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ON STRESS AND ACCENT IN INDO-EUROPEAN

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Roman Jakobson in memoriam, on the occasion of his hundredth birthday, October 12, 1996.

The IE accentual system is described in light of recent advances in the understanding of prosodic phenomena. It is proposed that the IE accentual system was much like that of modern Russian or Lithuanian in that the accent was a distinctive property of morphemes, and words without accent received initial stress. A set of simple rules is developed to account for this stress distribution. Since the theory predicts that loss of lexical accent should result in initial stress, the initial stress found, for example in Celtic, Germanic, and Italic, is attributed to this loss. A series of natural steps is outlined to account for the further evolution of a system with initial stress into one with noninitial stress of the kind found in Latin or Attic Greek.*

1. INTRODUCTORY REMARKS. Important advances in the understanding of prosodic phenomena have been made during the last twenty years. These advances, culminating in Idsardi's 1992 dissertation, have shed new light on the accentuation of Indo-European languages and hence also on the reconstruction of the accentual system of the IE proto-language. IE accentuation has long been notorious for its difficulty. In one of the best books dealing with this topic, Garde (1976:x) remarks on the esoteric quality of the subject and expresses the hope that readers of his book will 'never again be tempted to ask themselves the ritual question (cf. Lunt 1963): "What are they talking about?"' Recent theoretical advances have made this aim more readily attainable than it was twenty years ago, for, as I hope to show below, the facts of IE stress and accentuation pattern in striking ways that are there to be seen by all, and not only by specialists who have devoted a lifetime to the subject.

In §2 I introduce Idsardi's 1992 theory of metrical structure and illustrate it with a number of simple examples from Russian, noting especially the fact that morphemes in Russian are inherently (lexically) accented. The section concludes with a list of the rules that were developed to deal with these examples (see 10 below). In subsequent sections I argue that these rules plus the lexical accentuation of morphemes make up the core of the IE accentual system. In §3 I discuss the accentuation of Russian nouns in greater detail and conclude that when supplemented by two accent retraction rules, the core rules account for the accentual behavior of Russian nouns. Section 4 examines the Serbo-Croatian (Štokavian) accentual system and argues that it differs from that of Russian primarily in the addition of a special tone spreading rule. Sections 5 and 6 survey the nominal accentuation of Sanskrit and Lithuanian and demonstrate that lexical accent and the core rules constitute the centerpiece of the accentual system of these two languages as well. In view of this striking simi-

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larity among IE languages that are known to have developed independently for millennia, the most plausible hypothesis is that the mobile stress system of Sanskrit and Balto-Slavic is a survival of the accentual system of the IE protolanguage. This hypothesis is further supported by Verner's Law, which shows that proto-Germanic at some point also must have had the same mobile stress system as Sanskrit and Balto-Slavic. Section 7 draws attention to the fact that the accounts developed for these accentual systems require no reference to tonal phenomena and that this supports Saussure's 1894 proposal—as against that of Fortunatov 1880–that intonations such as acute, circumflex, and so on, were later developments in the different languages and provide therefore no insight into the accentual system of the protolanguage. Since Fortunatov's views have dominated the field for the last century, the consignment of intonational phenomena to a marginal role in the IE protolanguage constitutes a fundamental change in how the problems are conceived. In §8 I sketch the evolution of the accentual system in the daughter languages where the original system is no longer operative. The latter are of two kinds: systems with initial stress, as in Germanic, Italic, Czech, Latvian, etc., and systems with stress on one of the last three syllables of the word, as in Polish, Macedonian, Latin, Greek, and others. The core rule system (see 10) assigns initial stress exclusively if the lexical accentuation of morphemes is eliminated. I therefore propose that loss of lexical accentuation is the crucial development in the demise of the original IE accentual system and its evolution into one with fixed initial stress, and show that a system with initial stress is readily transformed into a system limiting stress to the last three syllables. This is an important result since it is well known that among the IE languages, those with initial stress are the historical antecedents of languages with stress on the last three syllables. Section 9 contains an account of the accentuation of three languages with accentuation on the last three syllables: Macedonian, classical Latin and Attic Greek, including a novel treatment of enclitic stress in the latter two languages, while §10 briefly reviews the nominal accent classes posited for the IE protolanguage by Schindler 1975 and Rix 1976 and shows that these classes fit naturally into the account offered above. Section 11 contains a brief summary of the main empirical and theoretical results.

The space limitations of a journal article allow me to discuss here only a small fraction of the supporting evidence for the account proposed. More extensive evidence will be presented in a book on the phonology of IE that Andrea Calabrese and I are now preparing.

2. THE METRICAL THEORY OF PROSODY. Two facts—one self-evident and the other less so—must be properly dealt with by any viable theory of accentuation. The self-evident fact is that not all phonemes in a sequence are capable of bearing stress. To deal with this fact formally I adopt here the Idsardi 1992 theory of prosody, in which stress is computed on a separate autosegmental plane. On this plane are projected all and only those phonemes in the sequence that are stress bearing. Example 1 illustrates the projection of the Russian word *gorodámi,* the instrumental plural form of the noun *górod* 'town'.

(1) * * * * line 0
| | | |
gorod + ami

In 1 each stress-bearing element is represented with an asterisk and the sequence of asterisks so generated is labeled LINE 0. I explain below how additional lines of asterisks are computed. The set of lines of asterisks associated with a given phoneme sequence is termed the METRICAL GRID.

To deal with the less self-evident fact referred to above I follow the suggestion of Liberman 1975 that stress is not a phonetic feature like nasality or backness, but rather the phonetic expression of grouping stress-bearing elements into prosodic constituents or FEET. These groupings are notated below with the help of ordinary parentheses. The Idsardi theory deviates from other theories of metrical structure, such as Halle & Vergnaud 1987, in that it does not require a matched set of parentheses to delimit a metrical constituent. Instead the theory postulates that a left parenthesis groups all metrical elements on its right up to the next parenthesis or to the end of the string, whereas a right parenthesis groups the elements on its left up to the next parenthesis or beginning of the string. Elements that are not to the right of a left parenthesis or to the left of a right parenthesis are not part of any constituent or foot. Thus, as shown in 2, the Russian word *gorodámi* has a left parenthesis before the accented case ending *-ami*. This parenthesis groups the last two asterisks into a foot; the two asterisks preceding the parenthesis are ungrouped.

(2) * * (* * line 0
| | | |
gorod + ámi

One element in each foot is marked. This element is called the HEAD of the foot, and it is located at either of the two ends of the foot, as determined by a special HEAD-MARKING RULE. In the cases under discussion here the heads are left-most. The head elements of a given line in the metrical grid are projected onto the next higher line in the grid as illustrated in 3.

(3) * line 1
* * (* * line 0
| | | |
gorod + ámi

Head elements of a metrical constituent/foot are usually marked phonetically by a (high) tone which is referred to as stress.

Implicit in the grid notation is the important proposition that the metrical structure is superimposed on the phoneme sequence, but is not literally composed of the elements that make up the sequence. Feet are composed of the stress-bearing elements in the sequence—that is, those projected on line 0 of the grid—rather than of syllables or of phonemes, as in other theories.

In the IE languages with movable stress it is an idiosyncratic property of each morpheme which of its stress-bearing elements is supplied with a paren-

thesis, that is, which is ACCENTED.[1] In *gorodámi,* the one example discussed to this point, the instrumental plural suffix was supplied with a left parenthesis before its first stress-bearing element or line 0 asterisk, whereas the stem *górod* had no parenthesis. The inherently accented stem *gorόx* 'pea', on the other hand, has a parenthesis of its own, which is placed before the second stress-bearing element. The instrumental plural form *gorόx + ami* will therefore differ from that of *gorod + ámi* in 3 in that *gorόx + ami* will have two parentheses as illustrated in 4, implying that the form has two feet.

(4)
```
    *   *     line 1
  *(*  (* *   line 0
  | |   | |
 gorόx + ami
```

On the assumption that heads of feet are phonetically marked by stress, our notation implies that *gorόx + ami* should have two stresses. This implication, however, is false, for it is well known that in Russian there is exactly one stress per word. As noted in Kiparsky & Halle 1977, in words with several accented morphemes it is the first of these that surfaces with stress. We must therefore have a means for distinguishing the first foot in a sequence of feet. In the notation employed here this fact is expressed formally by constructing a foot on line 1.

The device employed for this purpose in Idsardi's framework is a rule of EDGE MARKING. An edge-marking rule inserts a parenthesis next to—to the left or the right of—the edgemost element of the string. A given edge-marking rule is therefore defined by setting three binary parameters: (1) the rule must specify whether to insert a left or a right parenthesis; (2) the parenthesis may be inserted to the left or the right of the edgemost element in the string; (3) the rule must also specify whether the parenthesis is inserted at the left or the right edge of the string. Edge-marking rules are therefore referred to by a sequence of three R's and/or L's; e.g. the edge-marking rule RRR inserts a Right parenthesis to the Right of the Rightmost element (asterisk).

I assume—without argument at this point—that in Russian, and in all IE languages with movable stress, line 1 is subject to edge-marking by means of the rule LLL; i.e. the edge-marking rule places a L(eft) parenthesis to the L(eft) of the L(eftmost) element in the string. This will generate the metrical grid shown in 5.

(5)
```
   (*   *     line 1
  *(*  (* *   line 0
  | |   | |
 gorόx + ami
```

Since it is the first of the elements on line 1 that bears the stress, we assume

[1] In the terminology used here an ACCENTED element is one that is supplied with a parenthesis in its lexical representation. A STRESSED element by contrast is one that is phonetically more prominent than other elements in the word. Accented and stressed are therefore always distinguished below.

that line 1 feet are subject to the same head-marking rule as those on line 0. In Russian—and in Lithuanian and in Sanskrit—feet on line 1 are left-headed. This yields the grid in 6.

(6)
```
    *          line 2
  (*   *       line 1
 *(*  (*  *    line 0
 | |   | |
gorox+ami
```

By means of the edge-marking rule LLL on line 1 a formal distinction has been made between the two line 0 heads in 6. The one projected onto line 2 is called THE HEAD OF THE WORD and, in Russian and many other languages, is supplied with high tone; low tones are assigned to all other line 0 elements. Thus, as a first approximation, stress is equated in these languages with high tone, and stresslessness with low tone. In this way, the head of the word is distinguished here from other stress-bearing elements, replacing the device of CONFLATION employed in Halle & Idsardi 1994 and earlier studies.

The above procedure also takes a step towards characterizing the tonal contours of words. Since for most matters of interest here the tonal contours of words play no role, the additional rules needed to characterize these contours are disregarded below, except in instances such as that of Serbo-Croatian discussed in §4, where tonal contours are of the essence. The effect of tone assignment on 6 is shown in 7.

(7)
```
    *          line 2
  (*   *       line 1
 *(*  (*  *    line 0
 | |   | |
go rox+ami
 | |   | |
 L H   L L
```

To complete the sketch of the theory we need to consider an example where both stem and case ending are unaccented; that is, lack a parenthesis. A case in point is dative singular *gorod+u*. As noted above, the stem *gorod* is unaccented (has no inherent parenthesis), and the same is true of its dative singular suffix *+u*. *gorod+u* will therefore have the underlying structure in 8.

(8)
```
 * *   *   line 0
 | |   |
gorod+u
```

Since this form has no parentheses and hence no feet, the formalism assigns no stress to *górod+u*. This, however, is incorrect: *górod+u* has stress on the word-initial syllable. To obtain the correct stress in this case we have recourse to edge-marking. Specifically, we posit that Russian words are subject to the RRR edge-marking rule on line 0, which places a R(ight) parenthesis to the R(ight) of the R(ightmost) syllable of the string. As shown in 9, this produces the correct output.

(9)
```
   *          line 2
  (*          line 1
   * *   *)   line 0
   | |   |
  górod+u
```

As a check of the few examples discussed to this point readily reveals, adding a right parenthesis at the right end of line 0 will have no effect on the assignment of stress to these. By contrast, the addition of a left parenthesis at the left end of line 0 would result in incorrect assignment of initial stress to all forms of *gorόx* and in the instrumental plural *gorod+ámi*.

The rules of Russian stress developed to this point are summarized in 10. As will be shown below these very rules govern stress assignment to words in other IE languages with movable stress.

(10)
i. Morphemes have idiosyncratic accents which are notated in vocabulary representations with left parentheses on line 0.
ii. Line 0 is subject to the edge-marking rule RRR
iii. Line 0 is subject to the head-marking rule L
iv. Line 1 is subject to the edge-marking rule LLL
v. Line 1 is subject to the head-marking rule L
vi. Assign high tone to the head of the word, low tone to all other line 0 elements

These preliminaries out of the way, we turn to a more detailed examination of stress assignment in Russian nouns.

3. RUSSIAN NOUN STRESS. In discussions of Russian stress it is necessary to distinguish the three major accentual paradigms illustrated in 11. It is traditional to designate these paradigms with the letters A, B, C. I have replaced these arbitrary designations with the more descriptive terms shown in 11.

(11)

	ACCENTED (A)	POSTACCENTING (B)	UNACCENTED (C)
SG.DAT:	gorόx-u 'pea'	korol,-ú 'king'	górod-u 'town'
PL.DAT:	gorόx-am	korol,-ám	gorod-ám

In nouns of the UNACCENTED paradigm, stress is determined by the case ending: stress goes on the case ending in the dative plural, but falls on the stem-initial syllable in the SG.DAT. As discussed in §2, in Idsardi's framework these facts follow directly from the assumption that the stem *gorod* is unaccented (it has no parenthesis in its underlying representation). As a result, stress in the declension of nouns of this paradigm is fully determined by the case ending; i.e., by such facts as that the dative plural ending is accented, whereas the dative singular ending is unaccented.

In the other two accentual paradigms, stress is determined without regard to the number-case ending, for in these paradigms the stress reflects the accentuation of the stem. If the noun stem is ACCENTED—projects a line 0 asterisk that is preceded by a left parenthesis—stress falls on the stem.[2] If the stem is

[2] As shown by the examples below the accent can be placed on any syllable in the stem, at least in foreign borrowings: *síntaksis, akvárium, temperáment, koloratúr-a, avtomobíl'*

POSTACCENTING—has a left parenthesis after its last asterisk—stress falls on the post-stem syllable. As discussed in §8.1, this is the major accentual innovation of the East and South Slavic languages.

Statistical distribution of the different accentual paradigms in the Russian vocabulary are given in 12, based on data in Zaliznjak 1967. It is worth noting that 99% of the nouns fall into one of the three accentual paradigms.

(12) Fixed stress on a stem syllable [accented]	30,100	91.6%
Fixed stress on post-stem syllable [postaccenting]	2,176	6.6%
Stress alternates between desinence and initial syllable of stem [unaccented]	273	.8%
Others	316	1.0%
Total	32,865	

As shown in 12 only .8% of the Russian noun stems are unaccented, but this small group includes many widely used nouns such as *ruká* 'hand', *golová* 'head', *górod* 'town', *xólod* 'cold', *zóloto* 'gold', *zérkalo* 'mirror'. The remaining 99+% of nouns have inherent accents, these being marked with a left parenthesis placed before some stem syllable in the accented paradigm, but after the last stem syllable in the postaccenting paradigm. The same contrast of accented and unaccented is found in the case endings, which are given in Table 1 below. The accentual contrast in case endings was already noted in §2, where, for example, the instrumental plural ending *-ami* was shown to be accented, whereas the dative singular suffix *-u* was shown to be unaccented. Given this information about the accentuation of stems and suffixes, stress location is fully determined by the rules in 10.

	SINGULAR				
	a-stems (fem.)	o/e-stems		i-stems (fem.)	PLURAL
		masc.	neut.		
NOM	(a	O	o/e	E	y/i/(a
GEN	(y	a		i	ov(O/ej(O/(O
DAT	(e	u		i	(amO
ACC	u/(u	like NOM or GEN		E	like NOM or GEN
INS	(ojO/(oju	omO		Eju	(ami
PREP	(e	e		i	(axO

TABLE 1. Russian case endings.

Each Russian noun belongs to one of three declensions, which determine the choice of case ending. These are traditionally designated as the *a-* declension, the *o/e-* declension, and the *i-* declension.[3] The declensions are distinct only in the singular; in the plural, declension class plays no role in choice of case

[3] The number-case endings can be further decomposed into a theme and desinence. Such decomposition provides important further insight into the nature of the Russian nominal declension. For some discussion, see Halle 1994. I have omitted here a number of special case endings which occur only after a handful of specially marked stems, such as the zero nominative singular ending that occurs only with the 10 neuter i-stems *bremja* 'burden', *vremja* 'time', *vymja* 'udder', *znamja* 'banner', *imja* 'name', *plamja* 'flame', *plemja* 'tribe', *semja* 'seed', *stremja* 'stirrup', *temja* 'top of the head'.

ending. I have given the different case endings of the three declensions in Table 1. A left parenthesis before a case ending indicates that the ending is inherently accented, and the capital O and E represent the abstract yer vowels of Russian (see discussion following ex. 18 below).

The singular case endings of i-stems and o/e-stems are unaccented, whereas those of the a-stems are accented except for the accusative singular *-u*. The plural case endings are accented except for the nominative plural *-y/-i*, which are unaccented.

There is no correlation between the declension class of a stem and its accentual paradigm. Each of the three declensions includes both accented and unaccented case endings, and nouns of all three accentual classes are found in each of the declensions. This is illustrated in Table 2, where each stem is paired with two desinences, the first accented and the second unaccented.

The theoretical framework of §2 thus readily accounts for the behavior of the overwhelming majority of Russian nouns. A number of important details remain to be discussed, however.

As noted above, stems of paradigms B such as *korol,* are represented with a left parenthesis after their last syllable. This will insure that stress always falls on the post-stem syllable. It will also generate two left parentheses in the instrumental plural forms.

(13) * *((* *)
korol,-ámi

To deal with such parenthesis configurations we introduce the notational convention 14, which removes vacuous parentheses since they group no phonological material. Although this convention may appear to be a mere bookkeeping device eliminating unnecessary material from representations, we shall see at the end of this section that it has significant empirical consequences.[4]

(14) Parentheses that group no stress-bearing elements are deleted.

In Table 1, 316 noun stems were not assigned to any of the three accentual paradigms of the language. Of these, 269 are exemplified by the pattern in 15.

(15)

a-stems	o/e-stems		i-stems
kolbás-ami	kazák-ami	kolés-ami	not attested
kolbas-ú	kazak-ú	koles-ú	
'sausage'	'Cossack'	'wheel'	

The examples in the bottom line of 15 show that even when the case ending is not inherently accented, stress goes on the case ending. This implies that the

[4] Roman Jakobson once remarked that a fundamental difference between the nonrealist esthetics of Gogol' and the realist esthetics of Čexov is reflected in the references to people that appear in the conversations of the characters in their plays. In *Revizor* there are constant references in the conversations to individuals that are never heard of again and who have no relevance to the action of the play. In Čexov's plays no such idle references are to be found: when someone is mentioned she or he is sure to be relevant at a later point to the action of the play. Jakobson advised that scientific and scholarly writings must conform to Čexov's realist esthetics and eliminate all irrelevant comments from the text, and only if unavoidable or irresistible—as in the present instance—may they be consigned to a footnote.

a-stems (fem.)	o/e-stems		i-stems (fem.)
	masc.	neut.	
	A: LEFT PARENTHESIS BEFORE ANY STEM SYLLABLE		
rádug-ami	goróx-ami	kolén-ami	ladón,-ami
rádug-u	goróx-u	kolén-u	ladón,-i
'rainbow'	'pea'	'knee'	'palm'
	B: LEFT PARENTHESIS AFTER LAST STEM SYLLABLE		
gospož-ámi	korol,-ámi	tržestv-ámi	(l,ubv,-ámi)
gospož-ú	korol,-ú	tržestv-ú	l,ubv,-í
'lady'	'king'	'celebration'	'love'
	C: NO LEFT PARENTHESIS		
storon-ámi	gorod-ám	zerkal-ámi	ploščad,-ámi
stóron-u	górod-u	zérkal-u	plóščad,-i
'side'	'town'	'mirror'	'square'

TABLE 2. Accentual paradigms of Russian nouns.

stems belong to the postaccenting paradigm. They have, however, the special property that in the plural the stress is retracted from the desinence to the stem-final syllable, as illustrated in 16.

(16)

```
                                  *          line 2
                                (*  *        line 1
*  *  (*  *   →    *  (*  (*  *)  line 0
|  |  |  |          |  |  |  |
kolbas-ami         kolbás-ami
```

To account for this stress retraction we posit rule 17, which applies to these 269 nouns of the postaccenting paradigm.

(17) Insert (/ ____ * (*
S D

where S is a lexically marked stem and D stands for a plural case ending and several other suffixes

The effect of 17 is to retract the stress one syllable to the left of where it would otherwise have been assigned. The phenomena captured by rule 17 have been discussed in the literature, where they are referred to by the term NEO-ACUTE. A rule similar to 17 appears to function in Sanskrit, and, as noted in §10, has also been proposed by Schindler (1975) for the IE protolanguage.

Russian verbs exhibit the same three accentual paradigms as the nouns, and, as in the nouns, stress retraction in verbs is limited to stems of the postaccenting paradigm, though the conditions are slightly different than those in 17. Two commonly cited examples of stress retraction in verbs are given in 18.

(18) /l,ubl,-ú l,úb,-a-t/ 'I/they love'
/mog-ú móg-u-t/ 'I/they can'

Somewhat surprisingly it turns out that the language has still another rule that retracts the stress to the left. In order to understand the working of this rule it is necessary to make a short excursion into the vowel system of Russian. Like other Slavic languages, Russian has in addition to a set of concrete vowels two abstract vowels. These abstract vowels, traditionally called YERS, are represented here by the capital letters *O* and *E*. The yers surface as /o/ or /e/ respec-

tively, if followed by another abstract vowel; in all other contexts the yers are deleted. This is illustrated in 19.

	SG.DAT	SG.NOM
(19) a.	park-u	park < park-O
b.	turk-u < turOk-u	turok < turOk-O

Because of the many extraneous issues that they raise, I shall not state formally the rules that are responsible for these alternations, but will only give them a name, YER RULES, so as to be able to refer to them below. (For more on the yer rules, see Szpyra 1992 and literature cited there.)

As illustrated in 19, yers are not limited to appearing inside stems, they also appear freely in case endings. For example, the nominative singular suffix of i-stems and of masculine o/e-stems is the abstract vowel yer. Since the suffixal yer is word final, it is deleted, but its presence is manifested by the fact that the yer in the stem-final syllable of /turOk/ surfaces, as illustrated in 19. As shown by dative singular form 19 the yer rules delete the stem yer when the case ending is a full vowel.

This procedure immediately raises a question about how yer deletion affects the stress placement in a word. Consider to this end the two derivations in 20.

(20) a.

```
                                  *
  * * ( *) Yer  * *  ( ) 14  * *  )
korol,-O  →  korol,    → kórol,
```

b.

```
                                                  *
  * * ( *)  21   * (* ( *) Yer  * (*  ( ) 14    * (*)
korol,-O  →  kor ol,-O  →  kor ol,     →  kor ól,
```

The yer rules delete the word-final yer, which normally would bear the stress. Since the stem ends with a left parenthesis in this case, yer deletion should have given the output with initial stress shown in 20a (cf. 27). This, however, is incorrect. In order to obtain the correct stress contour an additional accent retraction rule (21) is needed.

(21) Insert (/____*(*

```
                |
            O/E [yers]
```

But 21 is so similar to 17 that arguments must be given showing that Russian, indeed, needs both retraction rules. The need for both 17 and 21 is shown by the examples in 22b and c, where 17 feeds 21: 21 is applicable only by virtue of the prior application of 17.

(22) a.

```
  * * * (*)Yer  **  (*)
polot-En-u  →  polot-n-ú SG.DAT
```

b.

```
  * * *  (*  *) 17  * * (*  (*  *)
polot-En- ami  →  polot-En-ami
                        Yer
  21  *(* (*  (*  *) 10vi  *(*  (*
  →  polot-En-ami  →  polót-n-ami
```

c.

```
                                                    Yer
  * *  * ( *) 17  * * (* ( *) 21  *(* (* ( *) 10vi *(* *)
polot-En-O  →  polot-En-O  →  polot-En-O  →  polót-en
```

This analysis is supported by the behavior of the small set of noun stems that are exceptions to the retraction rule (21). Among these are the numerals 5–20, all of which are i-stems; the regular stress is illustrated by the noun *ljubov'* 'love' in 23.

(23)

* *(- *	* *(- * *	* *(- *	
l,ubOv, -i	l,ubOv,-Eju	l,ubOv,-E	
SG.GEN	SG.INS	SG.NOM	
ljubv-í	*ljubóv-'ju*	*ljubóv'*	

Rule 21 applies in the instrumental singular and nominative singular and inserts a left parenthesis before the stem-final asterisk. It is on this syllable that the surface stress falls in these two words. In these two forms the yer rules lower the stem-final yer, but delete the yer in the case ending. In the genitive singular, the stem yer is deleted by the yer rules since the following syllable contains a full vowel.

The exceptional behavior of the numerals is illustrated with different forms of the postaccenting stem *desjat'* 'ten' in 24.

(24)

* *(*	* *(* *	* *(*	* * *(*
d,es,at-í	d,es,at,-Ejú	d,és,at,-E	ná-d,es,at,-E
SG.GEN	SG.INS	SG.NOM	SG.ACC

Since these nouns are exceptions to 21 no left parenthesis is inserted before the suffix. This accounts for the suffixal stress in the genitive singular. It also accounts for the suffixal stress in the instrumental singular: since the suffixal yer is deleted the surface stress shifts automatically to the remaining stress-bearing element in the foot.[5]

More instructive still are the last two forms in 24. The leftmost form in 25 shows the metrical grid after the application of the normal stress rules, after the right parenthesis is inserted by 10ii. Since 23 does not apply, application of the yer rules results in a pair of parentheses grouping no stressable elements. Convention 14 applies to such representation and removes the left parenthesis, because there are no stressable elements on its right. As a consequence, the word is stressed on its initial syllable as though it were unaccented.[6]

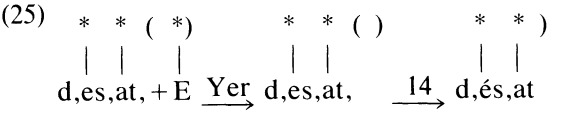
[5] It has been suggested by one of the referees that the theoretical framework for stress assignment should be replaced by a more parsimonious one employing only grids but no parentheses. The example *desjat'jú* 'ten' singular instrumental shows that this is impossible. If parentheses are eliminated the genitive singular and instrumental singular would have the respective representations below:

*	*
* * *	* * * *
/d,es,at-í/	/des,at,-Ejú/

The correct stress would readily be derived from the first of these, but not from the second, because in the absence of a parenthesis and foot structure, there would be no reason to shift the line 1 asterisk to the right. Even more serious problems arise in the case of the two remaining forms in 24, which are discussed below. Additional problems for the alternative proposal are noted in n. 6 and in the discussion of Saussure's law in §7 and of the evolution of postaccenting stems in Slavic in §8.1.

[6] Additional instances where 21 fails to apply are masculine short adjective forms such as *bólen* 'ill' (vs. *smešón* 'funny') and nouns with exceptional stress such as the postaccenting *ugol* 'corner', *uzel* 'knot', *ugor'* 'eel', and the nominative singular of the accented *zaem* 'loan', *naem* 'hire'.

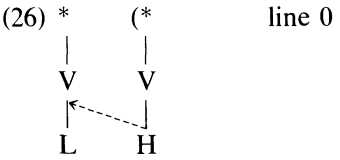
The notation assigns initial stress to the line 0 asterisk sequence **** as well as to (****. These

(25)


To sum up, Russian stems are either accented, postaccented or unaccented, and this is also true of affixes. The word stress is computed with the help of the rules in 10, supplemented by the accent retraction rules 17 and 21 and the yer rules. A subclass of the nouns of the postaccenting paradigm are subject to rule 17 in the plural, and another subclass of the same paradigm are exceptions to rule 21.[7]

4. SERBO-CROATIAN (ŠTOKAVIAN) ACCENTUATION[8]. In this section I sketch the accentual system of the Serbo-Croatian (SCr) literary language, the Štokavian dialects that underlie the literary language codified by Vuk and discussed in standard works such as Leskien 1914, Matešić 1970, Lehiste & Ivić 1986, and in comparative studies such as Stankiewicz 1993.

As noted by Browne & McCawley 1965, the Serbo-Croatian accentual system is essentially identical with that of Russian. In particular, the underlying representations of many Serbo-Croatian words are identical with those of their cognates in Russian. Like most languages with mobile stress, both Russian and Serbo-Croatian assign a high tone to the main stress of the word and low tones to the rest. The main difference between the two languages is that in Serbo-Croatian, but not in Russian, the high tone is spread to the preceding syllable by the rule given as 26.

(26)


High-tone spreading as in 26 creates a rising tone, which is marked in the official orthography as shown in 27.[9]

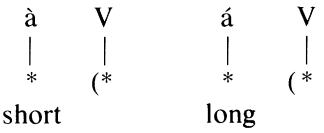
distinct representations are treated differently by the language, in spite of the fact that both have initial stress. As is well known, the initial vowel in the latter, but not in the former sequence is subject to shortening in Serbo-Croatian, and an analogous distinction is found in Russian dialects (such as the renowned Leka dialect discussed by Šaxmatov 1913). These phenomena are readily accounted for in the Idsardi notation employed here, but not in the grid-only notation referred to in the preceding note.

[7] The stem accent (parenthesis) of a number of stems is deleted before all plural case endings; e.g., *professor, učitel'*. Stem accent is also deleted by the accented locative singular endings /u/ and /i/.

[8] I thank Ellen Bursać for help with the SCr data. Forms quoted from Matešić 1970 are notated as (Mxyz), where xyz refers to the paragraph in Matešić's book.

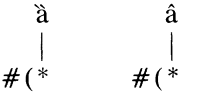
[9] A very similar rule is found in Vedic, where as in Serbo-Croatian there are contrasts between *udātta* and *svarita*. According to Allen (1953:87), 'In a given register a syllable with high tone is *udātta*, with low tone *anudātta* and with falling *(akṣipta)* tone *svarita;* the first half of the *svarita* is *udātta*.' However, in Vedic the high tone of the accented syllable is spread rightward, generating a *svarita*.

(27)



If there is no preceding syllable, no rising tone is generated, and the word-initial vowel is marked in the orthography with one of the falling tone marks:

(28)



As a consequence of the conventions on tone notation just described there are severe restrictions on the occurrence of the two kinds of tone mark, which I have summarized in 29.

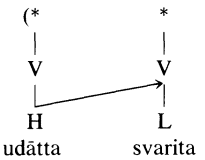
(29)

	MONOSYLLABIC WORD	POLYSYLLABIC WORD		
		INITIAL	MEDIAL	FINAL
FALLING	yes	yes	no	no
RISING	no	yes	yes	no

The two types of tone marks contrast only in the initial syllable of polysyllabic words; in the three other contexts the marks are either in complementary distribution or are not admitted. This lopsided distribution does not reflect reality: it is, as noted in Browne & McCawley 1965, an artifact of the manner in which the official SCr orthography represents the surface tone contour of words.

Underlyingly, in Serbo-Croatian, as in Russian and other East Slavic languages, accents are idiosyncratic properties of the morphemes that make up the word, and as in these languages the accent may be placed on any syllable or after the last syllable. This tripartite division of SCr noun stems was recognized also by Stankiewicz (1993: 103), who says that the SCr 'nominal inflection distinguishes three types of stems: (1) mobile stressed (α_0 or circumflex), which carry an absolute initial stress, (2) stem-stressed (α or acute), which may carry the stress on any syllable of the stem, and (3) desinentially stressed (β or oxytonic), which carry the basic stress on the desinence.' In sum, Serbo-Croatian has the same three accentual paradigms as Russian.

As shown below, the location of the word stress is computed by means of a set of rules identical to those given in §3 for Russian. The main innovation of Serbo-Croatian is rule 26, and it is primarily because of the effects of rule 26



Allen notes that 'in the texts of the RV, . . . the *svarita* and not the *udātta* is indicated by a vertical stroke above the syllable' (1953:88); i.e., just as in Serbo-Croatian it is the contour tone rather than the stationary high tone that is marked in the orthography.

	a-declension	i-declension	o/e-declension
SG.NOM	(-a	-E	-O/-o/-e
GEN	(-ē	-i	-a
DAT	-i	-i	-u
ACC	-u	-E	= NOM/GEN
INS	(-ōm	-i/-Eju	-om/-em
LOC	(-i	(-i	-u
PL.NOM/ACC	-e	-i	-i/(-a
GEN	(-ā	(-ī	(-ā
DAT/LOC/INS	(-ama	(-ima	(-ima

TABLE 3. Serbo-Croatian case endings.

that SCr words differ prosodically from those of Russian.[10] Serbo-Croatian has the same three noun declensions as Russian: the (overwhelmingly) feminine a-declension; the feminine i-declension, and the masc-neuter o/e-declension, each of which has its own case endings. The case endings of the SCr declensions are given in Table 3) and they show obvious resemblances to their Russian counterparts in Table 1.

Like in Russian, in the case of accentless stems, the rules in 10 assign stress to the desinence if the latter is accented, and to the word-initial syllable if the desinence is unaccented. As remarked above, the former of these two outcomes is notated in the SCr orthography with a rising tone on the predesinential syllable, and the latter with a falling tone on the initial syllable. As shown in Table 3, in the a-declension the dative singular, accusative singular and nominative plural endings are unaccented whereas all other endings are accented. We therefore expect falling tones in these three case forms, and rising tones in the rest of the paradigm, and analogous distributions are predicted for the other declensions. As shown below these expectations are fully borne out by the tone contours of the different declensions illustrated in 30–33 (see n. 8 above for source information).

(30) a-declension
unaccented des.: SG.NOM vȍd-u; SG.DAT vȍd-i; PL.NOM vȍd-e
accented des.: SG.NOM vòd-a; SG.GEN vòd-ē; SG.LOC vòd-i; SG.INS

[10] Zec 1993 has offered an alternative to the metrical account presented here. In Zec's account the three classes of accentual stems are distinguished as follows: accented and postaccenting stems are supplied with a floating H tone, whereas unaccented stems have no tone. The difference between accented and postaccenting stems is said to be determined by the last stem vowel: if it is long the stem is postaccenting; if the last vowel is short, the stem is accented. This account fails in view of the following problems: (1) there are postaccenting stems whose last vowel is short, e.g., SG.GEN *Dalmatínac*, SG.GEN *Dalmatínc-a* 'Dalmatian' is a postaccenting stem, yet the vowel of its last syllable is yer, the quintessential short vowel; (2) there are numerous accented stems whose last syllable has a short vowel that do not place the stress on the last stem syllable as predicted by Zec's tone linking rule, e.g. *jȁgod-a* 'berry', *pròfesoric-a* 'professor' (fem), *pòručnikovic-a* 'lieutenant's wife', etc.; (3) as Zec admits in note 26, she has no account of the accent retraction in the genitive plural for the large class of stems that have a yer vowel in their last syllable.

vòd-ōm; PL.DAT/LOC/INS vòd-ama; PL.GEN vód-ā 'water' (M132)[11]

(31) i-declension
unaccented des.: SG.NOM/ACC kôst; SG.GEN/DAT/INS kôst-i; PL.NOM/ACC kôsti
accented des.: SG.LOC kòst-i; PL.DAT/LOC/INS kòst-ima; PL.GEN kòst-î 'bone' (M112)

(32) masculine o/e-declension
unaccented des.: SG.NOM/ACC drûg; SG.GEN drûg-a; SG.DAT/LOC drûg-u; SG.INS drûg-om; PL.NOM drûz-i; PL.ACC drûg-e; PL.DAT/LOC/INS drûz-ima
accented des.: PL.GEN drûg-ā; 'friend' (M84)

(33) neuter o/e declension
unaccented des.: SG.NOM bȓd-o; SG.GEN bȓd-a; SG.DAT/LOC bȓd-u; SG.INS bȓd-om
accented des.: PL.NOM/ACC bȓd-a; PL.DAT/LOC/INS bȓd-ima; PL.GEN bŕd-ā 'chest bone' (M154)

In 34 I have illustrated the derivation of the tone contours of several of the forms cited above.

(34)

underlying	*	(	*	*	*	*	(	*	*	*	*	*	(	*	*	*	*		
representation	vòd-	ama		vod-	e		kòst-	ima		kost-	i		bŕd-	ima		brd-	o		
Stress		*			*			*			*			*			*		
rules (10)		(	*		(	*			(	*		(	*			(	*		
	*	(	*	*)	*	*)	*	(	*	*)	*	*)*	(	*	*)	*	*)		
	vòd-	ama		vòd-	e		kòst-	ima		kòst-	i		bŕd-	ima		bȓd-	o		
Tone rule	|	|	|	|	|	|	|	|	|	|	|	|	|	|	|	|	|	|	|
(26)	L	H	L	H	L	L	H	L		H	L	L	H	L		H	L		

The lengthening of the stem in the nominative singular *kôst* in 31 is due to special lengthening rules.[12]

Unlike the accentless stems, postaccenting stems place stress on the case ending, and this surfaces in Serbo-Croatian with a rising tone on the last stem vowel.[13] This is illustrated below with a-declension nouns in 35, and o/e-declension nouns in 36 and 37. There are no postaccenting i-declension nouns according to Matešić's survey.

[11] In the paradigm for the feminine nouns *planína* (M133) the dative singular form is cited as *planíni* indicating that the desinence is accented for this class of nouns. There thus appears to be some vacillation with respect to the underlying accent of the dative singular desinence *-i*.

[12] In discussing the stress alternations in nouns with accentless stems, Stankiewicz (1993:111–19) fails to note that with few exceptions the alternations are the consequence of the fact that after accentless stems, stress automatically falls on an accented desinence, and that stress falls on the stem-initial syllable only when both stem and desinence are accentless.

[13] If the stem vowel is a yer, which is deleted before non-yer suffixes, the noun will surface with falling tone on the suffix.

(35) SG.NOM slobòd-a; SG.GEN slobòd-ē; SG.DAT/LOC slobòd-i; SG.ACC slobòd-u; SG.INS slobòd-ōm; PL.NOM slobòd-e; PL.DAT/LOC/INS slobòd-ama; PL.GEN slobód-ā 'liberty' (M125)

(36) SG.NOM svjèdok; SG.GEN/ACC svjedòk-a; SG.DAT/LOC svjedòk-u; SG.INS svjedòk-om; PL.NOM svjedòc-i; PL.ACC svjedòk-e; PL.DAT/LOC/INS svjedòc-ima; PL.GEN svjedók-ā 'witness' (M82a)[14]

(37) SG.NOM/ACC pèr-o; SG.GEN pèr-a; SG.DAT/LOC pèr-u; SG.INS pèr-om; PL.NOM/ACC pèr-a; PL.DAT/LOC/INS pèr-ima; PL.GEN pér-ā 'feather' (M145a)

As in Russian, a number of postaccenting stems are subject to stress retraction in the plural by rule 17. These all belong to the o/e-declension. As shown in 38 these stems show—as expected—rising tone in the singular and falling tone in the plural.

(38) SG.NOM/ACC sèl-o; SG.GEN sèl-a; SG.DAT/LOC sèlu; SG.INS sèl-om; PL.NOM sȅl-a; PL.DAT/LOC/INS sȅl-ima; PL.GEN sȇl-ā 'village' (M157)

This brings us to the inherently accented stems. These have the expected fixed stress on a given syllable, as shown by the examples 39–42.

(39) SG.NOM rȉb-a; SG.GEN rȉb-ē; SG.DAT/LOC rȉb-i; SG.ACC rȉb-u; SG.INS rȉb-ōm; PL.NOM rȉb-e; PL.DAT/LOC/INS rȉb-ama; PL.GEN rȉb-ā 'fish' (M123)

(40) SG.NOM/ACC mȁt-i; SG.GEN mȁter-ē; SG.DAT/LOC mȁter-i; SG.INS mȁter-ōm; PL.NOM/ACC mȁter-e; PL.DAT/LOC/INS mȁter-ama; PL.GEN mȁtēr-ā 'mother' (M116a)

(41) SG.NOM jèlen; SG.GEN/ACC jèlen-a; SG.DAT/LOC jèlen-u; SG.INS jèlen-om; PL.NOM jèlen-i; PL.ACC jèlen-e; PL.DAT/LOC/INS jèlen-ima; PL.GEN jèlēn-ā 'deer' (M85a)

(42) SG.NOM/ACC dȍmin-o; SG.GEN dȍmmin-a; SG.DAT/LOC dȍmin-u; SG.INS dȍmin-om; PL.NOM/ACC dȍmin-a; PL.DAT/LOC/INS dȍmin-ama; PL.GEN dȍmīn-ā 'domino'

This concludes the survey of the main features of the SCr accentual system as reflected in the noun word. If the effects of rule 26 are disregarded, then both Russian and Serbo-Croatian are instances of the same basic metrical system, where morphemes are distinctively accented and where stress is computed by the rules in 10. Intonational contrasts play only a superficial role in the phonology of the language. This is in marked contrast to languages such as Lithuanian and Latvian, where, as discussed in §6, intonational contrasts are inherent properties of syllables with a long nucleus.

This conclusion directly contradicts the account found in most handbooks, where for well over a century it has been taught that the intonational contrasts of Slavic are on a par with those of Baltic. Thus, Meillet (1924; 139) says: 'The vowels that represent old long vowels and diphthongs admit two ''intonations''

[14] Stankiewicz (1993:110) notes that stress retraction off a yer-desinence (by yer retraction) does not take place in a number of stems ending with yer; e.g., /petr-'a/ (*Pètra*), /p'etar/ (*Pètar*); /svekr-'a/ (*svèkra*), /sv'ekar/ (*svèkar*) 'in law'. These are parallels to the Russian *uglá úgol* 'corner' etc. of n. 6.

in common Slavic.' It is on the basis of this identification that intonational contrasts have been assumed to have been part of the Balto-Slavic protolanguage. An immediate consequence of the alternative view presented here is that intonational properties such as ACUTE, CIRCUMFLEX, NEO-ACUTE must no longer be used to account for various aspects of the phonological evolution of Slavic languages. I return to this issue in §7 below.

5. SANSKRIT ACCENTUATION. This brief overview of Sanskrit stress is based on the data in the grammars of Macdonell 1975 and Whitney 1941. My analysis is indebted to Sarma 1994. In its basic outline the Sanskrit accentual system is quite like that of Russian and Serbo-Croatian; that is, stress is computed by the core rules in 10. Like the latter two languages, Sanskrit distinguishes between accented and unaccented morphemes. It differs from them in that Sanskrit has no postaccenting stems like the Russian *korol', gospoža, ljubov'* that place stress on the post-stem syllable and that constitute the accentual paradigm B. It was shown by Illič-Svityč 1963 that the postaccenting paradigm is a special development of Slavic that has no counterpart in the other branches of Indo-European. This development is discussed in §8.1.

Except for those of the vocative, case endings in Sanskrit are inherently accented. Some of the accented case endings trigger the Sanskrit analog of the stress retraction rule (17) and place an accent on the final stem syllable. The endings triggering retraction are those of the so-called strong cases: the nominative and accusative of both singular and dual, and the nominative of the plural. The fact that in the vocative, stress is on the initial syllable of both accented and unaccented stems will be captured by positing that the vocative desinence is unaccented and that like other 'dominant' suffixes it triggers a rule that deaccents stems (cf. Kiparsky 1982). In sum, there are two kinds of stems in Sanskrit—accented and unaccented—and three kinds of case endings—accented, preaccenting, and the unaccented vocative, which is also deaccenting. The six possible combinations of stem and case ending are illustrated in Table 4.

	ACCENTED STEM		UNACCENTED STEM		ENDING TYPE
	'wind'	'sister'	'daughter'	'foot'	
SG.DAT	marút-e	svásr-e	duhitr-é	pad-é	accented
SG.ACC	marút-am	svásār-am	duhitā́r-am	pā́d-am	accented, preaccenting
SG.VOC	márut	svásar	dúhitar	pāt	unaccented, deaccenting

TABLE 4. Sanskrit stems and case endings.

With the exception of the vocative, the accented stems *svásar* and *marút* have stress on the same syllable in all forms, as would be expected given the rules in 10. I have cited two accented stems in Table 4 in order to illustrate the fact that stem accent in Sanskrit is not restricted to the stem-initial syllable. The vocative singular form of the noun *marút,* whose lexical accent is stem final, has initial stress just like the inherently unaccented stem *duhitar*. Formally this is accounted for, as suggested above, by positing that the vocative singular

suffix, which happens to be phonetically NULL, triggers a rule that deaccents the noun stem. The rules in 10 then assign initial stress.[15]

Consider next the accusative singular forms *duhitár-am* and *pā́d-am*. Since the stem is unaccented and the case ending is accented we should have expected stress on the ending, not on the presuffixal syllable. An analogous situation arose in Russian, cf. 15, where I posited the accent retraction rule 17. A similar rule must be posited also for Sanskrit. This rule differs from the Russian rule in the contexts where retraction applies; in their effects on stress location the two rules are identical.

Notice in Table 4 that the stems *duhitar, and svasar* lose their last vowel before 'weak' case endings: case endings that are accented, but do not trigger accent retraction. This vowel loss is a Sanskrit example of the 'zero' grade ablaut, which deletes unaccented short *a* if the next syllable is accented. A more formal statement of the zero grade rule is given in 43.

(43) /a/ → 0 /____ . . . V

*	(* line 0
	* line 1

The zero-grade rule (43) is sensitive to the abstract accentual properties of the sequence rather than to its concrete stress contour. As shown by the forms *duhitr-é* vs. *svásr-e,* unaccented *a* in the stem final syllable is deleted before the accented dative singular ending *-e*, regardless of whether or not *-e* is stressed on the surface. The *-a* is not deleted in the stem-final syllables of *svásar-am, duhitár-am* because it is accented by the Sanskrit counterpart of rule 17 and protected thereby from deletion.[16]

In sum, Sanskrit is subject to the rules in 10 plus its own version of the retraction rule (17). Sanskrit, moreover, has a rule deleting stem accent in the vocative singular and the zero-grade rule (43). Sanskrit differs from Russian—and other Slavic languages—in that from an accentual point of view it has two rather than three classes of stems: accented like *marút, svásar* and unaccented like *duhitar,* but no counterparts of the Slavic postaccenting stems.

6. LITHUANIAN STRESS.[17] The Lithuanian accentual system is quite like that of both Sanskrit and Slavic: it is governed by the rules in 10. Like Sanskrit, Lithuanian distinguishes only accented and unaccented stems, and lacks counterparts of the Slavic postaccenting stems.

It is well known that the Baltic languages, Lithuanian and Latvian, exhibit

[15] The behavior of deaccenting ('dominant') suffixes was discussed in Kiparsky 1982, a paper that appears to have remained unpublished. For additional discussion, see Halle & Vergnaud 1987: 1 §3.2.1.

[16] Calabrese 1996 shows that rule 43 must be constrained so as to apply only in certain morpheme sequences. One of the reviewers has remarked that this limits the support that 43 offers for intermediate representations in phonology. It is therefore well to recall here that the need for intermediate representations in phonology is extensively documented in the literature, from Chomsky's 1951 MA thesis to Halle 1995.

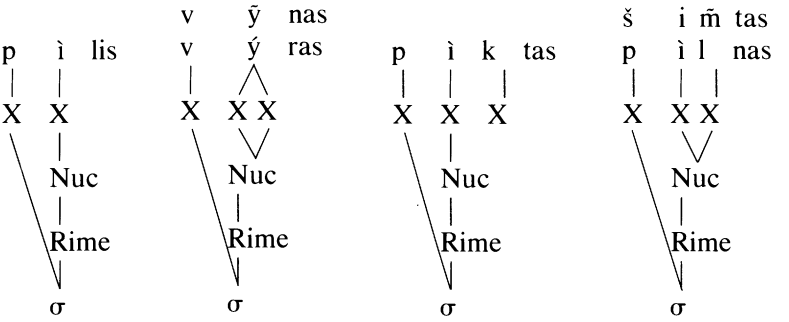
[17] I follow here, with some modifications, the account in Halle & Vergnaud 1987:190–203.

intonational contrasts on syllables whose nucleus is composed either of a long vowel or diphthong or of a short vowel followed by a sonorant consonant [r, l, n, m]. Syllables with short nuclei have no tonal contrasts. We illustrate these intonational contrasts in 44, where ⟨y⟩ represents a long [i:]

(44) SHORT pìlis 'fortress' pìktas 'evil'
ACUTE výras 'man' pìlnas 'full'
CIRCUMFLEX vȳnas 'wine' šim̃tas '100'

The syllable structure of the stressed syllables in 44 is shown in 45, where X stands for a timing slot.

(45)



I follow here the suggestion in Halle & Vergnaud 1987 that in Lithuanian, as in the other languages discussed here, only one nucleus slot of a syllable is stress bearing, i.e. projected on line 0 of the metrical grid. The unusual characteristic of Lithuanian is that it admits of a choice between projecting the initial or final nucleus slot of a syllable. Circumflex syllables are specially marked to indicate that their final nucleus slot is projected onto line 0; all other syllables are unmarked and project the initial nucleus slot (head). Thus the stem syllables of the two words in the top line of 45 project the final nucleus slot onto line 0 of the metrical grid, whereas all other syllables project the initial or only nucleus slot. In literary Lithuanian this contrast between acute and circumflex surfaces only in syllables bearing the main stress of the word, but the contrast is marked in underlying representations in all syllables. In other dialects of Lithuanian as well as in Latvian intonation contrasts surface on all syllables, not only on those under stress.

Representative stress patterns of the Lithuanian noun are given in Table 5.

The stress distribution in Table 5 is readily accounted for by the core rules in 10 plus the assumption that both stems and endings may or may not be accented. This is transparently so in the stress patterns of nouns of class I and

	I	II	III	IV
	'greyhound'	'finger'	'oak'	'wolf'
PL.LOC	kùrt-uose	piršt-uose	ažuol-uosè	vilk-uosè
SG.NOM	kùrt-as	piršt-as	ážuol-as	vil̃k-as
SG.LOC	kùrt-e	piršt-è	ažuol-è	vilk-è
PL.ACC	kùrt-us	piršt-ùs	ážuol-us	vilk-ùs

TABLE 5. Representative stress patterns of Lithuanian nouns.

III: in the accented class I stem *kurt* 'greyhound', stress remains on the stem regardless of the suffix; in the unaccented class III stem *ažuol,* stress is on the case ending when the latter is accented, and on the stem-initial syllable when the case ending is unaccented. We find the same stress distribution in the locative plural and nominative singular forms of class II and class IV stems. All are directly accounted for by the rules in 10.

The forms yet to be accounted for—the locative singular and accusative plural of stems of class II and IV—are instances of Saussure's law, which is traditionally stated as in 46 (see Collinge 1985:149).

(46) Stress is advanced from a syllable whose rime is short or has circumflex intonation to an immediately following syllable if the latter has (or had) acute intonation.

The first question to be addressed is how to express stress advance in the metrical grid notation utilized here. Since feet in Lithuanian are left-headed, the most economical way of dealing with this phenomenon is as a side effect of a syllable losing its line 0 asterisk and becoming incapable of bearing stress. As illustrated in 47, when a syllable with a line 1 asterisk loses its line 0 asterisk, the line 1 asterisk automatically advances to the next asterisk on the right, since it is the latter which is now the head of the foot.

(47) a.
```
      *              *      line 1
* * (* *) → * * (0 *)      line 0
```

b.
```
*            *             line 1
* * *) → 0 * *)             line 0
```

It has been remarked that the two syllables affected by Saussure's law bear tone on consecutive moras. Steriade (1988: §3) attempted to express this special type of context by enriching the notation with the addition of a line to the metrical grid on which moras are represented. This enrichment of the grid is not adopted here since all facts can be expressed without it, as I now show.

In the notation I employ here timing slots—represented in 45 by X's—are distinguished from their projections on line 0 of the metrical grid. As noted above, long syllables with circumflex intonation project their final nucleus slot onto line 0, whereas all other syllables (long syllables with acute intonation and short syllables) project their initial nucleus slot. As a result, in a sequence where an acute syllable is preceded by one that is circumflex or short, the two consecutive stress-bearing elements projected on line 0 of the metrical grid are separated by phonemes that are not part of the syllable nucleus, whereas in a sequence where an acute syllable is preceded by one that is also acute the phonemes separating the two stress-bearing elements include both nuclear and nonnuclear timing slots. This is illustrated in 48 with the underlying representations of the locative singular forms of the word *vinè* 'wine' and *výre* 'man'.

(48) a.
```
v  i  n  e
|  /\ |
X X X X X X      timing slots
   |  |
   *  *           line 0
```

b.
```
v  i  r  e
|  /\ |
X X X X X X      timing slots
   |     |
   *     *        line 0
```

In 48a the two consecutive stress-bearing elements belong to two consecutive moras, but this is not so in 48b, because the second nucleus slot of the stem is not stress bearing. If the rime of the first syllable in 48b were to be replaced by a short vowel, the two stress-bearing elements would belong to two consecutive moras. Saussure's law can now be reformulated as in 49, which is more economical than the traditional formulation in 46 since reference to the intonations can be dispensed with.[18]

(49) $*_1 \rightarrow 0$ /____ $*_2$ line 0

$X_1 \ldots X_2$

where X_2 is part of a branching nucleus
where . . . contains no nuclear timing slot

In 'A propos de l'accentuation lituanienne', Saussure (1894) presented extensive evidence that in Lithuanian, a historically long syllable nucleus[19] was assigned acute intonation, whereas a historically short nucleus received circumflex intonation. Saussure thought that this happened at an early stage in the evolution of Baltic and specifically excluded instances where a circumflex intonation represents a late borrowing from another language, or is a recent formation in the language, or is the result of metatony implemented by a morphological or phonological rule. If Saussure is correct in supposing that the Lithuanian stress shift entered the language at an early stage, the conditions for stress shift were originally somewhat more transparent than they are in the modern language; specifically, the stress shifted from a short syllable-nucleus to the directly following long syllable-nucleus. In its original form Saussure's law might therefore have read as in 50, which is somewhat simpler than the rule of the modern language given in 49.

(50) $*_1 \rightarrow 0$ /____ $*_2$ line 0

X_1 X_2

where X_2 is part of a branching nucleus
where X_1 is part of a nonbranching nucleus

7. ON INTONATIONS IN BALTIC AND SLAVIC AND OTHER IE LANGUAGES. The formulations of Saussure's law in (49) and (50) differ from the traditional statement (46) in that they make no reference to intonation and focus exclusively

[18] This account of Saussure's law expresses formally the insight that the rightward shift of the stress is crucially linked to the fact that feet in Lithuanian are left-headed. If correct, this understanding of the phenomenon also supports the need for the inclusion of foot boundaries (parentheses) in the notation of stress, for this insight cannot be captured in a bare (parenthesis-less) grid notation such as that in Prince 1983.

It is also to be noted that 49 presupposes that shortening of word-final acute syllables by Leskien's law and the general shortening of unstressed vowels are ordered after Saussure's law. For some discussion see Halle & Vergnaud 1987.

[19] Saussure used the term TRANCHE INTONABLE to designate 'the entities . . . which inside the word are subject to intonation or accent' [les unités . . . qui, dans le mot entrent en considération pour l'intonation ou l'accent]. I have translated Saussure's TRANCHE as 'syllable nucleus', where nucleus is understood as in 45. For additional details, see Halle & Vergnaud 1987.

on the structure of the two syllables involved. This brings us to the central issue discussed in Saussure 1894.

> In 1878, Fortunatov advanced a novel and somewhat unexpected idea in stating that there must exist a correspondence between certain phenomena in Indic, Greek, Latin and the intonations (or 'accents contraires') of Lithuanian; so that one cannot doubt that the former languages also exhibited the special intonational differences that characterize the Baltic dialects. Proof for this is provided by the fact that Sanskrit [long syllabic] *r* regularly changes into *i*:*r*, *u*:*r* in the cases where Lithuanian has the acute tone; thus *pìlnas*, Skt. *pu*:*rnas*, as against *vil̃kas*, Skt. *vṛkas*. Similarly, in Greek we have *-ρω-*, in Latin *-ra*:- according to the same tone law. (Saussure 1894:496ff.)

Saussure thus attributes to Fortunatov the idea that the IE protolanguage had intonational contrasts that survived (more or less) intact only in the Baltic languages, but left all sorts of nonintonational reflexes in the other branches of Indo-European. This proposition, which has been generally accepted in Baltic and Slavic studies for well over a century, is regarded as fundamentally mistaken by Saussure. In his opinion, long syllabic /r/ is the reflex of the sequence /r/ + laryngeal and contrasts therefore with short /r/ not in intonation, but in quantity (length).

> . . . once we accept formally that [long] *r* stands for (*vaut*) *r* + *ö*[20]—that it differs therefore fundamentally from [short] *r* as completely as *ā* differs from *ă*, or *st* from *s* . . . such a hypothesis about the intonation is logically excluded . . . We would find ourselves then [were we to adopt it] . . . almost in the same situation as someone who knowing of the IE [length contrast] *ā*:*ă* would study the vowel quality contrasts *η*:*α* of Ionian in order to discover the source of the former. It would never occur to him that because this [quantity] difference is IE, there is the slightest presumption that the vowel quality [difference] is also IE. (Saussure 1894:498)

Saussure's suggestion has radical consequences for the study of Slavic accentuation, where tonal contrasts have traditionally been used to explain many of the most important phenomena, and there are a number of indications that Saussure's suggestion is on the right track, that is, that tonal contrasts play a much less important role in Slavic accentual phenomena than has been generally believed. The most important part of the evidence is that the Serbo-Croatian intonations are secondary, as was argued in §4. In view of this, the tonal contrasts of Serbo-Croatian can no longer be said to provide evidence for the existence of tonal contrasts in proto-Slavic.

Questions about Fortunatov's conception of the role of tonal contrasts in IE are also raised in the important work of Dybo (1981). In discussing the relationship between the Slavic and the Baltic intonations, Dybo remarks that

> we do not appear to have correct correspondent forms which would show the genetic identity of the Slavic 'circumflex' with the Baltic circumflex. And if there is no proof of a genetic connection of the Slavic 'circumflex' with the Baltic circumflex, then functionally the former differs from the Baltic circumflex even more [strikingly]: the Slavic 'circumflex' appears exclusively in accentual paradigm C and is its most characteristic feature, whereas the Baltic circumflex is not related to any particular type of accentual paradigm. (p. 6)

Moreover, at the end of his survey of the accentual paradigms of nouns in

[20] The letter *ö* here is Saussure's notation of a laryngeal. I am indebted to Calvert Watkins for this crucial information.

Baltic and Slavic, Dybo specifically states that 'the generally accepted genetic identification of the Slavic and Baltic circumflex intonation is incorrect' (p. 54).[21]

In sum, the evidence—specifically, the fact that the intonational contrasts in Serbo-Croatian are demonstrably late developments and that the same is true of the intonations in Sanskrit (see n. 9 above) and in Greek (see §9.2 below)—appears to favor Saussure's position of a century ago according to which intonational contrasts played no role in the accentual system of the IE protolanguage and were everywhere late developments.

8. A SKETCH OF THE EVOLUTION OF THE IE ACCENTUAL SYSTEM.

8.1. SAUSSURE'S LAW AND THE EVOLUTION OF POSTACCENTING STEMS IN SLAVIC. The four languages examined to this point share the distinction between accented and unaccented stems. The two Slavic languages, Russian and Serbo-Croatian, differ from Lithuanian and Sanskrit, in that the former include in addition a class of postaccenting stems. Illič-Svityč 1963 showed that the Slavic postaccenting noun stems correspond to the Lithuanian accented noun stems of class II. As explained in §6 above, Lithuanian class II nouns have accented stems with nuclei that are short or have circumflex intonation; such stems advance the stress to the following suffix by Saussure's law (49) when followed by a syllable with underlyingly acute intonation (or with an originally long vowel). Since stress advancement from the last stem syllable to the post-stem syllable is also an essential step in the evolution of Slavic postaccenting stems, it has been widely assumed that these two advances in stress were the result of a single change that affected both Baltic and Slavic and is sometimes referred to in the literature as the Law of Fortunatov-de Saussure.

As Dybo pointed out, this law 'has never been strictly proven by anyone' (1981:4), and the reasons for this are not hard to find. First, although stress was advanced from the stem to the following syllable in both Slavic (postaccenting stems) and in Lithuanian (class II/IV nouns), the conditions under which the stress advance took place were rather different in the two cases. Whereas in Lithuanian the advance was conditioned by the following nucleus (see 49 and 50), the advance in Slavic was 'not motivated by the following vowel' (Dybo 1981:5). Furthermore, in Slavic the advance affected only accented syllables, but Saussure's law also applies to Lithuanian stems of class IV, which are not accented and receive stress only because they happen to be word initial (cf. 47b).

Since the conditions on stress advancement differ in the two cases, it is implausible that stress advancement in Slavic and stress advancement by Saus-

[21] It is puzzling that in spite of these statements Dybo's account of Slavic accentology is framed in terms of the traditional intonational categories and concludes with the declaration that 'the Balto-Slavic accentual system is a reflex of the IE tones' (p. 262). My puzzlement at this is further increased by the fact that Dybo explicitly recognizes that other approaches are readily available: 'Instead of intonational contours it is possible to reconstruct distinctions in quantity [syllable length] or in any other prosodic dimension, but this does not change the essence of the matter' (p. 231, n. 18).

sure's law are aspects of a single historical development. This negative conclusion, which was first advanced by Stang (1957:179), receives further support from the different status of stress advancement in Slavic and Lithuanian. As we have seen, Saussure's law is a synchronic rule of the modern Lithuanian literary language. It does not affect Latvian, which has initial stress, nor does it affect the dialects of Lower Lithuanian (see Lačjute 1979). By contrast the development of postaccenting stems is much more extensive in the Slavic languages. It affected all of the East Slavic (Russian, as well as Byelo-Russian and Ukrainian) and South Slavic (Serbo-Croatian as well as Slovene); it did not affect West Slavic, and as a result Kashubian, the only West Slavic language with mobile stress, has no postaccenting stems (Garde 1976:ch. 9).

Perhaps even more important from our point of view is the fact that in Slavic the distinction between postaccenting stems and other stems is a property of the lexical representation of stems. As noted above, postaccenting stems are entered in the lexicon with a left parenthesis placed after the last syllable. None of the Slavic languages has, therefore, a synchronic rule that might be a counterpart of Saussure's law.

It is plausible that postaccenting stems are the result of the addition of a rule that had some resemblance to Saussure's law. Like Saussure's law in its original form (50) the Slavic rule must have rendered certain short syllables non-stress-bearing, for this is the only mechanism available for advancing the stress under the circumstances. However, in Slavic these short vowels had to be accented and no restriction was imposed on the following vowel. As we have seen, Saussure's law originally also applied to syllables with short nuclei, but the affected vowel in Lithuanian did not have to be accented; instead it had to be followed by a long vowel.

The Slavic rule, moreover, did not survive long in the synchronic phonology of the language, but was almost immediately replaced by the introduction into the lexicon of stems with a left parenthesis after their final syllable. Once these postaccenting stems were included in the lexicon there was no longer any function for a stress-advancement rule in the language. As a consequence no Slavic language includes such as rule, whereas Saussure's law is part of the synchronic phonology of some modern Lithuanian dialects.

8.2. LOSS OF LEXICAL ACCENTUATION AND THE DEVELOPMENT OF WORD-INITIAL STRESS. Consider the hypothetical question of how stress would be distributed in a language that is subject to the core rules in 10 yet has lost the accent in its lexical entries. As Donca Steriade pointed out to me, and as those who have followed this exposition can readily see by themselves, once lexical accent—the proviso 10i—is removed the core rules (in 10) assign initial stress to all words.

Many of the IE languages that lost mobile stress replaced it with initial stress. This is true of the Germanic languages. Initial stress is found also in Czech and Slovak, among the Slavic languages, and in Latvian and Prussian, among the Baltic languages, as well as in Irish and some other Celtic languages. We know also that Italic went through a stage when it had word-initial stress (Leumann

1977:247–8) and the same is true of Polish, which replaced 'the initial stress common to the other West Slavic languages . . . with a stress fixed on the penult' (Garde 1976:295).

We account for the evolution of word-initial stress by positing that in these languages all accentual indications were eliminated from the lexicon. None of the other rules in 10 needs to be changed, although it appears likely that the RRR edge-marking rule (10ii) was replaced by one with the parameter settings LLL, since this is the unmarked parameter setting for languages with initial stress. It will be seen below that the RRR edge-marking rule (10ii) cannot figure in a language with stress on one of the last three syllables.

In connection with the hypothesized loss of lexical accent it is worth recalling that Verner's law effects—the voicing of fricatives in certain environments—are systematically absent in verbal forms of Gothic. (For recent discussion and literature on Verner's law, see Noyer 1992 and Suzuki 1994.) Since Verner's law effects are found only in words with noninitial stress in the protolanguage, the systematic absence of such effects in Gothic verbs suggests that verbs had initial stress already at the time Verner's law came into the language. Noyer (1992) points out that given the accentual formalism employed here this fact implies that (proto-)Gothic had eliminated lexical accents from verb stems at the time Verner's law was introduced into the language. Since the lexical accent was left intact in the nouns, Gothic exhibits Verner's law effects there. Noyer's proposal gains plausibility from the fact that deaccentuation of verb stems is attested elsewhere; in Attic Greek, for example, verbs have systematically 'recessive' accentuation, the stress contour assigned by the rules to strings without lexical accents. (For additional discussion of Attic Greek accentuation, see §9.2)

9. LANGUAGES WITH STRESS AT THE END OF THE WORD. Many IE languages have main stress on one of the last three syllables of the word. Well-known examples are Polish, with penultimate stress, Macedonian, with stress on the antepenult, Latin, with stress alternating between penult and antepenult, and Ancient Greek, where stress falls on one of the three last syllables of the word. Given the formalism employed here, in order to assign stress to the penult it is necessary to construct binary feet on line 0 from right to left and to place main stress on the last, rather than on the first, of these feet. As shown below this requires a set of accentual rules that deviate quite radically from the core rules (10); it is therefore necessary to explain how such a system evolved.

Long sequences of unstressed syllables apparently offend speakers' sense of rhythm, for in many languages such sequences are subject to a special rule that places stresses on alternate syllables. In descriptions of such languages the alternating stress contours are often discussed perfunctorily, because the alternating stresses interact with the rest of the phonology only to a limited extent. For example, in descriptions of Czech and Slovak, both of which have main stress on the initial syllable, it has often been noted that secondary stresses are found on alternating syllables, but the precise character of the alternating stress is discussed only in special studies such as Broch 1911 and Jakobson

1926. A notable improvement in this respect has taken place recently, in part as a direct consequence of explicit concern with metrical structure. Thus, Rubach & Booij 1985 and a number of subsequent publications have focused on the alternating stresses in Polish words, and Roca 1986 has documented similar facts for modern Spanish. (For a survey of much recent work in this domain see Hayes 1995.)

Since alternating stresses are quite common in languages the world over, theories of metrical structure include a special device generating alternating stresses. The device utilized here is a rule of ITERATIVE CONSTITUENT CONSTRUCTION (ICC), which inserts parentheses on alternating syllables beginning at one or the other end of the sequence. An ICC rule is defined by the setting of three parameters: choice of parenthesis: right or left; direction of insertion: L → R or R → L; and size of foot: binary or ternary.

To obtain the type of alternating stresses found in Czech words in addition to main stress on the initial syllable, we need the rule system in (51).[22]

(51) Line 0: i. Edge Mark: LLL
ii. ICC: insert L parentheses, L > R, binary
iii. Heads: L
Line 1: iv. Edge mark: LLL
v. Heads: L
vi. Assign high tone to the head of the word
Assign mid tone to heads of line 0 feet
Assign low tone to all other line 0 elements

A comparison of the rule system in 51 with the IE core rules (10) reveals that in addition to losing lexical accent, Czech has replaced the edge-marking rule RRR with an edge-marking rule LLL and has added the ICC rule 51ii which constructs binary feet from left to right. Czech has also added a second tone assignment rule, which marks the heads of all feet constructed by 51ii. Thus, only three of the IE core rules—10iii, iv, v—are preserved in 51.

Jakobson (1926: 615) reports that the nineteenth-century Czech phonetican Král recognized 'as normal for words of 4 and 6 syllables the stress pattern which these sequences have in slower pronunciation ('o $o_{,}o$ o, 'o $o_{,}o$ $o_{,}o$ o) but deviates from this pattern with regard to the five-syllable words for which the allegro type ('o o $o_{,}o$ o) is considered by him as the norm.' This stress pattern, which differs somewhat from that generated by 51, is identical with that of Garawa discussed in §6 of Halle & Idsardi 1994. To account for the difference the following two modifications are needed: the ICC rule (51ii) must apply from right to left rather than from left to right, and machinery must be added to eliminate stress clash in word-initial sequences. This may be done by the adding the 'avoid' condition suggested in Halle & Idsardi 1994.

[22] The edge-marking rule (51i) is motivated by the fact that in Czech, monosyllabic nouns are stressed. Without 51i, the remaining rules would predict incorrectly that monosyllables are stressless. As stated, rule 51ii will assign stress to the final syllable of a polysyllabic word. According to Jakobson (1926:615) this strictly binary stress alternation was the norm in the 1920s, but a somewhat different stress contour prevailed earlier. (For some details, see below.)

The existence of West Slavic dialects with Garawa-type stress contours generated by the rules in 51 (modified as outlined just above), is of relevance here because there is only a small step from a Garawa-type stress system with word-initial main stress to one like that of Polish, where main stress is assigned to the penult. Formally this is obtained by changing the parameters of the line 1 edge-marking and head-placement rules from left to right. The rules for the assignment of main stress to Polish words are given in 52. Because of space limitations the issues raised by the distribution of subsidiary stresses in Polish and elsewhere cannot be discussed here.

(52) Line 0: i. Edge mark: LLL
ii. ICC: insert L parentheses, R > L, binary
iii. Heads: L
Line 1: iv. Edge mark: RRR
v. Heads: R
vi. Assign high tone to the head of the word
Assign low tone to other line 0 elements

It is worth recalling at this point that like languages with initial stress, the IE languages with stress on the last three syllables of the word have lost the lexical accentuation of morphemes, which was a crucial property of the accentual system of the IE protolanguage. As we shall see in §9.2 below Greek reintroduced lexically accented morphemes. The lexical accentuation of Greek, however, is an original development that is unrelated to the accentuation of the protolanguage.

9.1. STRESS PATTERNS OF MACEDONIAN AND OF CLASSICAL LATIN. A minor addition to the rules in 52 accounts for the stress pattern of Macedonian, where word stress generally falls on the antepenult. As illustrated in 53 the addition of the RLR edge-marking rule to 52 insures that main stress is assigned to the antepenult rather than to the penult.

(53)

*	*	*
* *)	* *)	* * *)
(* (* *)*	(* * (* *)*	(* (* * (* *)*
vodéničar	vodeníčari	vodeni čárit e
'miller'	'millers'	'the millers'

With one further addition, the rule set 52 as modified for Macedonian will also account for the placement of main stress in Latin words. The rules of Latin word stress in 54 therefore include 54ii, which places a left parenthesis before nonfinal heavy syllables.

(54) Line 0: i. Edge mark: LLL and RLR
ii. Insert L parenthesis, L of nonfinal heavy syllable
iii. ICC: insert L parentheses, R > L, binary
iv. Heads: L
Line 1: v. Edge mark: RRR
vi. Heads: R
vii. Assign high tone to the head of the word
Assign low tone to other line 0 elements

Steriade 1988 has drawn attention to the fact, originally noted by Latin grammarians of classical antiquity, that in sequences of a word followed by an enclitic—both monosyllabic and bisyllabic—stress is displaced to the final syllable of the orthotonic word. Examples in 55.

(55) úbi 'where' ubí#libet 'wherever'
lí:mina 'thresholds' li:miná#que 'and thresholds'
éa 'this' eá:#propter 'for this reason'

Steriade has shown that this special stress behavior is fully accounted for on the following two assumptions: (1) that host + clitic sequences undergo two rounds of stress assignment (first to the host word and then to the host + clitic), and (2) that when metrical structure is assigned to the host + clitic sequence, the metrical structure assigned to the host on the earlier round is preserved.

In terms of the Halle & Vergnaud 1987 version of lexical phonology that is adopted here, this means that the Latin stress rules (54) figure in both the cyclic and the noncyclic rule stratum. The stress rules in the cyclic stratum, however, differ from those of the noncyclic stratum in that the former are composed of the line 0 rules (54i–ii), whereas the noncyclic rules are composed of rules 54iii–vii, i.e., of the rules applying to grid lines above line 0. I retain from Halle & Vergnaud 1987 the important convention that at the beginning of each pass through the cyclic rules metrical structure assigned on earlier cycles is deleted, so that the cyclic stress rules are effectively LAST CYCLIC. Noncyclic rules, by contrast, respect all structure assigned by the (last) cyclic rules. Finally, I follow Jacobs 1997 in positing that all Latin enclitics are assigned a right parenthesis before their final or only syllable (RLR). The Latin clitics resemble in this respect the Greek clitics as discussed in §9.2.

Ex. 56 illustrates this application of the rules in (54) with the derivation of the metrical grids of the examples *li:miná#que* 'and the boundaries' and *ubí#libet* 'wherever' in 55. After the application of all cyclic rules the host words have the grids shown in 56a. In 56b I have shown the input to the noncyclic rule stratum, and in 56c the effects of the rules of the noncyclic stratum.

(56) a. (* *)* (*) *
li:mina ubi

b. (* *)*) * (*) * *)*
li:mina#que ubi#libet

c. * *
* *) * *)
(* *)*) * (*)(* *)*
li:mina#que ubi#libet
| | | | | | | | |
L LH L L H LL

The derivations in 56 differ from those given in Halle & Kenstowicz 1991 in a number of details, which are a direct consequence of the somewhat different theoretical and empirical assumptions of this article. Mester (1994) has observed

that the treatment in Halle & Kenstowicz 1991 fails to compute the correct output for such forms as *íd#circo:* 'for this reason' where a monosyllabic host word is combined with a bisyllabic clitic. I show in 57 that the correct stress pattern for this form is readily derived once, following Jacobs 1997, a right parenthesis is placed before the final syllable of the clitic. I have also included in 57 the derivation of the sequence *cuiuscumquémodi* 'of whatever kind' quoted by Jacobs from Priscian, which was also beyond the capabilities of the earlier account.

(57) a.
```
(*          (*)*
íd          cuius
```

b.
```
(*    * )*        (*)*   ) *     ) *    *) *
íd#circo:         cuius#c um#que#modi
```

c.
```
*                                *
*)                 *       *     *)
(*    * )*         (*)*   ) *     ) *    *) *
íd#circo:          cuius#c um#que#modi
|    | |           | |    |      |    | |
H    L L           L L    L      H    L L
```

9.2. ANCIENT GREEK.[23] The following analysis of Attic accentuation is indebted to Steriade 1988 and to Noyer 1997. In the discussion below I focus exclusively on the placement of main stress in Greek and disregard the intonational contrasts—acute and circumflex—that main stress syllables exhibit in Greek. As shown by Noyer 1997, the intonational contrasts are the result of contraction and other well-motivated phonological processes. The intonational contrasts, moreover, are only of marginal relevance to the central question of this section, the relationship of the Greek accentual system to that of Indo-European.

The basic accentual rules of Greek are those in 58, which show notable resemblances to the Latin rules (54).

(58) Line 0: i. Edge mark: LLL; RLR if word final syllable is light[24]
ii. ICC: insert L parenthesis, R > L, binary
iii. Heads: L
Line 1: iv. Edge mark: RRR
v. Heads: R
vi. Assign high tone to the head of the word
Assign low tone to other line 0 elements

[23] I am grateful to Joshua Katz for discussing the Greek accentuation with me and answering my many questions. As usual, Katz is not to be held responsible for any errors of fact or reasoning in this article.

[24] In Greek a word-final syllable is counted light if it has a nonbranching nucleus that may be followed by at most one consonant. The diphthongs *-oi* and *-ai* 'are regarded as short . . . *própalai, ánthro:poi*. But in the optative *-oi* and *-ai* are long . . . as in contracted syllables. So also in the locative *oíkoi* 'at home'' (Smyth 1984:39).

In each of the three noun declension classes of Greek there are two accentual paradigms: traditionally termed RECESSIVE and OXYTONE. (Steriade 1988 characterizes the latter as being 'predesinentially accented'.) Verb forms are subject to recessive accentuation exclusively. I express the oxytone/recessive contrast by representing oxytone stems as having a left parenthesis before their final stress-bearing element, whereas recessive stems have no accented element (parenthesis). The accent is assigned to the theme vowel in thematic stems, and to the last root syllable in athematic stems. This is illustrated below with oxytone noun stems in 59, the recessive stems in 60.

(59) i. phug(-e: 'flight'; aret(-e; 'virtue'; arkh(-e: 'beginning'; agor(-a: 'market'; the(-a: 'goddess'; prasi(-a: 'flowerbed'
ii. potam(-o 'river'; hod(-o 'way'; zug(-o 'yoke'
iii. el(pid 'hope'; he:ge(mon 'leader'; ai(the:r 'upper air'

(60) i. ni:k-e: 'victory'; dik-e: 'justice'; stephan-e: 'crown'; basilei-a: 'kingdom'; thalatt-a 'sea'; basilei-a 'queen'; doteir-a 'giver' f.
ii. anthro:p-o 'man'; hipp-o 'horse'; kami:n-o 'oven'
iii. phulak 'watchman'; orni:th 'bird'; daimo:n 'divinity'; pod 'foot'; dunami 'power'; pe:khu 'forearm'

In 61 I have illustrated the application of the rules in 58 to the recessive *ánthro:pos* and the oxytone *potamós*.

(61)

*	*	*	*
*)	* *)	* *)	* *)
(* *)*	(* (* *	(* * (*	(* * (*
anthro:p-o-s	anthro:p-o:-n	potam-o-s	potam-o:-n

Greek also has inherently accented suffixes which, as Steriade notes, will surface with stress provided that no accented morpheme follows them and that they remain within the window of recessive stress. This is illustrated in (62a). In addition, the language has a small number of exceptional stems that have inherent accent on the penult. A few examples are given in 62b.

(62) a. asp(id-(ísk-o-s 'little shield'
kheli:d(on-(id-(té:-s 'singer of the swallow song'
iskh(u:-(ró-tat-o-s 'the most powerful'
iskh(u:-(ro-tát-o:n 'the most powerful' PL.GEN
b. ol(ígo 'small'; meg(álo 'big'; poik(ílo 'dappled'

Like other IE languages Greek thus distinguishes between inherently accented and unaccented morphemes. The accented/unaccented contrast in Greek, however, does not correspond to the accented/unaccented contrast in other IE languages. Recall that since Greek places stress on one of the last three syllables of the word, words with many suffixes will never exhibit stem stress. This is radically different from the situation in Russian, Serbo-Croatian, Sanskrit or Lithuanian, where accented stems are systematically stressed without regard to the number of suffixes. Moreover, Greek accented stems allow stress to surface only on the last stem vowel, whereas Greek unaccented stems admit stress on earlier syllables. This again is quite different from the other IE languages with mobile stress, as discussed above.

It is therefore not surprising that questions have been raised about the value

of Greek evidence for the reconstruction of the IE accentuation. Thus, Lubotsky (1988:121) has written:

> Already in prehistoric times Greek had generalized a uniform accentuation for many categories. A well-known example is the recessive accentuation of the finite verb. Moreover, all neuters (including those in -ον) became barytone [recessive], with only a few exceptions; also barytone are feminine in [short] -α, i-stems and substantives in -υς, while adjectives in -υς, -λος, -νος, and -ρος show pervasive oxytonesis. There are several indications that this process of generalizing a single accentuation pattern for every category went on in historical times. A good example is the suffix of nomina actionis -μο-, which shows both types of accentuation in Homer, but is almost exclusively oxytone in later texts . . . In this light, the identical accentuation found in Gr. *πόσις* 'husband' and Skt. *páti-* 'id.' or in Gr. *oís* 'sheep' and Skt. *aví* 'id.', which is mentioned time and again as proof of the original identity of the Sanskrit and Greek accentual systems (cf. Kurylowicz 1968:20), IS NOT SIGNIFICANT (emphasis added).

There remain the correspondences between the stress location in Sanskrit nouns with suffixal stress and Greek oxytones, on the one hand, and between Sanskrit nouns with stem stress and Greek nouns with recessive, i.e. barytone stress, on the other hand. These correspondences suggest that originally in Greek nouns, like in those of Sanskrit, the thematic suffix was accented. As a consequence, an accented stem would surface with stem stress, whereas an unaccented stem would surface with stress on the post-stem syllable. When Greek lost the lexical accentuation of IE and replaced the accentual rules in 10 with 58, these surface stress alternations were preserved by representing nouns with thematic stress as having lexically accented stem-final syllables, whereas nouns with barytone stress were unaccented. Although this lexical accentuation preserved the surface stress alternations of the protolanguage in Greek, the new accentuation of Greek stems bears no longer any direct relation to that of the protolanguage.

9.3. ENCLITICS IN GREEK. I conclude with an examination of the accentual properties of Greek enclitics. Steriade (1988) points out that the stress of the orthotonic word is preserved intact when an enclitic is added. In certain cases addition of the enclitic results in the addition of a second stress to the host word (examples in 65 below). Our problem here is to discover the principle that determines the conditions under which the second stress is added.

I am indebted to Christopher Bader for drawing my attention to the fact that Greek admits sequences of enclitics and that in such cases stress goes on each enclitic except the last, as illustrated in the underlined sequences in 63. (See Smyth 1984 ¶¶185, 1267.)[25]

(63) a. <u>eí poú tís tina</u> ídoi ekhthrón '<u>if ever anyone</u> saw an enemy anywhere'

b. ei mèn <u>theoí tinés eisin</u> hoi daímones 'if the daimons <u>are a sort of gods</u>'

[25] One of the referees has noted that 'the grammarians' statements on this point contradict each other as well as manuscript practices . . . Smyth's grammar . . . arbitrarily chooses to trust one side of this tradition.' This remark overlooks the fact that the stressings selected by Smyth are straightforwardly integrated into the theoretical framework and the account offered here, whereas this is not the case with other stressings reported by the grammarians. In light of this, the data in Smyth's grammar can hardly be termed arbitrary.

We can readily account for these stress effects of the enclitics by positing that, as in Latin, enclitics in Greek have inherent accent represented formally by a right parenthesis inserted before the final syllable. The clitic sequence in 63a would then be represented as in 64.

(64) ei)pou)tis ti)na

Since in Greek, line 0 feet are left-headed, stress in 64 will be assigned to every clitic except the last one. This example is especially telling, because the sentence-initial word *ei* 'if' is a proclitic and is therefore unstressed, except in position before an enclitic. On the account proposed here this is automatic.

As in Latin the addition of an enclitic to an orthotonic word in Greek assigns stress to the word-final syllable, if that syllable was extrametrical. We illustrate this with the examples in 65, where we have assumed that like those of Latin the line 0 stress rules 58i–ii are part of the cyclic stratum, whereas 58iii–vi are in the noncyclic stratum.

(65)

* *	* * *
(* *)*)*	(* *)* *)(*
ággelós tis	ággelós ti nos
* *	* * *
(*) *)*	(*)* *) (*
óikós tis	óikós ti nos
* *	* * *
(*(*)*	(*(* *)(*
hodós tis	hodós ti nos
*	* *
(*)*	(* *)(*
phó:s ti	phó:s ti nós
*	* *
(* *)*	(* * *)(*
phóiniks tis	phóiniks ti nós
*	* *
(* *)*	(* *) *)(*
dáimo:n tis	dáimo:n ti nós

The rudimentary proposal of placing a right parenthesis before the final syllable of an enclitic accounts for the line 1 asterisk distribution in almost all examples in 65. Note in particular that the proposed representation of enclitics automatically accounts for the fact that the latter assign no additional line 1 asterisks to words with heavy final syllables such as *phoiniks* and *daimo:n*, for it is in these cases that the clitic fails to generate a new foot. The same is true of cases where the orthotonic word has stress on the final syllable, e.g., *hodós tis* or *phó:s ti*.

Not all the facts in 65, however, are accounted for by the above proposal. Among those still to be explained is the fact that in Greek, unlike in Latin, the addition of the clitic preserves the stress of the orthotonic word. To obtain the correct output for Greek we posit that in Greek the cyclic stratum includes the rules 58i–v, whereas only 58iii, the line 0 head marking rule, and 58vi, the high tone assignment rule, are assigned to the noncyclic stratum. This is illustrated in 66.

(66) a. Input to noncyclic stress rules

```
    *           *
    *  )        *  )
   (*  *)*  )* (*  *)*  *)( *
    ággelós tis  ággelós ti  nos
```

b. Rule 58iii

```
    *           *
    *  )*       *  )*       *
   (*  *)*  )* (*  *)*  *)( *
    ággelós tis  ággelós ti  nos
```

It is obvious that 58vi will assign high tone only to the initial syllable in our two examples. In order to obtain high tone on the syllables following the main stress I modify 58vi as in 67a. This has the effects illustrated in 67b.

(67) a. Assign high tone to the head of the word and to the heads of feet to its right.
Assign low tone to all other line 0 elements.

b.

```
    *           *
    *  )*       *  )*       *
   (*  *)*  )* (*  *)*  *)( *
    ággelós tis  ággelós ti  nos
    |  | |  |  |  | |  |  |
    H LH  L  H LH  L  H
```

As shown in 67b the modified high tone rule 67a assigns the tone correctly except in one case, that of the final syllable of *ággelós tinos*. To deal with cases of this kind (for additional examples see 65) I propose rule 68, which eliminates iambic stress at the end of the word.

(68) H → L /H L ___ ##

The final set of exceptions to be dealt with here are the forms in 69.

(69)

```
   * *         * *        *
  (*)*  )*   (*)*  *) ( *
  phíl os tis phíl os ti  nós
```

'Since the final of the orthotonic word is light . . . we predict **phílós tis, *phílós tinos* like *óikós tis, óikós tinos*. The relevant generalization is that although accents may surface on adjacent syllables (as in *óikós tis*), they may not surface on adjacent moras' (Steriade 1988:290). I propose to handle these exceptions by adding rule 70, which has the effect of 'deleting stress under clash.'

(70)
```
          *       *   Line 1
Delete ) / (*  ____ *) Line 0
           |       |
           X1 . . . X2
```
where . . . contains no nuclear timing slot (X)

The condition on the application of rule 70 reflects formally Steriade's observation that accents may not surface on adjacent moras. It will be recalled that a very similar condition was required in the formulation of Saussure's Law in 49 above. The effect of rule 70 on 69 is shown in 71.

(71)
```
   *        *        *
 (**  )*  (**   *) ( *
phílos tis phílos ti  nós
```

An important effect of rule 70 is the preservation of the oxytone stress of *tinos*. The elimination of the accent on the case ending has the further consequence that *philos tinos* now ends in the tone sequence HLLH to which rule 68 does not apply.[26]

10. IE ACCENTUAL CLASSES ACCORDING TO SCHINDLER AND RIX. The accent and stress of IE words has frequently been accounted for by assigning the stems to different diacritic classes, each with its distinctive stress pattern. I review below a version of this approach as it appears in Schindler 1975 and Rix 1976 and relate it to the account offered above.

Schindler (1975) focuses on the relationship between ablaut and stress in IE s-stem nouns. He assumes that nouns of this type are composed of a stem (represented as R), a suffix (S), and a case ending or desinence (D). According to Schindler, in the IE protolanguage e-grade appeared in stressed syllables exclusively and unstressed syllables had either zero grade or o-grade. Stress distribution, in turn, is governed by the accent class of the noun stem, of which Schindler recognizes four of the five listed below; a fifth class, labelled MESODYNAMIC by Rix 1976, is added here as it rounds out the picture.

ACROSTATIC (= ACRODYNAMIC in Rix 1976:123) nouns have stems which are stressed in all forms of the paradigm. This leads us to expect e-grade on the stem (R), zero-grade on the suffix (S) and case ending (D); i.e. Schindler's formula R(é)-S(z)-D(z). In the present framework, this class of nouns is analyzed as having inherently accented stems which receive stem stress by the rules in 10.

HOLOKINETIC (= AMPHIDYNAMIC in Rix) nouns exhibit 'in the strong cases R(é)-S(o)-⟨D(z)⟩, in the weak cases R(z)-S(z)-D(é), and in the Loc. R(z)-S(é) ⟨-D(z)⟩' (Schindler, p. 262). In terms of the framework of the present study, this means that weak desinences are inherently accented, whereas the strong

[26] It is possible to account for all facts discussed in this section by assuming that unlike Latin enclitics, Greek enclitics are supplied with a right parenthesis before their first syllable. The latter formulation makes somewhat different predictions than the one I have employed above. As I have been unable so far to find relevant cases that would choose between the two alternatives, I leave this issue open here.

desinences are unaccented. The strong cases, thus, include no underlyingly accented morpheme, and stress is assigned to the word-initial syllable. Moreover, in the locative, which is a weak case, the predesinential suffix is accented by a precursor of the accent retraction rule 17.

In the PROTEROKINETIC (= Rix's PROTERODYNAMIC) nouns 'the stem is stressed in the strong cases, and the suffix in the weak cases, correspondingly the strong cases have zero-grade suffix and the weak cases zero-grade stems' (Schindler, p. 263); i.e. strong cases R(é)-S(z)-D(z) and weak cases R(z)-S(é)-D(z). In terms of the present framework, these nouns are subject to accent retraction in all weak cases, not only the locative. The stress on the stem in the strong cases is the normal initial stress assigned by 10 to words without accented morphemes.

In nouns of Rix's mesodynamic class, which is not mentioned by Schindler, the suffix is stressed in all case forms. In the present framework this stress placement implies that stems of this class are postaccenting. They share this property with stems of the HYSTEROKINETIC class described next.

HYSTEROKINETIC (= Rix's HYSTERODYNAMIC) nouns exhibit in the strong cases the structure R(z)-S(é)-D(z) (Schindler, p. 263), but in the weak cases the nouns have desinential stress; i.e., R(z)-S(z)-D(é). In the present framework, these nouns, like those of the mesodynamic class, will be assumed to have postaccenting stems. The hysterokinetic nouns differ from the mesodynamic in that they are subject to a special rule that renders the suffix non-stress-bearing when it directly precedes an accented (i.e., weak) desinence. This rule, which resembles Saussure's law (50), has the effect of shifting the accent from the suffix to the desinence.

In sum, noun stems have inherent accent in the acrostatic class, are postaccenting in the mesodynamic and hysterokinetic classes, and are unaccented in the holokinetic and proterokinetic classes. Weak desinences are accented, strong desinences unaccented. Two rules modify these underlying representations: an analog of rule 17 retracts the accent from weak desinences onto the stem. This rule applies to all weak cases in nouns of the proterokinetic class, but applies in the locative singular everywhere. Nouns of the hysterokinetic class are subject to a rule that renders the suffix non-stress-bearing in the weak cases. The rules in 10 then assign the correct surface stress to all forms.

Implicit in Schindler's account, therefore, is the proposition that the IE protolanguage already had postaccenting stems and that it was subject to analogs both of the accent retraction rule (17) and of Saussure's law (50). Future research will determine the precise relationship, if any, between these processes in the protolanguage and their analogs in the daughter languages.

11. CONCLUDING REMARKS. The central features of the prosodic system of the IE protolanguage, as it emerges from the discussions above, are the existence of two lexically marked classes of morphemes—accented and unaccented—and a set of rules (see 10) for computing the surface stress (tone) contour of the word. This system has survived essentially intact in many well-studied IE languages, Russian, Serbo-Croatian, Sanskrit and standard Lithuanian, for example.

Tonal contrasts played no role in the protolanguage, as already argued by Saussure 1894 (contra Fortunatov 1880). Where tonal contrasts are encountered in the daughter languages, they are late developments, and the distinctive intonational contrasts of Lithuanian are relatively late developments reflecting length distinctions in the protolanguage.

In the East and South Slavic languages, stems with the accent on a final short syllable became postaccenting. In addition, in some South Slavic languages—in particular, in the Štokavian dialects of Serbo-Croatian—the high tone of the word ictus was spread to the preceding syllable if any, resulting in a rising tone on this syllable. Vedic Sanskrit has a similar tone spread rule which spreads the high tone of the accented syllable to the following syllable resulting in a falling tone on this syllable *(udātta)*.

The Baltic languages distinguish marked syllables with rising tone (circumflex) from unmarked syllables that have falling tone (acute or short). Standard Lithuanian, moreover, differs from other Lithuanian dialects in being subject to Saussure's law, a rule of stress advancement. The process of stress advancement which underlies the development of postaccenting stems in Slavic is unrelated to Saussure's law.

As noted in §10, an implication of analyses such as those in Schindler 1975 is that some of the features attributed here to independent developments in East and South Slavic and to Lithuanian may have had parallels already in the IE protolanguage.

IE languages other than Sanskrit, Baltic, and East and South Slavic have lost the lexical distinction between accented and unaccented morphemes. As a result of the loss of this lexical distinction all words receive stress on their initial syllable in many of these languages. This is the case, for example, in Latvian, Czech, Italic, Old Irish, and Germanic, where, however, the original state of affairs is still discernible in the Verner's law phenomena. In several of these languages there are indications that long stretches of unstressed syllables gave rise to a special iterative constituent construction (ICC) rule, which constructs a series of binary feet over the unmetrified portion of the word.

In a further development a number of IE langauges subject to this type of binary foot construction assigned main stress to the final, rather than to the initial foot of the word. Among the languages that shifted main stress from the beginning to the end of the word are Polish, Latin, Macedonian and Ancient Greek. Greek, which also replaced the IE accented vs. unaccented distinction among stems, did so in its own characteristic manner. In Greek, unlike in the IE protolanguage, stem accent is restricted to the theme or the final stem syllable.

An important aspect of the problem that remains to be dealt with is the reconstruction of the accentual characteristics of individual stems and other morphemes in the IE protolanguage. The lists of such correspondences given in Stang 1957, Illič-Svityč 1963 and Dybo 1981 appear to provide reasonable coverage of Slavic and Baltic, but the data are less satisfactory with regard to the relationship between the latter two groups and Sanskrit and Germanic (via Verner's law). As noted above, the status of the Greek evidence is questionable and needs a thorough review.

To the extent that the above proposals about the IE accentual system stand up under further scrutiny, they provide support for the theoretical underpinnings of this investigation. This study thus supports the theory of metrical structure of Idsardi 1992 over alternative theories of stress. It also argues for a rule-based, as against a constraint-based, account favored by optimality theory (OT). Since there does not exist at this time an OT account of the complex IE data reviewed above, the present account constitutes a challenge to optimality theory, where derivations and rules are excluded on principle.

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