

Review

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REVIEW ARTICLE

Histoire de l'accentuation slave. By PAUL GARDE. 2 volumes. (Collection de manuels, 7:2.) Paris: Institut d'Études Slaves, 1976. Pp. x, 525.

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In his preface to this book, Garde tells us that his purpose was 'to show in broad outline how the accentual systems of the modern Slavic languages, compared with one another and with those of the Baltic languages, derive from a prior "Balto-Slavic" system, and how the latter derives from an anterior "Indo-European" system ...' (p. vii). He discovered that the present state of studies is such that writings on the topic are accessible only to readers who 'are already familiar with the discussions dealing with these subjects'; his original intention was simply to remedy this unsatisfactory state of affairs. But he found it was an impossible task: 'The things that we thought were the results of prior research, thoroughly tested by being subjected to a methodologically coherent exposition, turned out in a great many instances to be inconsistent and self-contradictory, and we were [thus] forced in spite of ourselves, in a host of cases, to take positions which do not correspond exactly to those espoused by any of our predecessors' (viii). This is the only originality to which G explicitly admits. Otherwise, his aims are much more modest—he wants to provide his reader with information about what generations of scholars have securely established (x):

'Such as it is, this book, based entirely on second-hand materials, does not pretend to any new discoveries; it will have attained its aim if, in developing a coherent view of the accentology of Slavic (and of Indo-European), it contributes to rendering this body of knowledge somewhat less esoteric ... and if its readers are never again tempted to ask themselves the ritual question (cf. Lunt 1963): "What are they talking about?"'

It will, we hope, become clear below that G is too modest in his evaluation of his own work. While most of the pieces of the puzzle have been around in the literature for many years, they have never been put together in quite so coherent a fashion, with so few pieces left over and with so few places where the fit is poor. Moreover, on a number of issues G makes important new proposals that are so well-founded that they should become part of the standard textbook account of the topic, to be mastered by all students in the field.

The clear superiority of G's account over that of his predecessors results from the fact that G's account is based on an explicit descriptive framework which determines in great detail the outlines of his exposition. Although G does not especially insist on the theoretical sophistication of his approach, his empirical results derive in considerable part from the fact that he takes his descriptive framework seriously, and views the facts consistently in terms of the categories and relationships implicit in that framework. In this review we

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have attempted to make clear the underlying assumptions of G's descriptive practice, and to show how further advances in understanding the empirical subject matter—the accentual systems of Baltic, Slavic, Sanskrit, Greek, and of the IE proto-language—can come from improvements and elaborations of G's theoretical framework.

1. GARDE'S FRAMEWORK. G assumes that, in the IE accentual system, three prosodic characteristics—quantity, tone, and accent—played a definite role. 'Quantity', according to G, 'is a non-accentual prosodic feature which is associated with each individual morpheme' (2). G accepts the traditional view that the tonal system had the following properties (5):

'short syllables (containing short vowels) are subject to no tonal opposition. Long syllables (containing a long vowel or a diphthong) can be either acute or circumflex. These interrelations (*rappports*) affect all syllables regardless of whether or not they are accented ...'

Thus there is tonal contrast only among long syllables; short syllables exhibit no contrast in tone, and are treated on a par with toneless syllables. Finally, G's system includes the feature [accented]. Unlike all other phonetic features, accent is peculiarly restricted in its distribution—there can be no more than one accented syllable per word.

'A Balto-Slavic word may contain any number of long and short, acute and circumflex syllables in any distribution whatever, but it may contain but a single accented syllable.'

However, not every word is accented. On the one hand, there are clitics, which are never accented; on the other hand, there are what G terms *mots accentogènes inaccentuables*—'which, though tending to produce the presence of an accent in the utterance, may not bear this accent on any of their own syllables' (7). We shall refer to such elements as WEAK WORDS.

In G's framework, a word is made up of a stem (*thème*) and a desinence. The stem consists of a root and zero or more suffixes. 'Desinence' is G's term for an inflectional ending, such as the person, number, gender, and case-markers of the familiar languages.

This brings us to the most original part of G's theory—the manner in which the place of the accent in a word is determined (14):

'The determination of the place of the accent inside a word ... is a morphological problem. The accent of every word depends on its morphological structure and on the identity of the morphemes that compose the word. Morphemes are endowed with accentual properties ... To study the accent of a language with free accent ... is to define the accentual properties of the different classes of morphemes, and to formulate the laws of combination of these classes of morphemes with one another, allowing one to deduce from the accentual properties of the morphemes the accent of every word.'

The accentual properties referred to above are thus rule features, i.e. abstract markers associated with particular morphemes that trigger the operation of particular rules of accent placement. Various aspects of this idea can be found in the work of other accentologists (cf. Kuryłowicz 1958, Lunt 1966), but G deserves credit for having stated the theory in a particularly systematic and explicit way. He recognizes the following three binary rule-features: all morphemes can be STRONG or WEAK; suffixes and desinences (but not roots) may

		SANSKRIT	LITHUANIAN
strong root	strong desinence	<i>bhrātī + ṅām</i> 'brother'	<i>móter + ū</i> 'wife'
	weak desinence	<i>bhrātár + am</i>	<i>móter + i</i>
weak root	strong desinence	<i>duhitī + ṅām</i> 'daughter'	<i>dukter + ū</i> 'daughter'
	weak desinence	<i>duhitár + am</i>	<i>dùkter + i</i>

TABLE 1. Athematic stems.

be DOMINANT OF ORDINARY; and dominant suffixes may also be NEGATIVE OR POSITIVE.

2. GARDE'S TREATMENT OF IE ACCENT MOBILITY. We begin by considering the accentuation of words containing only ordinary morphemes, since the classical problems of Balto-Slavic accentuation can be conveniently discussed with these restricted data. The BSL treatment in the four logically possible cases involving only a stem and a desinence is represented schematically by G (19) as in the following Lithuanian examples:

- (1) 'T D (Lith. gen. pl. *móter + ū* > *móterŭ* 'wife, woman')
 'T d (acc. sg. *móter + i* > *móteri*)
 t 'D (gen. pl. *dukter + ū* > *dukterŭ* 'daughter')
 ('t d (acc. sg. *dukter + i* > *dùkteri*)

Here the capital letters represent strong morphemes, while lowercase letters are weak morphemes. The tick mark (') indicates the place of the surface accent, with parentheses indicating the (recessive) accent of what we have referred to above as weak words.

G formulates the Accent Placement rules involved as follows (80):

- (2) 'In words containing only ordinary suffixes, the accent strikes the first strong morpheme. If the word does not contain any strong morphemes, it is unaccentable ...'

G thus follows Jakobson 1931 and Dybo 1978 in regarding words consisting exclusively of weak morphemes (our weak words) as being unaccented. When clitics precede or follow such words, the latter show up unaccented on the surface, e.g. Ru. *ná golovu* 'on the head', Lith. ill. pl. *galvosnà* 'on the heads'. When not accompanied by clitics, they have in the modern languages an accent on the first syllable: Ru. *gólovu*, Lith. *gálvos*. G assumes that these accents are caused by the fact that all Baltic and Slavic languages subsequently added to their grammars the Recessive Accent Rule:

- (3) Unaccented words take the accent on the initial syllable.

As we shall see, it is essential for G's account that 3 should be a late devel-

		SANSKRIT	LITHUANIAN
strong root	strong desinence	<i>púr̥v + ā + nām</i> 'first'	<i>pirm + μ</i> 'first'
	weak desinence	<i>púr̥v + a + m</i>	<i>pirm + a</i>
weak root	strong desinence	<i>dev + ā́ + nām</i> 'god'	<i>diēv + ū́</i> 'god'
	weak desinence	<i>dev + á + m</i>	<i>diēv + a</i>

TABLE 2. Thematic stems.

opment in both Baltic and Slavic. At an earlier stage, weak words were (according to him) literally unaccented.

This core of G's theory serves as a basis for his historical explanation of the BSL accentuation system in the following way. When we compare Balto-Slavic as a whole with Sanskrit and Greek, the most salient differences lie in the character of accent mobility and its extent in the inflectional system. In Sanskrit and Greek, accent mobility in noun paradigms is virtually limited to alternation between desinential and pre-desinential accent in athematic nouns; in thematic nouns, the accent is fixed on a particular syllable. But in Baltic and Slavic, accent mobility is not restricted to athematic inflections, nor is the alternation limited to pre-desinential and desinential accent. Instead, mobility is found in all kinds of stems, and it takes the form of an alternation of accent between the desinence and the first syllable of the stem. We illustrate this in Tables 1–2, using again the gen. pl. and acc. sg. forms to exemplify strong and weak desinences respectively.

To account for these facts, G modifies his framework somewhat. In particular, in place of the schematic formulas in 1, he postulates the following for Sanskrit and Greek (326):

(4) Thematic inflection:

$\left. \begin{array}{l} 'T \quad D \\ 'T \quad d \end{array} \right\}$ if the stem is strong, accent on the stem

$\left. \begin{array}{l} t \quad "D \\ t \quad "d \end{array} \right\}$ if the stem is weak, pre-desinential accent

Athematic inflection:

$\left. \begin{array}{l} 'T \quad D \\ 'T \quad d \end{array} \right\}$ if the stem is strong, accent on the stem

$\left. \begin{array}{l} t \quad 'D \\ t \quad "d \end{array} \right\}$ if the stem is weak, $\left\{ \begin{array}{l} \text{desinential accent} \\ \text{[on strong desinences]} \\ \text{pre-desinential accent} \\ \text{[before weak desinences]} \end{array} \right.$

The symbols "d and "D in 4 denote accent on the pre-desinential syllable. Moreover, according to G, in Greek and Sanskrit, strong stems are accented

on a non-final syllable, whereas weak stems have no accent on any non-final syllable. Thus, in these languages, by contrast with Balto-Slavic, monosyllabic stems and roots are by definition weak. This is an inadequacy in G's interpretation of the Sanskrit (and IE) system, since it excludes stems inherently accented on the last syllable—allowing no way of treating athematic nouns and verbs with fixed stem accent, e.g. Skt. *gāuḥ* 'cow', instr. sg. *gāvā*, or *tāṣṭī* 'fashions', 3pl. *tākṣati*. In our analysis, presented below, these stems are inherently accented and present no difficulty. We show below that the modifications in 4 are unnecessary, and that schema 1 adequately captures the facts of Sanskrit and Greek as well as those of Balto-Slavic.

G's structural analysis allows him to arrive at an ingenious explanation of the correspondences among Balto-Slavic, Sanskrit, and Greek. He argues that Sanskrit and Greek must represent the original IE type of accent mobility, and he formulates the BSl. innovation as follows (341):

(5) Accents on pre-desinential syllables were lost.

This innovation results in the extension of mobility to thematic stems, and in the relocation of accent from the pre-desinential syllable to the initial syllable before weak suffixes. The explanation depends crucially on the identification of weak words as unaccented, and later subject to the Recessive Accent Rule; see Table 3.

PRE-BALTO-SLAVIC	EFFECT OF 5	EFFECT OF 3	LITHUANIAN
*/dukter + ón/	no change	no change	<i>dukterj̃</i>
*/duktér + im/	<i>dukter + im</i>	<i>dùkter + im</i>	<i>dùkterj̃</i>
*/deivá + ón/	<i>deiva + ón</i>	no change	<i>dieṽj̃</i>
*/deivá + m/	<i>deiva + m</i>	<i>deiva + m</i>	<i>diēṽj̃</i>

TABLE 3.

We consider G's idea to be in essence correct. However, he is led into an unnecessary complication by his anxiety to sustain the purely phonetic character of 5. In order to turn it into a real Lautgesetz, he is forced to posit an internal word-boundary between stem and desinence for that period of Balto-Slavic in which 5 took place (341):

'We thus cannot formulate the conditions on this change and give it the form of a sound law unless we assume that the juncture between the stem and the desinence mentioned above at a certain period had a phonological value of the same order as a word boundary. In other words, we must go back to a period where what ultimately became stem and desinence in the Indo-European languages was separated from one another by a word boundary and had thus the character of two separate words.'

We see no reason not to recognize the above change as morphological from the beginning. The internal word-boundary is otherwise unmotivated, and is a very high price to pay for the questionable advantage of turning the innovation into a sound law. In particular, we find that none of the relevant IE languages treats the position before desinences on a par with word-final position.¹

¹ But of course the position before CONSONANTAL desinences shares certain properties with word-final position, e.g. in Sanskrit.

Moreover, the fairly substantial differences that G postulates between the accentual pattern of Sanskrit (and Greek) and that of Balto-Slavic appear to result from oversight on his part. First, G fails to notice that the accentual behavior of thematic nouns in Sanskrit is readily accounted for by the simple assumption that the thematic suffixes are strong. Thus, with weak roots, the thematic suffix will be accented regardless of the accentual properties of the desinence; but with strong roots, the accent will of course remain on the root. Thus the accentual behavior of Skt. thematic nouns requires no modification of schema 1.²

Second, G's characterization of NEGATIVE suffixes is imprecise. He says that negative suffixes 'retract the accent onto the root, regardless of the latter's accentual properties or of those of the desinence' (55). But this formulation fails to make explicit the fact that, when attached to polysyllabic stems, negative suffixes place the accent on the LAST stem syllable. We therefore propose to replace G's terms NEGATIVE/POSITIVE by PRE-ACCENTING/NEUTRAL, and we add this rule:

(6) Pre-accenting suffixes place the accent on the presuffixal syllable.

Given these fairly minor adjustments in G's framework, the accentuation of Gk. and Skt. paradigms is readily handled. We assume that, in these languages, weak desinences are redundantly pre-accenting. This assumption immediately explains why accent mobility in Greek and Sanskrit is strictly limited to the athematic inflection, and why (with certain marginal exceptions) it is restricted to an alternation between the desinence and the predesinential syllable. As shown by the Skt. examples in Tables 1–2, when an athematic stem is weak, the word is accented on the desinence if the latter is strong, and on the last syllable of the stem if the desinence is weak (and hence pre-accenting). Thus the assumption that weak desinences were pre-accenting in Sanskrit renders schema 1 fully adequate for all paradigms, and makes 4 unnecessary.

G rightly does not suppose that the accent loss of 5 continues to operate as a synchronic rule in Balto-Slavic. Rather, it leads to restructuring whereby the deleted accents are prevented from arising, i.e. by changing the desinences in question from pre-accenting to ordinary weak desinences. Moreover, G proposes that the BSl. thematic suffixes were re-analysed as part of the case-endings in the declension, so that the morphological analysis in Lithuanian is *diev+u diev+q* 'god', and in Ru. *ruk+u ruk+a ruk+ami* 'hand' etc. This agrees with the segmentation traditional in Baltic and Slavic grammars, and there is no reason to doubt its essential soundness.

3. THE BALTO-SLAVIC ACUTE–CIRCUMFLEX CONTRAST. G assumes that Balto-Slavic possessed a tonal contrast of acute and circumflex melodies on long vowels. He argues that the contrast was phonologically predictable at first, but later became distinctive through a number of secondary segmental and accen-

² The attentive reader will have noted that, in view of the preceding, the stem in the acc. sg. will have a predesinential accent supplied by schema 4 in addition to an accent on the root, if the root is strong; but there is no provision in G's framework for such doubly-accented stems. The revised framework which we sketch below solves this problem automatically.

tual changes. In non-desinential syllables, vowels and diphthongs ending in laryngeals acquired acute intonation, while other vowels and diphthongs acquired circumflex intonation, e.g. Lith. *ántis* 'duck' (accentual Class 1), from IE **anHt-* (cf. Latin *ana-s*) vs. Lith. *žqsis* 'goose' (Class 4), from IE **ghans-* (cf. Latin *ans-er*); or Lith. *pĩlnas* 'full' (Class 3)³ from IE **pĩn-os* < **plHn-os* (cf. Skt. *pũrnas*), vs. Lith. *viĩkas* 'wolf' (Class 4), from IE **wĩk^w-os* (cf. Skt. *vĩkas*).

For desinential syllables, a separate rule has traditionally been formulated: original long vowels acquired acute melody, and contracted long vowels acquired circumflex melody, e.g. fem. nom.sg. **-ā* (Gk. *-ē*, Lith. *-ó*) vs. gen.sg. **-ās* < *aHes* (Gk. *-ēs*, Lith. *-ōs*). G makes the original proposal that the melodies on desinential syllables can be derived by the same rule as those on non-desinential syllables:

- (7) Syllabic nuclei of the form VH get acute melody; other long syllabic nuclei get circumflex melody. Thus:

Acute: $*aH > *ā$
Circumflex: $*aHes > *āes > ās$

The acute/non-acute opposition (whatever its historical source may have been) triggers the well-known sound change in Lithuanian known as Saussure's Law, by which the two accentual paradigms—one with fixed, the other with mobile accentuation—were both split in Lithuanian into two subclasses:

- (8) The accent shifts from a non-acute syllable to a following acute syllable (cf. G, 191).

Hence acute strong stems retain fixed stem accent (Lith. Class 1), but circumflex and short strong stems shift the accent forward onto acute desinences (Class 2). The same is true of weak stems: when these are acute, they retain the recessive accent before weak desinences (Class 3); but when they are short or circumflex, accent is shifted forward to a following acute weak desinence (Class 4; after weak stems, strong desinences will, of course, always have the accent, by virtue of Rule 2). Since there are four types of stems and four types of desinences—strong/weak and acute/non-acute (i.e. circumflex or short)—sixteen combinations of stem + desinence must be considered, which by virtue of Rules 2 and 8 yield the distinct accentuations shown in Table 4.

	STRONG STEMS		WEAK STEMS		
	ACUTE CLASS 1	NON-ACUTE CLASS 2	ACUTE CLASS 3	NON-ACUTE CLASS 4	
STRONG DESINENCES					
acute	<i>várn + a</i>	<i>rank + à</i>	<i>gálv + à</i>	<i>barzd + à</i>	nom.sg.
		'crow' 'hand'	'head' 'beard'		
non-acute	<i>várn + os</i>	<i>raĩk + os</i>	<i>gálv + ōs</i>	<i>barzd + ōs</i>	gen.sg.
WEAK DESINENCES					
acute	<i>várn + a</i>	<i>rank + à</i>	<i>gálv + a</i>	<i>barzd + à</i>	inst.sg.
non-acute	<i>várn + ai</i>	<i>raĩk + ai</i>	<i>gálv + ai</i>	<i>barzd + ai</i>	dat.sg.

TABLE 4.

³ Not accentual Class 1 as given by G (38, 301; but correctly on p. 333). G's book is unfortunately plagued by misprints. A useful list of corrections is given by Kortlandt 1978.

In spite of frequent assertions in the literature that Saussure's Law was also operative in Slavic, no convincing case for this has ever been made, and G is entirely correct in limiting this law to Lithuanian. However, by a process intriguingly similar to Saussure's Law, Slavic strong stems with short vowels shift their accent forward to all endings. (In Lithuanian, by contrast, Saussure's Law affects both strong and weak stems (Classes 2 and 4), and the accent shifts only onto acute suffixes.) G calls this process Illič-Svityč's Law after its discoverer (Illič-Svityč 1963), and states it as follows (16):

(9) Non-acute strong stems shift their accent to the following syllable.

As a result, Lith. Class 2 nouns (e.g. *blusà* nom.sg. 'flea', *blusū* acc.sg.) correspond to Slavic nouns with fixed desinential accent (Stang's 1957 Paradigm B); e.g. Ru. *bloxá* *bloxú*.

4. THE SLAVIC NEUTRALIZATION OF TONE IN WEAK MORPHEMES. Another important difference between Baltic and Slavic is the following. The distinction between acute and circumflex shows up in Baltic both in strong stems (Lith. Class 1 vs. Class 2) and in weak stems (Class 3 vs. Class 4). But Slavic weak stems, regardless of their original quantity, all belong to a single mobile-accent type (Stang's Paradigm C), and no distinction corresponding to the Lith. acute/circumflex distinction appears in weak stems in any Slavic language. This can be seen in those Slavic languages, e.g. Serbo-Croatian and Slovak, which were subject to the Shortening Rule:

(10) Vowels with acute melody are shortened.

Because of 10, Lith. *lėpa* (Class 1) 'linden tree' corresponds to SCr. *lipa*, with short stem-vowel. Length was not affected in words corresponding to the Lith. circumflex; e.g., Lith. *peilis* 'knife' (Class 2) corresponds to SCr. *pila* 'saw' with a long stem-vowel. The phonetically parallel contrast in melody between Classes 3 and 4 before weak suffixes has no quantitative reflexes in Slavic; e.g., Lith. *gálva* 'head' (Class 3) contrasts melodically with *žiema* 'winter' (Class 4), but there is no contrast in their Slavic cognates, e.g. SCr. *glāvu*, *zīmu*.

The explanation of this is a matter of considerable controversy. Practically everyone who has written on this subject assumes that Slavic was once like Lithuanian in distinguishing between acute and circumflex weak stems, e.g. acc.sg. **gólvo* vs. **zīmō*. Stang (1957:10) attempted to interpret their merger as analogical in the following way. First, the difference between acute and circumflex melody was lost phonetically in unaccented syllables: nom.sg. **gólvá*, **zīmá* (where small capitals mark accent) became **golvá*, **zímá*. Then the accentual paradigm nom.sg. **zímá* ~ acc.sg. *zīmō* was extended by analogy to all movable stems, with **golvá* ~ **gólvo* replacing **golvá* ~ **gólvo*.

Characteristically, G seeks to replace this analogical account by a sound law. Once again, the key is provided by the assumption that weak words (composed exclusively of weak morphemes) are unaccented. According to this the acc.sg. forms of fem. nouns, for example, are phonologically unaccented in Slavic: /zīmō, galvō/. G can now formulate the following rule (198):

(11) The opposition acute/circumflex is neutralized in syllables preceding the accent and in weak words.

G then has no need to assume analogical leveling—since, by virtue of 11, the Shortening Rule (10) is inapplicable in words such as *zīmō*. Subsequently, melodic contrasts were also eliminated in Slavic on all unaccented syllables which followed the accent, and on all unaccented syllables in Baltic; but G argues that this happened at a considerably later period. The differences regarding tone between Baltic and Slavic on his interpretation are a matter of relative chronology: the Neutralization Rule applied early in Slavic, and late in Baltic.

Although the effect of the Neutralization Rule (11) was, as G remarks, to eliminate melodic contrasts on weak morphemes ‘in the overwhelming majority of cases’ (199), he believes that melodic contrasts on weak morphemes were preserved well into the Common Slavic period, or perhaps even later (199–200):

‘In weak roots (*r*) the opposition [of acute vs. non-acute] is neutralized and there are only long syllables without intonation (represented by length in SCr. and by brevity in Slovak), regardless of the Balto-Slavic tone (acute or circumflex) where the root syllable is before the accent or belongs to an unaccentable form—i.e. in the majority of cases ... However, the opposition acute/circumflex (in SCr. and Slovak short/long) is maintained in the forms of the structure ‘*r-s-d*, notably the infinitive as well as the *l*-participles of verbs with consonantal roots (§176), where in Balto-Slavic the accent was on the root syllable: acute > short in SCr. *grīsti grīzla, žīti, dāti*; Slovak *žit’, dat’*; circumflex > long in SCr. *vūči vūkla, pòčēti, ūzēti*; Slovak *vliect’, vlietka, vziat’* ...’

In sum, according to G, the cited alternations of length (and, as we shall see below, certain alternations of accent placement) in the modern Slavic languages require the recognition of the acute/non-acute contrast in weak (i.e. inherently unaccented) morphemes.

As noted above, the contrast between acute and circumflex strong stems finds a direct accentual reflex in their inflectional paradigms. In nouns with strong acute stems, the accent is invariably on the stem; but in nouns with strong circumflex stems, the accent is shifted by Illič-Svityč’s Law from the stem syllable to the post-stem syllable. In view of the Neutralization Rule (11), we cannot expect a parallel contrast in the inflection of weak stems. If a weak stem is followed by a strong desinence, the accent will go on the desinence, in accordance with schema 1. But this will result in the elimination of melodic contrasts on the stem by Rule 11, since the stem in these cases is in pre-accentual position. However, if the desinence is weak, the entire word will be weak, and Rule 11 will eliminate all melodic contrasts in the word. As a result, we find three accentual paradigms, illustrated in Table 5 with examples from the Russian *a*-stem noun declension.

	A	B	C
nom.sg.	<i>vorón + a</i> ‘crow’	<i>žen + á</i> ‘wife’	<i>golov + á</i> ‘head’
acc.sg.	<i>vorón + u</i>	<i>žen + ú</i>	<i>gólov + u</i>

TABLE 5.

Paradigms A and B both have strong stems, the former with acute and the latter with circumflex melody; Paradigm C is the accentual reflex of weak stems.

It has been shown by Stang 1957 that, in the present tense (as well as in

some other tense forms), the three accentual paradigms are exemplified somewhat differently than in the nouns, as shown in Table 6.

	A	B	C
1sg.	<i>lěz + u</i> 'get into'	<i>mog + ú</i> 'can'	<i>živ + ú</i> 'live'
2pl.	<i>lěz + ete</i>	<i>móž + ete</i>	<i>živ + éte</i> (dial. <i>živ + eté</i>)

TABLE 6.

Paradigm A exhibits fixed stem-accent. Paradigm B exhibits mobile accentuation alternating between the post-stem syllable, when the desinence is monosyllabic, and the predesinential syllable, when the desinence is polysyllabic (the latter caused by a retraction from polysyllabic desinences). Paradigm C exhibits desinential accent in all forms, since present-tense desinences in modern Russian are all strong. By contrast, the accentuation in the *l*-participles (= modern past tense) straightforwardly parallels that found in the nouns, as seen in Table 7.

	A	B	C
fem.sg.	<i>lěz + l + a</i>	<i>mog + l + á</i>	<i>pere + ži + l + á</i> 'survived'
plural	<i>lěz + l + i</i>	<i>mog + l + í</i>	<i>pére + ži + l + i</i>

TABLE 7.

What is interesting is that the majority of verbs belonging to the class illustrated immediately above—i.e. unsuffixed root verbs ending in a consonant, hereafter referred to as C-verbs—do not exhibit the correspondences in accentual paradigms illustrated in Table 6. Instead, the majority have the accentuation of Paradigm C in the present tense, regardless of the *l*-participle accentuation. Thus, in discussing the accentuation of this verb class in Russian, V. Kiparsky 1962 cites only five verbs with Paradigm A accentuation in the present tense and two with Paradigm B accentuation; but there are about 80 verbs with Paradigm C accentuation. Table 8 shows this neutralization of accentual contrasts in the present tense.

<i>l</i> -participles			
	A	B	C
fem.sg.	<i>grýz + l + a</i> 'gnaw'	<i>nes + l + á</i> 'carry'	<i>u + merl + á</i> 'die'
plural	<i>grýz + l + i</i>	<i>nes + l + í</i>	<i>ú + mer + l + i</i>
present tense (Paradigm C, cf. Table 6)			
1sg.	<i>gryz + ú</i>	<i>nes + ú</i>	<i>u + mr + ú</i>
2pl.	<i>gryz + éte</i>	<i>nes + éte</i>	<i>u + mr + éte</i>

TABLE 8.

That this situation is of considerable antiquity is shown by the facts of Serbo-Croatian and Slovak. It was noted above that both languages are subject to Rule 10, which shortens vowels in syllables with acute melody. As a consequence, stems of verbs exhibiting Paradigm A accentuation are regularly shortened in both languages; but those exhibiting accentuation according to the

other two paradigms are not subject to shortening in Serbo-Croatian, while Slovak (because of special developments) has shortening only in verbs exhibiting Paradigm C accentuation.

G proposes to account for the above facts in the following fashion. He observes that the majority of verbs with Paradigm A or B accentuation in the *l*-participle have stems ending with an obstruent, while those with Paradigm C accentuation have stems ending with a sonorant (glide, nasal, liquid, or vowel). Accordingly, G proposes (130) that the *l*-participle suffix is 'dominant negative' (= pre-accenting) when added to obstruent stems, but 'ordinary positive' (= neutral) when added to sonorant stems. As a consequence, the *l*-participle forms of obstruent stems are treated as if they had strong stems, and are not subject to the Neutralization Rule (11). These *l*-participle forms therefore exhibit the effects of melody contrasts: those with circumflex melody undergo Illič-Svityč's Law, while those with acute melody have Paradigm A accentuation and shortening in both Serbo-Croatian and Slovak. To provide further support for his analysis, G examines the individual verbs that constitute this class (149–57); he shows that the Baltic cognates of a majority of these stems are weak, and have the melodies (acute or circumflex) that must be postulated to account for the Slavic facts.

In sum, the cornerstones of G's account are the postulation of melodic contrasts in weak morphemes and the special treatment of *l*-participles. The *l*-participle suffix is generally pre-accenting. However, when added to stems of C-verbs, it is pre-accenting only when the stem ends with an obstruent.

While this account conforms to the facts, it seems implausible to us. It sets up four accentual classes of morphemes, in spite of the fact that there are only three accentual paradigms. Even the irregular verbs discussed in the preceding paragraphs exhibit the same three accentual paradigms as all other words. Their only exceptional feature is that they switch from one accentual paradigm to another in different parts of the conjugation. Since we have seen that a given morpheme can have different accentual rule-features in different morphological contexts—e.g., in G's account the *l*-participle suffix is pre-accenting only in certain environments, and neutral elsewhere—an obvious alternative is one in which stems are strong in certain environments and weak in others.

The advantage of this approach is that it requires us to set up only three accentual classes of morphemes, one for each attested accentual paradigm. This enables us to replace G's Neutralization Rule (11) with a more general rule:

(12) The opposition acute/circumflex is neutralized in all weak morphemes.

It is the consequences of this rule, we claim, that mark the break-up of the BSl. unity; and these consequences (unlike those of 11) are quite radical. Whereas 11 leaves the organization of the lexicon unaffected, 12 leads to an extensive restructuring of the lexicon, since it requires the elimination of all melodic contrast among weak morphemes.

We must now show how the facts of C-verbs, discussed in the above paragraph, are dealt with under the assumption that melodic contrasts could not be assigned to weak morphemes. Our basic assumption is that the accentuation

of the *l*-participle is criterial for the determination of the accentual class of the stem. If the verb exhibits Paradigm A or B accentuation in the *l*-participle, its stem is assumed to be strong; it is assigned the acute melody if the *l*-participle has Paradigm A accentuation, and the circumflex melody if the accentuation is that of Paradigm B. On this account, the exceptional behavior is to be found in the present tense, where all melodic contrasts are neutralized.⁴ Formally, this means that, when added to stems of C-verbs, the present-tense desinences are 'dominant' (= de-accenting), whereas elsewhere they are 'ordinary'. This rule is the counterpart of G's special subrule about the pre-accenting properties of the *l*-participle suffix. Each of the two competing accounts includes, therefore, a special rule that is not generally required for other classes of verbs. What differentiates the two is that, in G's account, it is necessary to recognize two distinct classes of weak (stem) morphemes; in our account, however, all facts are handled without this further bifurcation of the lexicon.

5. AN ALTERNATIVE ANALYSIS. Although G's treatment represents notable progress in our understanding of what surely is one of the most challenging topics of IE phonology, it fails to resolve a number of significant issues. We believe that one reason for this failure is G's excessively abstract approach, which does not give the phonetic facts their proper due. To cite but one example, G avoids taking a position with regard to the phonetic character of the contrast ACUTE/CIRCUMFLEX. He writes (5):

'We employ thus the terms "acute" and "circumflex", which conventionally designate features whose exact phonetic character escapes us. We know only that we are dealing with a tonal opposition, in the sense that it affects neither the quality of vowels, nor their quantity, and that it is independent of the accent.'

We sketch, therefore, at this point an alternative framework, which is a further elaboration of that of P. Kiparsky 1973 and of P. Kiparsky & Halle 1977. We shall attempt to show that this framework makes it possible to gain a deeper understanding of the accentual phenomena of Baltic and Slavic.

An essential difference between our framework and that of G is that, instead of G's abstract rule feature STRONG/WEAK, we make use of the phonetic feature [ACCENTED] which we identify with the feature [upper register] described by Yip 1980. Following Yip, we characterize the feature [accented] as contrasting segments which are produced on a higher vs. a lower pitch-register. In different languages, particularly in Slavic, additional phonetic cues may also be involved. The binary feature [accented] cross-classifies with the binary feature [high tone] to yield four relative pitch levels. In Indo-European, it appears that only the feature [accented] was distinctive in the lexicon, whereas the value of the feature [high tone] was supplied by the Basic Accentuation Principle (see 13, below) and other phonological rules, a situation which continues in Sanskrit. In Balto-Slavic, as we shall see below, [high tone] became distinctive, in addition to the feature [accented]. In the light of the preceding, we assume that

⁴ The solution proposed here has much in common with the suggestion of Stang (1957:155) that, in the present-tense inflection, 'Slavonic and Baltic have a feature in common, viz. that the majority of verbs of the type Sanskrit *bhāṛati* ... have marginal end-stress' [= Paradigm C].

IE strong morphemes had an inherently accented syllable, while weak morphemes had only inherently unaccented syllables in their underlying representation. Moreover, like G, we assume that underlying representations have no limit on the number of accented morphemes in the word: the word may contain no accented morphemes, or only accented morphemes, or any number in between. The place of the accent in the surface structure of the word is determined by the Basic Accentuation Principle, which subsumes Rules 2–3, but goes beyond them; it is a modification of the BAP of P. Kiparsky & Halle.

- (13) Accent and high tone are placed on the leftmost prominence peak in the word, and deleted elsewhere, where prominence is determined by the following scale: accented tones are more prominent than unaccented; high tones are more prominent than low; syllabic sounds are more prominent than non-syllabic.

It was observed above that Skt. and Gk. weak desinences were pre-accenting. When pre-accenting or inherently accented suffixes are added to inherently accented stems, we get multiple accents in the word, and the first prevails by Rule 13. Consider again the first example of Table 1, the inherently accented Skt. stem *bhrātar* 'brother'. Adding an inherently accented desinence, gen.pl. *-nām*, and a pre-accenting desinence, acc.sg. *-am*, we obtain the following derivations by Rules 6 and 13:

- (14) *bhrātar + nām* > *bhrātṛṇām*
bhrātar + am > *bhrātāram* > *bhrātaram*

With *duhitar* 'daughter', the same suffixes added to an unaccented stem yield the mobile paradigm (by Rule 6):

- (15) *duhitar + nām* > *duhitṛṇām*
duhitar + am > *duhitāram*

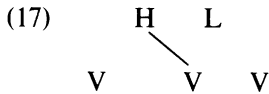
Our framework handles the thematic noun of Table 2 in equally straightforward fashion—provided that we assume, as above, that Skt. thematic suffixes are inherently accented. If the root of a thematic noun is inherently accented, the accent will remain on the root; if the root is not accented, the accent will fall on the thematic vowel in all case forms. Two other facts must be cited in support of the alternative framework proposed here, as against that of G. First, with the phonetic feature ACCENTED/UNACCENTED, any vowel in a polysyllabic morpheme may be accented; this freedom is not available with G's strong/weak distinction. The freedom is needed for polysyllabic morphemes like Ru. *děver-* 'brother-in-law', *skorlúp-* 'shell', which are accented on different syllables. Second, the placement of accent on the predesinential syllable by Skt. weak desinences accounts for the vowel/zero alternation in the stems illustrated above (cf. P. Kiparsky 1973). Note that the zero-grade rule can be formulated as a deletion of unaccented vowels, provided it is ordered before Rule 13. The 'hidden' predesinential accent of *bhrātaram* blocks deletion in the same way as the overt predesinential accent of *duhitāram*. Both these facts require the addition of special rules or restrictions to G's framework, where only the first 'strong' morpheme receives an accent in the derivation; but they are automatic consequences of the framework which we propose.

Our conception of tonal phenomena in language derives from the recent work by Williams 1976, Goldsmith 1976, Haraguchi 1977, and Clements & Ford 1979 on what has become known as the autosegmental theory of tone. Fundamental to this theory is the view that tones constitute a tier of representation that is separate and independent of, though not unrelated to, the familiar tier where utterances are represented as sequences of vowels and consonants. The full representation of an utterance, in this view, resembles the score of a song, with the melody indicated on one line and the verbal text on the other. Like musical notes, the tones of language are discrete entities, concatenated from left to right; and the association between individual tones and vowels (and other tone-bearing phonemes) must be indicated in each instance.

We assume that, in the absence of language-specific rules to the contrary, unassociated tones are linked to phonemes in accordance with the following universal well-formedness conditions:

- (16) a. Each tone-bearing phoneme is associated with at least one tone.
- b. Each tone must be associated with at least one tone-bearing phoneme.
- c. Association lines cannot cross.

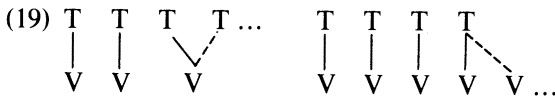
Associations between tones and tone-bearing phonemes are also implemented by rules which are partly language-specific. For Balto-Slavic we assume that, in the lexical entry of a morpheme, one tone of a morpheme is associated with one of its tone-bearing phonemes:



5.1. BALTO-SLAVIC AND BALTIC. The Tone Association Rule for Balto-Slavic was:

- (18) Unassociated tones of a word are associated with tone-bearing phonemes from left to right.

If the number of tones in the word is greater than the number of tone-bearing phonemes, the extra tones are associated with the last tone-bearing phoneme. If the number of tone-bearing phonemes is greater than the number of tones, the last tone is spread over the extra tone-bearing phonemes:



When a tone has been associated with one or more tone-bearing phonemes by 16a-c, then the association is changed only by a specific rule, or by a convention when some rule has resulted in a violation of 16.

Languages differ with regard to the type of phoneme that may bear tone: vowels are always capable of bearing tone, whereas obstruents apparently are never tone-bearing. We therefore postulate a universal rule which completes the interpretation of Rule 18:

- (20) Vowels are tone-bearing.

However, sonorant consonants after the syllabic nucleus—i.e. in the syllable CODA—are tone-bearing in some languages, but not in others. The tone-bearing propensity of sonorants (i.e. of liquids, nasals, and glides) is one of the essential differences between the Baltic and the Slavic languages. Baltic tones may be associated with sonorants—provided that, together with the vowel, they constitute the rime of a syllable. Moreover, Baltic long vowels are sequences of identical short vowels, and are treated the same as vowel–sonorant sequences. The facts just listed are what is sometimes meant when it is said that a given language has moras as constituents of syllables (cf. Trubetzkoy 1958:169–75, and Garde, 309). For Baltic, therefore, we add the following language-particular rule:

(21) Sonorants in the coda are tone-bearing.

Yet another difference among languages arises from the number of tones associated with a single phoneme. In the lexical representations of Balto-Slavic, as we shall see below, more than a single tone could be linked with a single phoneme. This contrasted with the situation in Slavic—where, in lexical representations, only a single tone could be linked with a phoneme.

As observed above, we believe that Indo-European originally had only a contrast between accented and unaccented syllables. It is this contrast that is captured in G's framework by the abstract rule feature STRONG/WEAK, and a direct effect of our proposal is thus to increase the phonetic realism of the solution. Furthermore, we assume that the BSl. melodic contrast of acute vs. circumflex was an independent development. This contrast (as was noted in §3, above) developed first as a redundant feature, predictable on the basis of vowel length and syllable structure. We shall assume that in Balto-Slavic, as in modern Lithuanian, the so-called acute intonation was originally a H(igh) tone, whereas the so-called circumflex intonation was a rising melody: L(ow) H(igh).⁵ Accent and tone are independent phonological features, governed by separate rules. The fact that words in the attested languages show prosodic contrasts only on the stressed syllable is accounted for here by the BAP (Rule 13).

After the development of melodies, a series of quantitative changes took place in Baltic and Slavic. Their effects were, in part, that melody became unpredictable from length in certain classes of morphemes, and, in part, that the rule accounting for the remaining predictability became opaque. The resulting system is essentially what remains in modern Lithuanian.

⁵ The acoustic measurements of Jernudd 1968 indicate that the contrast is phonetically so actualized in modern standard Lithuanian. Whether the contrast acute/circumflex was implemented in this manner in all Baltic languages is an open question. In particular, Stang (1966a:125) notes that, in Prussian documents, acute diphthongs were denoted by a macron over the second part of the diphthong, and circumflex diphthongs by a macron over the first part—e.g. Pruss. *pagaūt*, Lith. *pagāuti*, but Pruss. *rānkan*, Lith. *rañka*. If the macron signals the placement of H, this suggests that (in Prussian, at least) acute was rising, and circumflex falling. Moreover, Lith. circumflex corresponds to a falling tone in the majority of Latvian dialects. These facts raise a number of questions about any account which assumes that the Lith. development was also common Balto-Slavic.

Lithuanian morphemes have two cross-classifying prosodic features. The first, [accented], continues the inherited IE accentuation; it is fully unpredictable, and is marked in the lexicon for each morpheme. The second feature is the melodic contrast between Acute (H) and Circumflex (LH) that reflects IE syllable structure. This contrast in part remains predictable from syllable structure, but in part also figures as a distinctive prosodic feature in the lexicon. The result is a four-way classification of morphemes—which is, of course, identical with the traditional four classes of Lith. stems:

- (22) Class 1: accented stems with H melody
 Class 2: accented stems with LH melody
 Class 3: unaccented stems with H melody
 Class 4: unaccented stems with LH melody

Exactly the same four classes are also found in affixes.

Of the quantitative changes which caused melodies to become distinctive in Baltic, the most important are the following:

(a) **SHORTENING OF DIPHTHONGS.** Indo-European originally possessed a contrast between long and short nuclei in diphthongal combinations. Long vowels developed H tone, and short vowels developed LH melody in these diphthongs also. Subsequently, long vowels were shortened in diphthongs, but the melodic contrast was retained and re-interpreted in terms of a mora system shown in Figure 1.

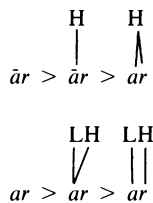


FIGURE 1.

The tonal melody of morphemes with diphthongs is, therefore, not predictable in general, and must be specified in the lexicon.

(b) **SHORTENING OF FINAL ACUTES.** Final vowels with acute accent were shortened (by what is called Leskien's Law). If, as appears to have been the case, the shortened vowels were re-analysed as underlying short, a series of morphemes with unpredictable H tone was the outcome.

We shall accordingly suppose that Lithuanian continues to have a Tone Assignment Rule of the following form, by which the bulk of the morphemes in the language receive their proper melody:

- (23) Assign LH to short syllables and H to long syllables.

For this rule, syllables are 'short' if they contain only one sonorant in the rime, and 'long' otherwise. Rule 23 operates only in the 'unmarked' cases, i.e. when no indication to the contrary is contained in the underlying lexical representation. Because of the lexically specified cases, which reflect the syn-

chronic consequences of the two shortening processes mentioned above, and because of other phonological and morphological regularities in the language, Rule 23 is far from being a surface regularity of Lithuanian or even of Baltic. Nonetheless, most Lith. morphemes need not carry a melody in the lexicon, but receive it by Rule 23. Thus *brólis* 'brother', *výras* 'man' are entered in the lexicon without a melody, and are automatically assigned H by 23 because of their underlying long vowel. (Cf. recent borrowings like *radāras* (Class 2) 'radar' and the alternants *Europà* (Class 2, with short stem vowel) vs. *Európa* (Class 1, with long stem-vowel). Similarly, *bizdas* 'anus', *rātas* 'wheel', and *viris* 'tapeworm' are automatically assigned LH by 23 because of their underlying short vowels.

The tones assigned by 23 may be modified in the course of the phonological derivation. The LH melody surfaces when the vowel is lengthened by a subsequent rule, and is simplified to H when no lengthening takes place. The lengthening rule involved here affects non-final *a* and *e* when they are associated with H and carry the surface accent. This restriction is captured simply by ordering the Non-final Lengthening Rule after the BAP (13):⁶

$$(24) \left[\begin{array}{c} \text{V} \\ -\text{high} \end{array} \right] [+ \text{seg}]$$

$$\begin{array}{c} | \\ \text{H} \\ 1 \end{array} \quad \begin{array}{c} \\ \\ 2 \end{array} \Rightarrow 112$$

All remaining short vowels are subject to Melody Simplification:

(25) Eliminate L when H is associated with the same phoneme.

As a result, short syllables can only have H or L on the surface, no matter what melody they may be assigned in the lexicon or in the derivation by 23. Rules 24–25 both make the operation of 23 opaque.

The derivations in Figure 2 illustrate our proposed analysis.

	<i>výr</i> + <i>as</i> 'man'	<i>rat</i> + <i>as</i> 'wheel'	<i>vir</i> + <i>is</i> 'tapeworm'
Rule 23	$\begin{array}{c} \text{V} \\ \text{H} \quad \text{LH} \end{array}$	$\begin{array}{c} \text{LH} \quad \text{LH} \end{array}$	$\begin{array}{c} \text{LH} \quad \text{LH} \end{array}$
Rule 13 (BAP)	$\begin{array}{c} \text{H} \quad \text{L} \end{array}$	$\begin{array}{c} \text{LH} \quad \text{L} \end{array}$	$\begin{array}{c} \text{LH} \quad \text{L} \end{array}$
Rule 24	—	<i>raat</i> + <i>as</i> $\begin{array}{c} \text{LH} \quad \text{L} \end{array}$	—
Rule 25	—	—	$\begin{array}{c} \text{H} \quad \text{L} \end{array}$
	<i>výras</i>	<i>rātas</i>	<i>viris</i>

FIGURE 2.

Consider next the morphemes whose melody is an unpredictable lexical property, e.g. the pair *pilnas* 'full' vs. *vīlkas* 'wolf' mentioned above. The original length difference which gave rise to the melodic difference has been

⁶ The conditioning of the rule is actually somewhat more complex (cf. Kenstowicz 1972:4–6).

eliminated. Rule 23 will correctly assign H to *pilnas*, but *vilkas* must be specified as having LH in the lexical representation.

In addition, there are rules of a morphological character which assign LH to morphemes before certain derivational suffixes, e.g. agentive *-ius* (so-called 'métatonie douce', cf. Stang 1966b),⁷ as shown in Figure 3.

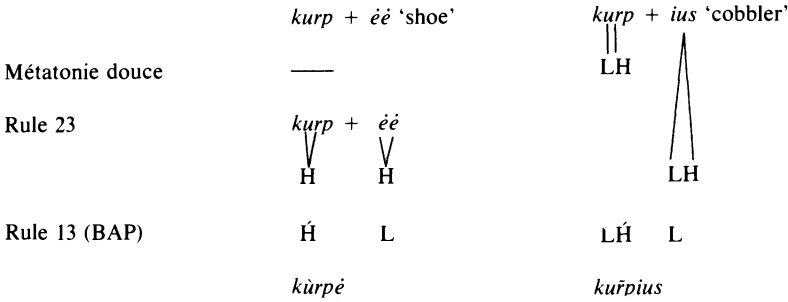
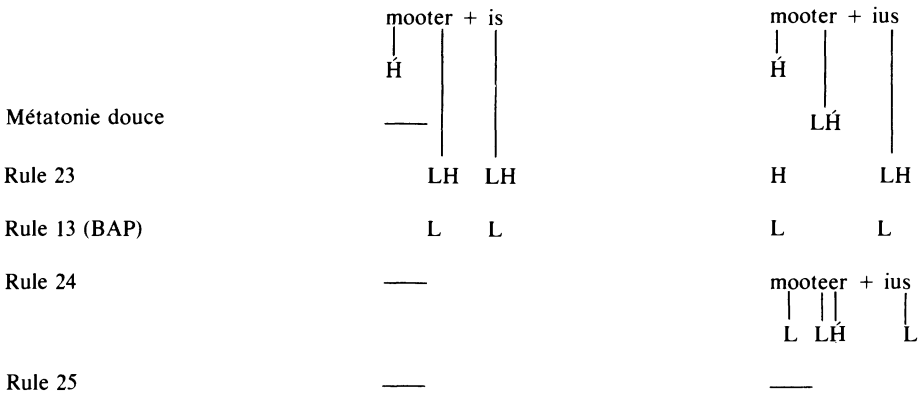


FIGURE 3.

Our assumption that Rule 23 continues to operate synchronically in Lithuanian is supported not only by the relative predictability of melody in underlying long-vowel stems and underlying short stems; it also explains certain alternations in the verb morphology. Consider the following representative forms:

	INFINITIVE	3PL. PRESENT	
(26)	<i>kárti</i>	<i>kāria</i>	'hang'
	<i>tārti</i>	<i>tāria</i>	'speak'
	<i>vìrti</i>	<i>vìria</i>	'boil'
	<i>mīrti</i>	<i>mīria</i>	'die'

⁷ The rule, in fact, deletes the stem accent and assigns accent to the presuffixal syllable, as can be seen from its effects on polysyllabic stems such as *móteris* (acc. Class 1) 'wife': *motērius* 'adulterer':



Phonological representations of Lith. words are given here in a hybrid orthography. Long vowels are represented as sequences, but the ordinary conventions of Lith. orthography are otherwise retained. In particular, palatalization of consonants is shown by writing *i* after the consonant, e.g. *motērius* [mooteer,us] is trisyllabic.

The roots are underlying /kar/, /tar/, /vir/, /mir/. Rule 23 assigns the correct H melody to the long syllables *kar-* and *vir-* in *kārti*, *virti*. The former also undergoes lengthening by Rule 24, as shown in Figure 4.

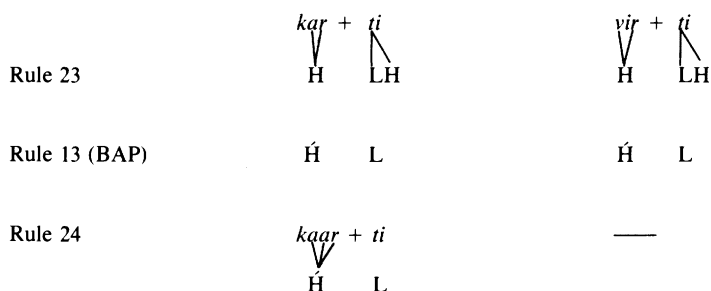


FIGURE 4.

In *taṛti* and *miṛti*, the operation of 23 is blocked by the LH melody supplied in the lexicon. As a result, the melody assigned in the lexicon appears in the output. Note also that lengthening by 24 in *taṛti* is correctly blocked, since *a* is not associated with H; cf. Figure 5.

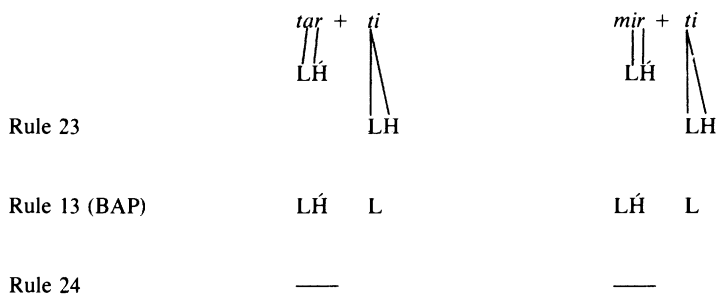


FIGURE 5.

The case of *kāria* is of special interest because it shows how Rule 23 is sensitive to variations in syllable structure. The first syllable of *kāria*, unlike that of *kārti*, is underlying short, since in *kāria* the /r/ constitutes the onset of the following syllable. Rule 23 therefore assigns LH to the stem vowel. Since the stem vowel is subsequently lengthened by 24, LH appears in the output,⁸ as shown in Figure 6.

⁸ Here again, the alternation between acute and circumflex intonation was originally dependent on vowel length:

$$*\text{kar}\acute{\text{a}} + \text{C} \rightarrow \text{k}\acute{\text{a}}\text{r} + \text{C} \rightarrow \overset{\text{H}}{\text{k}\acute{\text{a}}\text{r}} + \text{C}$$

$$*\text{kar}\acute{\text{a}} + \text{V} \rightarrow \text{kar} + \text{V} \rightarrow \overset{\text{LH}}{\text{kar}} + \text{V}$$

After the shortening of vowels in diphthongs ($\text{k}\acute{\text{a}}\text{r} + \text{C} \rightarrow \text{kar} + \text{C}$) the intonation was re-analysed as dependent upon syllabic length, as indicated.

A similar development can be postulated for early Slavic, as shown by residual alternations in the verb morphology between Paradigm A before consonantal endings and Paradigm B before

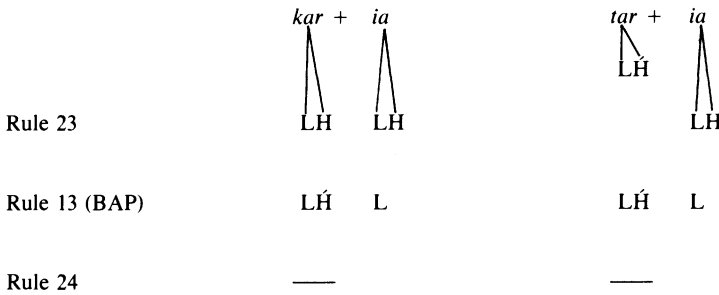


FIGURE 6.

The derivation of *viria*, *mīria* is similar, except that Rule 24 is inapplicable to *i*. As a result, Melody Simplification (Rule 25), operating as the last rule of the tonology, reduces LH on the short stem syllable to H; cf. Figure 7.

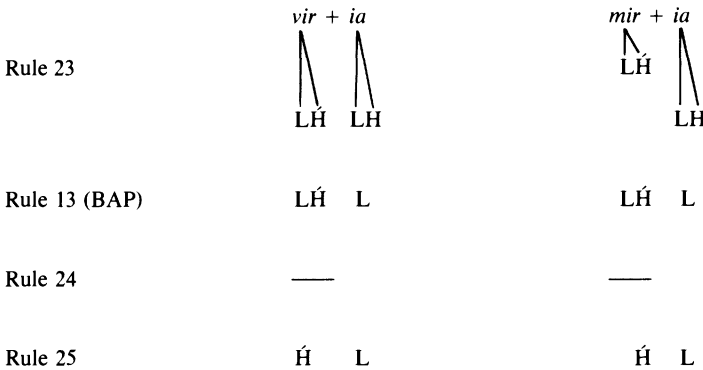


FIGURE 7.

Figs. 4 and 6 above show that Rule 23 is phonological, rather than a lexical redundancy rule, since it is sensitive to syllable structure as determined not in the lexical representation of morphemes, but in the morpheme sequence of particular words. Thus in *kārti*, before the infinitive suffix which begins with a consonant, /kar/ constitutes a long (branching rime) syllable, and therefore receives H. But in the present-tense form *kāria*, morpheme-final /r/ constitutes the onset of the second syllable, so 23 assigns LH to the short (non-branching rime) initial syllable of the word.

Additional evidence that Rule 23 is phonological is provided by the preterit forms of the verb *kārti* (Senn 1966, §503). In the preterit, the stem vowel /a/ is lengthened and rounded to /oo/ by a special ablaut rule, while the stem

vocalic endings, e.g.,

$$*mel\acute{o} + t\bar{i} \rightarrow m\acute{e}l + t\bar{i} \rightarrow m\acute{e}l^{\text{H}} + t\bar{i} \rightarrow m\acute{e}l\acute{t}i \text{ 'grind' (inf.)}$$

$$*mel\acute{o} + et\bar{i} \rightarrow mel + et\bar{i} \rightarrow m\acute{e}l^{\text{LH}} + et\bar{i} \rightarrow m\acute{e}l\acute{t}i^{\text{L}} + et\bar{i} \rightarrow m\acute{e}l\acute{j}\acute{e}t\bar{i} \text{ 'grinds' (3sg.)}$$

See Dybo 1978:39 for discussion of these cases.

melody is simultaneously changed from LH to H. The melody change is accounted for by the rules developed to this point, provided that the special ablaut rule is ordered before Rule 23. Preterit forms with circumflex (LH) melody, e.g. *rēmē* (inf. *reṁti* 'support') are derived by the same ablaut rule. However, these verbs must be assumed to have their LH melody supplied in the lexicon, as shown in Figure 8.

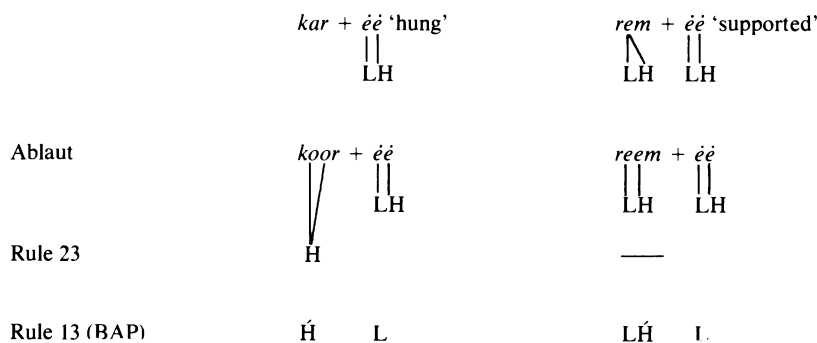


FIGURE 8.

Some verbs, with inherently long stem-vowel and lexically supplied LH, are subject to shortening in the present tense and related forms (see Senn, §502). We illustrate this in Figure 9 with the pret. *tūpé* and pres. *tūpia* of the verb *tūpti* 'alight'.⁹

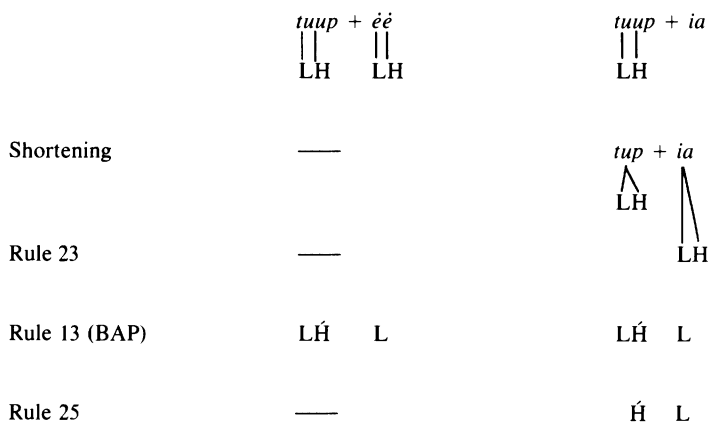


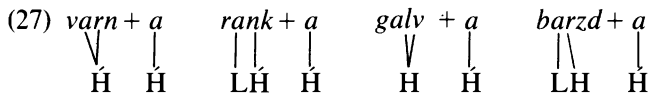
FIGURE 9.

A further consequence of the treatment proposed above may be noted here. Since Melody Simplification (Rule 25) deletes L, accented short syllables

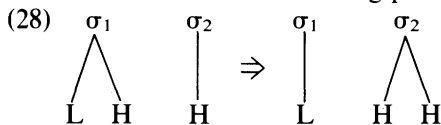
⁹ Alternatively, it is possible to assume that these verbs have lexically short stem-vowels, and are subject to the ablaut rule in both the perfect and the infinitive. The ablaut rule must then be ordered after Rule 23, whereas in Fig. 8 it must be ordered before Rule 23. We have therefore opted for the alternative analysis in Fig. 9.

emerge in the output with H. This conforms with the actual phonetic facts.¹⁰ Nevertheless, the data discussed above show that short syllables must bear LH melody in underlying representations. This independently motivated fact allows for a simple direct statement of the environment of a number of essential processes in the language. In the more traditional approach followed by G, short syllables are treated just like toneless syllables which appear in unaccented position. As a result, G's statement of what are perhaps the two most important phenomena of BSl. accentuation, Saussure's Law (Rule 8) and Illič-Svityč's Law (Rule 9), contains references to the ad-hoc category NON-ACUTE, referring to syllables that are either short, or long with circumflex melody—an arbitrary conjunction of entities within G's framework. Within our framework, NON-ACUTE syllables are those which have the LH melody prior to Melody Simplification. As in our replacement of G's STRONG and WEAK by ACCENTED and UNACCENTED, we obtain here a more natural phonetic basis for the operation of accentual processes. In particular, the formulation of Saussure's Law is rendered more perspicuous.

Before giving our formal statement of Saussure's Law, which we regard as a phonological rule still operative in modern Lithuanian, we note that it applies before the BAP. It thus affects a stage in the derivation of the surface form of an utterance where words may have any number of H tones and accents. For example, before the operation of Saussure's Law, the nom.sg. forms of the words quoted in Table 4 will be represented as follows:



We propose that Saussure's Law is a 'tone flop' rule (cf. Goldsmith) which detaches a H tone from the phoneme with which it was originally associated, and links it to the next tone-bearing phoneme:



It was noted at the beginning of this section that we view tones as entities composed of the two features [high] and [accented]. As a consequence, when Saussure's Law applies to H and shifts its association from one syllable to the next, it simultaneously shifts the feature [accented]. The output of Saussure's Law is subject to a rule of tone merger and accent spread, which spreads the feature [accented] to all tones linked with a given syllable, and simultaneously

¹⁰ See, e.g., Jernudd (75), who observes that the fundamental 'frequency rise is steeper for the grave intonations (being so much shorter), but the levels reached are slightly lower than those of the circumflex syllables'. ('Grave' refers to an accented short syllable, 'circumflex' to an accented long syllable with rising melody.) The acoustic data presented by Jernudd are too sparse to establish his conclusion (77) that the 'grave and circumflex intonations are realizations of the same accent (linguistic form element)'. What the data show very clearly, however, is that all accented syllables are produced with H for at least part of their duration.

merges adjacent identical tones into a single tone. The effects of this rule, which may be a special case of a more general convention, are illustrated as follows:



In Figure 10, we give derivations of the forms in Table 4, above.

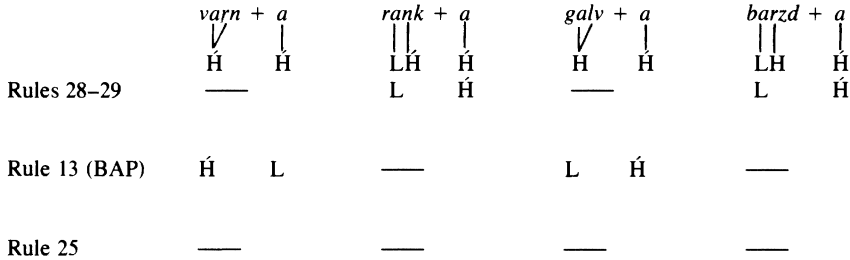


FIGURE 10.

We conclude this discussion of the Lith. accentual system with derivations of a number of forms from the verbal inflection.¹¹ Particular interest attaches to the derivations with prefixed forms, as in Table 9, since these are of considerable complexity in view of the length of the underlying strings. Stems with Acute (H) stem-melody show fixed accent—cf. (a) and (b)—whereas the stems that have the Circumflex (LH) melody exhibit accent mobility.

(a) 1sg. <i>ap + sé'j + u</i> 'sow'	(c) <i>pa + rĕk + iù</i> 'shout'	(e) <i>rĕk + iù</i> 'shout'
2sg. <i>ap + sé'j + i</i>	<i>pa + rĕk + i</i>	<i>rĕk + i</i>
3. <i>ap + sé'j + a</i>	<i>pa + rĕk + ia</i>	<i>rĕk + ia</i>
1pl. <i>ap + sé'j + ame</i>	<i>pa + rĕk + iame</i>	<i>rĕk + iame</i>
2pl. <i>ap + sé'j + ate</i>	<i>pa + rĕk + iate</i>	<i>rĕk + iate</i>
(b) 1sg. <i>iš + gráuž + iu</i> 'gnaw'	(d) <i>ât + neš + u</i> 'bring'	(f) <i>neš + ù</i> 'carry'
2sg. <i>iš + gráuž + i</i>	<i>ât + neš + i</i>	<i>neš + i</i>
3. <i>iš + gráuž + ia</i>	<i>ât + neš + ia</i>	<i>neš + a</i>
1pl. <i>iš + gráuž + iame</i>	<i>ât + neš + ame</i>	<i>neš + ame</i>
2pl. <i>iš + gráuž + iate</i>	<i>ât + neš + ate</i>	<i>neš + ate</i>

TABLE 9.

To derive the correct surface forms, we make the following assumptions: (i) 1sg. and 2sg. suffixes are lexically supplied with H; (ii) the stems *sėj* and *rĕk* (/seej/, /reek/) are lexically accented; (iii) *rĕk*, moreover, is lexically provided with LH; (iv) all other morphemes are lexically unaccented and have no melody; (v) Non-final Lengthening (Rule 24) does not apply in prefixes. Results are shown in Figure 11.

Slightly different assumptions would be required if a synchronic counterpart

¹¹ See Dudas & O'Bryan 1972 for a different treatment of the Lithuanian verbal accentuation.

of Leskien's Law were to be incorporated into the system. The 1sg. and 2sg. endings *-ū* and *-i* would then be derived from underlying long vowels by this rule, and their acute melody would be supplied by Rule 23. We leave it as an open question whether this should be done.

Latvian, the other major Baltic language, underwent developments that had the following major results: (a) With a few marginal exceptions, Latvian has fixed accent on the first syllable of the word. (b) It has tonal distinctions, but these are manifest only in the accented (initial) syllable. (c) Historically short syllables have, in the majority of dialects, the falling melody. (d) Historically long syllables that were originally accented have a high pitch which is accompanied by a slight increase in intensity (*Dehnton*). (e) Historically long syllables that were originally unaccented have rising melody interrupted by glottal stop, after which the pitch rise may or may not continue (see Laua 1969:112). We summarize the correspondences as follows:

- | | |
|--|--------------------------------|
| (30) Inherently accented long syllables: | High |
| Inherently unaccented long syllables: | Low-High- ² -(High) |
| Short syllables: | High-Low |

Subsequent to the establishment of these associations, new quantity changes developed, with the result that melodic contrasts became distinctive and had to be supplied in the lexical representation of individual morphemes.

Following the lexicalization of melodic contrasts, Latvian lost all accent specifications in the lexicon. As a result, all Latvian words received accent on their initial syllable by the BAP.¹²

Let us summarize our analysis so far. The Baltic system comprised these types of accent rule: Tone Association (16, 20, 21), Tone Assignment (23), the BAP (13), and Melody Simplification (25). Lithuanian has, in addition, Sausure's Law (28) and Non-final Lengthening (24). Latvian has eliminated underlying accent specifications, and as a result maintains tonal distinctions only on the initial syllable, where accent is supplied by the BAP.

5.2. SLAVIC. What modifications must be made in this system to derive the superficially rather different proto-Slavic accent pattern? The most obvious change is that unaccented syllables in Slavic lost their inherent tonal contrasts, and were uniformly assigned L tone in the lexicon (cf. Rule 12, §4 above). Thus Slavic morphemes exhibit a three-way melodic contrast in the lexicon: High, Low-High, and Low.

Recall that, as a consequence of the four-way prosodic contrasts among BSl. morphemes, there were four distinct accentual classes in the inflection of BSl. nouns (illustrated with Lith. data in Table 4). Since Slavic had only a three-way prosodic contrast, we expect three accentual classes in the Slavic inflections; and this is precisely what we find. Slavic stems with L tone are the cognates of BSl. stems of Classes 3 and 4, and have identical accentual behavior, as shown with Russian examples in Figure 12.

¹² A comparable development took place in the Lesbian dialect of Greek, where the recessive accent assigned to inherently unaccented words was generalized to the whole vocabulary.

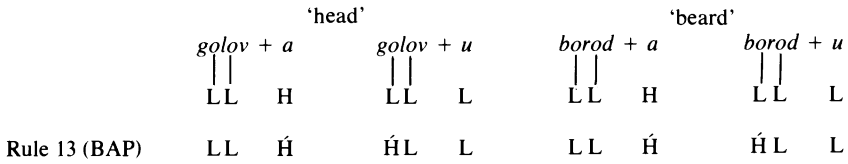


FIGURE 12.

Slavic stems with inherent H are the cognates of BSl. stems of Class 1; and like the latter, they exhibit fixed stem-accent throughout the entire paradigm. An illustration of this accentual paradigm (Stang’s Paradigm A) is:

(31) *vorón* + *a* ‘crow’, acc.sg. *vorón* + *u*¹³

The most interesting situation arises in Slavic stems with rising (LH) melody, which are the counterparts of Lith. Class 2 stems. Unlike the BSl. proto-language, Slavic allowed only a single tone to be linked to a single phoneme in the lexicon. Monosyllabic stems with LH melody were therefore represented in the lexicon with a linked L and a ‘floating’ H; e.g.,

(32) *pīl* ‘saw’ *stol* ‘table’
 | |
 L H L H

When such stems were combined with other morphemes into words, the un-associated ‘floating’ tones were handled by the regular Tone Association Rule (18), which had the effect of assigning the ‘floating’ H to the next syllable:

(33) *pīl* + *a* ‘saw’ (nom.sg.) *stol* + *a* ‘table’ (gen.sg.)
 | / | | / |
 L H H L H L

The BAP then applied, assigning accent to the syllable linked with the left-most H, which was always the syllable following the morpheme with rising melody. This forward shift of the accent is, of course, the phenomenon which G calls Illič-Svityč’s Law; it is responsible for the creation in Slavic of the oxytone paradigm (Stang’s Paradigm B).

The verbal paradigms discussed in Tables 6–7 above are derivable in exactly the same way, as shown with Russian examples in Figure 13.

¹³ In Slavic, liquid diphthongs underwent metathesis (*vorna* > *vrona* ‘crow’; cf. SCr. *vràna*). In East Slavic they then acquired an anaptyctic vowel which must be assumed to carry L tone (cf.

Ru. /*voron* + *a*/ > *voróna*). This contrasts with the tonal treatment of the Low-tone stem **vorn* ‘raven’—which, after the insertion of the anaptyctic vowel in East Slavic, had the gen.sg. form

/*voron* + *a*/, which by the BAP becomes /*voron* + *a*/, the attested surface accentuation in Modern

Russian. It might be remarked that the surface contrast /oro/ vs. /oro/, which arises in this fashion in East Slavic, has nothing in common with the superficially similar accentual contrast between Lithuanian circumflex (LH) and acute (H) melodies. The frequent identifications that are to be found in the literature for these quite different contrasts are, like so much else written on IE accentuation, devoid of adequate justification. The treatment of this topic by G (264–7) avoids this, as well as most other vulgar errors.

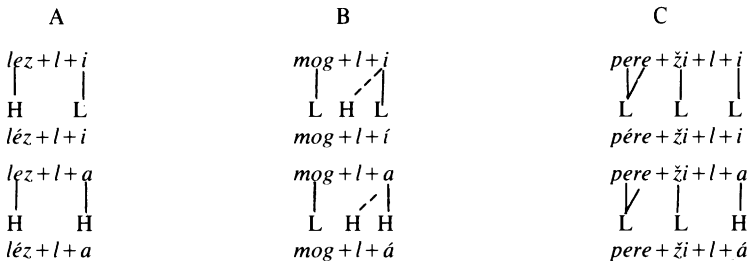


FIGURE 13.

As noted above, G regards Illič-Svityč's Law as an ordinary sound law having the form of 9. By contrast, our account views the same phenomena not as the effects of a phonological rule, but rather as by-products of the specifically Slavic restriction on the number of tones that could be linked with a single phoneme in the lexicon. The fact that, in its evolution, Slavic changed the way in which tones were represented in lexical entries must be specifically noted in every historical account of Slavic. The fact that Slavic also exhibits the rightward accent shift described by Illič-Svityč is, thus, in our account, not a separate phenomenon, but a consequence of the previous change. On G's account, the Illič-Svityč accent shift is separate and independent of the change in the lexical representation of tones. If our account is correct, it is to be preferred, since it reveals lawful connections among facts which, on G's account, appear to be unrelated.

The rightward shift of the accent in Slavic superficially resembles the accent shift produced by Saussure's Law; and there is a long tradition in comparative IE studies that identifies the two processes as manifestations of a single sound change. In the light of the preceding, it should be clear that there is no basis for such an identification. Our account thus confirms G's suggestion (212–13) that Saussure's Law was restricted to Lithuanian, and had nothing to do with the accent advance in Slavic.¹⁴

As noted already, Illič-Svityč established that the majority of stems causing the rightward accent shift in Slavic correspond to IE stems with short accented vowels. We remarked above that a major step in the evolution of the BSl. prosodic system was the development of tonal contrasts. Specifically, we noted that long syllables acquired H tone, whereas short syllables acquired the rising LH melody. Subsequently, when Slavic limited to one the number of tones that could be linked with a single tone-bearing phoneme in lexical representation, stems with LH melody (and only these) automatically became post-accenting. Our account, therefore, provides a reasoned explanation for the correspondences discovered by Illič-Svityč.

One of the G's most significant new proposals (208 ff.) is that the rightward shift of the accent just discussed does not affect all Slavic languages equally. He shows that the shift is completely general only in East and South Slavic, where it is found with all monosyllabic morphemes that have LH. The shift is

¹⁴ For a brief review of the literature on this hotly debated issue, see G (440).

correlated with another difference between Baltic and Slavic. Unlike Baltic, modern Slavic languages do not have mora structure; i.e., they do not treat long vowels as sequences of identical short vowels, nor do they allow tone on postvocalic sonorants. Formally, this means that Rule 21 is eliminated in Slavic. An immediate consequence of this is that monosyllables have only a single tone-bearing phoneme. Hence the general Slavic constraint limiting to one the number of tones that could be linked with a single tone-bearing phoneme in the lexicon has, as a further consequence, the fact that rightward accent shift is found with all monosyllabic morphemes that have the LH melody.

The situation is somewhat different in West Slavic. In the first place, with the exception of Northern Kashubian, all West Slavic languages have (or had) fixed accent on the word-initial syllable. Northern Kashubian, which exhibits accent mobility, differs from the East and South Slavic languages in having two instead of the three accentual paradigms found elsewhere. Thus we find in Slovincian, a Northern Kashubian dialect described by Lorentz 1903, one accentual paradigm with fixed stem-accent (corresponding to Stang's Paradigm A) and a second paradigm with accent alternating between desinence and stem (resembling most nearly Stang's Paradigm C). The absence in Slovincian of an accentual paradigm with fixed post-stem accent (corresponding to Stang's Paradigm B) is a major reason for G's belief that West Slavic never was subject to rightward accent shift. He writes:

'In the declension one finds only two paradigms: fixed stem (A) and mobile (C). Paradigm B does not exist. Words with fixed accent may contain not only a Common Slavic acute vowel ... as they do in East and South Slavic, but also a Common Slavic circumflex stem-vowel ... In the latter two cases the fixed accentual paradigm of Kashubian corresponds very frequently to East and South Slavic Paradigm B ... Thus, the accent in the declension is easily explained if one assumes that the accent advance ... did not take place' (211–12).

The implication here is that, since Paradigm B words did not undergo the rightward shift of the accent, they should remain with Paradigm A words in the fixed-stem paradigm.

This implication has been challenged by Kortlandt, who draws attention to Van Wijk's 1922 study, which appears to indicate that the distribution of Paradigm B stems between the Kashubian accentual paradigms is governed by syllabic properties of the stems; i.e., stems with short open syllables belong to the Kashubian mobile paradigm, whereas stems with long syllables belong to the Kashubian fixed-accent paradigm. Kortlandt proposes that Illič-Svityč's Law also applied in West Slavic, and that Paradigm B stems with long syllable joined the fixed-stem paradigm in Kashubian as the result of a further sound change which retracted accent from final syllables onto preceding long vowels. More simply, it may be assumed that Illič-Svityč's Law applied only to short stems in Kashubian. The hypothesis has a natural interpretation in our framework, as follows.

Recall that Slavic limited to one the number of tones that could be linked with a single tone-bearing phoneme in lexical representations. It was this limitation, together with the elimination of mora structure, that caused the wholesale rightward accent advance which produced the B paradigm in East and

South Slavic. Consider now what would happen in a language—subject to the Slavic limitation on tone association in the lexicon—which, unlike South and East Slavic, had preserved mora structure. In such a language, both tones of the LH melody would be linked to the stem where the stem syllable has two moras, i.e. consists of a long vowel or of a short vowel followed by a sonorant. With a one-mora stem vowel, however, only L would be linked with the stem syllable; H would be set afloat, with the result that the accent would appear on the post-stem syllable. In other words, the assumption that Kashubian (and perhaps all West Slavic) differed from East and South Slavic in preserving mora structure would account for the bifurcation of the Paradigm B stems documented by Van Wijk. The only thing that still needs to be explained is the merger of the Paradigm B forms that underwent accent advance and merged into the Kashubian mobile paradigm. Kortlandt (77–8) provides evidence that Kashubian was subject to accent retraction which, in the majority of case forms, eliminated surface distinctions between Paradigm B and C stems. The few remaining distinctions between these two paradigms were ultimately leveled by analogy with the rest of the case forms.¹⁵

In the absence of prosodic specifications in underlying representations, the BAP simply assigns stress to the initial syllable, by the third 'default' case of prominence. This is why inherently unaccented words receive initial accent in the IE languages. It follows that a language which loses lexical accent should establish fixed word-initial accent. We have already encountered an example of this on the Baltic side in Latvian; Slavic furnishes several cases which also confirm this prediction. The West Slavic languages (other than Kashubian) replaced accent mobility by fixed initial accent—still preserved, e.g., in Czech. Polish is known to have had it also, prior to acquiring its present penult accent pattern.

An essential element of our theory is the relationship between ictus and melody. The difference in PLACE of accent that obtained for long stems of Paradigm B between West Slavic and the other Slavic languages is necessarily correlated with a TONAL difference. In West Slavic, long stems of Paradigm B are predicted by our theory to have had the LH melody, contrasting with a L on stems of Paradigm C. Elsewhere they both had L; see Table 10.

	B	C
West Slavic	$\begin{array}{c} trqb + a \text{ 'pipe, horn'} \\ \swarrow \quad \downarrow \\ L \quad H \quad H \end{array}$	$\begin{array}{c} rqb + a \text{ 'hand'} \\ \downarrow \quad \downarrow \\ L \quad H \end{array}$
East and South Slavic	$\begin{array}{c} trqb + a \\ \downarrow \quad \swarrow \\ L \quad H \quad H \end{array}$	$\begin{array}{c} rqb + a \\ \downarrow \quad \downarrow \\ L \quad H \end{array}$

TABLE 10.

¹⁵ Čakavian and Kajkavian dialects of Serbo-Croatian (see Belić 1909) and Slovenian are the only Slavic languages that allow the association of more than one tone with a single vowel on the surface; but they do not allow such associations in lexical representations. These languages thus constitute symmetrical counterparts of (Proto-)Kashubian.

This prediction is in some measure confirmed by the quantitative reflexes of tone. Long stems of Paradigms B and C are treated DIFFERENTLY in West Slavic, but they are treated IDENTICALLY in the other Slavic languages.

To put this point into context, let us briefly reconsider, from our new theoretical perspective, the facts mentioned earlier (see §4, above) concerning the way length is affected by the accentual features of the different morphemes. The three major groups of Slavic languages exhibit strikingly different behavior. We noted above that South and West Slavic were subject to Rule 10, which shortens vowels with acute melody (i.e. with H tone, given the reformulation of tonal contrasts proposed above). East Slavic was not subject to shortening because it lost quantity contrasts rather early, before shortening became effective. In South and West Slavic, quantity contrasts were retained much longer—and are, in fact, maintained in many of these languages at the present time. There was, however, a difference between South and West Slavic: in South Slavic, shortening was limited to vowels with H tone (by Rule 10).

The manner in which H tone determines shortening is exactly parallel to the manner in which accent blocks zero-grade ablaut in Sanskrit: the relevant H tones are those which are present AFTER all tone association processes have applied, and BEFORE the BAP erases all but the first H tone. Like Sanskrit ablaut, South Slavic shortening therefore depends on the ABSTRACT tone pattern of the word, not on its surface accent. To see this, compare the *l*-participle and *n*-participle forms of the Čakavian dialect described by Belić:

- (34) *br̃is + a + l + o* ‘wipe’ *p̃is + ä + l + o* ‘write’
br̃is + ā + n + o *p̃is + ā + n + o*

The two types of participle differ in two respects: the thematic vowel has H in the *l*-participle, but L in the *n*-participle. Moreover, in the *n*-participle the tone on the thematic vowel is retracted to the stem-syllable by a special morphophonemic rule. We thus obtain these representations:

- (35) *br̃is + ā + l + o* *br̃is + ā + n + o* *p̃is + ā + l + o* *p̃is + ā + n + o*
 | | | | | | ^ | | ^ | | |
 H H L H L L LH H L LH L L L

The Shortening Rule applies to the first two vowels in *br̃isalo* and to the second vowel in *p̃isälo*, since these have H in the underlying representations. On the surface, the BAP applies and assigns accent to the vowel with the leftmost H, and simultaneously replaces all other H tones with L tones; this corresponds to the surface forms given in 34.

The situation in West Slavic was somewhat different from that in South Slavic. West Slavic shortening affected not only vowels with H, but also vowels with L (i.e. inherently unaccented vowels). Thus, in West Slavic, only vowels with rising melody (LH) preserve the original length; all other vowels are shortened. We see the effect of this process in the Slovak counterparts of the verb stems illustrated in Table 8, above:

- (36) *vlečiem* ‘I pull’, *vlieklo* ‘pulled’ (neu.sg.)

Recall that Slavic verbs of this type lost their stem melody in the present tense, where all stems received L. In 36, this means that the inherent rising melody

was replaced in the present tense by L. As a consequence, the stem vowel was shortened in the present tense, though its original length was preserved in the past tense. In Serbo-Croatian, by contrast, shortening did not affect stems with rising melody. Thus the SCr. cognates of the forms in 36 do not show length alternations. The stem vowel is long in both forms: *vúčēm*, *vúklo*.

To summarize: Balto-Slavic developed a H:LH contrast in lexical representations of morphemes. On the surface, Tone Association (Rule 18) and Melody Simplification (Rule 25) prevented the appearance of tonal melodies on a single vowel. In Balto-Slavic, these rules did not lead to a restructuring of the lexical representation of tones. In South and East Slavic, postvocalic sonorants became incapable of bearing tone (i.e., Rule 21 was eliminated), and long vowels were represented as single segments. Since Rule 20, restricting Tone Association, was maintained fully in East and South Slavic, the result was that morphemes with LH systematically shifted the accent to the next syllable—i.e. triggered the phenomenon described by Illič-Svityč. In West Slavic, mora structure was preserved. Hence accent shift was produced by the limitation on Tone Association in the lexicon only in the case of stems with LH melody and short open stem-syllable. As a result of later processes, these stems merged into a single accentual paradigm with stems of Paradigm C. All other LH stems retained stem-accent; and upon loss of surface melodic contrasts, they merged into a single paradigm with stems of Paradigm A.

6. CONCLUSION. G's book sets a new standard for work on IE accentology in the degree to which it develops a unified and consistent structural interpretation, and applies it in comprehensive detail to the individual Baltic and Slavic languages. The outlook reflected in G's analysis is that of structuralism at its best; and it shares with empiricist varieties of structuralism an agnostic attitude toward linguistic theory and universals. This attitude appears in G's reluctance to assign phonological features to such prosodic categories as STRONG and CIRCUMFLEX, and in his skepticism toward the typological considerations that have traditionally played an important role in the field. We have tried to demonstrate, in the second half of this review, that such skepticism is unjustified, and that an approach through a richer theoretical framework is rewarded by new insights that elude even Garde's careful investigations.

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