Optimizing Russian Stress

Eugene R. Vachon

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1. Introduction

The idiosyncratic stress system of Russian has proved a challenge for theories of metrical phonology. Russian stress is largely unpredictable and in some cases even a phonemic distinction (e.g., *muká* 'flour' vs. *múka* 'torture'). This leads to the conclusion that stress is an underlying lexical feature that must simply be learned. While it is true that some Russian morphemes must be underlyingly accented, it is not the case that word stress assignment in Russian is as totally arbitrary as other lexical features (e.g., gender). An additional challenge for explaining Russian stress is the phenomenon known as "stress shift" where the underlying stress of a given morpheme seems to shift in certain derivational (e.g., *lóšad'* 'horse' → *lošádka* 'little horse') and inflectional (e.g., *ruká* 'hand'→ *rúki* 'hands') environments. Any analysis of Russian stress must then be able to handle these two main issues -- (a) What is the nature of the underlying lexical accent? and (b) How can we account for the complex surface word stress patterns of Russian?

There have been many attempts to capture the relative systematicity of Russian lexical stress in various theoretical frameworks. Early generative approaches (e.g., Garde, 1965; Thelin, 1971) essentially treat accent as a phonetic multivalued feature which provides enough underlying information in the lexical representation of a given morpheme to account for its surface stress patterns. More recent analyses (e.g. Halle & Vergnaud, 1987; Idsardi, 1992) have put more emphasis on generalizing the metrical processes that realize the surface stress patterns based on minimal assumptions about the underlying stress features of morphemes. This second type of analysis lends itself quite naturally to reanalysis within the framework of Optimality Theory (OT; Prince & Smolensky, 1993), which will realize the surface stress patterns of Russian based on a set of ranked constraints. That it is possible to do such a translation from a rule-based to a constraint-based analysis is, I think, the least important of the results of such work. Much more interesting will be to assess whether or not an OT analysis provides a more unified account and facilitates a better understanding of the system of Russian stress than alternaticve approaches. To this end it will be important to rate the various approaches presented here along two metrics: (a) assumptions about the complexity of underlying structure required; and (b) elegance and plausibility of the rules/constraints needed to realize the surface forms.

The focus of this work will be the construction and evaluation of an OT analysis of the phenomena of Russian stress. However, for comparison's sake, I will also present a brief summary of alternative approaches to Russian stress (though this is not intended to represent any kind of thorough literature review). Section two will provide a basic descriptive analysis of the facts of Russian stress that will concern the analyses here. Section three will investigate early, feature-based generative approaches to Russian stress. Section four will outline the more recent metrical analyses focusing especially on the approach developed in William Idsardi's (1992) dissertation. In section five I will develop an analysis of Russian lexical accent and word stress within the framework of Optimality Theory, and the final section will attempt to compare and evaluate the effectiveness this OT approach with its ancestors.

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2. Russian Word Stress

Every word in Russian has one and only one phonologically stressed syllable. Viewed paradigmatically, it is possible to generalize two basic classes of Russian words: those with "fixed" stress and those with "mobile" stress. This distinction, though, is not nearly fine enough. In nouns, the fixed class can have stress consistently on the stem as in (1) below or on its inflectional endings as in (2)[1]:

(1) *Fixed stress on stem*

	(a) 'work' *fem.*		(b) 'bus' *masc.*	
	Sing.	*Plur.*	*Sing.*	*Plur.*
Nom	rabóta	rabóty	avtóbus	avtóbusy
Acc	rabótu	rabóty	avtóbus	avtóbusy
Gen	rabóty	rabót'ej	avtóbusa	avtóbusakh
Dat	rabót'e	rabót'am	avtóbusu	avtóbusam
Inst	rabót'ej	rabót'ami	avtóbusom	avtóbusami
Loc	rabót'e	rabót'akh	avtóbus'e	avtóbusakh

(2) *Fixed stress on ending*

	(a) 'lady' *fem.*		(b) 'battle' *fem.*	
	Sing.	*Plur.*	*Sing.*	*Plur.*
Nom	gospožá	gospožý	bor'bá	bor'yá
Acc	gospožú	gospožý	bor'bú	bor'bý
Gen	gospožý	gospož'éj	bor'bý	bor'b'éj
Dat	gospož'é	gospož'ám	bor'b'é	bor'bám
Inst	gospož'éj	gospož'ámi	bor'b'éj	bor'bámi
Loc	gospož'é	gospož'ákh	bor'b'é	bor'bákh

The mobile class can shift stress in a variety of directions and in a variety of environments illustrated in (3a) through (3d):

(3) *Mobile Stress*

	(a) 'head' *fem.*		(b) 'teacher' *masc*	
	Sing.	*Plur.*	*Sing.*	*Plur.*
Nom	golová	gólovy	učitel'	učitel'á
Acc	gólovu	gólovy	učitel'	učitel'á
Gen	gólovy	golov'éj	učitel'a	učitel'éj
Dat	gólov'e	golov'ám	učitel'u	učitel'ám
Inst	gólov'u	golov'ámi	učitel'em	učitel'ámi
Loc	gólov'e	golov'akh	učitel'e	učitel'ákh

[1] The various truncation effects that account for the vowel and consonant elision in the examples below will be ignored for purposes of this analysis.

	(c) 'love'		(d) 'hair'	
	Sing.	*Plur.*	*Sing.*	*Plur.*
Nom	l'ubóv'	l'ubví	vólos	vólosy
Acc	l'ubóv'	l'ubví	vólos	vólosy
Gen	l'ubví	l'ubv'éj	vólosa	volós
Dat	l'ubv'é	l'ubvám	vólosu	vólosam
Inst	l'ubóv'u	l'ubvámi	vólosom	vólosami
Loc	l'ubv'é	l'ubvákh	vólos'e	vólosakh

In verbs, we can make a finer distinction between verbs that contain a thematic morpheme as in (4) (which can be stressed or unstressed) and non-thematic verbs (5) (which can have fixed or mobile stress).

(4) *Thematic verbs*

	(a) 'to do' *stem stress*		(b) 'to sit' *theme stress*	
	present		*present*	
	Sing.	*Plur.*	*Sing.*	*Plur.*
1st	d'éla'u	d'éla'em	sižú	sidím
2nd	d'éla'eš	d'éla'et'e	sidíš	sidít'e
3rd	d'éla'et	d'éla'ut	sidít	sid'át
	past		*past*	
masc.	d'élal	d'élali	sidél	sidéli
fem.	d'élala	d'élali	sidéla	sidéli
neut.	d'élalo	d'élali	sidélo	sidéli

(5) *Non-thematic verbs*

	(a) 'climb' *stem stress*		(b) 'carry' *end stress*	
	present		*present*	
	Sing.	*Plur.*	*Sing.*	*Plur.*
1st	l'ézu	l'éz'em	v'ezú	v'ez'óm
2nd	l'éz'eš	l'éz'et'e	v'ez'óš	v'ez'ót'e
3rd	l'éz'et	l'ézut	v'ez'ót	v'ezút
	past		*past*	
masc.	l'éz	l'ézli	v'óz	v'ezlí
fem.	l'ézla	l'ézli	v'ezlá	v'ezlí
neut.	l'ézlo	l'ézli	v'ezló	v'ezlí

	(c) 'be able' *mobile stress*		(d) 'live' *mobile stress*	
	present		*present*	
	Sing.	*Plur.*	*Sing.*	*Plur.*
1st	mogú	móžem	živú	živ'óm
2nd	móžeš	móžet'e	živ'óš	živ'ot'e
3rd	móžet	mogút	živ'ót	živút
	past		*past*	
masc.	móg	moglí	žil	žili
fem.	moglá	mogli	žilá	žili
neut.	mogló	mogli	žilo	žili

3. Feature-based analysis

It is fairly clear that pre-metrical approaches that treat stress as a multivalued feature are inadequate. First of all such an approach predicts that stress should be subject to processes such as assimilation. Second, a feature-based treatment does not capture the crucial generalizations to be made about properties of stress (Eugene Buckley, p.c.). However, non-feature-based, metrical analysis of stress in a language like Russian must account for the fact that at some level, accent is a part of the underlying phonemic representation. Thus, although the spirit of this work will discount the notion of accent as a feature akin to say [high], it will be useful to look at the early attempts to account for Russian stress in this way.

One early approach (Garde, 1965) proposes a hierarchy of stress prominence of morphemes to account for the apparent variation within the stress of otherwise related words. For example the prefix *vy-* is commonly said to assume the stress of the word to which it is affixed (cf. example (6) above). However consider the alternation in (6a) below. Garde claims that a morpheme prominence hierarchy something like the one in (6b) will account for the stress patterns here. In this account the pre-stressing *'-tel'* outranks the prefix which accounts for the unstressed *vy-* in (ii), but the infix *-i-*outranks the prefix *po-* which accounts for the final stress in (iii).

(6) (a) (i) výrazit' (ii) vyraz'it'el' (iii) porazít'
(b) -t'el' > vy- > -i- > po- > raz'-

Obviously this is not the approach I wish to pursue, but without this sort of hierarchy approach, we must think of some other way to express the apparently inconsistent behavior of a prefix like *vy-*which often assumes stress but sometimes does not.

The other feature-based approach I will look at here is that outlined in Thelin (1971). The insight to this analysis was that the effect of the hierarchy approach could be captured by distinguishing Russian words essentially along two parameters -- stem stress vs. ending stress. Thus nominal stress could be catalogued roughly in the following categories:

(7) (a) fixed stress on the stem (e.g. *zdánie* 'building, *koróva* 'cow', *arxit'ektor* 'architect')

(b) fixed stress on the ending (e.g. *stat'já* 'article', *gospožá* 'lady')

(c) singular stress on stem; plural stress on ending (e.g. *d'élo* 'deed' / *d'elá* 'deeds')

(d) singular stress on ending; plural stress on stem (e.g., *kol'esó* 'wheel' / *kol'ósa* 'wheels')

Thelin proposes that the stress patterns can be realized by distinguishing those words which have fixed stress on the stem from those that don't using the feature [± stem stress] ([±SS]). The implication here is that inflectional endings need not have their own stress features, thereby limiting the amount of redundant lexical information. From the examples in (7) above then we get the following representations:

(8)	koróva	gospožá	d'élo	kol'esó
	[+SS]	[-SS]	[sg.+SS]	[sg.-SS]
			[pl.-SS]	[pl.+SS]

Even without the theoretical objections to accent as a multivalued feature raised above, Thelin's approach runs into difficulty on its own. While the paradigm in (8) above does account for many of the words of Russian, an approach like this is hard pressed to deal with an example like, *golová* 'head' (cf. (3a) above), where the stress shift patterns do not follow the [±plural] distinction. As well it is not clear how this should be applied to verbal forms. This is, of course, a rather crude summary of Thelin's more complete analysis, but what is important here are is the notion that the stress patterns of Russian can be categorized rather concisely. This is the level of phonemic accent that a metrical-based (and an OT) approach much account for once it abandons the notion of stress as feature.

4. Metrical-based analysis

As noted above the basic properties of stress are distinct from those of any of the multivalued phonetic features. An alternative approach is Liberman's (1975) metrical grid. Kenstowicz (1994) summarizes the grid as follows:

> ... For the metrical grid, stress is neither a feature nor an inherent property of syllables. Rather, stress is defined in terms of an abstract two-dimensional array that plots metrical positions for levels of prominence. Syllabic nuclei "bear" [sic.] a stress by autosegmentally associating with one of these metrical positions. In this way, stress is largely autonomous from the phonemic string... [p. 553]

The stress patterns of a language like English can be entirely realized without relying on lexical stress by the processes of building its grid (see Liberman (1975) for an analysis of English stress assignment). However there are languages where some lexical stress must be assumed. For example a language like Khalka Mongolian exhibits a less amenable stress pattern (see Hayes (1981)). Khalka Mongolian assigns primary stress to

the leftmost heavy syllable and in the absence of any heavy syllables stress is assigned to the initial syllable of the word. Thus there must be a way of giving prominence to heavy syllables. Halle & Vergnaud (1987) propose that this can be achieved by assuming that heavy syllables in Khalka Mongolian project an underlying mark onto the first line of the metrical grid, assumring that the word stress rule, which targets the leftmost line 1 mark, will place word stress on a heavy syllable if there is one present. In a way, the word stress system of Russian resembles that of Khalka Mongolian, with the one crucial exception that there is no principled way to determine which syllable will contribute an marker for the word stress rule to target. It must be assumed that this property of some syllables is simply a part of their phonemic structure. In this way the notion of accent as an underlying feature is captured by a metrical analysis.

Idsardi (1992) offers a more refined metrical analysis of Russian stress using the notion of lexicalized prosodic boundaries instead of projected line 1 asterisks. This approach to the metrical grid is based on alignment features of stress boundaries. Each line of the metrical grid has its own tripartite setting for insertion of parentheses arrayed parametrically according to the Edge Marking Parameter (EMP), given in (9) below. Also each line is specified for L or R headedness by the Head Location Parameter (HLP) in (10). The parametric settings assumed for Russian are given in (11)

(9) EMP: Assign L/R parenthesis on the L/R side at the L/R edge of a word.

(10) HLP: Align the head of a constituent on a given line of the metrical grid with the L/R edge of that constituent

(11) line 0 = EMP = RRR; HLP = L
line 1 = EMP = LLL; HLP = L

The notational convention equivalent to Halle & Vergnaud's inherent line 1 asterisk, used to denote underlying lexical stress is the Syllable Boundary Projection Parameter (SBPP), which inserts a L/R parenthesis in the underlying line 0 representation before the accented syllable. It should also be noted that in addition to the underlying possibilities of the word stems, and contrary to Thelin's (1971) analysis in section 3, Idsardi assumes that inflectional morphemes can be stress bearing.[2] The possible underlying representations for Russian words are reproduced from Idsardi (1992) [p.52] below:

(12) Possible underlying representations:

Word Type	Idsardi's Representation	SBPP Setting
Unstressed	σ σ σ σ	Ø
Post-Stressed	σ σ σ σ(	LRR
Initial Stressed	(σ σ σ σ	LLL
Second-syl. Stressed	σ (σ σ σ	LRL
Final Stressed	σ σ σ (σ	LLR

[2] Idsardi claims that when inflectional morphemes are stressed they have LLR alignment. Since all the inflectional morphemes in the analysis (if not all the inflectional morphemes of Russian) are monosyllabic this could just as easily be LLL. The true test would be to find a case of a polysyllabic inflectional ending.

The remainder of this section will focus in some detail on how well Idsardi's framework outlined above deals with the facts of Russian outlined in section 2 above. I will essentially follow the organization of Idsardi's analysis, focusing especially on those data that require additional assumptions and rules to those described in (9) through (11) above. It will be crucial to see how the OT analysis in section 5, which cannot appeal to the ordered rules which Idsardi will make use of, will handle these less cooperative data.

First we look at the treatment of nouns and nominal inflection. The data below shows the effect of adding the feminine nominative ending stressed *-á* and the feminine accusative ending *-u* to an unstressed stem noun in (13); to a post-stressing noun in (14); and to a stressed noun in (15). Notice that in the case of the stressed stem derivation, an unmatched L parenthesis is sufficient to define a constituent boundary for the purposes of the HLP.

(13) 'head'	golov + á	golov + u
UR	σ σ (σ	σ σ σ
RRR H:L line 0	x x x (x)	x x x x)
LLL H:L line 1	x (x x x (x)	x (x x x x)
output	golová	gólovu

(14) 'lady'	gospož ´ + á	gospož ´ + u
UR	σ σ((σ	σ σ(σ
RRR H:L line 0	x x x((x)	x x x(x)
LLL H:L line 1	x (x x x (x)	x (x x x(x)
output	gospožá	gospožú

(15) 'cow'	koróv + á	koróv + u
UR	σ (σ (σ	σ (σ σ
RRR H:L line 0	x x(x (x)	x x(x x)
LLL H:L line 1	x (x x x(x (x)	x (x x(x x)
output	koróva	koróvu

So far the analysis is fairly straightforward. Given the assumptions about the stress classes of the underlying morphemes, the line 0 and line 1 rules achieve the correct results,

but Russian is not always so well behaved. First, there are some words that appear to be constructed of the same types of constituents, but that do not follow the patterns of the three examples above. The two words *zúby* 'teeth' and *darý* 'blows *n.*' are both composed of unstressed stems plus the plural ending *y*. Idsardi says that this can be accounted for by allowing a certain degree of allomorphy that differs only by stress such that the plural morpheme is not *-y* but *-y/-ý* . Thus the difference here can be explained if we assume that *zub-* selects *-y* (= *zúby*), whereas *dar-* selects *-ý* (= *darý*).

Secondly, the stress pattern classes in (13) - (15) above do not cover the entirety of the possible stress patterns found in Russian. There are several "shifting" classes that cannot be explained by the alternation of unstressed stem and stressed ending as in (14). The first class are those that appear to have a stress shift only in the plural forms. Take for example the apparent shifting on the plural of *ózero / oz'óra* 'lake / lakes' and *kol'esó / kol'ósa* 'wheel / wheels'. Idsardi proposes that both these shifts can be explained by an operation called "doubling", which is formally described in (16) below and applies to a limited domain (not a well defined one) of lexical items in the plural. The effect of applying this operation to the examples above is illustrated in (17):

(16) Doubling: $\emptyset \rightarrow (\; / \_\_ \; x \; ($

(17) 'wheel'	kol'es´ + o	kol'es´ + á
UR	σ σ (σ	σ σ ((σ
Pl. Doubling	NA	σ (σ ((σ
RRR H:L line 0	x x x (x)	x x x (x (x)
LLL H:L line 1	x (x x x (x)	x (x x x (x (x)
output	kol'esó	kol'ósa

(18) 'lake'	oz'er + o	oz'er + á
UR	σ σ σ	σ σ (σ
Pl. Doubling	NA	σ (σ (σ
RRR H:L line 0	x x x x)	x x x (x (x)
LLL H:L line 1	x (x x x x)	x (x x x (x (x)
output	óz'ero	oz'óro

Another class of words that commonly undergo a stress shift are those that involve the infamous Russian *jer*. In the pedagogical literature this consonant is often called a "fleeting vowel" because of its tendency to vanish from the surface representation. I will

use the common notational convention of representing the *jers* with "E" and "O" (the nature of the difference between the two is not of concern for this analysis). A formalization of the behavior of *jer* is in (19) (from Idsardi (1992) [p.54]):

(19) *jer*: $V \rightarrow$ [-jer] / $\_C_0$[+jer]
elsewhere V[+jer] $\rightarrow \emptyset$

The fleeting vowel phenomenon is observable in words like *otÉc* → *otcá* ('father' *nom.* → *gen.*) and the full realization of the jer spectrum is visible in the nominative, genitive and instrumental cases of *l'ubOv'* 'love' (cf. (3b) above). Idsardi uses the doubling operation in (16) to remove a "dangling" final parenthesis. Combining this with the *jer* rules outlined above we can realize the three examples given above.

(20) 'father'	otEc + O	otEc + á
UR	σ σ(	σ σ (σ
jer	E→e	E→Ø
Doubling	σ (σ (	NA
RRR H:L line 0	x x (x)	x x (x)
LLL H:L line 1	x (x x (x)	x (x x (x)
output	ot'éc	otcá

(21) 'love'	l'ubOv'+O *nom*	l'ubOv' + E'u *inst*	l'ubOv' + i *acc*
UR	σ σ(σ	σ σ(σ σ	σ σ(σ
jer	O→o O→Ø	O→o E→Ø	O→Ø
Doubling	σ (σ (	σ (σ (σ	NA
RRR H:L line 0	x x (x)	x x x (x (x)	x x (x)
LLL H:L line 1	x (x x (x)	x (x x x (x (x)	x (x x (x)
output	l'ubóv'	l'ubóv'u	l'ubví

The analysis of stress carries over to verbs quite straightforwardly given the assumptions and rules devised to handle the nouns and nominal inflections. Russian verbs can be categorized into two distinct classes -- thematic and non-thematic. The theme is a stressed vowel that appears, when present, between the verbal stem and the inflectional endings. First let us look at the treatment of non-thematic verbs. The relevant morphology is summarized in the table below.

(22) Verbal morphology

Stem forms:	
SBPP = LLL 'climb'	l'éz-
SBPP = LRR 'carry'	v'ez'-
SBPP = Ø 'live'	živ-

past marker	- l	*present marker*	- ó
feminie ending	- á	*1st singular*	- ú
plural ending	- i	*2nd singular*	- ĚŠ

In Russian there are several truncation rules which delete the first vowel in a VV structure and simplify consonant clusters. I will not go further into a detailed analysis of the truncation processes here and simply assume that they are subsumed under a single operation -- Truncate. The contrastive forms of the verbs based on the stems in (22) are illustrated below.

(23) 'climb'

	Fem. past	*Pl. past*	*1st present*	*2nd present*
	l'éz+l+á	l'éz+l+i	l'éz+ó+ú	l'éz+ó+ĚŠ
UR	(σ (σ	(σ σ	(σ (σ (σ	(σ (σ (σ
jer	NA	NA	NA	E→Ø
Truncate	NA	NA	o→Ø	NA
RRR H:L line 0	x x (x (x)	x (x x)	x x (x (x)	x x (x (x)
LLL H:L line 1	x (x x (x (x)	x (x (x x)	x (x x (x (x)	x (x x (x (x)
output	l'ézla	l'ézli	l'ézu	l'ézeš

(24) 'carry'

	Fem. past	*Pl. past*	*1st present*	*2nd present*
	v'ez'+l+á	v'ez'+l+i	v'ez'+ó+ú	v'ez'+ó+ĚŠ
UR	σ((σ	σ(σ	σ((σ (σ	σ((σ (σ
jer	NA	NA	NA	E→Ø
Truncate	NA	NA	o→Ø	NA
RRR H:L line 0	x x (x)	x x(x)	x x (x)	x x (x)
LLL H:L line 1	x (x x (x)	x (x x(x)	x (x x (x)	x (x x (x)
output	v'ezlá	v'ezlí	v'ezú	v'ez'óš

(25) 'live'	*Fem. past*	*Pl. past*	*1st present*	*2nd present*
	živ+l+á	živ+l+i	živ+ó+ú	živ+ó+ĚŠ
UR	σ (σ	σ σ	σ (σ (σ	σ (σ (σ
jer	NA	NA	NA	E→Ø
Truncate	v→Ø	v→Ø	o→Ø	NA
RRR H:L line 0	x x (x)	x x x)	x x (x)	x x (x)
LLL H:L line 1	x (x x (x)	x (x x x)	x (x x (x)	x (x x (x)
output	žilá	žili	živú	živ'óš

There are two classes of verbs that can be handled by making use of the doubling rule and the stem stress deletion rule devised to deal with the less cooperative nouns. The first set includes *mog* ('to be able'), *porot'* ('to rip'). Idsardi proposes that there is a present tense doubling rule that applies to these verbs in the environment σ(σ(. The second class of verbs is represented here by *krast* ('to steal'). Idsardi proposes that this class can be dealt with by a present tense stem stress deletion rule.

(26)'be able'	*Fem. past*	*Pl. past*	*1st present*	*2nd present*
	mog+l+á	mog+l+i	mog+ó+ú	mog+ó+ĚŠ
UR	σ((σ	σ(σ	σ((σ (σ	σ((σ (σ
jer	NA	NA	NA	E→Ø
Truncate	NA	NA	o→Ø	NA
Pres. Doubl.	NA	NA	NA	(σ(σ(
RRR H:L line 0	x x (x)	x x(x)	x x (x)	x x (x (x)
LLL H:L line 1	x (x x (x)	x (x x(x)	x (x x (x)	x (x x (x (x)
output	moglá	mogli	mogú	móžeš

(27)'rip'	*Fem. past*	*Pl. past*	*1st present*	*2nd present*
	poró+l+á	poró+l+i	poró+ó+ú	poró+ó+ĚŠ
UR	σ (σ (σ	σ (σ σ	σ (σ (σ (σ	σ (σ (σ
jer	NA	NA	NA	E→Ø
Truncate	NA	NA	o→ o→Ø	o→Ø
Pres. Doubl.	NA	NA	NA	(σ (σ (
RRR H:L line 0	x x x (x (x)	x x (x x)	x x (x)	x x x (x (x (x)
LLL H:L line 1	x (x x x (x (x)	x (x x (x x)	x (x x (x)	x (x x x (x (x (x)
output	poróla	poróli	porú	pór'eš

(28)'steal'	*Fem. past*	*Pl. past*	*1st present*	*2nd present*
	krád+l+á	krád+l+i	krád+ó+ú	krád+ó+ĚŠ
UR	(σ (σ	(σ σ	(σ (σ (σ	(σ (σ (σ
jer	NA	NA	NA	E→Ø
Truncate	d→Ø	d→Ø	o→Ø	
Pres. SS Del.	NA	NA	σ (σ	σ (σ
RRR H:L line 0	x x (x (x)	x (x x)	x x (x)	x x (x)
LLL H:L line 1	x (x x (x (x)	x (x (x x)	x (x x (x)	x (x x (x)
output	krála	králi	kradú	krad'óš

The thematic verbs, which comprise the "regular" set of verbs are handled in this analysis without appeal to special rules and operations. They fall into two categories with a familiar flavor -- stem-stressed (29) and theme-stressed (30). I am making assumptions about the underlying nature of the thematic morpheme, underlined in the derivations below, that should not be mistaken as a committed analysis of these forms.

(29) 'do'

	Fem. past	*Pl. past*	*1st present*	*2nd present*
	d'éla+j+l+á	d'éla+j+l+i	d'éla+j+ó+ú	d'éla+j+ó+Ěš
UR	(σ σ (σ	(σ σ σ	(σ σ (σ (σ	(σ σ (σ (σ
jer	NA	NA	NA	Ě→Ø
Truncate	j→Ø	j→Ø	o→Ø	NA
RRR H:L line 0	x x (x x (x)	x (x x x)	x x (x x (x)	x x (x x (x)
LLL H:L line 1	x (x x (x x (x)	x (x (x x x)	x (x x (x x (x)	x (x x (x x (x)
output	d'élala	d'élali	d'élaju	d'élaješ

(30) 'sit'

	Fem. past	*Pl. past*	*1st present*	*2nd present*
	sid+ę́+l+á	sid+ę́+l+i	sid+ı̂+ó+ú	sid+ı̂+ó+Ěš
UR	σ (σ (σ	σ (σ σ	σ (σ (σ (σ	σ (σ (σ (σ
jer	NA	NA	NA	Ě→Ø
Truncate	NA	NA	i→Ø o→Ø	i→Ø
RRR H:L line 0	x x x (x (x)	x x (x x)	x x (x)	x x (x)
LLL H:L line 1	x (x x x (x (x)	x (x x (x x)	x (x x (x)	x (x x (x)
output	sid'éla	sid'éli	sižú	sidíš

Finally there is a second type of thematic verb that is subject to a present tense doubling rule, which seems to be coincidental with the thematic morpheme *-u-* (as in (31)).

(31) 'drown'

	Fem. past	*Pl. past*	*1st present*	*2nd present*
	uton+ú+l+á	uton+ú+l+i	uton+ú+ó+ú	uton+ú+ó+Ěš
UR	σ σ (σ (σ	σ σ (σ σ	σ σ (σ (σ (σ	σ σ (σ (σ (σ
jer	NA	NA	NA	Ě→Ø
Truncate	NA	NA	u→Ø o→Ø	u→Ø
Pres. Doubl.	NA	NA	NA	σ (σ (σ (
RRR H:L line 0	x x x x(x (x)	x x x(x x)	x x x (x)	x x x (x (x)
LLL H:L line 1	x (x x x x(x (x)	x (x x x(x x)	x (x x x (x)	x (x x x (x (x)
output	utonúlla	utonúli	utonú	utón'eš

The above "summary" of Idsardi's (1992) treatment of Russian stress has been so painstakingly worked through partly in order to elucidate the assumptions and rule necessary to make this metrical approach work, but also the above was undertaken in order to show that with reasonably minor tweaking and hand waving, Idsardi's approach does manage to account for the complex phenomena of Russian stress. In the next section I will turn my attention to an OT analysis of Russian stress, taking the data analyzed in Idsardi as the point of comparison of the two frameworks.

5. Russian Stress in OT

In Prince & Smolensky (1993) there is an analysis of Hindi stress, which assigns word stress according to a prominence hierarchy. At first blush it looks like the analysis of Hindi could be modified minimally to fit the Russian stress system. I will not go into the Hindi facts here but rather use the theoretical structures developed to describe these facts for a brief analysis of Khalka Mongolian, which the reader will recall has a stress assignment system that looks something like the Russian system. The descriptive analysis of Khalka Mongolian says that the first heavy syllable or the initial syllable in the absence of any heavy syllables will receive the primary word stress. This can be easily handled by two constraints. The first is a prominence constraint that will assure that a heavy syllable takes precedence in the assignment of word stress. The second is an edge alignment constraint that will provide the word initial tendency of KM stress. The formalization of these two constraints, borrowed from Prince & Smolensky (1993), and some sample tableaux are outlined below.

(32) PEAK PROMINENCE (PK-PROM.): Peak (x) › Peak (y) if |x| > |y|
"... x is a better peak than y if the intrinsic prominence of x is greater than that of y..." (p.39) In Khalka Mongolian intrinsic prominence is give to heavy syllables.

(33) EDGEMOST (pk; L ; Word)
"... a peak of prominence lies at the leftmost edge of the word ..." (p.39)

(34) input: /LLLL/	PK-PROM.	EDGE
☞(a) ĹLLL		
(b) LĹLL		*!
(c) LLĹL		*!*
(d) LLLĹ		*!**

(35) input: /LHHL/	PK-PROM.	EDGE
(a) ĹHHL	*!	
☞(b) LH́HL		*
(c) LHH́L		**!
(d) LHHĹ	*!	***

It is tempting then to use a similar method to explain Russian. The problem arises though in determining what will be a peak of prominence. As we have seen there is no analysis which accounts in any systematic way for which of the syllables will be accented. So without including something like a feature [±accent], Russian cannot be handled quite as straightforwardly as Hindi or Khalka Mongolian. What is needed then is some way of determining the lexical stress of the underlying morphemes.

One approach is to assume that lexical stress is predetermined as a part of the input to the OT constraints that will align word stress. I can think of three possibilities for achieving this, none of which will be entirely satisfactory. First, we might revert to a featural treatment of stress and assume that each accented morpheme arrives with its accented syllable marked [+prominent], but recall the theoretical reasons for avoiding such a treatment of stress in the first place. Another possibility is that each morpheme has something like Idsardi's line 0 projection in the input, but this is undesirable for at least two reasons -- (a) if line 0 of the metrical grid must be present in the input then the entire metrical grid might as well be present obviating the need for any constraint-based account; and (b) if an OT analysis must rely on this derived, ordered structure for its input then it is senseless to proceed further. Third, to reconcile these objections we might suppose that there are underlying constraint-type alignment settings of lexical accent on the input forms, but this amounts to little more than a sloppy translation of the previous approach and also suggests that there are levels in OT, which is not a proposal I would want to make.

It is fairly clear that adding structure to the input is not the way to realize Russian stress in the OT framework. Let us turn then to an attempt to capture the facts of Russian solely by manipulating the constraints that will evaluate the alignment of word stress in the spirit of OT.

Idasrdi's system expresses the lexical stress of a morpheme by making use of the notion of parameterized LXX line 0 projections (see (12) above). This system in effect creates morpheme classes based on the parameterized setting of the line 0 projection. As well as avoiding the need for an accent feature Idsardi's system allows some principled predictions about what will be possible lexical accent positions in Russian, which are largely (if not entirely) borne out by the facts of Russian.[3]

A similar method can be implemented in the OT framework using a family of alignment constraints. The parameterization within the constraints is determined by alignment of the L/R edge of a stressed syllable ([σ /]σ) with the L/R edge of a stem ($[_{Stem}$ / $]_{Stem}$) or affix ($[_{Affix}$ / $]_{Affix}$).[4] The classes and their OT definitions are given in (36) below.

[3] Recall that Idsardi cannot neatly account for the case where there is penultimate stress in a word of four or more syllbles, which do occur (e.g. arkhit'éktor, ginokólog).

[4] Note that this schema can account for the missing class in Idsardi's approach. Furthermore this schema predicts that the lexical stress domain of any morpheme is restricted to the two peripheral syllables on either edge. This would predict that there do not exist any five (or more) syllable morphemes with stress on the medial syllables.

(36) Preliminary Categorization of Lexical Classes

Lexical Class		Defining Constraints	Morpheme Shape
Stem 1	UNSTRESSED	None	σ σ σ σ
Stem 2	INITIAL STRESSED	ALIGN ([σ, $[_{STEM}$)	σ́ σ σ σ
Stem 3	SECOND-SYL. STRESSED	*ALIGN ([σ, $[_{STEM}$) >> ALIGN ([σ, $[_{STEM}$)	σ σ́ σ σ
Stem 4	FINAL STRESSED	ALIGN ( ]σ , $]_{STEM}$)	σ σ σ σ́
Stem 5	PENULTIMATE STRESSED	*ALIGN ( ]σ, $]_{STEM}$) >> ALIGN ( ]σ, $]_{STEM}$)	σ σ σ́ σ
Stem 6	POST-STRESSING	ALIGN ([σ, $]_{STEM}$)	σ σ σ σ ˗
Affix 1	UNSTRESSED	None	σ
Affix 2	STRESSED	ALIGN ([σ, $[_{AFFIX}$)	σ́

One way to implement the classes proposed above is to say that the ranking of constraints for a given word is as follows: the defining constraints of each morpheme ranked higher than EDGE (as defined above), but unranked relative to the other high ranked constraints, and all the other alignment constraints (since theoretically they are all there for all words) are ranked below EDGE, ensuring that the winning candidate will be one with the leftmost stressed syllable whose stress assignment best conforms to the high ranked constraints.

However, the notion of constraint "slots" that the above approach requires is a relatively unorthodox use of the OT framework (Buckley, p.c.). In OT a single ranking of constraints that will correctly handle any given input is the preferred model. Notice also that there is some redundancy in the constraint sets above. The way to rescue the analysis is to rethink the formulation of the alignment constraints so that they refer to specific morpheme classes. This will have the result that rather than having two levels of lexical marking (i.e., marking of lexical items for morpheme class membership and marking of morpheme classes for constraint rankings), we simply need each lexical item to be marked as a member of a specific morpheme class. We can now refer back to the analysis of Khalka Mongolian proposed earlier. Once we assume that class membership is marked in the lexical entry of a morpheme in Russian, the morpheme-class-specific (non)alignment constraints do the work of the PK-PROM constraint, acheiving the effect of marking each morpheme's lexcial stress by virtue of its class membership. And, like Khalka Mongolian, the lower ranked EDGE (L) constraint assures that when there is a conflict between two morphemes whose lexical classes align a peak of prominence to different syllables, the leftmost one will receive the word stress.[5] The reformulated alignment constraints are given in (37).

[5] There must also exist an undominated constraint -- possibly an unviolable constraint (i.e., a part of GEN.) -- which will prevent the combination of two morphemes that do not impose any high ranked constraints will not end up without word stress. Such a constraint is formulated below and will be assumed in all the tableaux presented in the paper:

CULMINATIVITY (CULM): A candidate must have one and only one accented syllable

(37) Morpheme class specific constraints

(a) ALIGN ([σ, $[_{STEM\ 2}$)	Align the L edge of an accented syllable with the L edge of class 2 & 3 stems
(b) *ALIGN ([σ, $[_{STEM\ 3}$)	Do not align the L edge of an accented syllable with the L edge of class 3 stems
(c) ALIGN ( ]σ, $]_{STEM\ 4,5}$)	Align the R edge of an accented syllable with the R edge of class 4 & 5 stems
(d) *ALIGN ( ]σ, $]_{STEM\ 5}$)	Do not align the R edge of an accented syllable with the L edge of class 5 stems
(e) ALIGN ([σ, $]_{STEM\ 6}$)	Align the L edge of an accented syllable with the R edge of class 6 stems
(f) ALIGN ([σ, $[_{AFFIX\ 2}$)	Align the L edge of an accented syllable with the L edge of class 2 affix

Before we go on to see how these constraints achieve the desired results we must make explicit an assumption about the set: the (non)alignment constraints are crucially unranked relative to the other (non)alignment constraints. Thus the ALIGNMENT set forms something like an articulated PK-PROM constraint which was used for Hindi (Prince & Smolensky, 1993) and Khalka Mongolian.

Let us now see how this will work for the now familiar set of basic data. For the sake of space, the constraint names have been abbreviated. Class membership of the underlying morphemes is indicated by the subscript number following it. Tableau (38) shows (unstressed) /golov/$_1$ in combination with the (unstressed) affix /u/$_1$ and (stressed) affix /a/$_2$.

(38) golová 'head' *f. nom.sg* and gólovu 'head' *f. acc.sg.*

/golov/$_1$+/a/$_2$	*([σ,[s_3)	([σ,[$s_{2,3}$)	*( ]σ,]s_5)	( ]σ,]$s_{4,5}$)	([σ,]s_6)	([σ, [a_2)	EDGE
(a) gólova						*!	
(b) golóva						*!	
☞ golová							**

/golov/$_1$+/u/$_1$	*([σ,[s_3)	([σ,[$s_{2,3}$)	*( ]σ,]s_5)	( ]σ,]$s_{4,5}$)	([σ,]s_6)	([σ, [a_2)	EDGE
☞ gólovu							
(b) golóvu							*!
(c) golovú							*!*

The tableaux in (39) and (40) show the unsurprising results for stem stressed classes 4 and 2 respectively:

(39) koróva 'cow' *f. nom.sg* and koróvu 'cow' *f. acc.sg.*

/korov/$_4$+/a/$_2$	*([σ,[s_3)	([σ,[$s_{2,3}$)	*( ]σ,]s_5)	( ]σ,]$s_{4,5}$)	([σ,]s_6)	([σ, [a_2)	EDGE
(a) kórova				*		*!*	
☞ koróva						*	*
(c) korová				*			*!*
/korov/$_4$+/u/$_1$	*([σ, s_3)	([σ,[$s_{2,3}$)	*( ]σ,]s_5)	( ]σ,]$s_{4,5}$)	([σ,]s_6)	([σ, [a_2)	EDGE
(a) kórovu				*!			
☞ koróvu							*
(c) korovú				*!			**

(40) zdánie 'building' *n. nom.sg*

/zdanie/$_2$	*([ɗ,[s_3)	([ɗ,[$s_{2,3}$)	*( ]ɗ,]s_5)	( ]ɗ,]$s_{4,5}$)	*([ɗ, [s_6)	([ɗ, [a_2)	EDGE
☞ zdánie							
(b) zdanie		*!					*
(c) zdanié		*!					**

In (41), we see how this analysis handles the post-stressing *gospož* $_6$'lady' Notice that the gen. pl. form which would require a special stipulative repair rule under the metrical approach falls out quite easily giventhe notion of violable constraints.

(41) gospožá 'lady' *f. nom.sg* , gospožú 'lady' *f. acc.sg.* and gospóž 'lady' *f. gen.pl.*

/gospož/$_6$+/a/$_2$	*([ɗ, [s_3)	([ɗ, [$s_{2,3}$)	*(]ɗ,]s_5)	(]ɗ,]$s_{4,5}$)	([ɗ,]s_6)	([ɗ, [a_2)	EDGE
(a) góspoža					*!*	*	*
(b) gospóža					*!	*	*
☞ gospožá							**

/gospož/$_6$+/u/$_1$	*([ɗ, [s_3)	([ɗ, [$s_{2,3}$)	*(]ɗ,]s_5)	(]ɗ,]$s_{4,5}$)	([ɗ,]s_6)	([ɗ, [a_2)	EDGE
(a) góspožu					*!*		*
(b) gospóžu					*!		*
☞ gospožú							**

/gospož/$_6$	*([ɗ, [s_3)	([ɗ, [$s_{2,3}$)	*(]ɗ,]s_5)	(]ɗ,]$s_{4,5}$)	([ɗ,]s_6)	([ɗ, [a_2)	EDGE
☞ gospóž					*		*
(a) góspož					**!		

The tableau in (42) below realizes the class 5 stem with penultimate stress. Recall that Idsardi's metrical analysis could not account for this set of words.

(42) arxitéktor 'architect' *m. nom.sg*

/arxitektor/$_5$	*([ɗ,[s_3)	([ɗ, [$s_{2,3}$)	*(]ɗ,]s_5)	(]ɗ,]$s_{4,5}$)	*([ɗ,[s_6)	([ɗ, [a_2)	EDGE
(a) árxitektor				**!*			
(b) arxítektor				**!			*
☞ arxitéktor				*			**
(d) arxitektór			*				***!

Let us look now at some more challenging cases. The first is the problematic shifted form in the plural of the neuter nouns *kol'esó / kol'ósa* 'wheel(s)', *óz'ero / oz'óra* 'lake(s)', and *d'élo / d'elá* 'deed(s)'. Idsardi's categorization of *kol'es* translates to class 6 (post-stressing) whereas *oz'er* would be class 1. This requires the stipulative plural bracket doubling operation to explain this stress shift. Since there can be no such fix-up process in OT, we must say that there is a distinct stem for plural which belongs to class 4 (final

syllable stressing), and for *d'el* we must say that the singular stem belongs to class 1 (unstressed) and the plural stem belongs to class 6 (post-stressing). An alternative is to appeal to the notion of allomorphy of inflectional endings that Idsardi introduces to explain the different plural forms *rúky* and *darý*.

The case of the neuter plural shift can be handled by saying that the plural form can select an additional class of affix -- one which should logically exist given the potential parameterizations of the alignment constraints -- that has the effect of "pre-stressing", which I will dub a class 3 affix. This is formally stated in (43) below.

(43) ALIGN ( ] ǵ, [$_{\text{Affix 3}}$) Align the R bracket of an accented syllable with the L bracket of a class 3 affix.

Given this allomorphy possibility we can achieve the desired results if we assume that like *oz'er, kol'es* is actually a member of class 1 (unaccented) and that it selects the class 2 (stressed) allomorph of the singular ending /o/. This presents a problem though when we consider the genitive plural form *kol'ós* which mirrors the pattern of the class 6 *gospož*.

However, the analysis can be saved if we assume that the neuter genitive plural ending is actually a *jer*, as Idsardi does, with a possible pre-stressing allomorph, which will be selected for *kol'es*. This *jer*, although ultimately phonologically null, will still contribute a violation if the preceding syllable is not stressed (see (19) above for the relevant *jer* rules).[6] The tableaux for the relevant forms of *kol'es, oz'er* and *d'el* are given in (44) through (46) (irrelevant constraints have been omitted).

(44) kol'esó 'wheel' *n. nom.sg* , kol'ósa *n. nom. pl.*. and kol'ós *n. gen. pl.*

/kol'es/$_1$+/o/$_2$	( ]ǵ,[a$_3$)	([ǵ, [a$_2$)	EDGE
(a) kól'eso		*!	
(b) kol'éso		*!	*
☞ kol'esó			**

/kol'es/$_1$+/a/$_3$	( ]ǵ,[a$_3$)	([ǵ, [a$_2$)	EDGE
(a) kól'esa	*!		
☞ kol'ésa			*
(c) kol'esá	*!		**

/kol'es/$_1$+/O/$_3$	( ]ǵ,[a$_3$)	([ǵ, [a$_2$)	EDGE
(a) kól'es	*!		
☞ kol'és			*

[6] I will avoid the issue of the correct OT treatment of how to handle the *jer* rule in (19) above. All that must be guaranteed here is that the constraints that deal with the facts about *jers* are ranked higher than the stress alignment constraints since *jers* will delete or remain without regard for word stress. I will lump those together and say that there is a constraint JER which will be violated if jers have not been handled according to the schema in (19).

(45) óz'ero 'lake' *n. nom.sg* , oz'óra *n. nom. pl.*. and oz'ór *n. gen. pl.*

/oz'er/^{1}+/o/^{1}	( ]σ, [a_3)	EDGE
☞ óz'ero		
(b) oz'éro		*!
(c) oz'eró		*!*
/oz'er/^{1}+/a/^{5}	( ]σ, [a_3)	EDGE
(a) óz'era	*!	
☞ oz'éra		*
(c) oz'erá	*!	
/oz'er/^{1}+/O/^{5}	( ]σ, [a_3)	EDGE
(a) óz'er	*!	
☞ oz'ér		*

(46) d'élo 'deed' *n. nom.sg* , d'elá *n. nom. pl.*.d'él *n. gen. pl.*

/d'el/^{1}+/o/^{1}	( ]σ, [a_3)	([σ, [a_2)	EDGE
☞ d'élo			
(b) d'eló			*!
/d'el/^{1}+/a/^{2}			
(a) d'éla		*!	
☞ d'elá			*
/d'el/^{1}+/O/^{5}			
☞ d'él			

Thus far there have been no examples of class 3 (second syllable accenting) stems. As noted above, it would be possible to class a disyllabic final accented stem, which I have placed in class 4 (final syllable accenting), as class 3. In principle it seems that if a morpheme is less than four syllables long it will be impossible to tell from which edge we should define the stress alignment, and four syllable morphemes are rare at best. It is tempting then perhaps to collapse the redundant classes in some way. However, the example of *l'ubOv'* 'love' requires that there be a distinction between class 3 (second syllable accenting) and class 4 (final syllable accenting).

Given the singular nominative and instrumental forms, *l'ubOv'* could, like e.g. *korov* 'cow', be categorized as class 4 (final accenting) or class 3 (second syllable accenting). The problematic form is the genitive singular *l'ubv-î* . If we assume that *l'ubOv'* is class 4 then the optimal form will be *l'úbv-i* as illustrated in tableau (47) below. If however, we assume that *l'ubOv'* is in fact class 3 (second syllable accenting) as in (48), then the higher ranked *ALIGN ([σ, [s_3), will rule out this incorrect form.

(47) * l'úbvi

/l'ubOv'/$_4$+/i/$_1$	(]σ,]$s_{4,5}$)	EDGE
X ☞ l'úbvi		
l'ubví	*!	

(48) l'ubví

/l'ubOv'/$_3$+/i/$_1$	*([ɕ, s_3)	EDGE
l'úbvi	*!	
☞ l'ubví		*

The system must, of course also be able to handle the stress alignment of the various verb classes discussed in section 4. The analysis of verbs will fall out quite straightforwardly given the assumptions about the various stem classes and allomorphy developed here.[7] Table (20) from section 4 is repeated here with the OT analysis terminology. We will not assign class membership to the inflectional endings in the table since they will be determined by the allomorphic selections imposed by the verb stems. The following tableaux and the allomorphy selections necessary to realize the correct forms should be self explanatory:

(49) Verbal morphology

Stem forms: *Class 2 'climb'*	l'éz	*Class 1 'rip'*	poro
Class 6 'carry'	v'ez	*Class 2 'do'*	d'ela
Class 1 'live'	živ	*Class 6 'sit'*	sid
Class 1 'be able'	mog	*Class 3 'drown'*	uton
past marker	- l	*present marker*	- o
feminie ending	- a	*1st singular*	- u
plural ending	- i	*2nd singular*	- EŠ

(50) 'climb'

/l'ez/$_2$+/l/+/a/$_2$	([ɕ, [$s_{2,3}$)	([ɕ, [a_2)	EDGE
☞ l'ézla		*	
(b) l'ezlá	*		*!
/l'ez/$_2$+/l/+/i/$_1$	([ɕ, [$s_{2,3}$)	([ɕ, [a_2)	EDGE
☞ l'ézli			
(b) l'ezlí	*		*!
/l'ez/$_2$+/o/$_2$+/u/$_2$	([ɕ, [$s_{2,3}$)	([ɕ, [a_2)	EDGE
☞ l'ézu		*	
(b) l'ezú	*		*!
/l'ez/$_2$+/o/$_2$+/EŠ/$_2$	([ɕ, [$s_{2,3}$)	([ɕ, [a_2)	EDGE
☞ l'ézeš		*	
(b) l'ezéš	*		*!

[7] We will require the addition of a constraint like the dismissive JER proposed above that will make sure that all the truncation operations will take place Let us call this constraint TRUNCATE (TRUNC). Like JER this TRUNC. constraint must be ranked higher than the ALIGNMENT set to ensure that stress assignment can never block the effects of the truncation properties of Russian.

(51) 'carry'

/v'ez/$_6$+/l/+/a/$_2$	([ɔ́,]s$_6$)	([ɔ́, [a$_2$)	EDGE
(a) v'ézla	*!	*	
☞ v'ezlá			*
/v'ez/$_6$+/l/+/i/$_1$	([ɔ́,]s$_6$)	([ɔ́, [a$_2$)	EDGE
(a) v'ézli	*!		
☞ v'ezlí			*
/v'ez/$_6$+/o/$_2$+/u/$_2$	([ɔ́,]s$_6$)	([ɔ́, [a$_2$)	EDGE
(a) v'ézu	*!	**	
☞ v'ezú			*
/v'ez/$_6$+/o/$_2$+/EŠ/$_2$	([ɔ́,]s$_6$)	([ɔ́, [a$_2$)	EDGE
(a) v'ézeš	*!	**	
☞ v'ezéš			*

(52) 'live'

/živ/$_1$+/l/+/a/$_2$	([ɔ́, [a$_2$)	EDGE
(a) žíla	*!	
☞ žilá		*
/živ/$_1$+/l/+/i/$_1$	([ɔ́, [a$_2$)	EDGE
☞ žíli		
(b) žilí		*!
/živ/$_1$+/o/$_2$+/u/$_2$	([ɔ́, [a$_2$)	EDGE
(a) živu	*!*	
☞ živú		*
/živ/$_1$+/o/$_2$+/EŠ/$_2$	([ɔ́, [a$_2$)	EDGE
(a) živeš	*!*	
☞ živéš		*

(53) 'be able'

/mog/$_1$+/l/+/a/$_2$	([ɔ́, [a$_2$)	( ]ɔ́, [a$_3$)	EDGE
(a) mógla	*!*		
☞ moglá			*
/mog/$_1$+/l/+/i/$_2$	([ɔ́, [a$_2$)	( ]ɔ́, [a$_3$)	EDGE
(a) mógli	*!*		
☞ mogli			*

/mog/$_1$+/o/$_2$+/u/$_2$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
(a) mógu	*!*		
☞ (b) mogú			*
/mog/$_1$+/o/$_3$+/EŠ/$_3$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
☞ (a) móžeš			
(b) možéš		*!	*

(54) 'rip'

/poro/$_1$+/l/+/a/$_3$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
(a) pórola		*!	
☞ (b) poróla			*
(c) porolá		*!	**
/poro/$_1$+/l/+/i/$_3$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
(a) póroli		*!	
☞ (b) poróli			*
(c) poroli		*!	**
/poro/$_1$+/o/$_2$+/u/$_2$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
(a) póru	*!		
☞ (b) porú			*
/poro/$_1$+/o/$_1$+/EŠ/$_1$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
☞ (a) póreš			
(b) poréš			*!

(55) 'steal'

/krad/$_1$+/l/+/a/$_3$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
☞ (a) krála			
(b) kralá		*!	
/krad/$_1$+/l/+/i/$_3$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
☞ (a) králi			
(b) kralí		*!	
/krad/$_1$+/o/$_2$+/u/$_2$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
(a) krádu	*!*		
☞ (b) kradú			*
/krad/$_1$+/o/$_2$+/EŠ/$_2$	([ɕ, [a$_2$)	( ]ɕ, [a$_3$)	EDGE
(a) krádeš	*!*		
☞ (b) kradéš			*

(56) 'do'

/d'ela/$_2$+/l/+/a/$_2$	([σ, [s$_2$)	( ]σ, [a$_3$)	EDGE
☞ dé'lala		*	
(b) de'lála	*	*!	*
(c) de'lalá	*	*!	**
/d'ela/$_2$+/l/+/i/$_1$	([σ, [s$_2$)	( ]σ, [a$_3$)	EDGE
☞ dé'lali			
(b) de'láli	*!		*
(c) de'laĺi	*!		**
/d'ela/$_2$+/o/$_2$+/u/$_2$	([σ, [s$_2$)	( ]σ, [a$_3$)	EDGE
☞ dé'la'u		*	
(b) de'lá'u	*	*!	*
(c) de'la'ú	*	*!	**
/d'ela/$_2$+/o/$_2$+/EŠ/$_2$	([σ, [s$_2$)	( ]σ, [a$_3$)	EDGE
☞ dé'la'eš		*	
(b) de'lá'eš	*	*!	*
(c) de'la'éš	*	*!	**

(57) 'sit'

/sid/$_6$+/e/$_2$+/l/+/a/$_2$	([σ,]s$_6$)	([σ, [a$_2$)	EDGE
(a) sídela	*	*!*	
☞ sidéla		*	*
(c) sidelá	*		**!
/sid/$_6$+/e/$_2$+/l/+/i/$_1$	([σ,]s$_6$)	([σ, [a$_2$)	EDGE
(a) sídeli	*!	**	
☞ sidéli			*
(c) sideĺi	*!		**
/sid/$_6$+/e/$_2$+/o/$_2$+/u/$_2$	([σ,]s$_6$)	([σ, [a$_2$)	EDGE
(a) sížu	*	**!*	
☞ sižú		**	*
/sid/$_6$+/e/$_2$+/o/$_2$+/EŠ/$_2$	([σ,]s$_6$)	([σ, [a$_2$)	EDGE
(a) sídiš	*	**!*	
☞ sidíš		**	*

(58) 'drown'

/uton$_3$+/u/$_2$+/l/+/a/$_2$	*([σ, [s$_3$)	([σ, [a$_2$)	EDGE
(a) útonula	*	*!****	
(b) utónula		**!*	*
☞ utonúla		*	**
(d) utonulá		*	***!
/uton$_3$+/u/$_2$+/l/+/i/$_1$	*([σ, [s$_3$)	([σ, [a$_2$)	EDGE
(a) útonuli	*!	**	
(b) utónuli		*!	*
☞ utonúli			**
(d) utonulí		*!	***
/uton$_3$+/u/$_1$+/o/$_1$+/u/$_2$	*([σ, [s$_3$)	([σ, [a$_2$)	EDGE
(a) útonu	*!	**	
(b) utónu		*!	*
☞ utonú			**
/uton$_3$+/u/$_1$+/o/$_1$+/EŠ/$_1$	*([σ, [s$_3$)	([σ, [a$_2$)	EDGE
(a) útoneš	*!		
☞ utóneš			*
(c) utonéš			*!*

6. Summary and Conclusions

In summary then, I have proposed that Russian word stress can be reasonably elegantly analyzed within the OT framework given the following assumptions: (1) Russian morphemes are lexically marked for class membership; (2) there is a set of (non)alignment constraints that make reference to these morpheme classes. The constraints in this set are crucially unranked relative to one another; (3) inflectional endings have allomorphic variations which belong to different morpheme classes

The last task is to compare the various treatments of Russian stress discussed in this paper. First of all, a multivalued (or even privative) feature based approach to realizing underlying accent was summarily dismissed on the theoretical grounds that stress / accent does not have any of the distinctive characteristics of other phonetic features.

Next we looked at the derivational metrical grid analysis of Idsardi (1992). This approach has the advantage that it need not rely on an [accent] feature and that it allows a principled way to categorize the morpheme classes by making use of the EMP. However, in order to achieve the correct results for the trickier cases of shifting stress patterns, Idsardi must devise stipulative repairing rules (e.g., bracket doubling and stem stress deletion).

Finally, the OT analysis developed here offers, I believe, a more elegant solution. First, the amount of information that must be encoded in the lexical entry of a given morpheme is minimized to indication of lexical class membership. Secondly, by making more extensive use of inflectional ending allomorphy, all the data can be handled by the interaction between the articulated ALIGNMENT constraint set and the lower ranked EDGE(L), which brings the analysis of Russian into line with accounts of other stress systems.

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