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Gothic <r> and Old High German <r>: Implications from phonological patterning

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This article reconstructs the archaic Germanic rhotic by examining a natural class pattern common to Gothic and Old High German (OHG). Specifically, I argue that the sounds represented by the graphemes <r> and <h> patterned as [high] segments. Due to the Obligatory Contour Principle, those [high] consonants triggered dissimilatory lowering of high vowels in Gothic. On account of the No-Crossing Constraint, the same (i.e. etymologically related) consonants blocked the OHG process known as Primary Umlaut. That is, <r> and <h> inhibited the height features of [i] and [j] from spreading regressively onto a preceding low vowel. These novel analyses not only offer insight into patterns which have been poorly understood for the better part of two centuries, but also add clarity to our understanding of the phonological and phonetic properties of Early Germanic rhotics.

Keywords: Rhotics; Old High German; Gothic; Germanic Phonology; Vowel Lowering; Primary Umlaut

1 Introduction

Owing to their significant phonetic diversity, rhotic sounds are difficult to characterize phonologically (see *inter alios* Wiese 1996; 2011; Walsh-Dickey 1997; Chabot 2019). This article aims to navigate that multiplicity in the absence of a phonetic record through an examination of two independent developments involving an interaction between rhotics and vowels. The first is Gothic Lowering, the second is Old High German Primary Umlaut. I claim that the interactions observed in these sound changes elucidate a natural class pattern, namely, that the rhotic sounds of these early Germanic languages pattern with segments that are marked with the feature [high].¹

Due to Gothic Lowering, all instances of Gothic [e] and [o] were regular reflexes of Proto-Germanic (PGmc) *[i] and *[u], respectively, before the graphemes <r> (a rhotic < PGmc *r) and <h> (a dorsal fricative < PGmc *x²), e.g. Gothic *w[e]r* ‘man’, *h[o]rn* ‘horn’, *sl[e]ht* ‘smooth’, *[o]hs* ‘ox’ < PGmc *w[i]r-, *h[u]rn-, *sl[i]xt-, *[u]xs-. It is my contention that PGmc *r and *x were specified with the vocalic feature [high] and, thus, PGmc forms like *wir-, *hurn-, *slixt-, *uxs- contained sequences of adjacent [high] segments. Those sequences resulted in an OCP violation (Leben 1973), which Gothic Lowering repaired by shifting the high vowels to corresponding mid vowels.

¹ For reference, the following abbreviations are used throughout this article: Proto-Germanic (PGmc), which has the daughters East Germanic (EGmc) and Northwest Germanic (NWGmc). Gothic is the only significantly attested East Germanic language. The Northwest Germanic languages are divided into North Germanic and West Germanic (WGmc). Old Norse is the daughter of North Germanic (and the mother of present-day Nordic languages). West Germanic has numerous daughter languages. The one most pertinent to this article is Old High German (OHG), which is the predecessor of contemporary German.

² I use *r and *x to indicate a reconstructed rhotic and dorsal fricative, respectively, which are of uncertain phonetic quality. I reserve bracketed reconstructions like *[r] and *[x] for reconstructions that are intended to express a specific phonetic articulation.

In Old High German (OHG), <r> and <h> were consonants that blocked Primary Umlaut, which was a regular process of distance assimilation that involved the spreading of the feature [high]. Due to that spreading, PGmc *[a] shifted to OHG [e] before a high front vowel or glide in the following syllable, e.g. OHG *g[e]sti* ‘guests’ < PGmc **g[a]stiz*. The blocking effect occurred when the blocking consonants intervened between the trigger and target of Primary Umlaut. Hence, forms like OHG *arbi* ‘inheritance’ and *mahti* ‘powers’ do not surface with umlauted vowels. As with PGmc and Gothic, I argue that OHG <r> and <h> were marked with the feature [high]. Because of that height specification, Primary Umlaut was blocked by the No-Crossing Constraint (Goldsmith 1976): the feature [high] of the umlaut trigger could not spread over the feature [high] of <r> and <h> to reach the targeted low vowel.

These analyses have several significant implications. For example, previous work consistently regards Gothic Lowering as an assimilatory process. The analysis here suggests that that centuries-old idea is a mischaracterization and that one of the central pillars of Gothic phonology has been misunderstood. Additionally, the analysis of the blocking of Primary Umlaut in OHG has never accorded with the analysis of the triggers of Gothic Lowering. Since <r> and <h> in Gothic, as well as OHG, can both be regular reflexes of the PGmc rhotic and dorsal fricative, respectively, the coherence of these two analyses offers new insight into reconstructed PGmc phonology.

Coherence of phonological properties within a language family is indicative of phonological characteristics that are learned consistently, notwithstanding temporally and geographically dissimilar contexts.³ Such observations appear to be inconsistent with the notion of feature emergence (in the sense of Mielke 2008), the idea that phonological specifications do not have to accord with their phonetic properties. To wit, unnatural classes are learnable. Indeed, a growing body of work indicates that rhotics – in the phonology of a single language variety – can pattern phonologically in ways that are phonetically unexpected, e.g. Hall (1993), and Noelliste (this volume). What has not been examined, however, are instances like the Gothic and OHG cases, where a feature (i.e. [high]) is or appears to be a common retention in multiple related languages. Since phonetic properties of utterances are the only ones that are consistent across space and time (as Mielke 2008 also makes explicit), this article finds that common feature specifications among daughter languages reflect feature encodings, which are based on common historical pronunciations. As such, the analyses here lend insight into the phonetic properties of archaic sounds.

The article is organized as follows. Gothic Lowering is discussed and analyzed in section 2. Section 3 follows with a treatment of Primary Umlaut in OHG. It is concluded that <r> and <h> in Gothic and OHG represented sounds that were marked with the feature [high]. In section 4, I address some of the implications that the analysis has for the phonetics and phonology of early Germanic languages. I also review some of the previous accounts of the Gothic and OHG data. Conclusions are stated in section 5.

2 Gothic Lowering

Gothic Lowering has received scholarly attention since the earlier part of the 19th century, e.g. Grimm (1822: 43–48). However, it is unclear how this process is to be interpreted phonologically. The discussion below is divided into three parts. The basic facts about Gothic Lowering are presented in section 2.1. Section 2.2 follows with a novel analysis of this lowering process as a kind of dissimilatory change. A second analysis is pre-

³ The extant Gothic corpus is associated with Germanic settlements north of the Black Sea during the 4th century BCE. The OHG language is associated with Germanic settlements in central Europe, between the 8th and 11th centuries.

sented, consistent with traditional assumptions, in which Gothic Lowering is assimilatory. Section 2.3 discusses how to evaluate the two analyses when no Gothic data are available to make such an evaluation possible.

2.1 Data

Gothic Lowering refers to the shift of the East Germanic (EGmc) short high vowels **[i]* and **[u]* to the corresponding Gothic mid vowels, *[e]* and *[o]*,⁴ before the sounds represented by the graphemes <*r*>, <*h*>, and its labialized counterpart <*hʷ*> (pronounced ‘hwair’). Some examples are presented in (1). EGmc reconstructions are presented in the first column; attested Gothic forms are presented in the second one.⁵ A comparison of the EGmc forms with the Gothic reconstructions in (1a) indicates that EGmc **[i]* lowers to Gothic *[e]* before the sound represented by the grapheme <*r*>, which is shown with bold-facing for emphasis. The data in (1b) exemplify lowering of the high back vowel in a pre-rhotic context.

(1a)	<i>EGmc</i>	<i>Gothic</i>	
	* <i>w[i]r-</i>	w[e] r	‘man’
	* <i>b[i]ran-</i>	b[e]ran	‘to bear’
	* <i>b[i]rht-</i>	b[e]rhts	‘bright’
	* <i>g[i]rn-</i>	g[e]rnei	‘desire’
	* <i>f[i]rn-</i>	f[e]rns	‘previous’
	* <i>g[i]rd-</i>	g[e]rda	‘belt’
	* <i>h[i]rd-</i>	h[e]rda	‘herd’
	* <i>h[i]rt-</i>	h[e]rto	‘heart’
	* <i>st[i]rn-</i>	st[e]rno	‘star’
	* <i>þ[i]rhw-</i>	þ[e]rh	‘through’
	* <i>w[i]rpan-</i>	w[e]rpan	‘throw’
	* <i>w[i]rþ-</i>	w[e]rþs	‘worth’
(1b)	<i>EGmc</i>	<i>Gothic</i>	
	* <i>d[u]r-</i>	d[o]r	‘door, gate’
	* <i>b[u]rg-</i>	b[o]rgs	‘castle’
	* <i>f[u]rht-</i>	f[o]rhts	‘fearful’
	* <i>h[u]rn-</i>	h[o]rn	‘horn’
	* <i>k[u]rn-</i>	k[o]rn	‘grain, wheat’
	* <i>m[u]rgin-</i>	m[o]rgins	‘morning’
	* <i>s[u]rg-</i>	s[o]rgan	‘to be worried’
	* <i>þ[u]rn-</i>	þ[o]rnus	‘thorn’
	* <i>w[u]rd-</i>	w[o]rd	‘word’
	* <i>w[u]rm-</i>	w[o]rms	‘snake’
	* <i>w[u]rt-</i>	w[o]rts	‘root’

The examples of Gothic Lowering in (2) show the graphemes <*h*> and <*hʷ*> as additional conditioners of the change. The data in (2a) illustrate the shift from EGmc **[i]* to Gothic *[e]* in this context; the examples in (2b) demonstrate the lowering of EGmc **[u]* to Gothic *[o]*.

⁴ It is well-understood that the Gothic mid vowels *[e]* and *[o]* were represented with the digraphs <*ai*> and <*au*>, respectively (see Collitz 1918, fn. 2). Grimm (1822) originally called the process *Brechung* ‘Breaking’ (i.e. ‘diphthongization’) due to a misinterpretation of those digraphs. Whether the Gothic mid vowels were tense or lax is left open here and does not bear on the analysis.

⁵ The EGmc forms are based on PGmc reconstructions from Orel (2003). They simply alter the PGmc stems to reflect the context-free raising of PGmc **[e]* to EGmc **[i]* (see discussion of this development in Heidermanns & Braune 2004: 32ff). In this way, the EGmc forms are intended to be informal reconstructions that aid the reader to account for that early raising process.

(2a)	<i>EGmc</i>	<i>Gothic</i>	
	*sl[i]ht	sl[e]hts	‘smooth’
	*f[i]h-	f[e]hu	‘money’
	*fr[i]hnan-	fr[e]hnan	‘ask’
	*r[i]ht-	r[e]hts	‘straight’
	*s[i]h-	s[e]hs	‘six’
	*s[i]hst-	s[e]hsta	‘sixth’
	*sw[i]hur-	sw[e]hra	‘father-in-law’
	*t[i]hund-	t[e]hunda	‘tenth’
	*t[i]hsw-	t[e]hswa	‘right’
	*t[i]hun	t[e]hun	‘ten’
	*w[i]ht-	w[e]hts	‘thing’
	*s[i]hwan-	s[e]hwan	‘see’
(2b)	<i>EGmc</i>	<i>Gothic</i>	
	*dr[u]ht-	dr[o]hti-witop	‘campaign’
	*d[u]ht-	d[o]htar	‘daughter’
	*d[u]ht-	d[o]hts	‘feast’
	*f[u]h-	f[o]ho	‘she-fox’
	*l[u]hatjan-	l[o]hatjan	‘to flash’
	*s[u]ht-	s[o]hts	‘sickness’
	*t[u]ht-	us-t[o]hts	‘completion’
	*[u]hwn-	[o]hns	‘oven’
	*[u]hs-	[o]has	‘ox’

In all other contexts, EGmc high vowels were inherited as such into Gothic. The forms in (3a) exemplify the retention of a high front vowel; the ones in (3b) reflect the faithful transmission of EGmc *[u] into Gothic. See Heidermanns & Braune (2004: 27ff) for further details.

(3a)	<i>EGmc</i>	<i>Gothic</i>	
	*l[i]b-	l[i]ban	‘live’
	*l[i]þ-	l[i]þus	‘limb’
	*f[i]sk-	f[i]sks	‘fish’
	*[i]s	[i]s	‘he’
	*l[i]st-	l[i]sts	‘cunning’
	*m[i]ss-	m[i]sso-	‘mutually’
	*m[i]zd-	m[i]zdo	‘reward’
	*l[i]t-	l[i]ta	‘hypocrisy’
	*m[i]n-	m[i]ns	‘less’
(3b)	<i>EGmc</i>	<i>Gothic</i>	
	*h[u]p-	h[u]ps	‘hip’
	*br[u]st-	br[u]sts	‘breast’
	*br[u]k-	ga-br[u]ka	‘crumb’
	*f[u]gl-	f[u]gls	‘bird’
	*h[u]g-	h[u]gs	‘mind’
	*fr[u]m-	fr[u]ma	‘first’
	*g[u]m-	g[u]ma	‘man’
	*d[u]lg-	d[u]lgs	‘debt’
	*g[u]lþ-	g[u]lþ	‘gold’

While Gothic Lowering is an excellent example of a neogrammarian regular sound change, its interpretation, despite that regularity, is not at all clear. In the section below, two contradicting analyses are presented, followed by a discussion on how to disambiguate those analytical treatments.

2.2 Analysis of Gothic Lowering

Because Gothic Lowering involves a shift of high vowels to mid vowels, an analysis of the process depends crucially on representations of vocalic height. High Vowels like [i] and [u] can be represented, more or less uncontroversially, as in (4).

$$(4) \quad \begin{array}{c} [i,u] \\ | \\ [\text{high}] \end{array}$$

The representation in (4) shows that high vowels are marked with an autosegmental feature [high]. For the purpose of this article, it is not crucial whether that autosegment is thought of as a binary feature '[+high]', a unary feature '[high]', or as an abbreviation for elements like '|i| and |u|'. What is important – and unanimous in feature theories – is that all high vowels are marked with an *active* feature.

It is unclear, however, if mid vowels are also marked with active features, due to an age-old debate. On the one hand, Chomsky & Halle (1968) argue that mid vowels are marked by *inactive* features. In privative approaches, e.g. Lahiri & Reetz (2010), that has been interpreted such that mid vowels are unmarked for height features. That is, mid vowels are non-high and non-low, as in (5a). On the other hand, Element Theory (Bacley 2011) and the related frameworks of Dependency Phonology (Anderson & Ewen 1987) and Government Phonology (Kaye et al. 1985; 1990; Harris 1994) have long argued that mid vowels are combinations of elements. That is, they are marked with two active features, as in (5b).

(5a) 'SPE-like'

$$\begin{array}{c} [e,o] \\ | \\ \emptyset \end{array}$$

(5b) 'ET-like'

$$\begin{array}{c} [e,o] \\ / \quad \backslash \\ [\text{high}] \quad [\text{low}] \end{array}$$

These two representations for mid vowels mean that there are two interpretations for the lowering of a high vowel to a mid vowel. These are stated in (6).

(6) Interpretations of High Vowel Lowering:

- a. **Subtractive Lowering:** high vowels become 'SPE-like' mid vowels (as in (5a)) by deleting the feature [high] from the representation in (4).
- b. **Additive Lowering:** high vowels become 'ET-like' mid vowels (as in (5b)) by adding the feature [low] to the representation in (4).

As I elaborate in section 2.2.1 and 2.2.2 below, both interpretations of Gothic Lowering – absent further data – are possible and depend crucially on the features ascribed to <r> and <h>. For this reason, sound changes that involve <r> and <h> as a natural class are significant because they offer a way to disambiguate the interpretations in (6), whereby deeper insight into the phonology of early Germanic languages becomes discoverable. If <r> and <h> are marked with the feature [high], as pursued in section 2.2.1, then Gothic Lowering is consistent with the interpretation in (6a). If, however, <r> and <h> are marked with the feature [low], then Gothic Lowering is consistent with (6b).

After these two possibilities are presented, I pursue independent arguments from OHG that favor the analysis of <r> and <h> as [high] segments and thus support the analysis of the Gothic development as an instance of subtractive lowering (i.e. (6a)). Additional arguments are presented in section 4.2.

2.2.1 Analysis 1: Gothic Lowering is subtractive lowering (to be accepted)

Because the sounds represented by <r> and <h> condition Gothic Lowering, these segments must be marked with a feature that can interact with high vowels and trigger the lowering of those high vowels to corresponding mid vowels. In this section, I propose that the sounds represented by <r> and <h> are marked with the feature [high], as in (7):

$$(7) \quad \begin{array}{c} \langle r, h \rangle \\ | \\ [\text{high}] \end{array}$$

As a result of the feature marking in (7), forms like EGmc **wir* ‘man’ have two adjacent segments that are specified with the feature [high]. As made explicit in (8), those contiguous [high] segments are marked on account of the Obligatory Contour Principle (OCP), in the sense of Leben (1973).

$$(8) \quad \begin{array}{ccc} w & [i] & r \\ & | & | \\ & [\text{high}] & [\text{high}] \end{array} \leftarrow \text{OCP Violation}$$

To resolve the OCP violation, Gothic deleted the feature [high] from the EGmc high vowel (as in (9a)). Due to the deleted feature, a vowel obtained that was unmarked for height features, as shown in (9b). That new vowel was an ‘SPE-like’ mid vowel, consistent with the representation in (5a).

$$(9a) \quad \begin{array}{ccc} w & [i] & r \\ & \neq & | \\ & [\text{high}] & [\text{high}] \end{array}$$

$$(9b) \quad \begin{array}{ccc} w & [e] & r \\ & & | \\ & & [\text{high}] \end{array}$$

If Gothic <r> and <h> represent sounds marked with the feature [high], an apparent shortcoming of the analysis in (9) is that Gothic has many forms containing the sequences <ri>, <ru>, <hi>, and <hu>, e.g. Gothic *riqiz* ‘darkness’, *runnub* ‘you all ran’, *hinder* ‘behind’, and *huzd* ‘treasure’. Those sequences are also characterized by adjacent [high] segments and could therefore be expected to trigger Gothic Lowering as well. For this reason, I argue that dissimilation, like assimilation can be progressive or regressive and that Gothic Lowering is a kind of regressive dissimilation. As such, [high] vowels dissimilate from *following* [high] consonants. Because the process is not progressive, however, [high] vowels do not dissimilate from *preceding* [high] consonants. For space, I do not discuss formal approaches that capture regressive dissimilation. However, there are analyses that can capture dissimilatory directionality. For example, Kostakis (2015: 72ff) argues for an OCP constraint that is contextualized to vowel-consonant sequences to account for regressive denasalization in French language history. This is precisely the kind of contextualization that should be extended here to capture the regressive nature of Gothic Lowering. Note also the specific nature of the OCP constraints proposed by Coetzee and Pater (2006) as well as Hall (2008); such OCP constraints can also capture directionality.

In sum, <r> and <h> are marked with the feature [high]. Thus, Gothic Lowering emerges as a dissimilatory process of subtractive lowering: in order to resolve the OCP violation that emerges from contiguous [high] segments, the feature [high] is deleted, and a mid vowel is produced by virtue of that deletion. The implication of this analysis is that Gothic mid vowels are SPE-like, as in (5a) and that <r> and <h> were [high] sounds.

2.2.2 Analysis 2: Gothic Lowering is additive lowering (to be rejected)

It is possible that the graphemes represented by <r> and <h> were not marked with the feature [high], but rather the feature [low], as in (10).

$$(10) \quad \begin{array}{c} \langle r, h \rangle \\ | \\ [\text{low}] \end{array} \quad (\text{to be rejected})$$

As a result of this feature marking, forms like EGmc **wir* ‘man’ are characterized by a vowel which is marked with the feature [high] and a following consonant that is marked with the feature [low]. These feature specifications are illustrated in (11).

$$(11) \quad \begin{array}{ccc} w & [i] & r \\ & | & | \\ & [\text{high}] & [\text{low}] \end{array}$$

Gothic Lowering occurs when the feature [low] spreads regressively from a consonant onto a preceding high vowel, as shown in (12a). As a result of that spreading, a new vowel is created, which is simultaneously marked with the features [high] and [low], as in (12b). That new vowel is an ‘ET-like’ mid vowel, consistent with the representation in (5b).

$$(12a) \quad \begin{array}{ccc} w & [i] & r \\ & | \quad \diagdown & | \\ & [\text{high}] & [\text{low}] \end{array}$$

$$(12b) \quad \begin{array}{ccc} w & [e] & r \\ & | \quad \diagdown & | \\ & [\text{high}] & [\text{low}] \end{array}$$

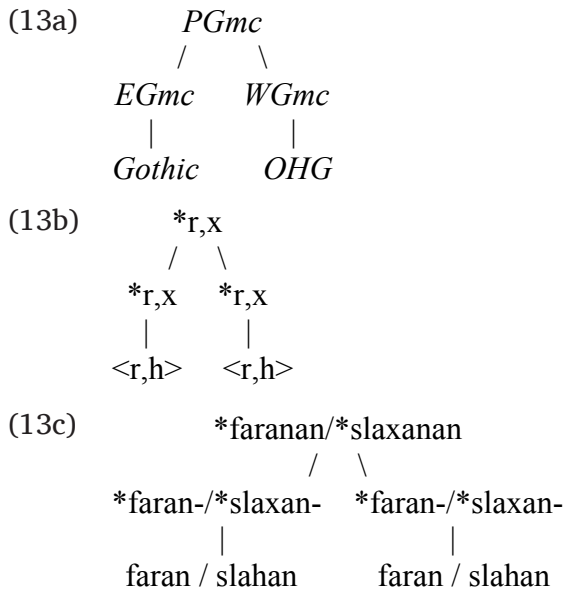
If the sounds represented by the graphemes <r> and <h> are marked with the feature [low], Gothic Lowering falls out from a process of feature spreading. Accordingly, it is an assimilatory process of additive lowering. For this to be the case, not only do <r> and <h> need to be marked with the feature [low], but Gothic mid vowels must also be ‘ET-like’.

2.3 Evaluating the best analysis

As the analyses in sections 2.2.1 and 2.2.2 suggest, the rhotic and dorsal fricative sounds of Gothic can be taken as [high] (as in (7)) or [low] (as in (10)). What is needed, then, is a way to disambiguate these specifications. Because there appear to be no other Gothic processes which point to one analysis or the other, the only additional information that can be used comes from related languages. For this reason, I turn to OHG.

There are three main reasons why OHG is a good language to consider for gaining insight into Gothic. Firstly, OHG is genetically related to Gothic. As the (simplified) family tree in (13a) makes clear, both languages descend from PGmc. Secondly, the sounds represented by <r> and <h> are inherited from the PGmc rhotic and dorsal

fricative, respectively, as indicated in (13b).⁶ In (13c), the development of the PGmc verbs **faranan* ‘to travel’ and **slaxanan* ‘to strike’ is presented as a concrete example of a common, inherited rhotic and dorsal fricative sound.



The third and most important reason why OHG can shed light on Gothic phonology is that, like Gothic, <r> and <h> pattern together as a natural class (elaborated in the next section). When these facts are taken together, there is a fairly strong syllogism that emerges: if the rhotic and dorsal fricative of Gothic pattern as a natural class and are inherited from PGmc and if the rhotic and dorsal fricative of OHG pattern as a natural class and are inherited from PGmc, then it is highly probable that Gothic <r> and <h> are phonologically the same as OHG <r> and <h>.

While it is clear that the comparison of these sounds is less convincing as more and more time elapses – and to be sure, Gothic and OHG have a great deal of temporal and geographic separation – the natural class patterning is very difficult to explain unless these later stages perpetuate some phonological attribute of the earliest common stage.

3 Old High German Primary Umlaut

In this section, I argue that <r> and <h> in OHG pattern as a natural class of [high] segments because they inhibit the process known as Primary Umlaut. Primary Umlaut is discussed and analyzed in section 3.1. Section 3.2 follows with a discussion and analysis of the blocking effect that <r> and <h> exact on Primary Umlaut. Because OHG <r> and <h> pattern as [high] sounds, the Gothic analysis in section 2.2.1, as dissimilatory lowering, is most consistent with the emerging picture of early Germanic phonology.

3.1 Primary Umlaut: The basic pattern

OHG Primary Umlaut is a sound change that refers to the raising and fronting of short [a] to a short, tense [e] when an [i] or [j] (i.e. an umlaut trigger) followed in an adjacent syllable. Some examples are presented in (14). The first column pre-

⁶ Unlike Gothic, where virtually all instances of <r> and <h> are old and descend from PGmc *r and *x, OHG has both old and new instances of <r> and <h>. The new cases of <r> emerge from the rhoticism of PGmc *z (compare Gothic *miz* ‘me’ with OHG *mīr*). The new instances of <h> come from PGmc *k (compare Gothic *īk* ‘I’ with OHG *ih*). With respect to Primary Umlaut, discussed in section 3, the old and new instances of OHG <r> and <h> pattern consistently. Their phonological representation is therefore taken to be consistent.

sents PGmc reconstructions from Orel (2003), using reconstructed inflections from Ringe (2006). Each of these forms has a short [a] followed by an umlaut trigger. The OHG forms in the second column are the reflexes of the PGmc forms. In each example, OHG [e] in the initial syllable corresponds to PGmc [a]. For space, the additional sound changes that separate the OHG forms from PGmc are not discussed.

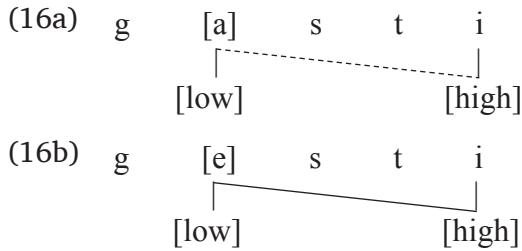
(14)	<i>PGmc</i>	<i>OHG</i>	
	*[a]r b [j]an	[e]rb[i]	‘inheritance’
	*b[a]d b [j]an	b[e]tt[i]	‘bed’
	*p[a]nn[i]gaz	pf[e]nn[i]ng	‘penny’
	*m[a]nn[i]skaz	m[e]nn[i]sc	‘human’
	*[a]t t [j]anan	[e]zzen	‘to eat’
	*h[a]ft t [j]anan	h[e]ften	‘to bind’
	*h[a]ld b [i]pi	h[e]lt[i]t	‘s/he holds’
	*w[a]hs b [i]pi	w[e]hs[i]t	‘s/he grows’
	*f[a]r r [i]si	f[e]r[i]s	‘you travel’
	*g[a]st t [i]z	g[e]st[i]	‘guests’
	*l[a]mb b [i]z	l[e]mb[i]r	‘lambs’
	*st[a]rk k [i]staz	st[e]rk[i]ste	‘strongest’

While the examples in (14) are diachronic in nature, Primary Umlaut also produced synchronic alternations in the language. Some examples are given in (15). OHG forms with non-umlauted stems are shown in the first column. Umlauted forms are presented in the second column. The latter forms are umlauted because their inflectional endings begin with an umlaut trigger, namely, [i]. Stem allomorphy among compositionally related verb forms is exemplified in (15a). The data in (15b) and (15c) show stem allomorphy in nouns and adjectives, respectively.

(15)	OHG Stems		OHG Allomorphs	
	a.	h[a]ltan .INF	h[e]lt[i]t .3.SG	‘to hold’
		w[a]hsan .INF	w[e]hs[i]t .3.SG	‘to grow’
		f[a]ran .INF	f[e]r[i]s .3.SG	‘to travel’
	b.	g[a]st .NOM.SG	g[e]st[i] .NOM.PL	‘guest’
		l[a]mb .NOM.SG	l[e]mb[i]r .NOM.PL	‘lamb’
	c.	st[a]rk .POS	st[e]rk[i]ste .SUP	‘strong’

Umlaut processes (in Germanic languages and elsewhere) are unequivocal examples of distance assimilation. All versions of Autosegmental Phonology model such processes as the result of feature spreading. Adopting privative features, there is only one possible height-based analysis:⁷ the umlaut trigger, which is specified with the feature [high], spreads that feature onto the target stem vowel, as in (16).

⁷ In a privative approach, minus-features, like [-low], are redundant (and thus analytically superfluous). It has been frequently pointed out in the literature on Element Theory, Dependency Phonology, and related frameworks (e.g. Backley 2011; Anderson & Ewen 1987; Harris 1994) that when minus features are interpreted as possible *active* features, the amount of redundancy in the phonological system becomes too high to make any meaningful generalizations. This excessive redundancy is especially severe when certain consonants pattern with vowels, as in Gothic and OHG.



In (16a), the active height feature spreads regressively from the umlaut trigger ([i]) onto the target ([a]). In consequence, a new mid vowel forms, as shown in (16b), which has two active height features. In other words, the resulting mid vowel is an ‘ET-like’ mid vowel, which is simultaneously [high] and [low].⁸

Given that the feature [high] is the only active feature which can trigger the process of Primary Umlaut (see also fn. 12), we stand to learn about the phonology of the OHG rhotic (<r>) and dorsal fricative (<h>), since these segments can inhibit Primary Umlaut. Examples are presented and analyzed in section 3.2.

3.2 Primary Umlaut blocking

OHG Primary Umlaut was blocked in certain dialects. This point is demonstrated in (17). The first column presents PGmc reconstructions that are expected to serve as inputs to Primary Umlaut in OHG. The second and third columns are representative of the two kinds of OHG dialects. ‘Blocking’ dialects are exemplified by the forms in the second column. Here we see that PGmc *[a] unexpectedly corresponds to OHG [a], despite the presence of an umlaut trigger in the following syllable.⁹ In contrast to the ‘Blocking’ dialects, ‘Non-Blocking’ dialects are characterized by the expected pattern of umlaut, as in the third column. Refer to Reiffenstein & Braune (2004: 29–31) for more detailed information about the dialect regions where blocking does and does not occur. There are three segments which block the application of Primary Umlaut: coda rhotics, as in (17a), dorsal fricatives (represented by <h>), as in (17b), and coda laterals, as in (17c).¹⁰

(17a)	PGmc	‘Blocking’ OHG	‘Non-Blocking’ OHG	
	*[a]rb[j]an	[a]rbi	[e]rbi	‘inheritance’
	*st[a]rk[i]staz	st[a]rchi	st[e]rchi	‘strength’
	*w[a]rm[j]anan	w[a]rmen	w[e]rmen	‘to warm’
(17b)	*w[a]hs[i]pi	w[a]hsit	w[e]hsit	‘s/he grows’
	*n[a]ht[i]z	n[a]hti	n[e]hti	‘nights’
	*m[a]ht[i]z	m[a]hti	m[e]hti	‘powers’
	*[a]h[i]z	[a]hir	[e]hir	‘ear (grain)’
	*sl[a]h[i]pi	sl[a]hit	sl[e]hit	‘s/he hits’
(17c)	*h[a]ld[i]pi	h[a]ltit	h[e]ltit	‘s/he holds’
	*w[a]ld[i]si	w[a]ltis	w[e]ltis	‘you rule’
	*[a]ld[i]zō	[a]ltiro	[e]ltiro	‘older’

For ease of comparison to Gothic <r> and <h>, the analysis below will focus only on the blocking effect imposed by OHG <r> and <h>. The fact that <l> in OHG is

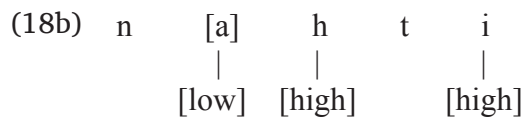
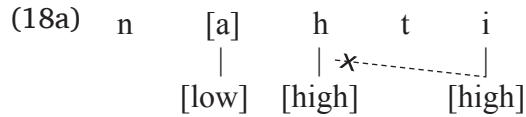
⁸ The difference between the mid vowel representation for OHG and the one for Gothic is discussed in section 4.3.2.

⁹ Or former presence of an umlaut trigger, as in OHG *warmen* < *warm[j]an*.

¹⁰ The blocked forms in (17) are clearly the upshot of phonology and not morphology: a form like *heltit* ‘s/he holds’ did not shift to *haltit* under influence of the infinitive *haltan* ‘to hold’. Such an analogical development can be ruled out because forms like *hebis* ‘you have’ are never influenced by their infinitives, i.e. *habēn*.

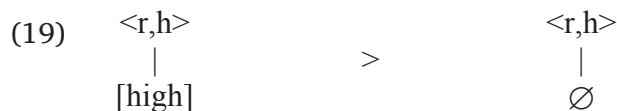
a blocking consonant, but <l> in Gothic does not trigger lowering,¹¹ is suggestive of a sound change which makes Gothic <l> and OHG <l> (at least in codas of OHG ‘Blocking’ dialects) phonologically distinct. This point is further discussed in section 4.3.1.

I argue that OHG <r> and <h> in ‘Blocking’ dialects must have had a vocalic feature that prevented the spreading of the feature [high]. If <r> and <h> are [high] – as they were in Gothic – then the blocking effect falls out predictably from the No-Crossing Constraint (Goldsmith 1976), as in (18).

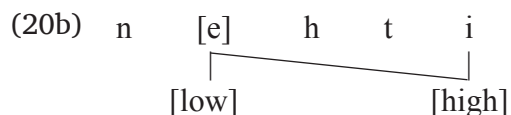
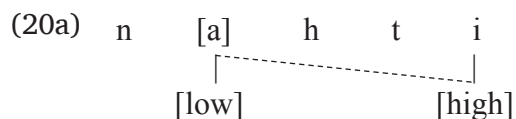


The diagram in (18a) shows that the dorsal fricative (<h>) and the umlaut trigger ([i]) are both marked with the feature [high]. When the umlaut trigger spreads its height feature regressively towards the umlaut target ([a]), it encounters another [high] autosegment from the intervening blocking consonant (<h>). Since that feature is on the same autosegmental tier as the height feature of the umlaut trigger, the spreading process is blocked due to the No-Crossing Constraint. As a result, non-blocking forms remain unshifted, as in (18b).

Because OHG forms with blocking are older than the ones which exhibit Primary Umlaut, accounting for ‘Non-Blocking’ dialects involves a phonological shift that affected <h> and <r>. This change is presented in (19).



The change in (19) indicates that <r> and <h> lost their height feature in ‘Non-Blocking’ dialects. As a result, Primary Umlaut could proceed unobstructed, as it did in (16). This point is made explicit in (20), which shows the feature [high] spreading from the trigger onto the target in (20a) to create the ‘ET-like’ mid vowel in (20b).



In sum, the analysis of Primary Umlaut indicates that the process falls out from spreading of the feature [high] and that OHG [e] is an ‘ET-like’ mid vowel. In this account, <r> and

¹¹ For example, lowering is not observed in Gothic forms like *filu* ‘much’, *gild* ‘tribute’, *hilms* ‘helmet’, *hilpan* ‘help’, and *fulls* ‘full’, *gulþs* ‘gold’ *mulda* ‘dust’, *hulþs* ‘kind’.

<h> in ‘Blocking’ dialects are also marked with the feature [high]. Consequently, those sounds inhibit umlaut as predicted by the No-Crossing Constraint.¹²

Because <r> and <h> pattern as a natural class in Gothic and in OHG, the best analysis of both languages is the one that can treat the natural-class pattern in a consistent way. In OHG, <r> and <h> were [high]. If the etymological connection is to be maintained, and if these sounds are assumed to pattern together for the same reasons, it follows that the best analysis of Gothic Lowering is the one that sees that change as a process of dissimilatory lowering, as in section 2.2.1.

4 Discussion

In this section, I discuss some selected points pertaining to the analyses presented above. Section 4.1 considers possible phonetic implications of the feature [high] for the sounds represented by <r> and <h>. Section 4.2 finds further support for the “rhotics-are-high” analysis by looking to instances where rhotics trigger postalveolarization. In section 4.3, I discuss some of the phonological implications that the analysis has for segments like velar stops, laterals, and mid vowels. Previous accounts of Gothic Lowering and OHG Primary Umlaut are addressed in section 4.4.

4.1 Possible phonetic implications

In phonological theory of the 1970s, 80s, and 90s, features were thought to be universal. The two most important reasons for assuming universality were that (1) features could be defined with respect to articulation (and to a lesser extent also acoustics), and (2) groups of sounds with a common feature patterned in natural classes, which turned up again and again in the synchronic and diachronic processes of diverse languages and language families.

More recent work on features and feature theories, most explicitly Mielke (2008), argues that features are not truly universal (in the sense of Universal Grammar), but rather emergent. An emergent feature system is newly constructed by every first language learner based on everything from non-language-specific categorizing of sounds to social factors. An important piece of supporting evidence for emergent theories is that unnatural classes are quite common. Since Emergent Feature Theory maintains that a learner can ascribe any feature onto any sound – so long as there is evidence for that feature assignment somewhere in the phonology, or even the linguistic community – any group of sounds can potentially enter into a natural class relationship.¹³

Nevertheless, the general facts about producing (and perceiving) a sound like [i] or [u] are similar from language to language. Thus, Emergent Feature Theory predicts that acquirers of a language will have a fairly high probability of encoding such sounds with consistent phonological features (e.g. [high]). In this way, ‘universal features’ and ‘emergent features’ can and should make the same predictions most of the time. Indeed, Mielke (2008: 118) finds that the SPE feature system is able to capture phonologically active natural classes in 70.97% of the 6,077 cases investigated. Put differently, features correlate to

¹² It might be possible to imagine an approach to Primary Umlaut blocking that sees <r> and <h> as [+low] segments. Such an approach might argue that Primary Umlaut is actually the spreading of [–low] and that the [a] and <r> in a word like *arbi* share a linked [+low] autosegment. In this approach, the feature [–low] would be blocked due to the so-called linking constraint (Hayes 1986). Apart from the question of whether or not [–low] can be an active feature (see fn. 7), there are at least two major shortcomings to such an analysis. Firstly, it does not clearly account for the difference between blocking dialects and non-blocking dialects. For example, the delinking of the [+low] feature shared by [a] and <r> still predicts umlaut blocking by the no-crossing constraint. Secondly, later reflexes of the OHG rhotics go on to trigger postalveolarization. The shift of [rs] > [rʃ] is not only characteristic of German language history, but of other Indo-European languages as well. As I elaborate in section 4.2, such developments are difficult to capture with the feature [low].

¹³ Substance-free phonology (Blaho 2008, and sources therein) represents an alternative approach to account for phonological features that do not accord with their phonetic properties, thereby licensing unnatural classes.

articulation with some degree of success. Even if articulation does not *cause* feature structure, the *correlation* between articulation and feature structure suggests that analyses like the one in section 2 and section 3 likely reveal characteristics of pronunciation.

The Chomsky & Halle (1968: 304) definition of [high] is presented in (21).

- (21) “High sounds are produced by raising the body of the tongue above the level that it occupies in the neutral position;¹⁴ non-high sounds are produced without such a raising of the tongue body.”

Applying the findings of this article to the definition in (21), we can make stronger hypotheses about the phonetic nature of <r> and <h>, as summarized in (22).

(22)

	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular
Rhotics	r r	(r r)	ɻ ʀ			ʁ
ɹ – Rhotics	ɹ	ɹ	ɹ	ɹ	ɹ	
Fricatives	s	ʃ	ʂ	ç	x	χ

The chart in (22) shows the IPA symbols for rhotics and fricatives with reference to the Chomsky & Halle (1968) definition of the feature [high]. Beyond the high vowels, all consonants at postalveolar, retroflex,¹⁵ palatal, and velar places of articulation are also marked with the feature [high]. Alveolar and uvular consonants, by contrast, do not involve tongue raising above the neutral position. Thus, they are non-high sounds.

From an articulatory perspective, the IPA symbol [ɹ] refers to a collection of different rhotic sounds that are produced along an exceptionally broad range of places. For this reason, it is set apart from the other rhotic symbols in (22), which are more precise articulatorily. Quoting phrases from Ladefoged & Maddieson (1996: 234), [ɹ] can be “alveolar or postalveolar.” It can be “more or less retroflex.” If bunched, [ɹ] will have constrictions “at the center of the palate” (and in the lower pharynx¹⁶). Zhou et al. (2008: 4466) further clarify that “the locations of constrictions, and the degrees and lengths of constriction significantly differ, especially along the palate.” Since the center of the palate is the dividing point for palatal and velar sounds, it follows that bunched [ɹ] could be palatal or velar. In sum, [ɹ] is a rhotic symbol for numerous rhotic articulations that overlap entirely with the places of articulation corresponding to the feature [high]. Thus, if there is a rhotic sound (with all its phonetic diversity) that may be prototypical of a [high] rhotic, [ɹ] is clearly a persuasive candidate.

From the perspective of Germanic linguistics, *ɹ – in its diverse forms – is the most likely [high] rhotic, insofar as postalveolar [r] and [r] are exotic¹⁷ and the ‘true’ retroflex sounds that are found in the Nordic languages are unequivocally recent developments. Accordingly, the [high] rhotic of early Germanic languages was very likely some realization of the [ɹ]-sound.

¹⁴ Chomsky & Halle (1968) define the neutral position as the ‘[ε]-like’ posturing of the tongue body in a resting state.

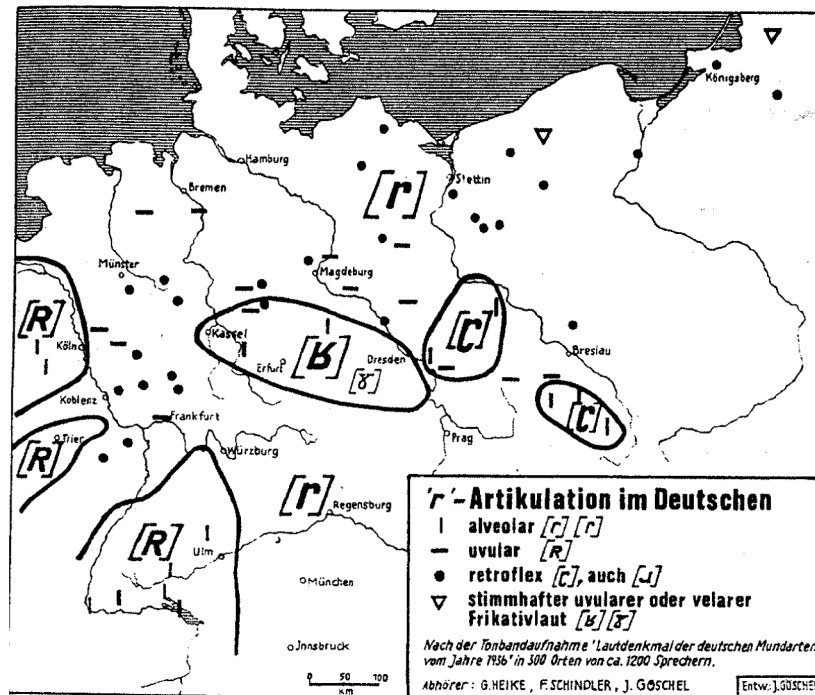
¹⁵ I assume that retroflex sounds can also be interpreted as [high] sounds. While this assumption is partly inconsistent with definitions in SPE, the purpose of the discussion to follow is to establish a list of *possible* phonetic values for the triggers of Gothic Lowering and the blockers of OHG Primary Umlaut. If future research were to find that retroflex sounds never pattern as [high] segments, it would have no bearing on the analysis. It would only require that the retroflex column from (22) be removed from the list of possible segments.

¹⁶ Shahin (2011) points out the pharyngeal sounds frequently pattern with uvulars. Accordingly, it may be appropriate to understand [ɹ] as having a secondary uvular articulation as well.

¹⁷ The symbols [r] and [r], while generally alveolar (and therefore non-[high]), may have articulations in the postalveolar region, which would be associated with the feature [high]. However, such postalveolar trills are extremely rare from a cross-linguistic perspective (cf. Ladefoged & Maddieson 1996: 218ff).

There are a number of independent reasons to reconstruct PGmc *[ɹ]. Firstly, [ɹ] is found throughout the Germanic languages into the present day. In American English and Faroese, [ɹ] occurs in all environments. Árnason (2011: 115) describes the Faroese rhotic as “typically (post-) alveolar or retroflex, and most of the time...more like an approximant than a trill.” Additionally, [ɹ] is frequent in Dutch (e.g. Goeman & Van de Velde 2001; Sebregts 2014). It is found in Frisian (cf. the transcription in Walker 1990: 27). It is also a feature of German (which has declined significantly in recent decades). Consider, however, the map of German rhotic pronunciations in (23) from Göschel (1971).

(23)



It can be seen from the map that, in the mid 1930s, the German of far eastern dialects employed a retroflex rhotic or alveolar approximant [ɹ]/[ɹ].¹⁸ This is observed also by Bellmann (1961: 21–23). In addition to the larger regions of [ɹ]/[ɹ], the map uses dots to indicate further locations where [ɹ]/[ɹ] was in use throughout Low and Central German dialects.¹⁹

In sum, the collection of sounds captured by the symbol [ɹ] may best represent a ‘[high] rhotic’. Since such [ɹ]-sounds are found in North Germanic (e.g. Faroese) and West Germanic (e.g. English, Frisian, Dutch, and German), the analyses from section 2 and section 3 suggest that the [high] rhotics of Gothic and OHG were similar to the [ɹ]-sounds of North and West Germanic languages. One area for future research might consider whether the diverse articulations characteristic of [ɹ] can shed light on the rhotic diversity of present-day Germanic languages.

Another important direction for future research will be in rhotic allophony. The rhotic sound of many Germanic languages stands in complementary distribution. In Walker’s (1990: 27) transcription of Mooring Frisian, for example, [r] appears in onset position and [ɹ] appears in a syllable coda. Such observations lead to a prospectus of further inquiry, which, for space, is briefly summarized with a list of research questions: How old is rhotic

¹⁸ I interpret the cooccurrence with [ɹ] as an indication that these dialects had a rhotic like the one in American English, which can be articulated with retroflexion but may also lack retroflexion.

¹⁹ The map is based on recordings of about 1200 speakers taken in 1936 from 300 places. It is not clear if any socioeconomic factors were taken into account. There is also no indication of the phonological environment of these rhotic sounds.

allophony in Germanic languages? Was rhotic allophony characteristic of PGmc? If so, does a phonologically mono-rhotic language like Icelandic, which only has [r], come about because of an *[ɾ]-allophone that neutralized to [r]? Does a mono-rhotic language like American English, which only has [ɾ], come about because of an *[r]-allophone that neutralized to [ɾ]? In languages with r-vocalization, does the [ɾ]-variant diachronically feed the vocalized alternant of present-day dialects of languages like English and German? Is the [r]-variant more likely to license a diachronic shift to uvular [ʀ]? Once a rhotic shifts phonetically, can its original feature specification be retained? If so, for how long?²⁰

The range of IPA fricatives that are [high], which could have been represented by the grapheme <h> are more restricted. Almost all instances of Gothic <h> derive from Centum *k (< PIE *k, *k̑, etc.), which, owing to Grimm's Law, spirantized to PGmc *[x]. Many instances of OHG <h> derive from that same origin. For example, <h> in Gothic *ganah* 'it suffices' and OHG *ginah* 'it suffices' both descend from Centum *k. Because of the OHG consonant shift, additional instances of OHG <h> derive from WGmc *k. The significant generalization, then, is that the grapheme represented by <h> always goes back to a velar consonant. For this reason, when <h> patterns as a [high] sound – in the Chomsky & Halle (1968) sense – it is most likely the orthographic expression of [x].

There are two additional pieces of evidence supporting that <h> was [x] and not some other fricative. The first is that conservative Bavarian and Alemannic dialects preserve the velar articulation. For example, Russ (2002: 77) notes that [x] is pronounced in the Alemannic dialect of Bosco Gurin. Berroth (2001) transcribes Middle Swabian (Alemannic) words with a velar fricative. Bachmann (2000) offers a particularly detailed phonetic description of the Bavarian dialect spoken in Eslarn. According to Bachmann, an advanced velar fricative [x̥] is even found after back vowels.

The second piece of evidence that <h> was [x] is that, before [s], the sound represented by <h> dissimilated its continuancy feature and shifted back to [k]. For example, OHG *ahsa* 'axis', *flahs* 'flax', *fuhs* 'fox', *lahs* 'salmon, lox', *sehs* 'six' > Modern German *Achse* [aksə], *Flachs* [flaks], *Fuchs* [fuks], *Lachs* [laks], *sechs* [zɛks].²¹ If OHG <h> in fact represented anything other than [x], we would expect this pre-sibilant shift to produce a non-velar sound.²² Accordingly, the analysis presented above, in addition to evidence from conservative dialects and the development of the <h>-sound before [s] makes any reconstructed sound other than [x] untenable. This finding is significant because it is frequently assumed that PGmc *[x] retracted to [χ] in early Germanic languages (see discussion in Barrack 1987 and Hall 2009). Some researchers even argue for early debuccalization, whereby <h> represented [h] (Howell 1991; Iverson et al. 1994; Howell & Somers Wicka 2007). Counter to these claims, the evidence above indicates that <h> in Gothic and OHG represented [x].

²⁰ Hall (1993) finds that the uvular [ʀ] of modern Standard German patterns as a coronal sound in the synchronic phonotactics of the language. One interpretation of Hall's finding is that the coronal feature was supported by an earlier pronunciation. When that pronunciation shifted to [ʀ], the coronal specification continued, even though it did not accord with its phonetic implementation. Future research will need to investigate how long it is possible for a feature specification to be retained when that specification is no longer supported by a sound's phonetic characteristics.

²¹ WGmc *k is rendered in OHG orthography as <k> and <c>, where it is retained, but as <h>, where it has shifted to a fricative. If <hs> sequences entered into OHG from an earlier *[ks] sequence, as a reviewer suggests, that [k]-sound would be the only orthographic instance of an inherited [k] that was represented by <h>. Additional facts in other Germanic languages make clear that the <h> in OHG <hs> sequences was a frequent reflex of PGmc/WGmc *[x], (which was a frequent reflex of Centum *k).

²² The change occurred *independently* in English language history. For this reason, Modern English has cognates with <x> (i.e. [ks]), namely, *axis*, *flax*, *fox*, *lox*, *six*. These data suggest with near certainty that WGmc *[x] was the sound from which German [k] and English [k] in pre-sibilant context derive.

4.2 Further evidence from postalveolarization

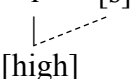
The present section examines instances of rhotic-conditioned postalveolarization as further support for the “rhotics-are-high” analysis. Section 4.2.1 discusses postalveolarization in Germanic language history, and section 4.2.2 considers how [high] rhotics may also advance our understanding of so-called ‘ruki-rules’ outside of Germanic languages.

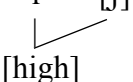
4.2.1 Early New High German Postalveolarization

Early New High German (ENHG) Postalveolarization is exemplified by the forms in (24). In the first column, Middle High German (MHG) examples are provided. Each form contains a rhotic followed by [s]. ENHG reflexes of the MHG examples are presented in the second column. From these examples it can be observed that MHG post-rhotic [s] corresponds to [ʃ] in the ENHG, thus exhibiting the regular shift of MHG <r> + [s] > ENHG <r> + [ʃ].

(24)	<i>MHG</i>	<i>ENHG</i>	
	hir[s]	hir[ʃ]	‘deer’
	kir[s]e	kir[ʃ]e	‘cherry’
	hēr[s]en	herr[ʃ]en	‘to rule’
	bar[s]	bar[ʃ]	‘perch’
	mür[s]-	mor[ʃ]	‘rotten’

If the rhotic of MHG and ENHG, as in OHG, was [high], the development in (24) can be analyzed as an example of progressive height assimilation. This change is presented in (25).

(25a) h i r [s]


(25b) h i r [ʃ]


In (25a), the feature [high] spreads progressively from the rhotic sound onto the following alveolar sibilant. As a result of that spreading, [s] (which is alveolar and therefore non-[high]) shifts to [ʃ] (which is postalveolar and [high]), as illustrated in (25b).²³

The characterization of [ʃ] as a [high] sound is not controversial. Beyond the fact that a ‘high’ [ʃ] is consistent with the definition presented in (21), there is overwhelming cross-linguistic evidence to support the claim. For example, there are *many* instances of postalveolarization, which are conditioned by high vowels (see Kochetov 2011 for a discussion of such cases, which comprise a subset of coronal palatalization processes). These instances make clear that [ʃ] and high vowels frequently pattern together as a natural class.

In contrast to high vowels, Kochetov (2011) finds *no* instances of postalveolarization, which are triggered only by low vowels. Accordingly, it is unclear how a ‘rhotics-are-low’ analysis of these data could be reconciled with broader cross-linguistic facts about postalveolarization.

²³ For space, I am setting aside two details about the development of OHG [s] > MHG/ENHG [ʃ]. First, is that OHG [sk] sequences coalesced into [ʃ] (usually assumed to occur over the intermediate stage [sx]), e.g. MHG [ʃ]if ‘ship’ < OHG [sk]if. For an analysis of this development that is compatible with the approach taken in (25), see Hall (2007: 217–219) and Kostakis (2015: 41–45), who contend that the coalescence of [sk] is a kind of height assimilation. Second, is that MHG [s] shifts to [ʃ] before [p t m n l w], e.g. ENHG [ʃ]nell < MHG [s]nel. That change was completed in some German dialects by ENHG, but is still incomplete in a number of present-day varieties. This development has also been analyzed with reference to active height features. For example, Hall (2007) argues that this postalveolarization is a kind of height dissimilation.

In sum, the ‘rhotics-are-high’ analysis captures high vowels, postalveolar consonants, and the rhotic of early Germanic languages as a natural class. That natural class pattern, unlike any other proposals that I am aware of, points to the feature [high] as a common phonological structure involved in Gothic Lowering, Primary Umlaut Blocking, and ENHG Postalveolarization. As I discuss in the next section, it is precisely this group of sounds that are also involved in so-called ‘ruki-rules’.

4.2.2 An application beyond Germanic

An example of a ruki-rule is observed in the Avestan reflexes of Proto-Indo-European (PIE) *[s]. In Avestan, PIE *[s] is reflected as a post-alveolar [ʃ] following the segments [r, u, k, i]. Some examples of the change from Hall (1997: 211) and Martínez & de Vaan (2014) are presented in (26).

(26)	Postalveolarization in Avestan	
	<i>IE</i>	<i>Avestan</i>
	*[s]	pā[ʃ]na (< *par[ʃ]na) ‘heal’
		ar[ʃ]ti ‘spear’
	*[s]	hu[ʃ]ka ‘dry’
		zu[ʃ]ta ‘enjoyed’
		ratu[ʃ] ‘span, time’
		tanu[ʃ] ‘body’
	*[s]	da[ʃ]ina (< *dak[ʃ]ina) ‘right hand’
		vax[ʃ] (<x> = [k]) ‘grow’
	*[s]	vi[ʃ]a ‘poison’

Following the Chomsky & Halle (1968) definition of [high] in (21), postalveolar consonants like [ʃ] and velar consonants like [k] are marked with the feature [high]. If Avestan rhotics – like the Gothic rhotics in section 2, the OHG rhotics in section 3, and the ENHG rhotics in 4.2.1 – also pattern as [high] segments, the shift from [s] to [ʃ] can be formalized as the spreading of that height feature from a [r, u, k, i] segment onto a following [s], as in (27). Due to this spreading [s] shifts to [ʃ].

(27)	ruki-Postalveolarization	
	r u k i	[s]
	└───┬───┘	└───┬───┘
	[high]	[high]
		[ʃ]
		[high]

The analytical sketch in (27), which is not intended to be a detailed account, may be helpful to better understand data that have not been easy to capture in phonological terms. Blevins (2017: 49) points out that ruki-rules have not been satisfactorily accounted for with reference to any traditional approach to features. Blevins sees the lack of a featural explanation as a failure of formal phonological approaches to these data. While there are undeniably ‘crazy rules’ that speak to Blevins’ point, the sketch here suggests that ruki-rules might not be among them.

4.3 Implications for other segments

This section aims to address some of the questions left open by the analyses in sections 2 and 3. In section 4.3.1, the status of non-continuant velars is considered. Implications for the structure of mid vowels are addressed in section 4.3.2.

4.3.1 On non-continuant velars

The definition of the feature [high] in (21) includes velar stops (oral and nasal). Both Gothic and Old High German had the sounds [k], [g], and [ŋ]. The examples in (28a) indicate that these velar segments did not trigger Gothic Lowering. The examples in (28b) show that velar stops also did not block the application of Primary Umlaut in OHG.

(28a)	<i>EGmc Gothic</i>		
	*[i]	f[i]ggrs ²⁴	‘finger’
	*[i]	r[i]gn	‘rain’
	*[i]	br[i]kan	‘to break’
	*[u]	ga-br[u]ka	‘crumb’
	*[u]	f[u]gls	‘bird’
	*[u]	h[u]gs	‘mind’
(28b)	<i>WGmc OHG</i>		
	*[a]	l[e]ngiro	‘longest’
	*[a]	sk[e]nken	‘to give to drink’
	*[a]	r[e]cken	‘to reach’
	*[a]	d[e]cken	‘to cover’
	*[a]	l[e]ggen	‘to lay’
	*[a]	w[e]ggen	‘to move’

The examples in (28) are not problematic for the analyses presented above because [k], [g], and [ŋ] constitute a natural class of velar stops. There are different ways to account for this regularity. In the logic of Contrastive Feature Hierarchies (Dresher 2015 and sources therein), for example, features are only active, which is to say contrastive, for a particular natural class of sounds (see further discussion of this framework in Noelliste, this volume). The data in (28) indicate that the feature [high] in early Germanic languages is only active for sounds that are [continuant]. For this reason, the sounds represented by <r> and <h>, like vowels, are marked with the feature [high], while the velar stops, [k], [g], and [ŋ], are not.²⁵

Lateral segments are also german to the discussion of velar stops. On the one hand, this is because laterals in Germanic languages are both ‘clear’ (non-velarized) and ‘dark’ (velarized). Only the latter variant is predicted to be specified with the feature [high] according to the definition in (21). On the other hand, the status of laterals with respect to their continuancy is debated. By SPE convention, lateral sounds are [-continuant]. However, Mielke’s (2005) findings based on 561 languages indicate that laterals pattern with continuants about as frequently as they pattern with non-continuants. Consequently, there are two reasons why laterals may not pattern as [high] sounds: (a) they may not be [high] due to their articulation (e.g. <l> may represent clear [l]), and (b) they may pattern with velar stops like [k] and [g] as non-continuant sounds.

A tentative conclusion regarding the OHG <l> which blocked Primary Umlaut is that it represented an [ɫ], which like [x], had a velar place and a continuant manner of articulation.²⁶ A non-blocking <l>, however, may obtain either from a clear [l] or a non-continuant [ɫ]. In a similar vein, Gothic <l> might not have patterned as a [high] segment either because of its articulation or its continuancy. Owing to these multiple explanations,

²⁴ Gothic <gg> is the orthographic representation for [ŋg]. In OHG, <gg> is a geminate [g:].

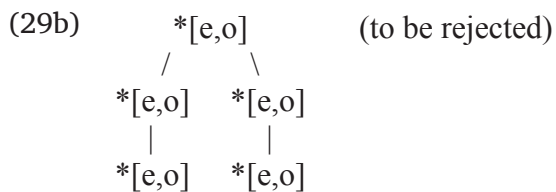
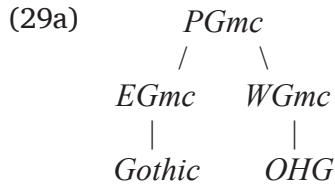
²⁵ The same restriction is not true of languages with ruki-postalveolarization. That stops in these languages may be marked by the feature [high] would indicate a differently structured hierarchy of contrastive features.

²⁶ While this formal explanation is novel, the idea that ‘dark’ [ɫ] had something to do with the blocking of Primary Umlaut is already suggested by Braune (1877) in what, to the best of my knowledge, is the very first account of Primary Umlaut blocking.

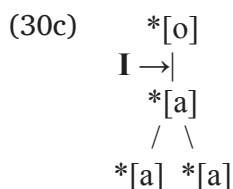
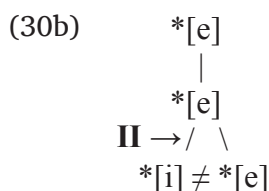
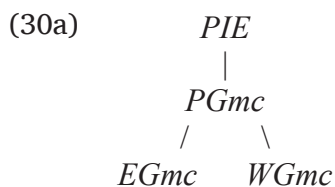
future research will need to continue exploring the phonological patterns of lateral sounds in Gothic and OHG to better understand their featural makeup.

4.3.2 Implications for mid vowels

One of the conclusions from the analysis above is that Gothic and OHG had different mid vowel structures. I argued above that Gothic mid vowels were SPE-like (non-[high] and non-[low]), while [e] and [o] in OHG were ET-like ([high] and [low]). This conclusion would be problematic if Gothic [e,o] < EGmc *[e,o] < PGmc *[e,o] *and if* OHG [e,o] < WGmc *[e,o] < PGmc *[e,o], as in (29b). If these historical circumstances were true, Gothic mid vowels and OHG mid vowels would be etymologically related.



The historical sketch in (29b) is counterfactual. Owing to two context-free sound changes, there are no etymological ties between the Gothic mid vowels and the ones in OHG. The first change, labeled as ‘I’ in (30c), is that all instances of PIE *[o] shifted to PGmc *[a]. As a result, *[o] did not occur in PGmc at all. The new PGmc *[a] was generally retained in EGmc and WGmc. Thus, cognate words from corresponding daughter languages, like Go *gasts* ‘guest’, OHG *gast* ‘guest’ have an etymologically related low vowel, [a], that corresponds to [o] in other Indo-European languages, e.g. Latin *hostis*. The second change, labeled as ‘II’ in (30b), pertains to instances of PGmc *[e], which all shifted to EGmc *[i]. On account of that raising, only WGmc languages retain instances of PGmc *[e] in words like OHG *neman* ‘take’. The corresponding EGmc form, Gothic *niman* ‘take’, is representative of the context-free EGmc raising.



Both Gothic and OHG developed new mid back vowels that were reflexes of PGmc *[u]. However, these new back vowels developed at different times and in different contexts. That is, Gothic [o] and OHG [o] are never of common origin. The new mid back vowel in Gothic is always the result of Gothic Lowering. In OHG, most of the new instances of [o] are inherited from Northwest Germanic (NWGmc): due to the sound change known as a-mutation or a-umlaut, PGmc *[u] shifted to NWGmc *[o] when a non-high vowel followed in the immediately adjacent syllable. Because of Gothic Lowering, Gothic [o] corresponds to OHG [u] in words like Gothic *b[o]rgs* ‘castle, city’ OHG *b[u]rg* ‘castle, city’ (< PGmc **burgz*). On account of a-mutation, Gothic [u] corresponds to OHG [o] in examples like Gothic *huzd* ‘treasure’ OHG *hort* ‘treasure’ (< PGmc **huzdan*). Apparent examples of a common [o] occur only in words which originally contained a trigger of Gothic Lowering (*r, *h) and a trigger of a-mutation (i.e. a non-high vowel in the following syllable). Reflexes of PGmc **burdan* exemplify this point. The word is realized as Gothic *b[o]rd*²⁷ ‘board’, where the mid vowel obtains from Gothic Lowering. It is reflected as OHG *bort* ‘board’ owing to a-mutation.

The important point to be drawn from the discussion above is that the mid vowels of Gothic and OHG *never* have a common origin. As such, it is possible, as the analysis indeed suggests, that the two languages developed new mid vowels that were typologically distinct. Gothic mid vowels were SPE-like mid vowels. They were non-[high] and non-[low]. OHG mid vowels, by contrast, were ET-like mid vowels, which is to say, they were simultaneously [high] and [low]. Because the OHG mid front vowel is sometimes inherited from PGmc, an implication of the analysis may be that PGmc, like OHG, had ET-like mid vowels. I leave this open to further research.²⁸

4.4 Previous accounts

In the earliest accounts of Gothic Lowering (e.g. Grimm 1822: 44; Braune 1880: 6–7; Le Marchant Douse 1886: 20–21; Brugmann 1888: 58; Prokosch 1939: 114; Hill 1936: 18, *inter alios*) <r> and <h> are understood as triggers of the change. In Hill’s (1936: 18) words, for example, Gothic Lowering was “obviously phonetically controlled.” However, any reason for that control received no comment. Only Grimm (1822: 44) speculates that <r> and <h> cause high vowels to shift to mid vowels²⁹ “ihrer schwierigen aussprache wegen.”³⁰ Later work on Gothic Lowering, e.g. Beade (1971: 40ff), Bennett (1980: 89ff), and Binnig (1999: 50–53), offers no further insight into Gothic <r> and <h> and why those sounds trigger the lowering of high vowels.

Concerning Primary Umlaut, Braune (1877: 552) first noted that <r> and <h> (and <l>) blocked the sound change from occurring when they were situated between the trigger and target of Primary Umlaut. In Braune’s opinion, <r> and <h> (in words like OHG *arbi* ‘inheritance’ and *mahti* ‘powers’) were ‘dark’ sounds, meaning that they were closer in articulation to back vowels. As such, they counteracted the umlauting effect of [i]. Beyond that initial speculation, later work did not supply much insight into the inhibitory nature of <r> and <h>. For instance, Voyles (1992: 212) simply notes that various consonants “such as [h, x] can inhibit the application of the [Primary Umlaut] rule.”

More formal accounts of Gothic Lowering and Primary Umlaut Blocking have continued to be unable to capture the <r> and <h> pattern as a conspiracy. I use the term

²⁷ Attested in the compound *fo tubaurd* ‘footstool’.

²⁸ If there are two kinds of mid vowels, future research will need to examine if there are other historical examples of a mid vowel shifting from one type of specification to another. An additional question is if both types of mid vowels can coexist in the same language.

²⁹ Grimm believed that this change occurred via an intermediate stage of diphthongization; see fn. 4.

³⁰ “On account of their difficult pronunciation” [AEK].

‘conspiracy’ to refer to a linguistic commonality, which turns up in temporally and geographically disparate contexts.³¹ Vennemann (1972) argues that Gothic Lowering is a kind of ‘relative’ assimilation. From this perspective, <r> and <h> have a relative feature {low}³² since, relative to the high vowels [i] and [u], the tongue posturing of <r> and <h> is claimed to be lower. In a similar manner, the mid vowels [e] and [o], relative to [i] and [u], are also marked with the relative feature {low}. In this way, Vennemann (1972) can formalize Gothic Lowering as a kind of relative assimilation: Gothic high vowels shift to {low} mid vowels owing to the influence of the {low} consonants <r> and <h>.³³ Relative features are clearly language specific. For example, in OHG, Vennemann argues that all dental consonants are {low} with respect to the high back vowel [u]. If Gothic were similar to OHG, dental consonants in Gothic in words like *brust* ‘breast’ and *gulþ* ‘gold’ should be {low} and, as such, trigger Gothic Lowering. In the end, it is unclear how the relative feature responsible for Gothic Lowering might account for the blocking of Primary Umlaut in OHG.

A formal treatment of OHG Primary Umlaut is proposed by Iverson et al. (1994). In their approach, <r> and <h> are vowel-like. That vocalic quality is responsible for blocking Primary Umlaut (for space, the specific formal reasons are not discussed here in detail). Evidence for the vocalic character of <r> is rhotic vocalization in modern dialects. The authors follow Howell (1991) in that they believe <h> represents [h]. Since [h] can be understood as a voiceless vowel, <r> and <h> can pattern together as a natural class.

As discussed above, however, there is no evidence that <h> ever debuccalized in words like OHG *mahti* ‘powers’, which retain a dorsal fricative into the present day. Additionally, the pronunciation of <h> as [k] before [s] strongly indicates that <h> had a velar articulation, not a glottal one.

The additional problem with the account by Iverson et al. (1994) is that there is no attempt to explain why <r> and <h> in Gothic also pattern together as a natural class. Vocalized forms of <r> and <h> are clearly not conditioners of Gothic Lowering (especially since onset and coda consonants serve as triggers). Thus, their account of OHG Primary Umlaut leaves us to conclude that this historical conspiracy is coincidental; two separate accounts would be needed to analyze the OHG facts and Gothic facts. If each historical change were to require a unique account, there is little hope of aggregating insight into broader characteristics of early Germanic phonology.

5 Conclusion

One of the difficulties in individually analyzing archaic phenomena like Gothic Lowering and OHG Primary Umlaut Blocking is that the assortment of possible theoretical representations (e.g. the representation of rhotics, dorsal fricatives, and mid vowels) corresponds to an array of plausible analytical treatments of the phenomena in question.³⁴ This article aims to evaluate the different analytical treatments of one language by looking to a sister

³¹ An uncontroversial example of a linguistic commonality would be a palatalization rule like [k] > [tʃ]/[i], which as Blevins (2004: 138) points out, is characteristic of Indo-Iranian, Bantu, Chinese, Cowlitz Salish, and Mam language history.

³² I use curly brackets to distinguish the relative feature {low} from the absolute feature [low].

³³ It is unclear if Vennemann’s notion of feature relativity holds up to closer scrutiny. In its original conception, Vennemann’s (1972) idea doubles the phonological system into “true” phonology and “relative” phonology without careful discussion of how the two systems might or might not interact. I am aware of no other study arguing for relative features.

³⁴ This is equally true for phonetic research. Because rhotics, for example, can interact with vowels in an assortment of ways, it is essential to examine rhotic effects that are embedded within a larger natural-class pattern. Future research that aims to retrofit the phonetic properties of sounds in modern languages to archaic developments (as in Denton’s 2001, 2003 work) needs to better account for natural class patterns.

language. It finds that the phonology of one sister language can elucidate the phonology of another when both languages exhibit a common natural class pattern.

I have argued that the graphemes <r> and <h> in Gothic and OHG have in common that they are [high] sounds. With that representation, both the analysis of Gothic lowering and the analysis of OHG Primary Umlaut Blocking fall out in a straightforward way. In Gothic, the height feature of <r> and <h> triggered dissimilatory lowering of preceding high vowels due to an OCP violation. In OHG, that height feature blocked the application of OHG Primary Umlaut due to the No-Crossing Constraint. Further evidence for a [high] rhotic in Germanic language history was observed in the rhotic-conditioned postalveolarization of MHG [s].

Because the rhotic and dorsal fricative sounds of Gothic and OHG are reflexes of PGmc *r and *x, their patterning as [high] segments in Gothic and OHG implies that they also patterned as [high] sounds in PGmc. In this way, the approach here aggregates insights from Gothic and OHG into a broader characteristic of early Germanic phonology.

Insofar as feature representations generally correlate to phonetic implementations, the collection of articulations subsumed under the IPA symbol [ɹ] represents the most prototypical kind of [high] rhotic. That is the case because they can be produced anywhere from the postalveolar ridge to the soft palate – precisely the range of places that, according to Chomsky & Halle (1968), pattern as [high]. From a phonological perspective, [ɹ]-sounds are likely to have been characteristic of early Germanic languages. Dialect evidence corroborates this finding; [ɹ] is found in all surviving branches of Germanic languages. With respect to the dorsal fricative, [x] appears to be the only viable phonetic realization. Not only do conservative dialects of German preserve [x], but later shifts of [x] > [k] strongly indicate the velar character of the sound represented by <h> in Early Germanic languages.

Abbreviations

3.SG = third person singular, EGmc = East Germanic, INF = infinitive, NOM.SG = nominative singular, NOM.PL = nominative plural, NWGmc = Northwest Germanic, OHG = Old High German, POS = positive, PGmc = Proto-Germanic, SUP = superlative, WGmc = West Germanic.

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Competing Interests

The author has no competing interests to declare.

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