

**Contrastive feature hierarchies and Germanic phonology:
Jørgen Rischel's analysis of the Scandinavian runic transformation**

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Abstract: I discuss an analysis of changes in the Scandinavian runic alphabet, or futhark, by Jørgen Rischel (1966). Rischel's article accounts for some puzzling changes in the futhark by employing contrastive feature hierarchies represented as branching trees. Feature hierarchies can be traced back to the work of Roman Jakobson and his colleagues. They enjoyed a brief period of prominence in the 1950s and 1960s, but then disappeared from mainstream phonological theory. However, they were employed in a number of interesting studies of Germanic and other languages whose insights we can still profit from today. The goal of this paper is to bring attention to this largely forgotten approach to phonological analysis, and to spell out the principles that underlie it.

Keywords: Scandinavian, Germanic, runes, contrast, phonological theory, feature hierarchies, branching trees, futhark.

1 Introduction

It was once common in phonological theory to represent the phonemes of a language as made up of distinctive features that are ordered into a hierarchy. Contrastive feature hierarchies, which could be depicted in the form of a branching tree, played an important role in Germanic phonology in particular (Dresher 2018, to appear), though typically they were not acknowledged as such; rather, their existence has to be inferred by working back from the presented analyses. Explicit discussions of the theory that underpins these analyses are rare.

Therefore, the analysis of changes in the Scandinavian runic alphabet, or *futhark*, by Jørgen Rischel (1934–2007), is of particular interest. This article, published in 1966 and reprinted in Rischel (2009: 254–271), is distinguished by its innovative application of contrastive feature hierarchies to runology, as well as by Rischel's insightful discussion of the theory behind these hierarchies. It thus gives us a unique window into the state of distinctive feature theory at a crucial time, just before branching trees were abandoned by mainstream generative phonology.

In §2, I discuss the origins and history of branching tree diagrams in phonology up to the early 1970s. Section 3 presents Rischel's analysis of the changes in the Scandinavian runes. Section 3.1 looks at the older Scandinavian vowel runes, and §3.2 gives Rischel's analysis of how the vowel system and the runes changed. Sections 3.3 and 3.4 look at the obstruent system and its runes in the older and the newer systems. Section 3.5 reviews some critiques of Rischel's approach.

Section 4 discusses the theory behind Rischel's analysis. In §4.1, I review criteria for ordering features and Rischel's insightful comments on "branching diagrams" (feature hierarchies) and the criteria he proposes. Section 4.2 presents Contrastive Hierarchy Theory, a theory of contrastive specification that is consistent with Rischel's analysis, and §4.3 calls attention to the importance of noncontrastive features that are introduced in a post-phonological phonetic component. Section 5 is a brief conclusion that cites some

recent applications of contrastive feature hierarchies to West and North Germanic phonology.

2 Origins and history of contrastive feature hierarchies, aka “branching trees”

In Dresher (2007, 2009, 2015, 2016), I have traced the origins of contrastive feature hierarchies to early writings of the Prague School phonologists, notably Roman Jakobson and N. S. Trubetzkoy, although branching diagrams do not actually appear there. Jakobson (1941) posits that contrasts are crucial in phonological acquisition and that they develop in a hierarchical order. In particular, he proposes that learners begin with broad contrasts that are split by stages into progressively finer ones. Thus, following an initial split into vowels and consonants, the vowel system develops by splitting into a narrow (high) vowel, typically /i/, and a wide (low) vowel, typically /a/. As detailed in Jakobson & Halle (1956), the high vowel then splits into a palatal (front) and velar (back rounded) vowel, giving the common vowel system /i, a, u/, represented in Figure 1.¹

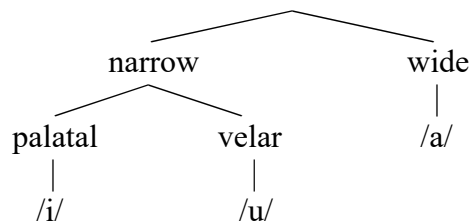


Figure 1. Common three-vowel system (Jakobson & Halle 1956: 41)

The branching tree is alluded to by Jakobson et al. (1952). They propose that listeners identify phonemes by distinguishing them from every other phoneme in the system. These distinctions are effected by making a series of binary choices that correspond to the oppositions (i.e., contrasts) that are “linguistically relevant” in the language. Thus, not all phonetic properties of a phoneme are equally important to the phonology, but only the contrastive ones. Publications that explicitly featured branching trees include Cherry et al. (1953) and Halle (1959). Branching trees are prominent in the first generative phonology textbook (Harms 1968).

Halle (1959: 46) has a branching tree diagram that shows the contrastive feature specifications of every Russian phoneme (for discussion, see Dresher & Hall 2021). This book contains a novel argument for specifying features by branching trees. Halle proposes that segments are properly contrastive only if they meet the Distinctness Condition, given in (1). He argues that phonological features *must* be ordered into a hierarchy, because this is the only way to ensure that segments meet the Distinctness Condition.

¹ Jakobson & Halle (1956) propose that this ordering is universal, though that claim appears to be too strong; see Dresher (2019: 14–19) for discussion.

(1) *The Distinctness Condition* (Halle 1959: 32)

Segment-type /A/ will be said to be different from segment type /B/, if and only if at least one feature which is phonemic in both, has a different value in /A/ than in /B/; i.e., plus in the former and minus in the latter, or vice versa.

As in general phonology, structuralist analyses of Germanic sometimes alluded to a hierarchical organization of distinctive features.² In addition to Rischel (1966), contrastive feature hierarchies are explicitly employed by Hreinn Benediktsson in several publications. Here I consider in particular his (1967) article on the Proto-Germanic vowel system, which employs a Jakobsonian approach to distinctive features, and his account of the *First Grammatical Treatise* (H. Benediktsson 1972), a twelfth century Icelandic study of Old Norse by an anonymous author known as the First Grammarian (the FG).

H. Benediktsson (1972: 126) diagrams the short nonnasal vowel system presented by the FG as in Table 1.³ He assigns these vowels binary distinctive features as in Table 2.

Table 1. Old Norse short oral vowel phonemes in the *First Grammatical Treatise* (H. Benediktsson 1972: 126)

	FRONT		NONFRONT	
	UNROUNDED	ROUNDED	UNROUNDED	ROUNDED
HIGH	i	y		u
MID	e	ø		o
LOW	ɛ		a	ɔ

Table 2. Distinctive features of the vowels in Table 1 (H. Benediktsson 1972: 126)

	i	y	u	e	ø	o	ɛ	a	ɔ
low	–	–	–	–	–	–	+	+	+
high	+	+	+	–	–	–			
front	+	+	–	+	+	–	+	–	–
rounded	–	+		–	+			–	+

The particular pattern of underspecification in Table 2 (i.e., cells which have no + or –) derives from assigning contrastive features in the order of the rows. The feature [low] is assigned first, with the result that every vowel is specified either [–low] or [+low]. The feature [high] is assigned second, but applies only in the [–low] vowels; since the [+low] vowels are all nonhigh, [high] is not contrastive in this branch of the tree. The third feature, [front], is contrastive in all the vowels, but the last feature, [rounded], is not specified in /u/, /o/, and /ɛ/. This is because these vowels are already uniquely specified by the first three features (/ɛ/ only by [low] and [front]), as is clearly shown in the tree in Figure 2.

² An example is Moulton (1954), discussed in §3.3.

³ H. Benediktsson (1972: 144) goes on to argue that there is no conclusive evidence for a contrast between /e/ and /ɛ/, and that the language described by the FG has only eight short vowel phonemes. However, the nine-vowel system in Table 1 will be interesting to compare with Rischel's analysis of a similar system.

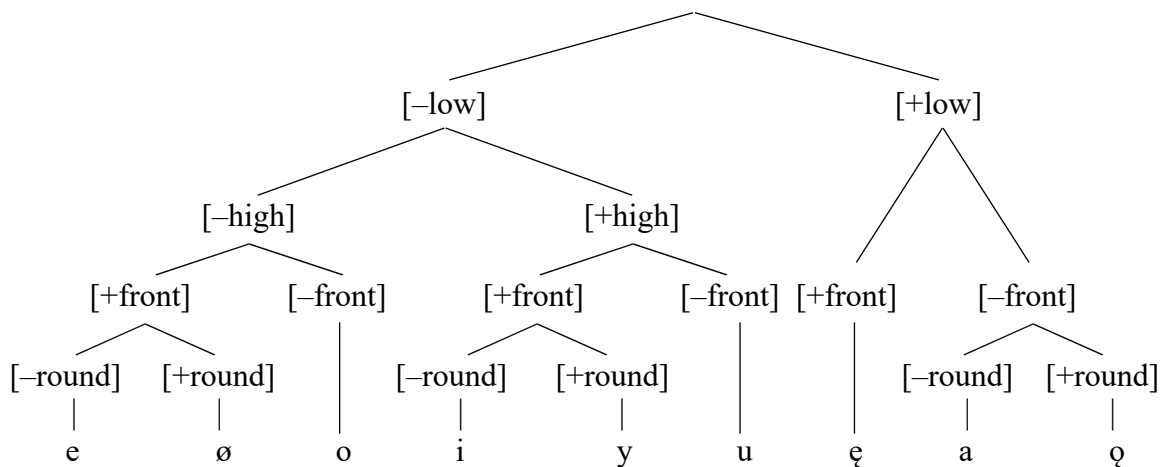


Figure 2. Tree diagram corresponding to Table 2.

Though H. Benediktsson made insightful use of contrastive feature hierarchies, showing how a Jakobsonian structuralist analysis can shed light on both synchronic and diachronic phonological systems, he did not discuss the theory that underpinned his analyses. Consider, for example, the feature chart in H. Benediktsson (1967) for the vowels of Proto-Germanic at a stage where the language had four short vowels and five long vowels (Table 3).⁴

Table 3. Distinctive features of the Proto-Germanic vowels (H. Benediktsson 1967: 176)

	i	e	u	a	ī	ē ₂	ū	ō	ē ₁
long	–	–	–	–	+	+	+	+	+
low	–	–	–	+	–	–	–	–	+
high	+	–	(+)		+	–	+	–	
back-round	–	(–)	+		–	–	+	+	(–)

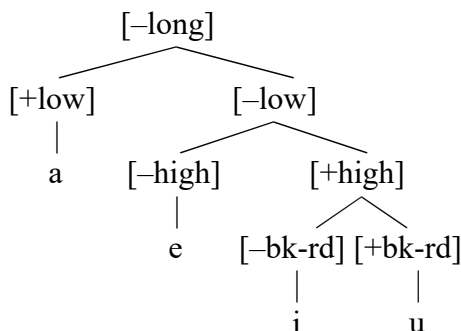
Under /ē₁/, the parentheses around the value for [back-round] indicate that this specification is redundant.⁵ However, the meaning of the parentheses in the specifications of short /e/ and /u/ is not clear. If we generate feature specifications hierarchically in the order of the rows in Table 3, we derive the tree in Figure 3(a), where /u/ is contrastively [+high] and /e/ lacks a specification for [back-round]. If we reverse the order of these two features, then /e/ is contrastively [–back-round] and /u/ is unspecified for [high].⁶

⁴ For easier comparison with features elsewhere in this article, I have renamed H. Benediktsson's features, changing compact to low, diffuse to high, and grave-flat to back-round. [F₁] ≫ [F₂] means that feature [F₁] is ordered before [F₂].

⁵ I have discussed H. Benediktsson's analysis of the Proto-Germanic long vowel system in Dresher (2018: 8–10).

⁶ The tree in Figure 3(b) is almost the same as the short vowel system for Proto-Germanic proposed by Antonsen (1972); see Dresher (2018: 5–8, 21–24) for discussion.

a. [high] » [back-round]



b. [back-round] » [high]

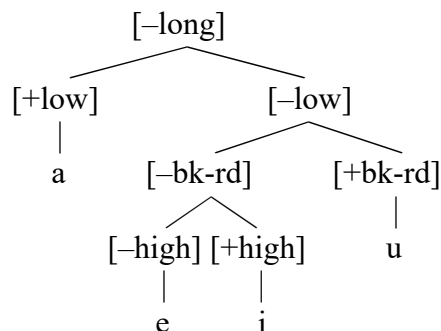


Figure 3. Proto-Germanic feature hierarchy for short vowels based on Table 3

Other possible interpretations of the parentheses in Table 3 are not consistent with a hierarchical contrastive specification. The trees in Figure 3 show that, if we keep [long] and [low] at the top of the hierarchy, no ordering of [high] and [back-round] can yield a tree with both parenthesized values under /e/ and /u/ present at the same time.⁷ Nor can both of these values be omitted: no feature hierarchy can generate such a set of representations, which violate the Distinctness Condition (1).

Ambiguities such as these in how underspecification works were common throughout the phonological literature. Rischel's account of the changes in the Scandinavian runes stands out in the way he explicitly discusses the theory that underlies his analysis.

3 Rischel's analysis of the transformation of the Scandinavian runes

3.1 Vowels: the older futhark

Before 700 CE, the Scandinavian runic alphabet, the “older futhark”, had symbols for five vowels, which are assumed to correspond to the five vowel phonemes of what Rischel (1966) calls Proto-Scandinavian, as shown in Figure 4. Vowel length was phonemic; Rischel assumes that each vowel had a short and a long form. However, vowel length (along with some other prosodic features) was not represented in the futhark, and will not be considered further here.

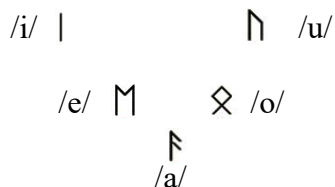


Figure 4. Proto-Scandinavian vowel phonemes and runes

⁷ Of course, starting from either tree, further noncontrastive specifications can be added later; see further §4.3.

Most scholars assume that at a relatively early stage each vowel phoneme developed positional allophones caused by fronting, backing, raising, lowering, and breaking. After vowel reduction and syncope, the conditioning contexts were lost or became obscure, resulting in the creation of new phonemes. According to Rischel (2009 [1966]) (henceforth simply Rischel), the significant developments were as in (2):

- (2) *Reorganization of the Proto-Scandinavian vowel phonemes (Rischel: 260–261)*
- a. Before *j* and sometimes before *i*, the phonemes /u, o/ had front rounded allophones which became new phonemes /y, ø/, respectively.
 - b. The phonemes /i, e/ became rounded before /w/; these allophones eventually became new phonemes which merged with the front rounded vowels in (a). Rischel writes that this phenomenon had more limited distribution than (a).
 - c. /a/ developed two important allophones which became new phonemes: front [æ] in the same conditions as in (a), and [ã] before /w/ or /u/.⁸
 - d. In some contexts /i, u/ were lowered to [e, o], and before certain consonant clusters /e, o/ were raised to [i, u], thus creating many alternations between /e/ and /i/ and between /o/ and /u/, establishing a close connection between these vowels.
 - e. In unstressed syllables, short vowels were deleted, long vowels were shortened, and /i, u/ coalesced with /e, o/. The result was that only three unstressed vowels were distinguished, designated /a, i, u/ or /a, e, o/.

As a result of the changes in (2), the number of vowel phonemes increased from five in Proto-Scandinavian to nine in what Rischel calls Old Scandinavian (or Old Norse).⁹ Rischel (p. 264) portrays this vowel system as shown in Figure 5.¹⁰

i	y	u
e	ø	o
	æ	ã
	a	

Figure 5. Old Scandinavian vowel phonemes

3.2 Transformation of the vowel runes: the younger futhark

Recall that the older futhark had five vowel runes for five vowel phonemes. When the phonemes went from five to nine, the futhark could perhaps have added new runes to keep up with phonological changes, as was the case with the Old English runes (Schulte 2009: 115; Barnes 2012: 37–41), but this did not happen. Instead, counterintuitively, the number of vowel runes was *reduced* from five to three! The old runes for /e/ (ᛚ) and /o/

⁸ The editors of Rischel (2009) note that /æ/ corresponds to IPA /ɛ/, and /ã/ to IPA /ɔ/.

⁹ Antonsen (1963, 1967) proposes that there were more vowels; see H. Benediktsson (1974) for a critique. See now Schalin (2017, 2018, 2024), who argues that patterns of fronting, rounding, and breaking require a more complex set of vowel contrasts.

¹⁰ See §3.2 on the geometry of the low vowels in Figure 5.

(⊗) were discontinued. Assuming that there were reasons why it would not have been practical to invent four new vowel runes, why were the original five not retained?

Rischel (p. 256) suggests that there may have been an orthographic reason for dropping the **e** and **o** runes. He observes that the younger futhark “avoids characters which do not have one full-size vertical line”. The **i** (l), **u** (ŋ), and **a** (†) characters all have one full-size vertical line, but the **e** and **o** runes do not (the **e** rune has two full-size vertical lines, and the **o** rune has none).¹¹

However, Rischel (p. 262) argues that the more important reasons are phonological: “If the nine vowel phonemes were to be distributed on five runes in such a way that these were still used with roughly the same sound values as before, one would be forced to group the vowel phonemes in a way that would violate the pattern of the language.” Rischel imagines what such a system might have looked like, if the existing runes were reassigned based on phonetic closeness. The **i** rune could stand for /i/; the **u** rune could be assigned to /u/ and /y/; the **e** rune could represent /e/ and /æ/; the **o** rune could stand for /o/, /ø/, and /å/; and the **a** rune would continue to designate /a/.

Rischel argues that these groupings “would entail a vehement break with spelling tradition and would be absurd from a morphophonemic point of view.” Specifically, the phonemes /a/, /æ/, /å/ are closely related by alternation and etymology (2c), but these would be divided among three different runes; /i/ and /e/ are related by alternations (2d), but these would belong to different runes. Finally, as per (2e), unstressed vowels are reduced to three: /i/ from /i/ and /e/; /u/ from /u/ and /o/; and /a/.¹² We arrive, then, at three logical groupings for both the stressed and unstressed vowels: /i, e/; /u, y, o, ø/; and /a, æ, å/. Each group is represented by a single rune, as shown in Figure 6.¹³

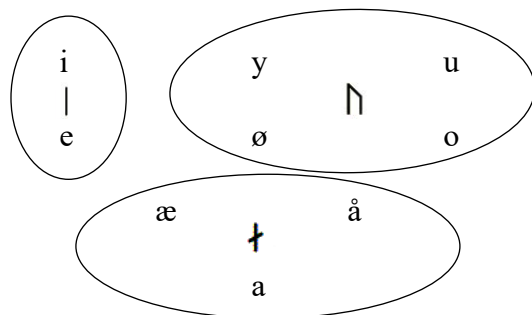


Figure 6. Old Scandinavian vowel phonemes and runes

The rune for the low vowel changed because of sound change. The name of the old **a** rune, †, was **ansuz*, which became **ãss*; following the acrophonic principle (Liestøl

¹¹ See Schulte (2006: 52–53) and Barnes (2009) for discussion of the possible role of graphic simplification in the creation of the younger futhark.

¹² Haugen (1969) proposes that unstressed syllables are a key to the reductions in the younger futhark. See Birkmann (1995: 198–200), Schulte (2006: 54–55), and Barnes (2009: 131) for arguments against this view.

¹³ Rischel (p. 263) notes that the phonemes /y, ø/ derived from /i, e/ by (2b) are problematic from a morphophonemic point of view because they are grouped with ŋ rather than with l, but that these cases are fairly restricted.

1981a, 1981b; Schulte 2006: 58–60; Barnes 2009), this rune was reassigned the value nasalized /ã/. Meanwhile, the name of the j rune, †, called *jāra, lost its initial glide and became *āra, and so came to represent a in the younger futhark.

Rischel next considers how these groups can be characterized phonologically. Building on proposals by Diderichsen (1945) and Antonsen (1963), he employs a feature tree to illustrate how the three younger futhark vowel runes map onto the nine vowel phonemes. The key insight is that, in the newer orthography, some vowel features are *underspecified*; as Antonsen (1963: 201) put it, “only the crassest oppositions” were represented. The highest feature is [high-low]. The high vowels are divided by [unrounded-rounded]. These are the only features represented in the younger futhark (Figure 7; here and elsewhere I have slightly modified the layout of Rischel’s trees).

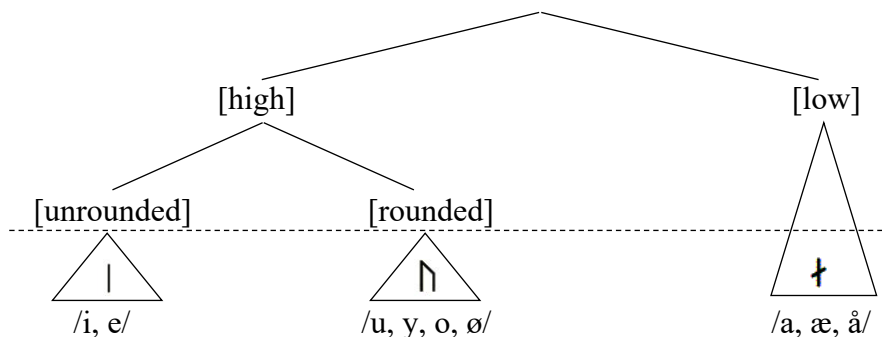


Figure 7. Younger futhark vowel feature hierarchy (Rischel, p. 265)

Rischel completes the Old Scandinavian vowel feature hierarchy as in Figure 8, extending it to features not represented by the younger futhark. The next feature after [unrounded-rounded] is [close-open]. There are no further contrasts in the [unrounded] branch, which terminates with [close] /i/ and [open] /e/. In the [low] branch, there is only one [open] vowel, namely /a/. The remaining branches of the tree are divided by [front-back]. This completes the feature hierarchy for the Old Scandinavian vowels; the features are ordered [high-low] ≫ [unrounded-rounded] ≫ [close-open] ≫ [front-back].

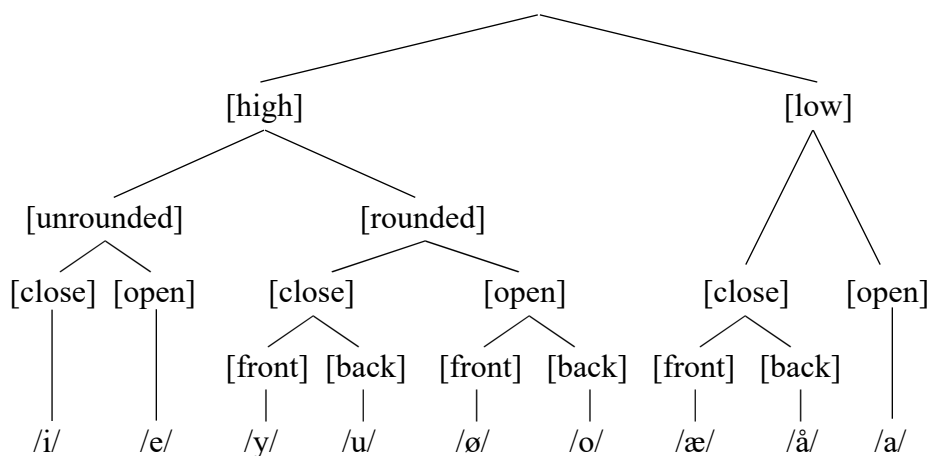


Figure 8. Old Scandinavian: all contrastive vowel features

Rischel (p. 265) writes that “it requires some explanation” why the contrast between /i/ and /u/ in the basic /i, u, a/ system should be considered to be unrounded–rounded rather than front–back.¹⁴ He observes that if the two highest features were [high-low] and [front-back], then one would arrive at four sets of vowels rather than three, because the low vowels also exhibit a front–back contrast. However, he goes on that this argument “may not hold water”, because the contrasts in the low vowels may have been different. He writes (p. 261) that not all scholars would agree with his depiction of the low vowels: rather than /a/ being more open, the main contrasts could be rounding and place of articulation (compare H. Benediktsson’s analysis of a similar nine-vowel system shown in Table 1). The geometry in Figure 5 is the same as that given by Haugen (1950); see H. Benediktsson (1959, 1963: 416–418) for a critique.¹⁵

This consideration may be why Rischel avoids making [unrounded–rounded] contrastive in the low vowels. But this move may not be necessary, for there are many examples of languages in which a contrast is suspended in one branch of the feature tree but not in another one; see, for example, the analysis of vowel reduction in unstressed syllables of Bulgarian by Spahr (2014). I can add that, even leaving aside the [low] vowels, choosing [front-back] as the higher feature over [unrounded–rounded] would not give the right mapping to the three vowel runes, because the features [high, front] would group /y, ø/ together with /i, e/ rather than, as is the case, with [high, back] /u, o/.

3.3 Obstruents: the older futhark

Rischel uses feature hierarchies to account for changes in the obstruents of Proto-Scandinavian and their corresponding runes. These are shown at the bottom of the tree in Figure 9, not including /s/ which is not relevant here. He writes (p. 266) that in early Proto-Scandinavian there were two important ~ contrasts in the obstruent system: fortis ~ lenis and stop ~ fricative. Fortis consonants, probably voiceless, were in contrast with lenis consonants, which were probably voiced; hence, fortis [p] (IPA [θ]) was a member of a different phoneme from lenis [ð]. Stops, for example [t], were in contrast with fricatives, like [p]. Rischel proposes that “the fortis-lenis distinction seems to have had the higher rank in early Proto-Scandinavian.”¹⁶ This is mainly because the stop-fricative opposition had narrower scope, as it existed only within the fortis obstruents. There was

¹⁴ The front-back contrast is higher in H. Benediktsson’s (1972) analysis in Table 1; however, he proposes (pp. 144–146) that the order of these contrasts reversed at a later stage. Schalin (2018: 109–111) discusses similar variation in H. Benediktsson (1959).

¹⁵ Alternatively, Rischel (p. 265) suggests that “maybe it would be reasonable to say that ‘unrounded–rounded’ and ‘front–back’ combined into one distinctive opposition in low vowels.” Jakobson (1962 [1931]) proposed that in vowel systems where all front vowels are unrounded and all back vowels are rounded the two dimensions cannot be dissociated. H. Benediktsson (1967) combines them in the chart in Table 3 and also (1972: 148) in his analysis of the three-vowel unstressed system of the language of the FG.

¹⁶ Compare Moulton’s (1954: 5) analysis of the Gothic labial obstruents: “Two distinctive features characterize these three phonemes: a primary one of voice, which distinguishes voiceless /p f/ from voiced /b/; and a secondary one of occlusion, which distinguishes the stop /p/ from the spirant /f/.” He analyzes the Proto-Scandinavian obstruents similarly.

no such contrast in the lenis consonants, which could be realized as stops or fricatives depending on context. Thus, the ordering of the features was major place features \gg [fortis-lenis] \gg [stop-fricative], as illustrated in Figure 9. As with the vowels, each obstruent phoneme is represented by a separate rune in the older futhark.

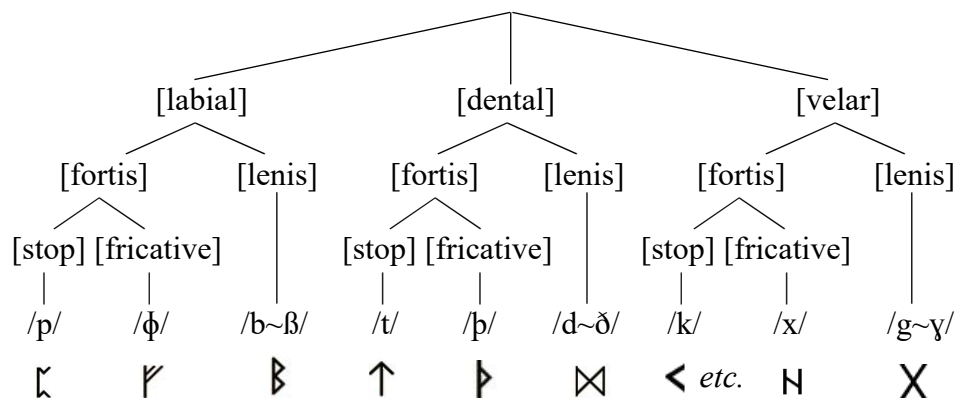


Figure 9. Proto-Scandinavian obstruent features

3.4 Transformation of the obstruent runes: the younger futhark

Rischel (1966) shows how a series of changes in the Proto-Scandinavian obstruent system led to a reorganization of the system of contrasts. Unlike the changes in the vowel system, the allophones of the original obstruents did not create additional phonemes. Rather, some allophones changed their phonemic membership. Drawing on Moulton (1954), Rischel shows how through changes such as devoicing, voicing, and the syncope of medial vowels, fortis and lenis consonants that had been in contrast (e.g. fortis [p] and lenis [ð]) came to be in complementary distribution and members of a single fricative phoneme (/p~ð/). At the same time, the stop ~ fricative contrast was extended to the lenis consonants; for example, stop [d] became a separate phoneme from fricative [ð]. The result was a contrast shift whereby [fortis-lenis] changed places with [stop-fricative], so that the feature hierarchy was major place features \gg [stop-fricative] \gg [fortis-lenis]. Now the fortis ~ lenis contrast holds only in the stops, as shown in Figure 10.¹⁷

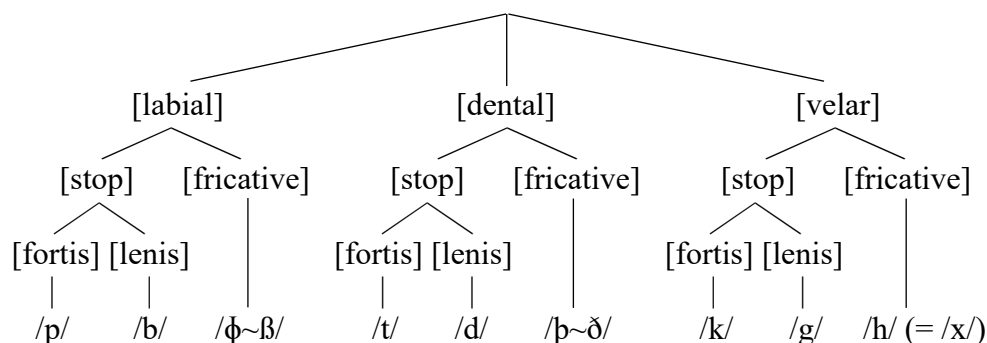


Figure 10. Old Scandinavian obstruent features

¹⁷ Compare Moulton (1954: 20): “the roles of primary and secondary feature had been reversed.” Occlusion became the primary feature and voice the secondary feature.

As with the vowels, the number of runes in the younger futhark was reduced, in this case from nine to six, although there remain nine phonemic obstruents in the language. The runes for **p** (𐌰), **d** (𐌦), and **g** (𐌆) were dropped, and the phoneme pairs /p, b/, /t, d/, and /k, g/ were each represented by one rune: **b** (𐌗), **t** (𐌦), and **k** (𐌃), respectively.¹⁸ Again, Rischel proposes that the younger futhark represents only the higher-ranked place and stop ~ fricative distinctions; it omits the fortis ~ lenis distinctions, as shown in Figure 11.

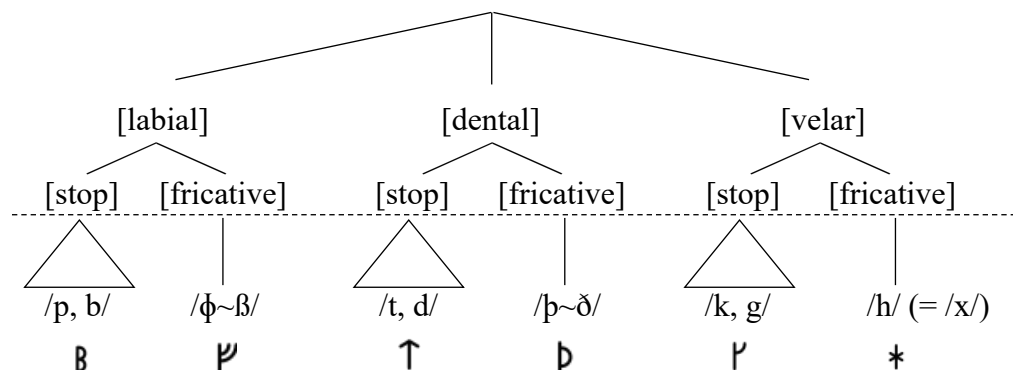


Figure 11. Younger futhark obstruent feature hierarchy

Morphophonemic alternations can also be cited in support of the new arrangement. Thus, although /p, b/, /t, d/, and /k, g/ remain separate contrasting phonemes, as a result of final devoicing the members of each pair came to alternate with each other; e.g., late Proto-Scandinavian *bindan ‘to bind’, past tense *bant, shows [d] alternating with [t].

While the analysis works well for the labials and dentals,¹⁹ Rischel (p. 269) writes that the “neat system of representation discussed here breaks down in the velars.” Instead of the voiced fricative [ɣ] being represented by the **h** rune, *, it is instead represented by the **k** rune, 𐌃. Rischel writes that it was already the practice in the oldest runes to represent [ɣ] by **k**, and that this may have to do with /h/ having lost its velar character.²⁰

3.5 Critiques of Rischel’s account of the runic transformation

Rischel (p. 257) did not expect that his phonological account would be enthusiastically received by runologists:

Phonological (phonemic) principles have been applied to this field of study before, notably by Trnka [1939], and Diderichsen (1945), although no

¹⁸ /p/ was rare in Germanic and the **p** rune was discontinued early (Schulte 2006: 42; Barnes 2012: 56). It is the loss of the **d** and **g** runes that is the biggest puzzle.

¹⁹ Barnes (2004) observes that the labial order was less consistent than the dental, and that the **b** rune 𐌗 continued to sometimes represent a fricative.

²⁰ The velar series was similarly out of step with the labials and dentals in Gothic. Moulton (1954: 7) writes, “The most likely hypothesis is that /h/ did not belong to the velar order at all, but was a glottal spirant.” It could be, then, that at some point the **k** rune came to represent [velar] and the **h** rune [glottal].

comprehensive analysis has been undertaken. Most runologists probably look upon this kind of approach without too much enthusiasm, and it is to be emphasized that the phonological notions of phonemicization, neutralization, etc. only help to illuminate the phenomena from one angle. We are faced with a problem of considerable complexity, and we must not overestimate the explanatory power of structural statements.

Rischel's account has indeed been criticized on various grounds. One concerns the term "runic reform" which occurs in the subtitle as well as in the text. Schulte (2006, 2009) has argued against the notion that the younger futhark came about as a result of a conscious or deliberate reform. He writes (Schulte 2009: 109) that it is "astounding" that Rischel puts the term "runic reform" in his title, and uses that label "unreservedly". His own view (Schulte 2009: 117) is that the younger futhark came about through "a successive development of graphemic substitution [...] rather than a mandated runic reform."

Though Rischel uses the term "reform", his approach is rather nuanced. He writes (pp. 255–256):

The classic conception of the change is that it is a gradual development and certainly not a deliberate reform made at a definite time. [...] There are, on the other hand, several features of the change which make it attractive to think of it as at least guided by meaningful principles if not carried out once and for all as a deliberate reform[...]"

This formulation is not so different from that of Schulte (2006: 68), that a "reliance on consistent principles largely determined the fate of the Scandinavian futhark." In a review of the issue, Barnes (2009: 136) suspects that "we are dealing not with absolutes but matters of definition" involving the meaning of "reform". Barnes (2012: 59) concludes, "on the basis of the evidence currently available some kind of conscious reform looks more probable than gradual attrition."

Runologists have argued that a phonological analysis does not by itself explain *why* the runic transformation occurred (Birkmann 1995: 198; Schulte 2006: 57). Rischel himself concedes that phonological notions "only help to illuminate the phenomena from one angle", and that other factors were involved in bringing about the changes in the futhark.

Schulte's own approach is that some runes became multifunctional (represented more than one phoneme) quite early, and multifunctionality then became a guiding principle (see also Barnes 2009, 2012). But this view is not at odds with Rischel's analysis; rather, Rischel's account shows *in what way* the runes of the younger futhark were multifunctional. The mapping from runes to sounds is not arbitrary, but has a coherent phonological rationale (Rischel, p. 258, emphasis original):

In the new system each rune stands for a class of phonemes, but the interesting thing is that these classes are *intrinsic* (structurally motivated) categories of the spoken language, and that they are not (or are only sporadically) intersecting.

Schulte (2006: 57) comments that Rischel’s model is “valid from a synchronic (static) point of view”. As a synchronic analysis, Rischel’s account illuminates the relation between the younger futhark and the phonology, however that came about.

4 Towards a theory of contrastive feature hierarchies

4.1 Criteria for ordering features into a hierarchy

In the 1960s, contrastive feature hierarchies, also known as branching trees, had the status of a sort of orthodoxy among phonologists who paid attention to the work of Jakobson, Halle, and their collaborators. Thus, Rischel (pp. 263–264) writes:

Recent analyses of phoneme systems into distinctive features generally appear in the form of branching diagrams, in which the distinctive oppositions among the phonemes ... form a hierarchy. The idea of hierarchy implies that some items are considered prior to, or more basic than, others.

If features are put into a hierarchy, we need to have criteria that tell us what the feature hierarchy is for a given inventory. As we saw in §2, this aspect of the theory was not at all clear. In a survey of publications that tacitly or explicitly alluded to feature hierarchies, Drescher (2016) finds three main principles for ordering features, listed in (3).

- (3) *Criteria for ordering features found in the literature (Drescher 2016: 1)*
- a. *Activity*: Features are ordered so as to identify the specifications that are relevant to the phonological computation (that is, the features assigned should reflect the way phonemes pattern in the language).
 - b. *Minimality*: Features are ordered to minimize redundancy in phonological representations and to maximize the amount of information conveyed by each feature.
 - c. *Universality*: It is hypothesized that there is a universal feature ordering which expresses universal tendencies in the nature of phonological inventories and in the order of acquisition of feature contrasts.

The principles in (3) conflict in practice: an ordering that reflects phonological patterning in a given language (3a) may not minimize the number of feature specifications (3b); phonological universals assumed by (3c) may not exist, and any proposed universal feature ordering may give results different from those guided by (3a) and (3b). Moreover, these criteria do not appear to have been widely known. Therefore, Rischel sets out to develop his own criteria. I summarize his proposals in (4).

- (4) *Criteria for ordering features* (Rischel: 264–265)
- a. *Coverage*: A distinction that affects a greater part of the system must be hierarchically superordinate to one that affects a lesser part.
 - b. *Subsystems*: If a subsystem utilizes only some of the distinctions utilized by the entire system, then, everything else being equal, these distinctions must be the basic ones.

According to criterion (4b), the vowel distinctions used by the reduced subsystem in unstressed syllables should be the most basic (i.e., the highest ranked). Rischel adds that these criteria may not always be applicable, and may not be the most important ones. He concludes (p. 271), “We have as yet no well-developed theory about rank ordering of distinctive features; all we can do is to consider the problem from various aspects and to weigh the various criteria as best we can.”

There is evidence that Rischel had been thinking about this issue for some time. In 2007, Nina Grønnum interviewed him in connection with the collection of his writings that appeared as Rischel (2009). According to the interview notes on the runic reform article, Rischel stated that he had been interested in feature theory (Danish *trækteori*) since the late 1950s and through the 1960s, and had submitted an article to *Word* about the hierarchization of features in the early 1960s. He goes on (translation slightly rephrased from the Danish):²¹

When at the time I tried to argue that it was possible to provide a justified hierarchization of the features and not an arbitrary one (as was often done), one not based on which features were major and minor and so on, but based on how they worked in the individual language ... my point of view was that features that function in many different structurally relevant positions – à la Twaddell – are ranked higher than features that only function in a few positions.

In other words, Rischel argued that the ordering of the features in a language should be based on the phonological patterning, or activity, displayed by the language (how they worked in the individual language), as in (3a). The article was never published, however, because *Word* wrote back that it was too long, and should either be expanded into a monograph or shortened. Rischel said that he went on to write other things and did not return to this article. As we will see in the next section, Rischel’s approach anticipated by some fifty years a central tenet of Contrastive Hierarchy Theory. It is truly unfortunate that his article was never published, because I am not aware of any other attempts in that period to make explicit the principles for ordering features into a hierarchy.

²¹ “Hvor jeg på det tidspunkt forsøgte at argumentere for at man kunne give en begrundet og ikke en vilkårlig — som man tit gjorde — begrundet hierarkisering af trækkene, ikke ud fra hvilke der var major og minor og så videre, men ud fra hvordan de fungerede i det enkelte sprog ... da var mit synspunkt det at træk som fungerer i mange forskellige strukturelt relevante positioner — à la Twaddell — er højere rangeret end træk som kun fungerer i få positioner.”

4.2 Contrastive Hierarchy Theory

It is reasonable to suppose that the lack of discussion of the foundations of branching trees contributed to their demise. For despite their prominence in the 1950s and 1960s, in the years after the publication of *The Sound Pattern of English* (Chomsky & Halle 1968) contrastive feature hierarchies virtually disappeared from phonological theory for the rest of the twentieth century, for reasons discussed by Dresher (2009: 76–102). Contrastive feature trees made sporadic appearances (Cairns 1988; Boersma 1998) before they were more systematically revived by G. N. Clements (2001, 2009) and, independently, by phonologists at the University of Toronto and colleagues (Dresher et al. 1994; Dyck 1995; Zhang 1996; Dresher 1998, 2009; Hall 2007, 2011; Mackenzie 2011, 2013; Ko 2010, 2011, 2018; Spahr 2014; Oxford 2015; Krekoski 2017; among others). The latter approach was initially called Modified Contrastive Specification; I refer to it now as Contrastive Hierarchy Theory.

Contrastive Hierarchy Theory is an effort to fill out the theory that underlies analyses such as Rischel’s account of the Scandinavian runes. Some tenets of the theory are given in (5).

- (5) *Some principles of Contrastive Hierarchy Theory*
- a. *The Successive Division Algorithm* (Dresher 2009: 16): Assign contrastive features by successively dividing the inventory until every phoneme has been distinguished.
 - b. *Variability of feature ordering*: Feature hierarchies are language particular.
 - c. *The Contrastivist Hypothesis* (Hall 2007: 20): The phonological component of a language operates only on contrastive features.

Principle (5a) reiterates that features are assigned in a hierarchical order, and (5b) states that feature ordering is not universal, but language particular (contrary to (3c)). The Contrastivist Hypothesis (5c) posits that the contrastive features assigned by the procedure in (a) are the *only* features that the phonology can operate on. That is, new noncontrastive features cannot simply be added as needed in the phonological component. This hypothesis establishes a tight connection between contrast and phonological activity, in the sense of (3a): if only contrastive features can be active, then features should be ordered in such a way that the active features are all contrastive.²²

A working definition of phonological activity is given in (6).

- (6) *Phonological activity* (adapted from Clements 2001: 77)
- A feature can be said to be *active* if it plays a role in the phonological computation; that is, if it is required for the expression of phonological regularities in a language, including both static phonotactic patterns and patterns of alternation.

²² Thus, minimization of feature specifications (3b) is *not* the main motivation for underspecification in this approach, unlike some other underspecification theories discussed by Sullivan (1998); see further Dresher (2015) and Dresher & Hall (2021).

I believe that principle (3a), mentioned by Rischel in the interview notes, is the main criterion that Rischel (1966) actually used in determining the feature hierarchies for early and later Scandinavian. Thus, his hierarchies are based on the phonological patterning, that is the activity, exhibited by the language, supplemented by orthographic evidence from the futhark.

4.3 The addition of noncontrastive features: enhancement

The distinctive features hierarchically generated by a branching tree are underspecified, and thus have to be supplemented by additional noncontrastive features in order to become pronounceable speech sounds. Stevens et al. (1986) propose that feature contrasts can be *enhanced* by other features with similar acoustic effects (see also Keyser & Stevens 2006). Our hypothesis is that enhancement takes place after the contrastive phonology, when further phonetic detail is specified (see Hall 2011 for elaboration).

Though redundant, such noncontrastive features play an important role in synchronic and diachronic phonology, because a feature that begins as a noncontrastive enhancement can at a later time be acquired by a new generation as a contrastive feature. Dresler (2018, to appear) argues that this development was central to the phonologization of *i*-umlaut in West Germanic.

5 Conclusion

I have tried to situate Rischel's article on the Scandinavian runes in a wider theoretical context. Thinking in terms of feature hierarchies was a significant strand of phonological theory in the twentieth century, and played an important role in synchronic and diachronic studies of Germanic in particular. Nevertheless, a theory of feature hierarchies—that is, a study of the principles that govern the ordering of features—never quite materialized, and often remained in the background of analyses that relied on them. In this context, Rischel's article provided not only an interesting application of feature hierarchies to a problem in Scandinavian runology, but also a refreshingly explicit discussion of the theory of feature hierarchies itself.

With the revival of interest in feature hierarchies in the twenty-first century, Germanic languages have again been proving to be a fertile area in which to explore the synchrony and diachrony of such hierarchies. They provide a challenging test of the validity of theories of feature ordering and contrastive underspecification, and the interplay between contrast and activity. Relevant work on West Germanic and Old English includes, in addition to the publications mentioned in the previous section, Purnell & Raimy (2015) and Purnell et al. (2019).

Studies of North Germanic phonology that make use of feature hierarchies include: Voeltzel (2016) on Faroese and Icelandic consonants and vowels; Schalin (2017, 2018, 2021, 2024) on early Scandinavian vowel systems and how they developed in eastern and western dialects; Natvig (2018) on Norwegian vowel systems; and Sandstedt (2018) on Old Norwegian vowel harmony. These studies have been providing new insights that make it worthwhile to revisit the analyses of Proto-Scandinavian and Old Scandinavian

pioneered by Rischel and others in the last century. However, that is a project I cannot pursue here.

I will conclude by reiterating Rischel's comment (p. 271) that "We have as yet no well-developed theory about rank-ordering of distinctive features". Though research into contrastive feature hierarchy theory was abandoned shortly after Rischel wrote those words, almost sixty years later we can again hope to make progress on this question.

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