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STUDIES IN HONOR OF CALVERT WATKINS

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Grimm's and Verner's Laws: A New Perspective

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This paper is an attempt to discuss the evidence for Grimm's and Verner's Laws from a perspective that takes into account the main results of phonological investigations of the last half century. It is a curious fact that up to the present, these results have exerted little influence on the study of Indo-European phonology, the central topic of linguistic research during much of the preceding period. One of our aims is to begin to correct this anomalous situation and to bring together the results in these two domains, which for far too long have developed in total isolation from one another. We believe that a review of the rich collections of data and the sophisticated theoretical accounts provided by Indo-Europeanists can only result in important new advances both in linguistic theory and in our understanding of the evolution of the Indo-European languages.

1. Theoretical Background

It is assumed here that underlying all linguistic events is the knowledge that speakers and hearers have of a language. To elucidate the nature of this knowledge is the central aim of all linguistic research.

We can get a useful perspective on the issues of interest here by noting that much of this knowledge is stored in the memory of speakers. This is self-evident in the case of our knowledge of the words of a language: we are not born with the knowledge of the words of our mother tongue, but must learn them; i.e., commit them to memory one by one. And as a first approximation we shall assume that the same is true of all learned aspects of linguistic knowledge: these too are stored in the memories of speakers. Knowledge of a language is therefore not a record of the utterances that a speaker encounters in her/his lifetime, nor is it a Platonic object. It is a concrete state of an individual's memory by virtue of which the individual is capable of producing and understanding utterances in a given language, and it is the content of this state of an individual's memory that must be a major subject of linguistic inquiry.

As illustrated in (1) with the Gothic words meaning 'a giving' and 'thief', words are commonly composed of smaller pieces, morphemes.

(1) *fra-gif-t-s* *hlif-tu-s*

It is the morphemes—in addition to the words—that make up the Vocabulary of the speakers of a language. Each Vocabulary item consists of a phonetic exponent providing information about the sound of the item and a morpho-syntactic matrix indicating the terminal node of a syntactic structure into which the item is to be inserted. The phonetic exponent consists of a sequence of phonemes, where each phoneme is a complex of binary distinctive features,

such as [+nasal], [-back], [-continuant]. It is assumed here without further discussion that the feature complexes of the different phonemes have internal structure that is represented by special constituent trees. (For some discussion see Clements 1985, Halle 1995.)

2. Marking statements and the phoneme "alphabet"

Languages differ as to phoneme "alphabet"; i.e., as to the feature complexes that may figure in their Vocabulary items. We adopt here the proposal of Calabrese 1995 that part of every speaker's innate linguistic competence—i.e., of the uniquely human capacity that allows her/him to acquire a natural language—is constituted by a set of filters or marking statements, which assign a cost to specific configurations of features. Examples of these marking statements are given in (2):

(2) Marking statements for obstruents:

a. *[-sonorant, +continuant]
<obstruents are stops>

b. *[-sonorant, +constricted glottis]
<obstruents are non-glottalized>

c. *[-continuant, -stiff vocal folds] /[___, -sonorant]
<stops are voiceless>

c′. *[+continuant, -stiff vocal folds] /[___, -sonorant]
<continuants are voiceless>

d. *[-continuant, +spread glottis] /[_____, -sonorant]
<stops are unaspirated>

e. *[+continuant, -spread glottis] /[_____, -sonorant]
<fricatives are aspirated>

f. *[+constricted glottis, -stiff vocal folds] /[___, -continuant, -sonorant]
<glottalized stops are voiceless>

Because of their cost, languages generally avoid the feature combinations mentioned in the marking statements. Thus, many languages lack aspirated ([+spread glottis]) stops or glottalized ([+constricted glottis]) obstruents, and the reason for this is the marking statements (2b,d) that attach a cost to these feature configurations, a cost which for these languages is prohibitive.

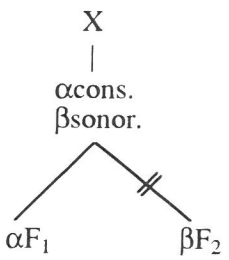
Segments characterized by a feature combination mentioned in a marking statement may occur in a language if and only if the relevant marking statement is *deactivated*. If the marking statement is active, the relevant segment is ruled out. Languages differ one from another in that they deactivate certain marking statements but not others. For example, languages with voiced obstruents or with aspirated stops deactivate the marking statements (2c,c′) and (2d), respectively. (For further details, see Calabrese 1995 and below).

3. Repair strategies

Speakers often encounter phonemes containing a feature complex disallowed by a marking statement active in their language. These phonemes can either belong to foreign languages or be the outcomes of sound changes. One option available to speakers is to accept these segments, and therefore to deactivate the relevant marking statements (see Calabrese 1995 for examples and more discussion.) The other possibility is to react to the disallowed sounds and try to adjust them. Interestingly, speakers react to them in a nonrandom fashion. The reactions are the province of the three repair strategies: fission, delinking, and negation. Since only delinking is relevant for this paper we focus on this strategy exclusively here and refer those interested in the other strategies to Calabrese 1995.

Delinking is an operation by which one of the incompatible features of a disallowed configuration is delinked and replaced with a compatible feature. An example of delinking is the replacement of aspirated stops by fricatives, which is encountered, among other places, in Grimm's Law in Germanic. Delinking is formally represented in (3):

(3) DELINKING:



where αF_1 conflicts with βF_2 because of the active marking statement/prohibition $*[\alpha F_1, \beta F_2]$ $(\alpha,\beta = +/-)$.

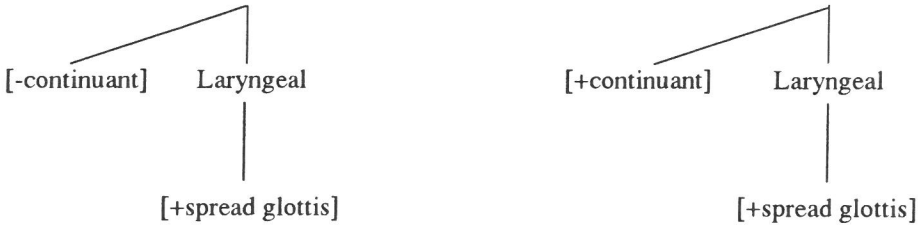
The delinking in (3) results in an incomplete representation: a new specification for F_2 must therefore be inserted. The missing feature specifications are inserted by the last resort convention in (4) which always creates optimal configurations by inserting "unmarked" specifications:

(4) Given the marking statement [αF, βG], fill in -βG in a feature bundle that contains αF, but no specifications for G, and fill in -αF in a bundle that contains βG, but no specifications for F.

We argue below that in Germanic aspirated stops were eliminated by reactivation of the marking statement (2d). A direct consequence of this is to mark as illicit all aspirated stops of the language. The automatic response of a language to the appearance of phonemes that violate an active marking statement is to invoke one of the available repair strategies. In the present instance the strategy invoked

was delinking of the [-continuant] feature in the offending complexes. As illustrated in (5), this delinking in turn triggered the replacement of the delinked [-continuant] feature by the unmarked [+continuant], pursuant to convention (4).

(5) [+consonantal] → (Delinking of [-cont] + (4)) → [+consonantal]



The repair strategy resulting from a violation of marking statement (2d) replaces all aspirated stops with continuants; i.e., it affects both the voiceless aspirated stops introduced by special rules of proto-Germanic phonology, as well as the voiced aspirated stops that were in the language as continuators of original IE phonemes. Subsequently, in consequence of an independent sound change, voiced fricatives became stops in certain contexts; e.g., in word initial position.

4. Laryngeal features

Halle and Stevens (1971) noted that a basic difference between vowels and sonorants, on the one hand, and obstruents, on the other, was that during production of vowels and sonorants the supraglottal air pressure is substantially identical with that in the ambient air, whereas in the production of obstruents the supraglottal air pressure is higher than that of the ambient air, because some air is trapped in the vocal tract. Assuming that the subglottal air pressure is the same for all types of speech sounds, it follows that the pressure drop across the vocal folds is greater in vowels and sonorants than in obstruents. Since the pressure drop across the vocal folds is the prime factor in setting the vocal folds into vibration, it is more difficult to make the vocal folds vibrate in obstruents than in vowels and sonorants.

A second factor that affects vocal fold vibration is the stiffness of the folds. When the folds are very stiff it takes a greater air pressure drop to make them vibrate than when the folds are less stiff. Thus, one way of preventing the folds from vibrating is to increase the stiffness of the folds. Halle and Stevens noticed that the mechanism of preventing vocal fold vibration by increasing their stiffness can work only when the pressure drop is small. When the pressure drop is large—as in vowels and sonorants—increasing the stiffness of the folds does not prevent them from vibrating; instead it increases their rate of vibration, i.e., the fundamental pitch of the sound. Thus, one and the same articulatory action —vocal folds stiffening—has two distinct acoustic effects: it raises the pitch in vowels and prevents voicing in obstruents.

Putting these two observations together, Halle and Stevens proposed that the universal feature set does not include a feature of [voice]. Rather the universal set has the feature [stiff vocal folds], which serves to distinguish, on the one hand, voiced from voiceless consonants and, on the other hand, high pitch vowels from their low pitch cognates.

An important argument in favor of this proposal is that it explains the well-known interaction between voicing and vowel pitches that has been observed in the East Asian languages, the famous *Yin/Yang* contrast of Chinese, as well as the effects of voicing on the fundamental frequency of adjacent consonants that had been noted by phoneticians, e.g., House and Fairbanks (1953).

Halle and Stevens (1971) proposed that vocal fold stiffness is controlled by two distinct features: [+/-stiff vocal folds] and [+/-slack vocal folds]. They suggested that the combination [+stiff vocal folds, +slack vocal folds] represented a physiological impossibility like [+high, +low]. More recent, still unpublished work has led them to question the latter suggestion and to admit the combination [+stiff vocal folds, +slack vocal folds].

To sum up, the feature [stiff vocal folds] replaces the traditional [voiced] feature in obstruents, and in vowels this feature serves to characterize pitch contrasts. The feature [slack vocal folds] serves to distinguish pitch contrasts in vowels and sonorants only. This allows us to distinguish four degrees of pitch in vowels. These consequences are summarized in (6).

(6)

[+stiff vocal folds, -slack vocal folds]	pitch 4	voiceless obstruents
[+stiff vocal folds, +slack vocal folds]	pitch 3	
[-stiff vocal folds, -slack vocal folds]	pitch 2	voiced obstruents
[-stiff vocal folds, +slack vocal folds]	pitch 1	

As noted above, this feature analysis explains the well-known relationship that exists between vowel pitch and voicing of adjacent obstruents. The tonal system of the Songjang dialect of suburban Shangai discussed by Bao 1990 provides a nice example of this relationship. The Songjang tone system is characterized by two different registers, a high variant, the so-called *Yin* register, and a low variant, the *Yang* register, as shown in (7):

(7)

Yin register	53	44	35	5
Yang register	31	22	13	3
	falling	level	rising	level [only in syllables closed by glottal stop]

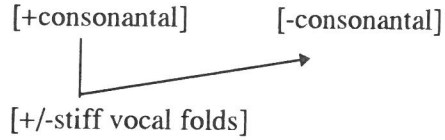
What is interesting is that there are constraints on the distribution of the two registers; in particular, the *Yin* register occurs after voiceless obstruents, while

the *Yang* register occurs after voiced obstruents. After sonorants the two registers are partially distinctive.

It will be assumed here that the tonal contours are sequences of the feature [slack vocal folds]. Thus, the tone contours 53 and 31 both reflect the sequence [-slack vocal folds]—[+slack vocal folds], whereas 35 and 13 reflect the sequence [+slack vocal folds]—[-slack vocal folds]. The level tones are assumed to be [-slack vocal folds]. Register is reflected by the feature [+/- stiff vocal folds]: Yin = [+stiff vocal folds], Yang = [-stiff vocal folds].[1]

We can now account for the distribution of the two registers in (7) by positing the rule in (8), which spreads the laryngeal feature of the obstruent into the following vowel:

(8)



5. Rules

The phonetic shape of a morpheme is frequently modified in the vicinity of other morphemes. For example, as illustrated in (9), the English past tense exponent /d/ assimilates the feature [+stiff vocal folds] from the final phoneme of the verb stem. By contrast the /t/ exponent of the past tense, which is taken by about 40 English verbs, transmits its [+stiff vocal folds] feature to the stem final obstruent.

(9)

a.	no effect:	*blame-d*	*derive-d*	*clogg-ed*	*close-d*
	[+stiff vf]:	*usurp-ed*	*clock-ed*	*replace-d*	*brief-ed*
b.	no effect:	*bough-t*	*knel-t*	*dwel-t*	
	[+stiff vf]:	*lef-t (leave)*	*los-t (lose)*		

As shown in (10), word-internal sequences of obstruents differing in [stiff vocal folds] (i.e., voicing) are admitted in English.

(10) *disbar* *disdain* *disgrace* *misbehave* *misdemeanor* *misguided*

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[1] We leave open the question whether or not vowels with contour tones are long; i.e., consist of more than one timing slot. If so, the two features in the sequence are assigned to the separate timing slots; if not, the feature sequence is assigned to the single timing slot, much like the feature sequence [-continuant]—[+continuant], in the case of affricates in many languages. For more discussion of this issue see Duanmu 1991.

We assume therefore that the two past tense exponents in (9) are subject to two distinct assimilation processes: the regular past exponent /d/ assimilates [+stiff vf] from the preceding stem consonant; the marked exponent /t/ transmits [+stiff vf] to the preceding stem consonant. We capture this with the rules in (11).

(11) a. [-sonorant] + [-sonorant] → [+stiff vocal folds]

b. [-sonorant] + [-sonorant] → [+stiff vocal folds]

We draw attention to the formal similarity between the rules in (11) and (8). In both instances there is assimilation of the feature [+stiff vf]. In (11) the consequences are trivially obvious: suppression of vocal fold vibration. In (8) the consequences are somewhat less self-evident, but equally predictable on the assumption that the acoustical correlate of [+stiff vf] is voicelessness in obstruents and higher pitch in sonorants. As shown below, Verner's Law is strikingly similar to (8).

6. The consonantal system of Proto-Indo-European

Before proceeding to discuss Grimm's and Verner's Law in Germanic, we need to deal with the IE obstruent system. The one widely, though not universally, assumed is given in (12).

(12)

	*t	*d	*dʰ
stiff vocal folds	+	-	-
spread glottis	-	-	+

As is well known this traditional reconstruction was challenged by some (Gamkrelidze and Ivanov 1984) in reaction to Roman Jakobson's observation that he had never encountered such a stop system. While no such system is to be found in Maddieson's 1984 survey, an example of such a system has been reported by Blust (1974).[2]

The rarity of the traditional IE stop system is, of course, not sufficient reason by itself for rejecting it. The situation would be considerably different if there were deeper, theoretical reasons for rejecting the traditional stop system, but no such reasons are known. In the framework proposed here, the absence of voiceless aspirated stops must be considered an accidental gap.

[2] Elbourne (1997) presents cogent arguments for the old hypothesis that the stop system of the Indo-European proto-language included a fourth series of voiceless aspirated stops. If Elbourne is correct, the issues discussed in this section are moot.

The alternative stop system proposed by Gamkrelidze and Ivanov (cf (13)) requires deactivation of the marking statement prohibiting glottalized obstruents in addition to the deactivations required by the traditional system (12).

(13)

	$*t^h$	$*t'$	$*d^h$
stiff vocal folds	+	+	-
constricted glottis	-	+	-
spread glottis	+	-	+

The alternative system has serious problems of its own. As noted by Garrett 1991, the system in (13) forces us to explain the developments in the different daughter languages in a highly unnatural fashion; in particular, "it would require the proposed ejectives to have been deglottalized throughout IE and voiced in six more branches." In the words of Watkins 1995, "while the new 'typological interpretation' may account for some problematic features, it introduces considerable complexities (and 'unnaturalness') elsewhere in the system." In sum, no advantage is gained by positing the stop system (13), since it forces us to adopt an unacceptable account of known developments as well as to posit an underlying system that is more complex than the traditional system (i.e., requires additional deactivations of marking statements). We assume instead that the proto-language had the system in (12). Implicit in this view is the claim that the language deactivated the marking statements (2c,d).[3]

7. Grimm's Law

Grimm's Law is the traditional term for a number of changes in the obstruent system of the ancestor of the Germanic languages. In the first of these some of the [+stiff vocal folds] stops were replaced in Germanic by their cognate continuants as illustrated in (14), whereas others were preserved intact (see (16)).

(14)

Latin	**Greek**	**Gmc.**	**Baltic**	**Sanskrit**	
ped-	*pod-*	*fo:t* (OE)	*ped-*	*pad-*	'foot'
tre:s	*tri-*	**θri-*	*tri-*	*tri-*	'three'
kruor	*kreas*	*hra:r* (ON)	*kraujas*	*kravis*	'blood, raw'

In agreement with other researchers who have written about these changes, and in particular with Iverson and Salmon (1995), we propose that this part of Grimm's Law took place in two steps. In the first step, Germanic was subject to a rule which aspirated voiceless stops. In the second step, aspirated stops became fricatives. Following Iverson and Salmon, we assume that the sound

[3] In view of the deactivation of (2c,d) a four-way contrast of stops would be expected. The absence of voiceless aspirates is therefore an accidental gap. See Calabrese 1995 for further discussion of accidental gaps.

change accounting for the first step involves the assignment of the feature [+spread glottis] (aspiration) to voiceless stops, i.e., rule (15):

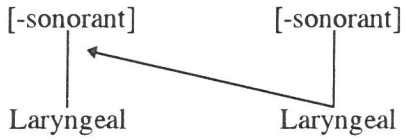
(15) [+stiff vocal folds] → [+spread glottis]/ [____, -continuant]

Our analysis diverges from that of Iverson and Salmon in the explanation of the exceptions to (14) illustrated in (16) where only the first component of the cluster is fricativized in Grimm's Law.

(16)	**Greek**	**Latin**	**Sanskrit**	**Gmc.**	**Baltic**	
	okto:	*octo*	*aṣṭau*	*axtau*	*aštuoni*	'eight'
Cf also	Lat.	*-spicio*	OHG	*speho:n*		'spy'
		scindo		*sceidan*		'separate'
		stella		*sterno*		'star'
		neptis		*neftila*		'niece'
		piscis		*fisk*		'fish'

Iverson and Salmon hypothesize that obstruent clusters share a single laryngeal component and attribute this to a special principle governing clusters. Our alternative is to posit a rule that assimilates—regressively—all laryngeal features of the last obstruent in a cluster. This rule, formulated in (17), was already active in the proto-language, as shown by the examples of regressive voicing in (18) (Szemerényi 1989:108, as quoted by Iverson and Salmon 1995). (See (35) for some Germanic examples.)

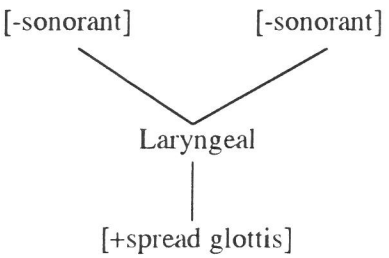
(17)



(18) IE **yeug-* 'join': Sanskrit *yuk-tá-*, Greek *zeuk-tós* 'joined'
IE **sed-* 'sit': Avestan *nižda-* < **ni+sd+os* 'nest'
IE **ped-* 'foot': Avestan *fra-bda-* 'forepart of the foot'

The application of (17) to obstruent clusters affected by (15) in Germanic (NB: (17) is ordered after (15)) resulted in the linked structures in (19):

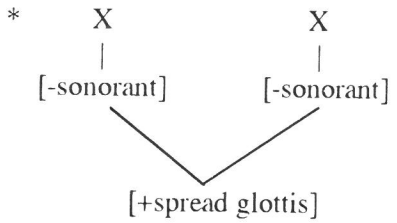
(19)



Iverson and Salmon hypothesize that the glottal opening associated with the feature [+spread glottis] is of limited duration whose peak occurs at a specific point in the interval. In a singleton this peak corresponds with the release phase of the obstruent. In obstruent clusters the peak of the gottal opening lies in the end of the first member of the cluster and the second member of the cluster is characterized by narrowing and closing of the glottis. Thus in structures such as (19) only the first obstruent will actually be phonetically characterized by open glottis.

To implement this observation formally we assume that the marking statements assigning costs to different feature configurations include the constraint against multiply linked [+spread glottis] features proposed in Calabrese and Keyser (forthcoming) and given in (20):

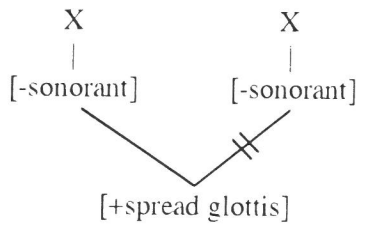
(20)



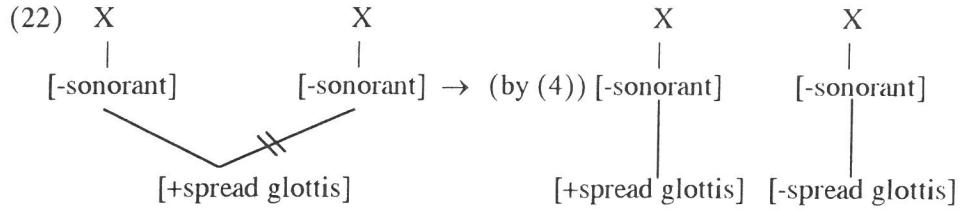
Rather than treating it as merely a fact of phonetic implementation, as was done by Iverson and Salmon, we assume that the temporal limitation on glottal opening described above has a direct reflex in the marking statements that restrict the admissible feature configurations.

The application of the laryngeal assimilation rule in (19) creates the structure disallowed by (20). The disallowed structure is repaired as shown in (21), by delinking the feature [+spread glottis] from the non-initial segment.

(21)



Delinking creates a structure in which there is no specification for the feature [spread glottis] in the non-initial member of the cluster. By virtue of convention (4) the unmarked feature [-spread glottis] is inserted here, as shown in (22):



The application of (15), (17), and (21) to the proto-Germanic forms in (23a) will produce the forms in (23c).[4]

(23)	a. *kaptas* >> (by (15))	b. *$k^hap^ht^has$* >> (by (17) and (21))	c. *k^hap^htas*
	a. *g^hastis*	b. *g^hast^his*	c. *g^hastis*
	a. *nak^wt-*	b. *$nak^{wh}t^h$-*	c. *$nak^{wh}t$-*
	a. *$steig^heti$*	b. *$st^heig^het^hi$*	c. *$steig^het^hi$*

At this point we have to account for the spirantization. Along the lines of Iverson and Salmon, we hypothesize that subsequent to the aspiration of voiceless stops, Germanic was subject to a second change which spirantized (i.e., turned into [+continuant]) all aspirated stops, both those generated in the first step as well as the voiced aspirates that were inherited from the proto-language. We shall assume—and here we differ from other writers—that this change was implemented not by adding a special rule, but rather by the reactivation of marking statement (2d). As detailed above, a consequence of the reactivation of (2d) is to render illicit all aspirated stops of the language.

This in turn triggers recourse to a repair strategy. In the instance under discussion the strategy invoked was the delinking of the [-continuant] feature in the offending complexes. Convention (4) then brings about the replacement of the delinked [continuant] feature by the unmarked [+continuant]. This process affects both the voiceless aspirated stops introduced by rule (15) as well as the voiced aspirated stops that were in the language as continuators of original IE phonemes. Voiced fricatives were subsequently turned into stops in certain contexts—e.g., in word-initial position.

This analysis diverges from the traditional view (cf Watkins 1995) that assumes that the voiced aspirated stops of Germanic became simply unaspirated. The proposition that both voiceless and voiced aspirates were spirantized together was advanced already by Hermann Paul in 1874. Among the evidence cited by Paul in support of this position was the fact that in Gothic a) the obstruents voiced by Verner's Law are transcribed with the same letters as the reflexes of IE voiced aspirates--letters which in the contemporary Greek represented voiced continuants; and b) that in position before voiceless consonants and word-finally (where devoicing occurred) the reflexes of IE voiced aspirates

[4] Recall that voiceless fricatives are [+spread glottis] given the marking statement in (2e).

are represented with the same letters as the reflexes of Grimm's Law in other environments.

While our proposal is thus not novel, our reasons for it are. As stated above, we propose to account for the changes under discussion not by means of adding a new rule to the phonology of the language, but rather by reactivating the universal marking statement (2d). The repair strategy that results from the reactivation of this filter does not permit us to distinguish different types of aspirated stops, but forces us to treat all aspirated stops alike. Thus, the account of the facts here is motivated not only empirically, but also theoretically.

An additional change always subsumed under Grimm's Law is the devoicing of voiced stops illustrated in (24):

(24) a.	Gr.	*kannabis*	Eng. *hemp*
	Lat.	*duo*	Eng. *two*
	Lat.	*genus*	Eng. *kin*
b.	Gr.	*ozd-*	Germ. *ast* 'branch'
	Lith.	*mezg-* 'knit'	OHG. *mask* 'stitch'
	Slav.	*gnězd-*	Eng. *nest*

Since all stops are now devoiced we shall formally capture this fact by reactivating the marking statement (2c).

8. Verner's Law

The following treatment of Verner's Law has been much influenced by the proposals of Noyer 1992, although our approach differs from Noyer's in rejecting the underspecification of features.

An instructive illustration of the effects of Verner's Law is given in (25) with an example cited by Verner himself, the hypothetical IE form *akasatam*, which in Germanic becomes *axasaθam* as a result of Grimm's law. This form would have the following outcomes depending on the position of the stress in the word.

(25) *áxazaðam* *agásaðam* *agazáθam* *agazaðám*

As shown in (25), Verner's Law has the effect of voicing a continuant in position after a vowel that is unstressed in IE, but not elsewhere. As noted by Verner, the fact that in this environment /s/ goes to /z/—and subsequently to /r/—in words such as those in the last line in (26) indicates that the change affected [+continuant] obstruents.

(26)	Skt.	*pitár-*	Go. *fadar* 'father'
	Skt.	*tɣtí:yas*	Go. *θridja* 'third'
	Skt.	*saptá*	Go. *sibun* 'seven'
	Lith.	*ausís*	OS *o:ra* 'ear'

When the IE stress preceded the continuant, no voicing took place, as shown in (27).

(27)

Skt. *páñca*	Go. *fimf* 'five'
Skt. *bʰrá:tr-*	Go. *broθar* 'brother'
Skt. *dánt-*	Go. *tunθu* 'tooth'
Lat. *caput*	OE *hēafod* 'head'

For present purposes it suffices to note that at the stage at which Verner's Law was operative, stress in proto-Germanic was an idiosyncratic property of a word that could fall on one of its syllables. Simple examples of this fact are the forms in (26), (27).[5]

It is common for stressed vowels to be marked phonetically with High tone, whereas unstressed vowels are marked with Low tone. This principle operates in both modern Russian and, more strikingly, in modern Lithuanian (see Halle 1997 for more discussion). To implement this observation formally we posit that words in IE were subject to rule (28).

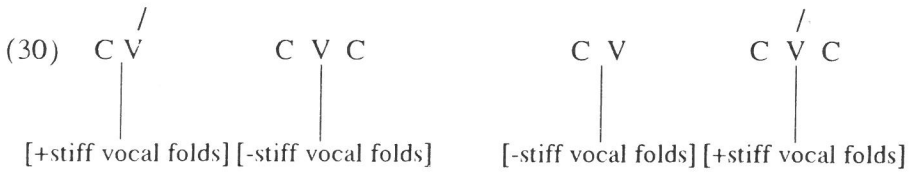
(28) Assign [+stiff vocal folds] to the stressed vowel of the word, and [-stiff vocal folds] to unstressed vowels.

The introduction of rule (28) into the language was accompanied by the deactivation of the marking statement (29), which reflects the fact that the Low tone is the unmarked tone for vowels.

(29) *[-consonantal, +stiff vocal folds]]

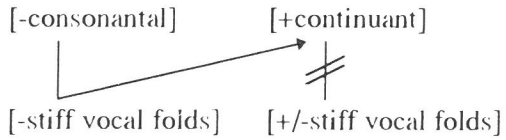
As a result, representations such as those in (30) are admitted into IE.

(30)



The required output is now obtained by assuming that Verner's Law is a rule that spreads the feature [-stiff vf] to an immediately following continuant as illustrated in (31).

(31)



Rule (31) is formally similar to the tone spreading rule (8) except that in that case the [stiff vocal folds] feature was spread from a consonant to the

[5] For a discussion of stress in IE see Halle 1997.

following vowel, whereas here the feature is spread from the vowel to the following consonant.

Since examples where vowel tone determines the voicing of consonants are considerably rarer than examples where consonant voicing determines vowel tone, it was suggested by Hyman (1975:229) that "consonant types affect tone, but tone does not affect consonant type." Hyman's suggestion, however, has been shown to be invalid by Poser (1981). Poser reviewed evidence from the New Guinea language Jabem, where "voiceless obstruents occur only in high-toned syllables and voiced obstruents occur only in low-toned syllables," and concluded that "<t>he treatment of Jabem phonology and morphology is considerably simpler if tone is taken to be the independent variable and if obstruents are voiced in low-toned syllables...Consequently, Jabem constitutes a counterexample to the claim that 'Consonants affect tone, but tone does not affect consonants.'"

The Jabem facts have been cited by Kortlandt (1986:158) in support of the suggestion that in IE there was "a correlation between voiceless stops and high tone on the one hand, and between voiced aspirates and low tone on the other." Noting the association of High tone with stress and Low tone with stresslessness Kortlandt hypothesized that the accentual properties of IE roots are predictable from their consonantal structure and that roots with voiceless stops were accented, while roots with voiced aspirates and voiced stops were unaccented. Kortlandt's hypothesis was investigated in detail by Lubotsky 1988. Although Lubotsky concluded that Kortlandt's hypothesis was not incompatible with the evidence, Jamison's 1991 detailed review of this study leaves little doubt that Kortlandt's proposal is not supported by the data.

A number of further facts are automatically explained by our account. As illustrated in (26) Verner's Law applies not only to a continuant that directly follows the stressless vowel but also to a continuant that is separated from the stressless vowel by a sonorant consonant. If, following Calabrese 1995, we assume that Verner's Law is a phonological rule for which only contrastive features are visible then we can reformulate Verner's Law as in (32) where [-stiff vocal folds] is spread from the vowel not to the adjacent, but to the nearest continuant.

(32)

Since only contrastive features are visible for this rule, any phoneme for which [stiff vf] is contrastive will block the spreading of the feature. The feature [stiff vocal folds], however, is noncontrastive for sonorants because the independently needed marking statement (33) is active in Germanic.

(33) *[+sonorant, +stiff vocal folds]/ [_____ , +consonantal]

A further exception to Verner's Law is illustrated in (34):

(34) Skt. *napti-* OHG, OE *nift* 'little girl'
Gk. *okto:* Go. *ahtau* 'eight'

Verner's Law would be expected to voice the first obstruent in this cluster. This exception is readily accounted for by assuming with Noyer that these clusters are subject to the voicing assimilation rule in (17), whose role in Germanic is amply documented in such Gothic forms as those in (35):

(35) *gib-an* 'to give' *fra-gif-t-s* < *fra-gib-t-s* 'a giving'
mag-um 'we may, can' *mah-t-s* < *mag-t-s* 'power, ability'

As Verner stated in his original paper, in verbs voiceless fricatives appear "in all present (stem) forms (inf., pres. ind., conj., imper. and part.), and in the singular forms of the preterite indicative; all remaining verb forms have voiced plosives" (104). It is in the latter forms of the verb that Indic (and hence IE) had suffixal stress, whereas in all other verb forms stress fell on the initial, root syllable. According to Verner, this must also have been true of proto-Germanic, at least in its earliest stages, and explains the voicing alternations in the Germanic verb stems noted at the beginning of this paragraph. A few examples surviving in the modern German are given in (36).

(36)

zieh-en	*zieh-e*	*zog*	*ge-zog-en*
schneid-en	*schneid-e*	*schnitt*	*ge-schnitt-en*

As Verner also noted, this alternation is not found in the verb forms of Gothic, where we consistently find voiceless fricatives in root-final position, indicating stress on the root syllable. A plausible explanation for this deviance of Gothic was offered by Noyer 1992, who proposed that verbal suffixes lost their lexical accent in Gothic. In this respect, Gothic parallels classical Greek, where verbs invariably have recessive stress, indicating absence of inherent accent on any morpheme. As a result of the deaccentuation of verb suffixes, Gothic lost verb forms with non-initial stress. Since non-initial stress is a prerequisite for voicing of the root final obstruent, Gothic verbs also lost the voicing alternations in root-final obstruents found in the other Germanic languages.

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