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On accent, stress and quantity in West Slavic☆

M. Halle*

MIT, Department of Linguistics, Cambridge, MA 02139, USA

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Abstract

Among the Indo-European languages with mobile stress, the Slavic languages are distinguished by possessing, in addition to accented and unaccented morphemes, a class of post-accenting morphemes, whose cognates in the other IE languages are accented. The paper employs Idsardi's (1992) metrical theory of stress and accent to account for the evolution of this class of morphemes. It is proposed that the development of these morphemes was a consequence of Dybo's Law, a rule that rendered certain accented vowels unstressable. This proposition also provides a straightforward explanation for the striking fact that the West Slavic cognates of the post-accenting morphemes are exceptions to the otherwise pervasive vowel shortening process and hence preserve the original quantity contrasts. Since West Slavic (except for Kashubian) lost mobile stress many centuries ago, it has been proposed (e.g., by Garde, 1976) that Dybo's Law by-passed West Slavic. This common sense conclusion, however, is untenable in the light of the length preservation facts noted above. It is shown that the Idsardi's metrical theory of prosody allows for a full account of this complex body of data. The paper thus explains not only a hitherto puzzling set of facts, but also provides important empirical support for the Idsardi theory of prosody.

Keywords: Accent; Stress; Vowel length; Syllable structure; Indo-European; Slavic; West Slavic; Russian; Slovak; Czech; Kashubian; Lithuanian; Historical development of stress and quantity; Idsardi theory of accent and stress; Dybo's Law; Saussure's Law

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* Phone: +1 617 2533221; Fax: +1 617 2539725; E-mail: halle@mit.edu

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1. Introduction

One of the most striking typological characteristics of many Slavic languages is their mobile word stress. Anyone who has learned Russian as an adult will no doubt remember the enormous effort required to master this aspect of the language. Mobile word stress of the Russian kind is encountered in other Slavic languages such as Ukrainian, Serbo-Croatian, Kashubian, but it is relatively rare among the Indo-European languages outside of Slavic, where we find the system intact only in modern Lithuanian, in Sanskrit, and, in a somewhat attenuated form, in classical Greek; traces of the system are found in Latvian and in Germanic (Verner's Law); elsewhere even traces of the original system have been lost.

The Slavic system differs from that of Lithuanian and Sanskrit in one important respect. While all these languages are alike in having both accented and unaccented stems and affixes, Slavic, unlike Lithuanian and Vedic, has developed a special class of post-accenting morphemes. The detailed documentation of this development is the result of the work of the last half century, among which the most notable are the contributions of the Norwegian linguist Stang (1957), the French Slavist Garde (1976), and the Russians Illič-Svityč (1963) and – last but most important – Dybo, in particular, Dybo (1981) as well as Dybo et al. (1990).

Not all Slavic languages preserve the original mobile stress. In particular, in the West Slavic languages, with the exception of Kashubian, mobile stress was replaced with fixed initial stress many centuries ago. This fact has led some (e.g., Garde, 1976: 209) to propose that the processes resulting in post-accenting morphemes bypassed West Slavic altogether, because by then West Slavic had already lost mobile stress. Clear traces of post-accentuation, however, survive in the modern West Slavic languages in the distribution of vowel quantity. In particular, the remnants of IE vowel length in the modern West Slavic languages, most notably Slovak, indicate that in West Slavic vowel shortening took place at a point where the language still distinguished post-accenting morphemes from the rest, and before the original mobile stress was replaced by fixed initial stress. The chronology of the changes that emerges is thus the following:

Post-accentuation → Shortening → Loss of mobile stress

The proposition that West Slavic, too, had undergone post-accentuation was entertained by earlier workers, but was rejected on the grounds that it required the assumption, which seemed implausible until recently, that stressed vowels lost their length whereas unstressed vowels preserved it. Thus, Grünenthal (1922: 1) wrote: "... the quantity distinctions, which were present everywhere in West Slavic once upon a time, much as they still are today in Czech, have led to a view that regards the fixed accent [in the modern West Slavic languages] as not reflecting the original [IE] state of affairs and posits an older free accent of the kind still present in the East Slavic languages. This presumed accent has usually been identified with that of Russian and Serbian and has been used to explain the vowel lengths in Czech and in early Polish. This, however, has led to the result, contradicted by all experience

[orig. 'zu dem allerdings aller Erfahrung widersprechenden Ergebnis'], that in West Slavic original length was shortened under stress, but preserved intact in unstressed pretonic position. Only under certain kinds of 'intonation' (this concept may remain unexplained here) is Czech alone supposed to have preserved original length in a number of cases".

As a result of the advances in the understanding of the nature of accent and stress that were initiated by Liberman's (1975) dissertation, many instances of both shortening and deletion of vowels under stress have been discovered. As noted by Hayes (1995: 41f.): "Until recently, most phonologists would not have imagined that rules of vowel deletion could apply to stressed vowels ... The cases found so far behave contrary to [this] naive expectation: the stress borne by the deleted vowel does not disappear, but migrates to the right or left". It will be shown below that Slavic post-accenting morphemes arose as the result of such a migration of stress to the right. Since this proposition becomes compelling only in the light of conceptions of stress and accent that differ fundamentally from those that until recently have been held almost universally, we begin with an exposition of the theory of stress and accent that underlies this study.

2. On the nature of stress

Until about 1975, it was generally believed that stress is an ordinary phonetic feature that distinguishes words from each other. Thus, it was said that the English words *billow* and *below* differ in the placement of the stress feature, just like the words *nod* and *don* differ in the placement of the nasality feature, or *debt* and *Ted* differ in the placement of voicing.

(1) bíllow – belów nod – don debt – Ted

This conception of stress was challenged by Liberman in his dissertation (Liberman, 1975). Liberman observed that in many languages the phoneme sequences that make up the words are grouped or chunked into subsequences that usually are larger than a syllable and smaller than the entire word. Liberman referred to these subsequences as *feet*, by analogy with the syllable groupings encountered in metrical verse, and this term is also employed below. Liberman's main proposal was that stress everywhere is a reflection of foot structure; and foot structure is thus the key to an understanding of stress. There have been a number of different attempts to formalize Liberman's insights. The one that I believe to be the correct one and therefore have adopted here is that of Idsardi (1992).[1]

Perhaps the most obvious fact about stress is that not all phonemes are capable of bearing stress. In most languages all and only vowels are stressable. This, however, is not true of all languages. For example, in Indonesian schwa vowels may never

[1] For some additional discussion, see Halle and Idsardi, 1995; Halle, 1997; Purnell, 1998.

bear stress (cf. Halle and Idsardi, 1994). On the other hand, in Lithuanian, not only vowels, but also glides, nasals and liquids are stressable (Halle and Vergnaud, 1987). In view of this, a minimal requirement for an adequate stress notation is that it include a means for indicating which phonemes in a sequence can bear stress. As illustrated with Russian examples in (2), this is implemented here formally by projecting the stressable phonemes on a separate autosegmental tier, and it is these sequences of projected phonemes represented by asterisks in (2) and elsewhere that are grouped into feet.

Since on our account stress is a reflex of foot structure, we need a formal device for grouping the projections of stressable phonemes into feet. As illustrated in (2), footing – i.e., the grouping of stressable phonemes into feet – is accomplished by boundary markers or junctures, represented here by ordinary parentheses. A left parenthesis foots the stressable elements on its right, whereas a right parenthesis foots those on its left; elements that are neither to the left of a right parenthesis, nor to the right of a left parenthesis are unfooted. Examples of unfooted asterisks can be found in (2a) and (2b), but in (2c) all asterisks are footed.

As shown by the example (2c) *górod-u*, a single parenthesis is sufficient to foot a sequence of asterisks. This fact distinguishes the notation employed here from other notations where feet are delimited by matched pairs of parentheses. Unlike the matched parentheses notation, the present notation cannot accommodate the embedding of feet within feet. The feet in the present theory differ thus fundamentally from syntactic constitutents in that they do not enter into (or form) hierarchical structures.[2,3,4]

(2) a. *(* *)
oréx – u

b. * * (*)
korol, – ú

c. * * *)
górod – u SgDat C

d. *(* (*)
oréx – am
'nut' A

e. * * ((*)
korol,- ám
'king' B

f. * * (*)
gorod – ám PlDat A
'town' C

A left parenthesis foots stressable elements on its right, a right parenthesis foots those on its left. Feet are not constituents.

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[2] This fact has not always been recognized in the published literature. I myself have have often referred to feet as constituents, which is incorrect and confusing. I am grateful to Sylvain Bromberger for an illuminating discussion of this important issue.

[3] It is well known (cf., e.g., Chomsky, 1957: 3) that a notation admitting matched parentheses exceeds the expressive powers of a finite state Markov process. Since there are no stress facts that require recourse to matched parentheses, the extra expressive power of a notation with matched parentheses has no functional purpose. The fact that the Idsardi notation adopted here does not exceed the expressive powers of a finite Markov state is thus a point in its favor.

[4] Here and below I talk about parentheses and asterisks as if these were literally present in the mental representations of speakers and hearers. Obviously, no such claim is intended. I do assume, however, that mental representations – whatever their nature – include indications about which segments are stressable and about how stressable segments are grouped into feet.

In (2) feet are delimited by parentheses. We now need to explain how parentheses are inserted into asterisk sequences such as those in (2). In the formalism adopted here parentheses have two main sources. Some parentheses are an inherent part of the underlying representation of a morpheme; i.e., of the form in which a given morpheme – stem or affix – is stored in the speaker's memory. We shall use the adjective *accented* to designate morphemes with parentheses in their underlying representation. Other parentheses are inserted by rules. In particular, as shown in (2), Russian is subject to a rule which inserts a Right parenthesis at the end of every word. Such rules, marking the ends of asterisk sequences, are called Edge Marking Rules and play an important role in various accentual systems.

In addition to Edge Marking rules, the theory admits two other types of rules that insert parentheses. One of these, inserts parentheses next to (asterisks projecting) stressable phonemes in specific contexts; e.g, in syllables with heavy rimes. The second type of rule inserts parentheses iteratively starting at one end of the word and proceeds to its other end skipping two or three stressable phonemes after each insertion. As the latter two types of parenthesis insertion rules play no special role in matters discussed below, nothing further is said about them here (for more details, see Idsardi, 1992; Halle and Idsardi, 1995).

With regard to their effect on foot structure, Russian morphemes, both stems and affixes, fall into three accentual classes, which have been designated below by the capital letters A,B,C. Every class A morpheme contains an accented stress-bearing element; the morphemes belonging to class B are post-accenting, whereas those of class C are accentless. This is illustrated in (3), where the first line for each class illustrates noun stems, and the second line exemplifies both case endings and derivational suffixes. As noted in (3), there are no case endings of class B.

(3) Class A:	užin- 'supper'	orex- 'nut'	izumrud- 'emerald'
	(* *	*(*	* * (*
	-am PlDat	-ami PlInst	-ist- adj.
	(*	(* *	(*
Class B:	korol, – 'king'	stol- 'table'	l,ubOv, – 'love'
	* *(	*(	* *(
	no case endings	-nik-	
		*(	
Class C:	gorod- 'city'	terem- 'tower'	kolokol- 'bell'
	* *	* *	* * *
	-y PlNom	-u SgDat	-ov- adj.
	*	*	*

In order to stress a Russian word correctly, one must memorize which, if any, of its vowels is accented – i.e., supplied with a left parenthesis on line 0 in the underlying representation. The parenthesis placement in the different morphemes of a word fully determines the word's foot structure. Foot structure alone, however, is not sufficient to locate the word stress, because a foot may contain several stressable vowels, and there may be several feet in a word. It is a universal property of a foot that

one of its two end elements is specially marked. This element, called the *head*, is determined by a language-specific rule and is projected onto the next higher line of the grid. It is the heads of feet to which stress is assigned. As shown in (4), feet in Russian are left-headed (see especially (4a) and (4c)).

(4)	a.	b.	c.	
	*	*	*	line 1
	(*)	* * (*)	* * *)	line 0
	oréx – u	korol, – ú	górod – u	SgDat
	d.	e.	f.	
	* *	*	*	line 1
	((*)	* * ((*)	* * (*)	line 0
	oréx – am	korol, – ám	gorod – ám	PlDat A
	'nut' A	'king' B	'town' C	

Line 0 feet are left-headed

Examination of the examples in (4) shows that with one exception line 1 asterisks coincide with the vowel that bears the word stress. The exception is the PlDat form *oréx-am* (4d), where there are two line 1 asterisks, incorrectly implying that the word has two stresses. As shown in (5) it is easy to correct this, by adding a second Edge Marking rule which inserts a Left parenthesis before the first asterisk on line 1, and by stipulating that the feet so generated are left-headed, just like those on line 0.[5] This leaves every form with exactly one asterisk on line 2, which in all cases coincides with the vowel bearing the word stress.

(5)	a.	b.	c.	
	*	*	*	line 2
	(*	(*	(*	line 1
	(*)	* * (*)	* * *)	line 0
	oréx – u	korol, – ú	górod – u	SgDat C
	d.	e.	f.	
	*	*	*	line 2
	(* *	(*	(*	line 1
	((*)	* * ((*)	* * (*)	line 0
	oréx – am	korol, – ám	gorod – ám	PlDat A
	'nut' A	'king' B	'town' C	

Line 0,1 feet are left-headed

As shown in (5) stress in every Russian word is placed either on the first accented syllable, or, in words without accented syllable, on the first syllable. This principle of stress distribution was first noted in Kiparsky and Halle (1977), where it was

[5] It may be have been noticed that identical results to those in (5) are obtained if the line 1 Edge Marking rule inserts a Right parenthesis rather than a Left parenthesis. The reason a Left parenthesis has been chosen in (6b) is the assumption that there is a connection between foot headedness and the parentheses that define the feet. In particular, it has been assumed here that Left parentheses are preferred in the case of Left-headed feet, and Right parentheses, in the case of Right-headed feet.

called the Basic Accentuation Principle (BAP) and where it was shown that the BAP applies in other Indo-European languages with mobile stress as well. The five rules that generate this stress distribution are given in (6).

(6) Line 0:
  a. Insert Right parenthesis at the end of the asterisk sequence
  b. Heads: Left
  Line 1:
  c. Insert Left parenthesis at the beginning of the asterisk sequence
  d. Heads: Left
  e. Assign stress – i.e. High tone – to the vowel with line 2 asterisk.

With a few additions, the rules in (6) determine the correct stress assignment of all words of Russian. (For some additional discussion, see Halle, 1997: 280–286.) It can, moreover, be shown that the set of rules (6) also account for the stress system of Ukrainian and Byelo-Russian as well as of Serbo-Croatian and other Slavic languages with mobile stress. The same rules are also central in the placement of stress in Lithuanian and Sanskrit, two other IE languages with mobile stress. I have therefore argued in Halle (1997) that these rules make up the core of the stress system of the IE proto-language.

I conclude this introductory section by noting two effects of the formalism introduced above.

A property of the formalism that is important to the historical developments to be discussed below is the effect of loss of lexical accent. It will be recalled that lexical accents in Russian are represented by Left parentheses, and this is also true of the other IE languages with mobile stress. Formally, accent loss has the effect of eliminating all Left parentheses from lexical representations. As a result, there will be no Left parentheses on line 0 of the metrical grid and all words will have essentially the same grid as (5c) placing stress on the initial syllable. In other words, the prediction of the formalism is that the loss of lexical accent should be accompanied by the establishment of systematic initial stress. The West Slavic languages, except Kashubian, show this development.

The second effect of interest here concerns the consequences of deletion for word stress. It was remarked above that unlike nasality or voicing, stress is not a phonetic feature, but rather a reflex of foot structure. This fundamental fact is strikingly illustrated by the behavior of stress under deletion. In the introductory section we quoted Hayes's observation that "[u]ntil recently most phonologists would not have imagined that rules of vowel deletion could apply to stressed vowels ...". In fact, as noted above, it was theoretical preconceptions that were responsible for the rejection, as implausible, of evidence that stressed vowels could be deleted or shortened or otherwise reduced. When such facts were encountered they were re-interpreted in a way so as to make it appear that stressed vowels never were deleted or reduced.

The theory of stress and accent that has been developed here sees these facts in a radically different light, because in this theory stress is not directly present in the

underlying representation but is rather deduced from the metrical grid. To see what is involved consider the hypothetical examples in (7).

(7) a.

*	*	line 1
(*	*(*	line 0
biróna → birná		

b.

*	*
* *)*	*)*
biróna → bírna	

As shown in (7) the stress on the second syllable of the hypothetical word *biróna* may arise in two distinct ways: the stressed syllable may be the head of a Left-headed foot as in (7a), or it may be the head of a Right-headed foot as in (7b). The difference in footing the two lines becomes significant when for some reason the stressed vowel is deleted. Though the vowel and its projection on line 0 are both deleted, the foot structure remains, and this accounts for the different effects of deletion in (7a) and (7b). As shown in (7a), when the deleted vowel is the head of a left-headed foot, deletion results in stress being shifted to the following syllable, and, as shown in (7b), if the deleted vowel is head of a right-headed foot, stress shifts to the preceding syllable. Since in Russian – and in most IE languages – feet are left-headed (see (6b)) we expect to find examples of the type illustrated in (7a) where stress is shifted to the following syllable. And this expectation is borne out, as shown in the discussion below.

The vowel deletion process in (7) consists of two simultaneous steps: deletion of the feature complex representing the phoneme /o/ and deletion of the asterisk that the phoneme projects on line 0. It is to be noted that it is asterisk deletion alone that is responsible for stress shift to the adjacent vowel. In fact, the stress shifts in (7) can be produced by deleting the line 0 asterisk without also deleting the phoneme. By deleting a line 0 asterisk we imply that the phoneme from which the asterisk was projected is now no longer stressable.

3. Stress advancement in Lithuanian and Slavic

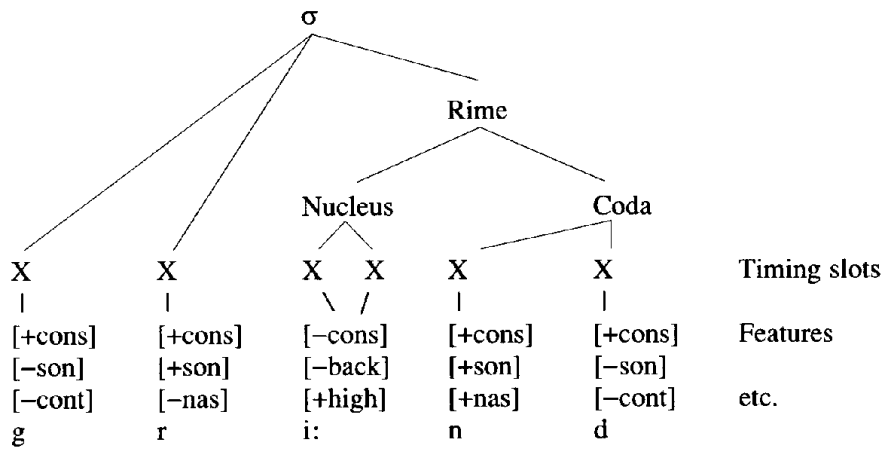
Stress advancement is a phonological process of interest in both Lithuanian and Slavic. As the advancement processes – Saussure's Law in Lithuanian (11) and Dybo's Law (13) in Slavic – show striking resemblances, it has been widely assumed that these changes derive from a single source. More recent work – see especially the Introduction to Dybo (1981) – has, however, questioned this identification, and it is assumed below that (11) and (13) are distinct phonological developments. An additional argument for the separate character of the two processes is the fact noted below that Saussure's Law is a rule of modern Lithuanian, whereas Dybo's Law was a rule in the phonology of Common Slavic, but is not part of the phonology of any modern Slavic language.

Our main interest at this point is in the precise characterization of the stress advancement processes. Of particular importance for present purposes is the nature of the intonations that play a fundamental role in both (11) and (13), and it is to this issue that we turn first.

Like stress, but unlike nasality or lip rounding, length is not a phonetic feature. Following the practice common in autosegmental phonology (see, for example,

Levin, 1985) each phoneme is viewed here as consisting of a complex of features and one or more timing slots, and it is the slots rather than the phonemes on which syllable structure is imposed. This is illustrated in (8), where the features of short phonemes are linked to a single timing slot, and the features of the long phoneme [i:] are linked to two slots.

(8)

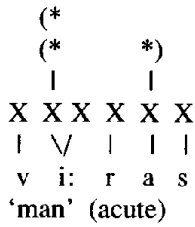


In view of the distinction made between timing slots and feature complexes it is to be noted that the asterisks on line 0 of the metrical grid are not projected by the feature complexes (phonemes), but rather by the timing slots to which the feature complexes are linked. The two lines – that of the timing slots and that of the asterisks projected from the timing slots – constitute a plane orthogonal to the plane in (8). It is on this plane that the feet of the metrical grid are constructed.

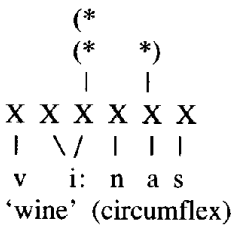
Although in the neutral case only the left-most timing slot of a syllable is stressable, it is not uncommon for languages to stress syllable elements other than those of the leftmost timing slot of the Nucleus. For example, in Southern Paiute (cf. Halle and Vergnaud, 1987: 18f.) both Nucleus slots of a long syllable are stressable; i.e., both Nucleus slots are projected on line 0. Of interest for present purposes is the fact that there are languages that project either, but not both Nucleus slots. In Halle and Vergnaud (1987: 190f.) we suggested that the Baltic languages – Lithuanian and Latvian – were of this kind. In particular, we suggested that the Baltic 'acute' intonations are instances of a long syllable whose initial Nucleus slot is stressable – i.e., projected on line 0 – while in 'circumflex' syllables it is the noninitial Nucleus slot that is stressable. Short vowels, of course, project their only Nucleus slot, and therefore, cannot manifest intonation contrasts.[6] This is illustrated in (9).

[6] There is an unfortunate terminological confusion in the literature: in Greek long vowels whose initial mora (timing slot) is stressable (and when stressed receives high tone) are called 'circumflex' and long vowels with a non-initial mora that is stressable are called 'acute'. This is the exact opposite of the terminology employed in the literature on Balto-Slavic and in the present paper. Caveat lector.

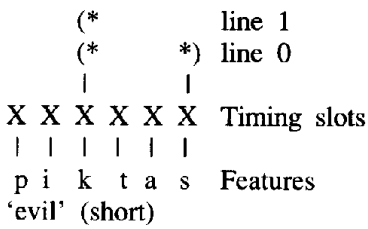
(9) a.



b.



c.



In the literary dialect of Lithuanian, which has received the lion's share of scholarly attention, intonational contrasts are phonetically manifested only in syllables with word stress; i.e., in syllables with a projection on line 2 of the metrical grid. In other dialects of Lithuanian (cf. Lačjute, 1979) as well as in Latvian, intonational contrasts are phonetically manifested also in unstressed syllables. Moreover, as shown by Saussure's Law (see (11)) it is necessary to assume for the literary dialect of Lithuanian the same intonational contrasts in the underlying representations of all long syllables, whether or not they receive surface stress. (For additional discussion, see Halle and Vergnaud, 1987: 194–196.)

As noted, Saussure's Law is a phonological rule of modern Lithuanian. It accounts for a series of alternations in surface stress position, of which the most familiar and readily appreciated are those in the nominal declension. These are illustrated in (10).

(10)

	I	II	III	IV
	'greyhound'	'finger'	'oak'	'wolf'
SgN	kùrt-as	pir̃št-as	ážuol-as	vil̃k-as
PlAc	kùrt-us	piršt-ùs	ážuol-us	vilk-ùs
PlL	kùrt-uose	pir̃št-uose	ažuol-uosè	vilk-uosè
SgL	kùrt-e	piršt-è	ažuol-è	vilk-è

To see the point of the examples (10) it is necessary to recall that, like Russian, Lithuanian has both accented and unaccented morphemes.[7] Saussure's Law shifts the main stress of a word off a syllable that is either short or long with circumflex intonation onto a following (underlyingly) long syllable with acute intonation. The important point to observe is that the shift occurs regardless of accent: both accented and unaccented stems shift main stress onto the following suffix without regard to whether or not the suffix is accented.

Thus in (10) the stems in columns I and II are accented, those in columns III/IV are unaccented. The case endings in the first two rows – i.e., SgN and PlAc – are unaccented; those in the last two rows – PlL and SgL – are accented. Stress shift occurs only in columns II and IV – i.e., with stems that are circumflex or short. But it is shifted off the accented stem in column II as well the unaccented stem of column IV.

[7] Lithuanian lacks post-accenting morphemes, which, as noted, are a special Slavic development. They are the result of a phonological change (see Dybo's Law (13) below), which shifted the main stress of a word to the following syllable.

Since Lithuanian is subject to the rule (6) and stress goes on the first accented syllable in the word, we expect stress on the stem in all case form of the accented stems of classes I/II. In fact this is true only of stems of Class I; stems of class II have circumflex intonation and are therefore subject to Saussure's Law if followed by a suffix with (underlyingly) acute intonation – i.e., in the Pl.Acc and SgL.

The rules in (6), which are also valid for Lithuanian, assign stress to the unaccented stems only before unaccented suffixes; i.e., in the SgN and PlAcc; in the PlL and SgL stress goes on the accented suffix. This preliminary stress assignment is 'corrected' by Saussure's Law, and, which shifts the stress off the circumflex stem (column IV) onto the ending in the PlAcc.

The context in which Saussure's Law applies is quite complex: as remarked already, it shifts the stress off a vowel that either is short or is long with circumflex intonation onto a following (underlyingly) long vowel with acute intonation. The rule is stated formally in (11a).

(11a)

	*		line 2
	*		line 1
Delete * in the env.	____	*	line 0
	|	|	
	(X) X . . .	X X	Timing slots
	\ /	\ /	
	Nucleus	Nucleus	

As explained above, by deleting a line 0 asterisk, rule (11) renders the affected vowel non-stressable. Since line 0 feet are left-headed this results in shifting the main stress to the following syllable in a manner parallel to that shown in (7a).

It was shown by Saussure (1894) that the length of many long vowels of modern Lithuanian is not of IE provenience; these secondary long vowels are rather the result of subsequent lengthening in Lithuanian, or of borrowing. The long vowels of IE origin are distinguished from these secondary lengths by intonation: originally long vowels have acute intonation, the other long vowels have circumflex intonation.

In the notation adopted here the genesis of this intonational contrast is readily accounted for by positing that originally all vowels projected their left-most or only nucleus element onto line 0. The process that lengthened the short vowels had the effect of inserting a timing slot to the left of the original nucleus head and thereby generated nuclei with circumflex intonation. This is shown below in (11b):

(11b)

*		*	Line 0
|		|	
X	→	X X	Timing slots
|		\ /	
Nucleus		Nucleus	

The effects of this process were subsequently lexicalized. Once that happened, long vowels in words borrowed into the language were systematically treated as having

circumflex intonation; i.e., as projecting the non-initial timing slot on line 0 (cf. (9b)); whereas long vowels of IE origin retained acute intonation; i.e., as projecting their initial timing slot on line 0 (cf. (9a)). It is assumed below – and this represents a change from the views I expressed in Halle (1997) – that Common Slavic also was subject to the same or a similar process resulting in a contrast between acute and circumflex intonations.

It can be readily seen that in its original form Saussure's Law was less complex than (11). If Saussure's Law was introduced at a time when the language had short vowels in place of the long vowels with circumflex intonation, the Law would have shifted the stress from a short vowel to an immediately following vowel. In more modern times the rule assumed the more complex form in (11) because of the changes that the language has undergone subsequently, in particular because of the lexicalization of intonational contrasts in long vowels.

As observed at the beginning of this paper, Slavic differs from other IE languages with mobile stress in having post-accenting morphemes of the kind illustrated by the class B noun *korol'* 'king' in (5). As a result of the work of Stang (1957), Illič-Svityč (1963); Garde (1976), Dybo (1980), Dybo et al. (1990), it is now well established that the Slavic post-accenting stems correspond to accented stems in other IE languages. As illustrated in (12), post-accentuation can be seen as the effect of a rule, similar to Saussure's Law (11a), that renders the stressed vowels in question unstressable; i.e., by deleting its line 0 asterisk.

```
(12) a.   *              *      b.   *                 *
         (*         (    *          (*   *            (*
        *(*   *) →  *(.    *)      *(* ( *) →   *(.    (*)
       korol, – u   korol, – u    korol, – am  korol, –  am
```

It was remarked above that the accented vowels that became unstressable in this manner were either short or had circumflex intonation. The rule responsible for this development is stated in (13). Rule (13) deletes a line 0 asterisk if it is accented and hence follows a left parenthesis, and the asterisk projects a non-final vowel that is either short or has 'circumflex' intonation. Following Collinge (1985), I refer to rule (13) here as Dybo's Law.[8]

```
(13) Delete * in the env.     ( ____ *       Line 0
                                   |
                              <X>  X         Timing slots
                                 \ |
                              Nucleus        Syllables
```

[8] The stress advance due to Dybo's Law is a process distinct from the stress retraction off 'weak yers'. For some discussion of stress retraction, see Halle (1997: 283–286).

Deletion of a line 0 asterisk is, of course, not the only way of formalizing the rightward shift of the stress that is the main surface effect of Dybo's Law.[9] The reason for preferring rule (13) over the alternatives is that (13) accounts for both the rise of post-accenting morphemes as well as for the further development of vowel quantity in the West Slavic languages, which are discussed next.

4. Vowel shortening in Slavic

The vowel system of Common Slavic is generally assumed to have been that shown in (14).[10] Of special interest here are the length contrasts.

(14)	long, + back	long, –back	short, + back	short, –back
+high, –low	u: y:	i:	U	I
–high, –low			O	E
–high, +low	a:	e:		

These length contrasts have been radically altered in the modern languages. In East Slavic, there are now no surface length contrasts; in South Slavic length contrasts have been preserved in Serbian and Slovene, but lost in Macedonian and Bulgarian. Most West Slavic languages preserve some length contrasts, but transform them in various ways, which depend mainly on the accentual character of the words in Common Slavic.

Vowel length in the contemporary South and West Slavic languages that have preserved length is an idiosyncratic property of individual vowels in particular morphemes. Our main concern below is with the historical evolution of the modern length contrasts in Serbian and in West Slavic. Like all accounts of phonological evolutions, the one offered below cannot be expected to cover all length contrasts in the modern languages, because new words constantly are being added to the vocabulary of a language, and since length is distinctive in the modern languages, a given morpheme may obtain its length by means other than the rules sketched below.[11] The

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[9] For example, one might suggest a rule like (ia) that metathesizes an asterisk with a Left parenthesis preceding it. Alternatively it is possible to posit a pair of rules, of which the first places a Left parenthesis after an asterisk preceded by a Left parenthesis, and of which the second deletes the first of two consecutive Left parentheses on line 0. This is illustrated in (ib).

(i) a. line 0 (* → *(

b. (* → (*(→ *(

[10] The long /u:/ derives from IE diphthongs: *ux-o* 'ear' Latv. *aus-is*; *kup-iti* 'buy' Goth *kaup-on* 'trade'; *kus-iti* 'to test, taste' Goth *kaus-j-an* Germ. *kosten*. The short high vowels – or yers —are subject to lowering in certain contexts, elsewhere they delete (cf. Halle, 1997, sec. 3 for some discussion).

[11] For example, in discussing the historical process of word-final shortening, Nonnenmacher-Pribić (1961: 31) notes that in Slovak, final long vowels in words such as *matiné*, *resumé* are not counterexamples to this shortening process. Since these words are obvious foreign borrowings they show that in modern Slovak the word final shortening rule is no longer general, but this fact does not undermine the proposition that at an earlier time shortening was a general rule of Slovak.

regularities in the distribution of length in West Slavic leave little doubt, however, that at an earlier time these languages included a rule of shortening which crucially interacted with the word stress.

4.1. Vowel shortening in Serbo-Croatian

As noted in the handbooks, in SCr. accented stems – i.e., those of class A – are systematically shortened (see (15a); whereas length is preserved in the post-accenting stems of class B (15b) and in the unaccented stems of class C (15c).[12]

(15) In Serbo-Croatian
- a. vowels are shortened in accented stems <class A>:
  (iv-(a 'willow', (vran-(a 'crow', (lip-(a 'lindentree',
  (dim- 'smoke', (sir- 'cheese', (mat-i 'mother',
  (brat- 'brother'
- b. vowels retain length in postaccenting stems <class B>:
  pi:l(-(a 'saw', tru:d(- 'work', hva:l(-(a 'praise',
  kri:l(-o 'wing', li:c(-e 'face', klobu:k(- 'hat',
  pavu:k(-'spider'
- c. vowels retain length in unaccented stems <class C>:
  gla:v-(a gla:v-u (SgAc) 'head'; bra:d-(a bra:d-u (SgAc)
  'beard'; vra:n- 'raven', dru:g- 'friend', zvijer- 'animal',
  drijev-o 'tree', zu:b- 'tooth', me:h- 'bag', sve:t- 'light'

The shortenings in (15a) are generally accounted for by positing that SCr was at some stage in its history subject to the shortening rule (16), which deletes a Timing Slot of an acute Nucleus; i.e., of a Nucleus whose first timing slot is projected on line 1.

(16)

	(*	Line 0
	|	
Delete X in env.	X __	Timing slots
	\/	
	¶Nucleus	Syllables

None of the long vowels undergoing Dybo's Law (13) was subject to shortening by (16). This is as expected, for Dybo's Law applies to vowels that are short or long and

[12] In (15) and below I deviate from the common practice of representing accent and length in the orthographies of the original sources of the examples. Since the different orthographies employ the same typographic means to designate vastly different sets of phonetic facts, this imposes a heavy burden on readers that has no other justification than conformity to a long, but not very sensible tradition. In the notation employed here, vowel length is represented by a colon and the underlying accent is symbolized by a left parenthesis preceding the vowel in question.

circumflex, whereas shortening applies to vowels that are long and acute.[13] Moreover, vowels shortened by rule (16) do not undergo Dybo's Law. This is readily explained on the assumption that Dybo's Law was ordered before the shortening rule (16). Since Dybo's Law deletes the line 0 asterisk which is crucially required for rule (16) to apply, the prior application of Dybo's Law to these forms renders them immune to shortening by rule (16).[14]

In sum, at some time in its history the phonology of SCr included both Dybo's Law and the shortening rule (16). It is understood, of course, that at a later time both rules were lexicalized; i.e., the two rules were dropped from the phonology, and their effects were incorporated directly into the underlying representations of the morphemes. However, at the earlier time of interest here both rules were part of the phonology of the language.

4.2. Vowel shortening in Slovak

Vowel length was lost also in West Slavic, but under conditions that differ interestingly from those in SCr, which is a South Slavic language. We begin with a review of the length distributions in Slovak noun stems, based mainly on the extensive data in Nonnenmacher-Pribić (1961). The fact that vowel shortening differs somewhat from language to language suggests that shortening arose at a point after Common Slavic had split up into dialects.

It emerges clearly from the data gathered in Nonnenmacher-Pribić (1961) that at some point in its history Slovak shortened all stems with one striking exception: there was no shortening in stems that were subject to Dybo's Law. This is illustrated in (17), where, like in (15), Left parentheses reflect the placement of the Common Slavic accent and length is symbolized by a colon.

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[13] In a criticism of Kiparsky and Halle (1981); Kortlandt (1983: 39) cites SCr forms where shortening occurred also in certain unaccented stems. According to Kortlandt, "a long stem vowel is shortened in polysyllabic forms of paradigm (c), but not (b). Thus, in South Slavic, e.g. SCr. *mlÀdōst* 'youth', *prÀseta* 'pig' (gen. sg.), *rùkama* 'hand' (obl. pl.), cf. *mlâd* 'young', nom. sg. *prâse, rúka*". These forms were discussed already in Leskien (1914) par. 607: and it was noted there that native authorities differed with regard to the phenomenon, suggesting that, unlike shortening in acute syllables, the shortening in unaccented polysyllabic stems was different in different dialects. Stankiewicz 1(993: 114), characterizes this shortening process as optional. In sum, the shortening in polysyllabic words referred to by Kortlandt is a separate phenomenon from the shortening of acute syllables, and nothing but confusion results from the attempt to treat the two under a single rubric.

[14] As stated in (16) the shortening rule requires that the deleted timing slot be in a branching Nucleus and moreover that it be non-initial. The requirement that the Nucleus be branching is crucial, since otherwise the rule would incorrectly delete the timing slots associated with short accented vowels. On the other hand, the requirement that the Timing slot to be deleted should also be right-most, rather than left-most in the Nucleus, is redundant. The reason for this is that Nuclei with right-most stressable Timing slot – i.e., 'circumflex' Nuclei – will undergo Dybo's Law. These Nuclei will therefore lack a projection on line 0, and the Shortening rule (16) will not apply to them. In (16) and (18) the symbol ¶ before the Nucleus is an attempt on my part to signal the fact that only the branchingness of the Nucleus is relevant and not the relative position of the Timing slot in the Nucleus. This fact plays a role in the developments in West Slavic discussed below.

(17) In Slovak

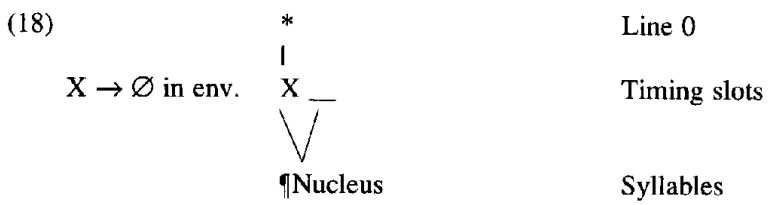
a. vowels are shortened in stems of class A:
(bratr- 'brother', (ded- 'grandfather', (dym- 'smoke',
(blat-o 'mud', (let-o 'summer', (jutr-o 'morning', (brez-(a
'birch', (knih-(a 'book', (strun-(a 'string', (jahod-(a
'berry', ma(lin-(a 'raspberry', ko(pyt-o 'hoof'

b. vowels retain length in stems of class B:
by:k(- 'bull', ca:r(- 'Tsar', su:d(- 'lawcourt', pavu:k(-
'spider', klobu:k(- 'hat'; hniezd(-o 'nest', kri:l(-o
'wing', pi:sm(-o 'letter'; chva:l(-a 'praise', hviezd(-a
'star', pi:l(-a 'saw', tru:b-a 'pipe'; vin-a:r(- 'wine
merchant', chvast-u:n(- 'braggart'

c. vowels are shortened in stems of class C:
hrad- 'town', zver- 'animal', dub- 'oak', syn- 'son',
drev-o 'tree', sen-o 'hay', tel-o 'body', zlat-o 'gold',
brad-(a brad-u SgAc 'beard', hlav-(a hlav-u SgAc 'head',
ruk-(a ruk-u SgAc 'hand', zim-(a zim-u SgAc 'winter'

As shown by the examples in (17), Slovak shortening treats accented (class A) and unaccented (class C) stems alike and distinguishes these from post-accenting (class B) stems, which do not undergo shortening. We can explain this fact readily if we assume that at the time shortening became effective in Slovak, the language was also subject to Dybo's Law. Dybo's Law, it will be recalled, generated unstressable vowels, and it is these vowels that were immune to shortening. The shortening rule in Slovak must thus have be more general than (16): it applied not only to accented vowels, but to all stressable vowels. As shown in (18), this effect can be achieved formally by a minor modification of (16), i.e., by removing the Left parenthesis on line 0.

(18)



As pointed out to me by Paul Elbourne, the Slovak shortening facts can be also accounted for without assuming that Dybo's Law was still an active rule of the language. It may be assumed instead that the effects of Dybo's Law were lexicalized before the shortening rule came into the language, and that at the time shortening entered the language, class B morphemes were represented as ending with unstressable vowels; i.e., vowels without a line 0 asterisk. Since the empirical consequences of this account are identical with the account that assumes Dybo's Law to have been an active rule of the language, the choice between these two alternative can only be made on theoretical grounds. For example, it might be argued that Dybo's Law is of

a highly marked type, which languages tend to replace at the earliest moment by lexicalizing its effects. The evidence for this presumably universal tendency does not seem especially compelling to me, in view of the fact that Saussure's Law (11), which is even more marked than Dybo's Law, has been a rule in the synchronic phonology of modern Lithuanian for centuries. I therefore leave the lexicalization of Dybo's Law in West Slavic as an open question.

In any event, Dybo's Law had to be in the synchronic phonology of a language before it could be lexicalized. As noted above, Dybo's Law entered the language before shortening. The loss of lexical accent in West Slavic, moreover, must have occurred after shortening, as shown by the well-known fact that one West Slavic language, Kashubian, has preserved the lexical accent, while undergoing both Dybo's Law and shortening. The chronology of the changes in West Slavic must have been that in (19).

(19) Dybo's Law → Shortening → Accent loss

The first two changes affected all West Slavic languages, while the third change – accent loss – by-passed Kashubian.

4.3. Vowel shortening in Czech and Sorbian

The length distributions in Czech differ somewhat from those of Slovak. As noted above, in Slovak all vowels were shortened except those that had undergone Dybo's Law (13). In Czech the exceptions to shortening include in addition to the vowels just mentioned, also those of acute monosyllabic stems. A few examples of the difference between Czech and Slovak are given in (20); numerous additional examples are to be found in Nonnenmacher-Pribić (1961).[15]

(20) Czech:	dy:m 'smoke'	bla:t-o 'mud'	li:p-a 'lindentree'
Slovak:	dym	blat-o	lip-a

We capture this difference between the two languages formally by positing that at a later date – at a time when Czech and Slovak had become independent languages or

[15] In his criticism of Kiparsky and Halle (1981), Kortlandt (1983: 33) writes that "West Slavic shows two different quantities in originally unaccented syllables; e.g. Czech *holub* 'pigeon', *žalud* 'acorn', *labut'* 'swan', *oblast* 'region' vs. *měsíc* 'month', *peníz* 'coin', *jestřáb* 'hawk', *pavouk* 'spider' ...". The last example is evidently cited in error, as the word belongs to class B and therefore is expected to preserve length. The other three examples of unexpected length were discussed by Nonnenmacher-Pribić (1961: 34), who remarked that the Slovak and Polish cognates of *jestřáb* showed shortening, suggesting that "the Czech length is secondary". She states that *peníz* being a foreign borrowing "may have substituted the foreign quantity". This leaves *měsíc* (and Czech *zajíc* 'hare') which, according to Nonnenmacher-Pribić, are formed with the suffix *-ęti* "which was not very productive in noun formation in the Slavic languages, and this [fact] must explain also the [quantity] vacillations ...". In sum, there are simple, unforced explanations for Kortlandt's putative counter-examples.

dialects – Dybo's Law (13), was modified in Czech so that the condition limiting the rule to vowels with 'circumflex' intonation does not hold in the case of monosyllabic stems. Formally this was implemented by adding to Dybo's Law the condition stated in (21).

(21) Delete * in env. ___ Line 0
|
<X>X Timing slots
\ |
Nucleus Syllables

Condition: Restriction on Nucleus branching is dropped in the case of monosyllabic stems

Since in Czech, Dybo's Law thus applied to monosyllabic stem of all kinds – not only to stems that are short or have circumflex intonation – monosyllabic stems were never shortened. Implicit in this proposal is the perhaps daring suggestion that in Czech at some stage all monosyllabic stems might have been post-accenting.

The proposition that Dybo's Law applied in West Slavic is further supported by the facts of Upper Sorbian. According to Bethin (1998: 143), in Upper Sorbian, length is preserved in the vowels that in Common Slavic vowels were either accented (class A) or post-accenting (class B), and the only long vowels that are shortened in Upper Sorbian are therefore those that are unaccented in Common Slavic (class C). If we assume that like the rest of West Slavic Upper Sorbian was subject to the shortening rule (18), we account for these developments by generalizing Dybo's Law so that in Upper Sorbian it applied to all accented vowels, without regard to intonation. The Upper Sorbian version of Dybo's Law is given in (22), which should be compared with the original version of the Law in (16).

(22) Delete * in env. (___ Line 0
|
X Timing slots
|
Nucleus Syllables

5. Conclusion

On the account presented above, the central event in the evolution of Slavic stress was the introduction of Dybo's Law, which made certain accented vowels incapable of bearing stress. As a consequence, in words subject to Dybo's Law, stress was advanced to the following syllable. When the Law was subsequently lexicalized – i.e., when it was dropped as a phonological rule of Slavic and its effects on stress placement were expressed directly in the underlying representations of morphemes –

this resulted in the appearance of post-accenting morphemes in Slavic languages with mobile stress.

Since mobile stress was lost in most of the West Slavic languages many centuries ago, it might have been expected that Dybo's Law did not apply there. The distribution of vowel quantity in the West Slavic languages, however, shows conclusively that these languages too must have been subject to Dybo's Law at some point in their history. The IE vowel quantities are preserved in the modern Slavic languages to different degrees. As observed above, Serbo-Croatian shortens accented vowels, but preserves length if the vowel is unaccented or post-accenting. West Slavic, on the other hand, preserves the length of post-accenting vowels, but shortens all other long vowels. The fact that all West Slavic languages preserved length in post-accenting morphemes indicates that West Slavic must have been subject to Dybo's Law at one stage in its evolution, and that it was only after the lexicalization of both Dybo's Law and shortening that lexical accent was lost and word-initial stress was instituted in West Slavic.[16]

The fact that in West Slavic the effects of both Dybo's Law and the shortening rule can be reconstructed from the vowel length distribution in the modern languages is reminiscent of the developments accounted for by Verner's Law.[17] Although Germanic lost its lexical accent quite early and had fixed word-initial stress far back into the distant past, the distribution of obstruent voicing in the modern daughter Germanic languages made it possible to reconstruct an earlier stage of the language where morphemes were lexically accented. In similar fashion, West Slavic (with the exception of Kashubian) lost the mobile stress of Common Slavic long ago and also shortened many vowels, yet the distribution of vowel length in the modern West Slavic languages permits us to reconstruct the Common Slavic state of affairs.

Dybo's Law itself and its centrality in the above account depend crucially on 'stressability', an abstract property of phonemes that is only indirectly related to the phonetic facts of utterances. As we have seen, an unstressable phoneme is invisible to rules that refer to properties of the metrical grid, but does not differ from stressable phonemes in any directly observable phonetic property. This conception is, of course, not theory-neutral. It is part of the Liberman–Idsardi theory of stress and accent sketched in the first section of this paper. To the extent that the account presented above is shown to be correct in the light of further research and criticism, it also provides support for the Liberman-Idsardi theory.

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[16] The argument for this ordering is straightforward. The shortening rule (18) applies to all stressable vowels. Vowels that preserved length and to which shortening did not apply must therefore have been made unstressable by prior application of Dybo's Law. There are many words in West Slavic that preserve length in word-initial syllable – e.g., those listed in (17b). In order for the shortening rule not to apply to these words, their initial syllable must have been unstressable by virtue of having undergone Dybo's Law. These word-initial syllables could therefore not have borne stress at the point where the shortening rule applied, and the generalization of initial stress in West Slavic could only have taken place after the effects of Dybo's Law and the shortening rule had been lexicalized. The preceding corrects the view I advanced in *Language* (Halle, 1997), where, following Garde (1976) I stated that Dybo's Law did not apply in West Slavic. I am grateful to Bert Vaux for drawing my attention to these facts.

[17] For a recent discussion of Verner's Law, see Calabrese and Halle (1998).

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