down to morphology deserves to be tested against a more complete set of alternations in Russian and other languages.

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