Transparency and blocking in
Old Norwegian height harmony

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Abstract

This paper provides a new phonological and philological analysis of previously unexplained disharmonic patterns in Old Norwegian height harmony. Old Norwegian displays cross-linguistically rare forms of blocking and transparency, which under traditional assumptions of Old Norwegian vowels and vowel harmony are both phonologically and orthographically irregular. I show that these patterns make perfect phonological sense if we reinterpret the Old Norwegian neutral vowels *æ–ǫ* as [−low, −ATR] /ɛ, ɔ/ and assume that Old Norwegian height harmony was relativized to [high] contrastive visibility and bounded by high-sonority elements, resulting in the transparency of [high] non-contrastive items and blocking by high-sonority [+low] vowels. This featural interpretation fits with the later diachronic development of Old Norwegian vowels and additionally helps explain patterned spelling variation found in both roman and runic writing.

1. INTRODUCTION

Vowel harmony represents constraints on what are possible and impossible vowel sequences in a language for which there are both articulatory and perceptual motivations (Walker 2005), and yet it is not unusual for harmony languages to feature systematic disharmony through skipping, blocking, and other locality effects. How neutral harmony patterns are to be explained raises a number of fundamental questions about the nature and organization of harmony systems, and in this paper I explore some intricate underdescribed examples in 12th–13th-century Old Norwegian which illustrate the role vowel contrastivity, sonority, and intervening featural under/specification can play in deriving surface disharmony. Old Norwegian featured height harmony, traditionally characterized as the lowering of non-initial /i, u/→[e, o] following non-high vowels, but height harmony uniquely fails to occur for unknown reasons following the short vowels *æ* and *ǫ* and behaves inconsistently following derivational and definite suffixes. These exceptional behaviors were first documented already in the earliest descriptions of Old Norwegian vowel harmony (Keyser & Unger 1849; Hægstad 1899, 1907) and have been extensively studied in later investigations (Hagland 1978a, Rajić 1980, Grønvik 1998, Majors 1998, S. Johnsen 2003, Myrvoll 2014)—but the causes of these neutral harmony patterns remain a classical problem in Old Norwegian phonology.

In this new analysis, I demonstrate that traditional reconstructions of Old Norwegian neutral vowels are incompatible with their phonological and orthographic behavior, and I propose featural reinterpretations which are much more consistent with their phonological patterning and which

help explain recurring spelling variation in both roman and runic writing. Using Nevins' (2010) principles-and-parameters approach to vowel harmony, I argue that Old Norwegian height harmony was relativized to [high] contrastive items and bounded by high-sonority elements, causing the transparency of non-contrastive vowels and blocking by high-sonority [+low] vowels. These newly identified blocking patterns constitute an important example of cross-linguistically rare sonority threshold effects on vowel harmony (so-called *sonority hurdles*; Nevins 2010: pp. 168–90). The study of Old Norwegian neutral harmony patterns therefore contributes important empirical data on harmony blocking and is very informative in refining our understanding of Old Norwegian vowels and vowel harmony.

1.1.   Old Norse vowels

A common problem in reconstructing historical and pre-historical stages of languages is that the available evidence often provides us with an incomplete picture. Since it is difficult to reconstruct variation and because there is a "tendency of handbooks [and linguists, JJS] to prefer order to chaos" (Barnes 1997: p. 40), our historical models are often overly uniform, abstracting away from the kind of diversity and complexity we find in living languages. This can lead to problems not only in the representation of historical linguistic units but can inhibit our understanding of their grammatical behavior as well. A study of Old Norse vowels and vowel harmony provides an excellent example of this.

Early West Norse dialects (*c.* 12th-century Old Icelandic, Old Norwegian, Old Faroese, and Old Norn) are commonly reconstructed at their point of departure as having a highly symmetric stressed vowel inventory: nine qualitatively distinctive monophthongs—each contrastive for length—as schematized below using normalized Old Norse representations (Küspert 1988: p. 170; Schulte 2002; Kristoffersen & Torp 2016: p. 118). This is a phonological interpretation of the basic vocalic inventory proposed by the *First Grammatical Treatise* of Iceland (AM 242 fol.), a mid-12th-century work on Old Icelandic phonology and orthography.[1]

(1)   Old Norse stressed vowels

[−back, −rd]	[−back, +rd]	[+back, −rd]	[+back, +rd]	
i	y		u	[+high, −low]
e	ø		o	[−high, −low]
æ		a	ǫ	[−high, +low]

For historical languages like Old Norse, the number of contrastive vowels, their features, and phonemic–graphemic correspondences are all matters of reconstruction and were geographically and chronologically variable. For a summary and critique of the various solutions that have been proposed for different stages in Nordic language development, see Hreinn Benediktsson (1974) and citations therein. The above inventory provides a parsimonious fit with traditional philological evidence—from the accounts of contemporary grammatical descriptions (Hreinn Benediktsson 1972, Raschellà 1982), the distribution of characters in Roman and runic writing (e.g. Spurkland 1993), the rhymes and metrical properties found in Eddic and scaldic poetry (e.g. Kristján Árnason 1980, Gade 1995), and internal and comparative evidence from contemporary and modern Nordic dialects (e.g. Garmann 2008). In addition to this evidence, the representations in (1) and their corresponding distinctive features make predictions about phonological behavior. This is an additional kind of evidence which can be used to refine our understanding of historical speech sounds but which has not been adequately exploited in previous literature. If we inspect the way in which Norse vowels phonologically pattern—for instance, in the height harmony system of Old

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[1]There were additionally three diphthongs in Old Norwegian—/au, ei, øy/—which for simplicity's sake are not included in this presentation.

Norwegian—we will find that their behavior is considerably more complex than this orderly distribution would predict. As I demonstrate in the following sections, using typological and theoretical linguistic insights coupled with detailed philological study, we can make substantial improvements to traditional models of Old Norwegian vowels and vowel harmony.

1.2. *Old Norwegian vowel harmony*

Very generally defined, vowel harmony is a process in which vowels in a word show systematic correspondence for some feature. Central dialects of Old Norwegian (*c* 12th–14th centuries) featured height harmony, resulting in suffixal alternations of *i/e* and *u/o* in unstressed (non-initial) syllables (Hødnebø 1977). The basic harmony pattern is that non-initial [+high] vowels follow [+high] vowels while non-initial [−high] vowels follow [−high] vowels as shown with normalized spellings in (2), which shows phonologically-driven alternations in DAT.SG./PL. inflections. Orthographic data are provided in angle brackets; acute accents represent long vowels.[2]

(2) Height harmonic [-i]/[-e] and [-um]/[-om] alternations
a.	ˈskip-i	*ˈskip-e	\<ʃkɪpɪ\>	ship-DAT.SG.
b.	ˈhús-i	*ˈhús-e	\<huʃi\>	house-DAT.SG.
c.	ˈsegl-e	*ˈsegl-i	\<ʃegle\>	sail-DAT.SG.
d.	ˈorð-e	*ˈorð-i	\<orðe\>	word-DAT.SG.
e.	ˈmál-e	*ˈmál-i	\<male\>	matter-DAT.SG.
f.	ˈland-e	*ˈland-i	\<lande\>	land-DAT.SG.
g.	ˈskip-um	*ˈskip-om	\<ʃkɪpum\>	ship-DAT.PL.
h.	ˈhús-um	*ˈhús-om	\<huʃū\>	house-DAT.PL.
i.	ˈsegl-om	*ˈsegl-um	\<ʃeglō\>	sail-DAT.PL.
j.	ˈorð-om	*ˈorð-um	\<orðom\>	word-DAT.PL.
k.	ˈmál-om	*ˈmál-um	\<malō\>	matter-DAT.PL.

Two vowels are exceptional to this pattern. These are the short variants of normalized orthographic *æ–ǫ*, which are represented variably in Old Norwegian manuscripts as \<æ, e\> and \<o, a\>, respectively.[3] These vowels have been interpreted above as [−high] and are neutral to height harmony; that is, they are invisible to the harmony process and are followed as a default by [+high] vowels.

(3) Neutral short *æ* and *ǫ*
a.	ˈsæt-ti	*ˈsæt-te	\<ʃætɯɪ\>	set-PRET.INDIC.3.SG.
b.	ˈsæt-tu	*ˈsæt-to	\<ʃætɯu\>	set-PRET.INDIC.3.PL.
c.	ˈsǫðl-i	*ˈsǫðl-e	\<ʃoðʒlɪ\>	saddle-DAT.M.SG.
d.	ˈsǫð-ul	*ˈsǫð-ol	\<ʃaðul\>	saddle-ACC.M.SG.

This neutral behavior was widespread across Old Norwegian harmony dialects and has been well-documented in 12th–13th-century textual material (Keyser & Unger 1849; Hægstad 1899, 1907; S. Johnsen 2003). Though the pattern is well known in Norse philological circles, the cause of

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[2]Old Norwegian height harmony featured considerable geographic and chronological variation which is still poorly understood. For the sake of uniformity, unless otherwise indicated, I have collected the data in this paper from the *The Legendary Saga of St. Olav* (De la Gardie 8, 70v–110v — *c* 1225–50). See O. A. Johnsen (1922) and Holtsmark (1956) for editions. An electronically searchable lemmatized diplomatic transcription is available in the Medieval Nordic Text Archive: http://www.menota.org/. Digital facsimiles are available from Uppsala University: http://www.alvin-portal.org/alvin/.

[3]These vowels feature considerably more spelling variation than other vowels in Old Norwegian writing and are occasionally also represented digraphically—\<ei, au\>—and with diacritics or as ligatures—\<ę, ⱥ, ai\>. The implications of this spelling variation for reconstructions of Old Norwegian vowels are further explored in section 2.2.2.

this harmony neutrality remains to be explained. These patterns are unexpected for a number of reasons: both vowels are interpreted as [+low] vowels in Old Norwegian since they were historically derived via the leftwards fronting and rounding (*i/j*- and *u/w*-umlaut) of Proto-Norse *a (e.g. *sætja* "set" < *satjan and *sǫðull* "saddle" < **saðula*ʀ); and there is no other secondary feature or obvious characteristic which should make these vowels neutral to height harmony. That is, given the representations in (1), we would expect these vowels to initiate [−high] harmony like any other non-high vowel in Old Norwegian.

Previous analyses of these exceptional patterns have relied on highly complex and unlikely harmonic rules (Hagland 1978a,b; Rajić 1975, 1980) or on typologically rare and unlikely phonological representations (Grønvik 1998), none of which has received any consensus (Myrvoll 2014). Both Hagland (1978a,b) and Rajić (1975, 1980) have proposed similar quasi-phonetic explanations for the lack of harmony following short *æ–ǫ* vowels. Both argue that height harmony in Old Norwegian is restricted in various ways following low vowels since cross-linguistically "VH [= vowel harmony] only seems to operate on phonologically closely related vowels" (Hagland 1978a: p. 143). In other words, /i, u/ lower to [e, o] following mid vowels as a result of height harmony (e.g. /ˈorð-i/→[ˈorðe]) but low vowels behave differently since they are either not phonologically similar enough (Hagland 1978a) or phonologically too distant (Rajić 1980) from /i, u/ to initiate height harmony. Instead, we find two harmony patterns for long and short low vowels. Long low vowels are analyzed either as initiating height harmony (Rajić 1980) or as causing the reduction of subsequent unstressed vowels to [e, o] due to the "high intensity of articulation for such [i.e. low] vowels resulting in comparatively little stress on the vowel of the subsequent syllable" (Hagland 1978a: p. 144; cf. Rajić 1980: pp. 319–20). That is, for Hagland vowel lowering on the surface is caused by two independent processes: harmony following mid vowels and reductions following low vowels. No lowering or reductions however occur in cases like [sætti] or [sǫðul] in (3) since these vowel pairs are either "phonologically too similar" to initiate reductions (Hagland 1978a: p. 145) or phonologically too distant to initiate harmony (Rajić 1980). There are a number of problems with these analyses.

First, we know now from greater typological coverage that vowel harmony does not only operate on "phonologically closely related vowels". Harmony is conditional on featural similarity in some languages which have so-called *parasitic harmony systems*—such as Yowlumne (Yokutsan) where rounding harmony only occurs if trigger and target vowels are similar in vowel height and is blocked otherwise (Steriade 1981, Cole & Trigo 1988)—but it is not the norm, and the lowering of /i, u/→[e, o] following low vowels is found elsewhere—for example, in Buchan Scots (Paster 2004) and many Bantu languages (Hyman 1999: p. 242). So there is no *a priori* reason to assume that lowering of /i, u/→[e, o] following [+low] vowels in Old Norwegian is not height harmony or should require special length conditioning. Indeed, both analyses falsely predict that short [+low] [a] should be neutral to harmony (2f) and both Hagland and Rajić are therefore forced to make the ad hoc assumption that this vowel had greater duration than other short low vowels and therefore patterns like long low vowels (cf. Myrvoll 2014: p. 16). Second, there is little independent motivation for these interpretations. Both Hagland and Rajić split vowel harmony into two processes following low and non-low vowels only in order to achieve a kind of operational gap where neither harmony nor reduction occurs following *æ–ǫ* vowels, but the only real phonological evidence for these interpretations are the harmony neutral patterns in (3) these analyses are supposed to explain.

As we currently understand Old Norwegian vowels and vowel harmony, it is thus difficult to find a non-arbitrary grammatical explanation for these neutral harmony patterns, and Grønvik (1998) has therefore proposed an alternative diachronic explanation. He assumes that the initial phonemicized products of Proto-Norse umlaut were short diphthongs /æⁱ, ǫᵘ/ (e.g. *sæⁱtja* < *satjan and *sǫᵘðull* < **saðula*ʀ), and that these diphthongs patterned as [+high] vowels in the height harmony system due to their [+high] [ⁱ, ᵘ] off-glides: e.g. [+high] harmonic [ˈsæⁱtti]. As evidence for these reconstructions, he cites digraphic <ei, æi, au> spellings in a variety of early manuscripts and

runic inscriptions—e.g. <sæitia>–*sætja* "set" or <gaurðum>–*gǫrðum* "yard" (Noreen 1970: p. 92; cf. Knudsen 1967). Grønvik argues that these digraphic spellings only rarely occur elsewhere because short diphthongs were monophthongized at an early stage to [+low] *æ–ǫ*, but we can still infer their existence because of the [+high] harmony patterns they left behind.

As with previous proposals, there is little independent motivation for these new reconstructions. As I demonstrate in section 2.2.2, digraphic spellings in roman and runic writing can be much more simply interpreted as a lack of a one-to-one correspondence between Old Norwegian phonemic and graphemic inventories. Furthermore, apart from the harmony patterns in (3), there is no other phonological evidence for these short diphthongs, and Grønvik (1998) does not explain why height harmony patterns did not change following the monophthongization of [+high] *æⁱ–ǫᵘ* > [+low] *æ–ǫ*. We must make the radical assumption, as do Kristoffersen & Torp (2016: p. 130), that "the suffixal vowels *i* and *u* following short *æ* and *ǫ* are not vowel harmony at all, but simply relics of an older vowel system" (*endingsvokalane* i *og* u *etter kort æog ǫ ikkje er vokalharmoni i det heile, men rett og slett relikt av eit eldre vokalsystem*). But this assumption would either require positing etymologically conditioned harmony patterns, for which there are no cross-linguistic parallels, or demoting all vowel harmony in Old Norwegian to the morphology (cf. Hreinn Benediktsson 1964: pp. 97–100), and these are quite drastic steps to take over two problematic neutral vowels.

As the foregoing discussion illustrates, we have been unsuccessful thus far at finding a phonological analysis that adequately explains the unique neutral harmony behavior of *æ–ǫ* vowels in Old Norwegian in a way that is simultaneously consistent with other phonological and philological evidence. But apart from these aforementioned issues, there are a number of further complications that have not yet received much attention in previous literature. First, according to these data, length must play a crucial role in Old Norwegian harmony, given that the short vowels *æ–ǫ* are neutral while their long counterparts *ǽ–ǿ* are not (4).

(4) Neutrality–length correlations
   a. ˈsætti *ˈsætte <ʃæʍɪ> set-PRET.INDIC.3.SG.
   b. ˈsǽtte *ˈsǽtti <ʃæʍe> reconcile-PRET.INDIC.3.SG.
   c. ˈjǫrðum *ˈjǫrðom <ʃarðuŋ> earth-DAT.PL.
   d. ˈtǿrom *ˈtǿrum <ʈarō> tear-DAT.PL.

This is however a highly suspicious pattern. There is little typological evidence that harmony neutrality like this can be conditioned or constrained by differences in vowel length alone in the absence of other qualitative or prosodic differences (Gunnar Ólafur Hansson 2001: pp. 245–51), and it is likely that harmony processes only have reference to segmental features and not higher prosodic positions. If this is correct, and if we represent vowel length as an association between segments to higher-level timing units (Hyman 1985, McCarthy & Prince 1996), then harmonically different behaviors are not predicted to be possible in near minimal pairs like in (4) since the stressed vowels in these examples are featurally identical on the root tier, as shown in (5).

(5) Moraic representations of vowel length in Old Norwegian

5
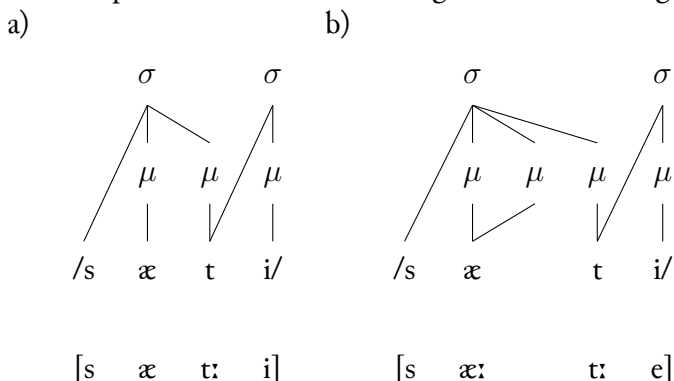
This therefore constitutes a very interesting and rare pattern whereby neutral harmony patterns are minimally dependent on vowel length, but it is unclear how such a pattern can be accommodated in existing vowel harmony models. Even if we were to treat vowel length as a distinctive feature such that the class of neutral vowels in Old Norwegian could be distinctly defined as [−long, +low] vowels, we run into further problems because, as mentioned previously, not all [−long, +low] vowels are neutral to height harmony in Old Norwegian. Unlike the vowels *æ–ǫ*, short *a* not only initiates harmony in stressed syllables (6ab) but even blocks rightwards [+high] harmony in unstressed positions (6cd): e.g. [ˈdýrk-að-**e**], not *[ˈdýrk-að-**i**]. There are thus three [−long, +low] vowels which display two different harmony behaviors: short *a* is harmonic while short *æ–ǫ* are harmonically neutral. This raises the question, what is the crucial difference between *a* and *æ–ǫ* that drives these differing harmony behaviors? Given the traditional representations in (1), it is not obvious what this could be.

(6)   Blocking *a*
       a.   ˈhaf-ðe   *ˈhaf-ði   \<haꝼðe\>   have-PRET.INDIC.3.SG.
       b.   ˈsag-ðe   *ˈsag-ði   \<ſagðe\>   say-PRET.INDIC.3.SG.
       c.   ˈrit-að-e   *ˈrit-að-i   \<ritaðe\>   write-PRET.INDIC.-3.SG.
       d.   ˈdýrk-að-e   *ˈdýrk-að-i   \<ðýrkaðe\>   worship-PRET.INDIC.-3.SG.

In summary, following traditional assumptions of Old Norwegian vowels and vowel harmony, the class of neutral vowels in Old Norwegian is typologically very irregular and resists a straightforward definition. According to the conventional inventory in (1) it is specifically [−long, αback, αround, +low] vowels—i.e. *æ/ǫ*—which fail to initiate harmony, and the reasons for this are very unclear. The patterns and problems discussed in this section illustrate that a working solution will need to be able to account for the following patterns: *a) æ/ǫ*–harmony neutrality: sætti–sǫðul; *b) a*–blocking patterns: ritaðe—dýrkaðe; and *c)* the length correlation between *æ/ǫ*–neutrality and *ǽ/ǿ*–harmony. This paper provides a new analysis of Old Norwegian vowels and vowel harmony which explains these neutral patterns as instances of transparency of [high] non-contrastive elements and blocking by sonority hurdles.

The rest of the paper is organized as follows. The theoretical assumptions which underlie my harmony analysis are presented in section 2.1. I argue that the harmony patterns described above are not compatible with the vocalic inventory presented in (1), and I propose revised representations of Old Norwegian vowels in section 2.2. The broader phonological and philological evidence for these revisions are explored in the rest of section 2, and I provide a new analysis of Old Norwegian height harmony in section 3 which is shown to be typologically much more consistent with common harmony systems. A final summarization of the results of this study are given in section 4.

2.   THEORETICAL ASSUMPTIONS

2.1.   *Modelling harmonization*

Very generally defined, vowel harmony is a process in which vowels within some domain over some distance show systematic correspondence for some feature. Within this very general definition there is substantial cross-linguistic variation in what domain and over what distance correspondence occurs, what set of features may be involved, and what segments may transparently and defectively intervene. In exploring the common conditions underlying harmony variation in Old Norwegian and other languages, I adopt a vowel harmony model recently proposed by Nevins (2010) with some modifications described below. This framework has a strong typological focus and makes clear predictions about what kinds of neutral harmony patterns are cross-linguistically possible and under what conditions they can arise. This is a very useful tool for uncovering the potential causes of Old Norwegian neutral harmony patterns because while Old Norwegian textual material

displays consistent harmony patterns, the features of the individual vowels involved and therefore the conditions under which different harmony behaviors occur need to be phonologically interpreted.

This is a target- or recipient-centric model of vowel harmony which assumes that harmonization is initiated by value-seeking elements unspecified for some feature. This differs significantly from existing trigger- or donor-centric models such as agreement by correspondence (Baković 2000, Krämer 2003) or feature spreading (Goldsmith 1976, Gafos 1996), both of which interpret vowel harmony as the requirement of surface correspondence *to* or the spreading of some feature *from* a trigger to target vowel. In Nevins' (2010) framework, a segment (the harmony recipient) which is unspecified and therefore uninterpretable for some feature initiates a search in some or all directions for the closest suitable donor within its domain which can provide a feature-value to copy from. That is, the vowels which undergo harmony initiate harmonization.

This is a principles-and-parameters theory of vowel harmony, and variation across harmony languages is limited by language-particular parameter settings which restrict the scope within which harmony occurs or which set conditions on what constitutes a viable source for feature-copying. Intersegmental relationships are defined by traditional binary features (Chomsky & Halle 1968), and harmony derivations are treated in terms of classical (rule-based) generative phonology (Chomsky & Halle 1968, King 1969). The harmonization procedure is formalized as follows:
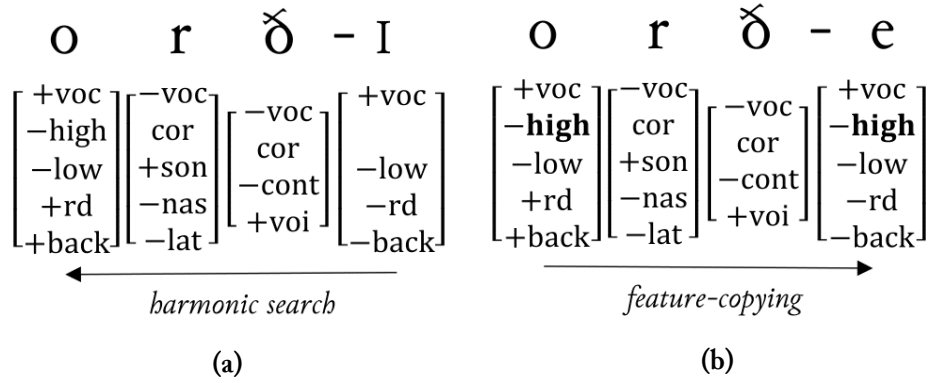
(7)　Harmonic Search-and-Copy procedure, in two steps (Nevins 2010: p. 26)
　　1.　Find: x = the closest τ to the recipient y in the direction of δ
　　2.　Copy: the value of F on x onto y, where x, y are segments,
　　　　F is a feature, τ is a predicate over segments.

In languages which feature constraints on the harmony procedure with regard to what domain, over what distance, and with what segments harmony may occur, there is always an intrinsic asymmetry with regard to the harmony feature. In cases where these requirements are not met— where no suitable value-source is available—value-seeking elements surface with a default-value which is specified in the harmony procedure, represented here by a parenthetical setting (e.g. F = [(+)high]). For ease of illustration, I use capitalization as a shorthand represention for unspecified segments (e.g. /-U/ [__high, −low, +back, +round]). In the way of a simple example, the basic Old Norwegian height harmony patterns in (2) can be defined as below. This entails that Old Norwegian unstressed vowels which are unspecified for the harmony feature (F = [(+)high]) will search leftwards (δ = left) for the closest value-source of [±high] to copy from. I assume that all [high] unspecified suffixes generalize this pattern.

(8)　Old Norwegian unstressed vowels must:
　　High-Harmonize: δ = left, F = [(+)high]

As illustrated below using Old Norwegian /ˈorð-I/ *word*-DAT.N.SG., in the first step of the derivation, the dative suffixal vowel starts out unspecified for [high] and searches leftwards for the closest viable source to copy from. It finds [−high] on the stressed vowel /o/ and copies this value, surfacing as [−high] [e]. As can be seen from this example, a *leftwards* harmonic search procedure results in what we traditionally consider *rightwards* vowel harmony.

Figure 1: Height harmonization in Old Norwegian

$$\text{o} \quad \text{r} \quad \text{ð} - \text{I} \qquad\qquad \text{o} \quad \text{r} \quad \text{ð} - \text{e}$$

(a) o r ð – I

$$\begin{bmatrix} +\text{voc} \\ -\text{high} \\ -\text{low} \\ +\text{rd} \\ +\text{back} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ \text{cor} \\ +\text{son} \\ -\text{nas} \\ -\text{lat} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ \text{cor} \\ -\text{cont} \\ +\text{voi} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\text{low} \\ -\text{rd} \\ -\text{back} \end{bmatrix}$$

$\longleftarrow$
harmonic search

(a)

(b) o r ð – e

$$\begin{bmatrix} +\text{voc} \\ -\textbf{high} \\ -\text{low} \\ +\text{rd} \\ +\text{back} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ \text{cor} \\ +\text{son} \\ -\text{nas} \\ -\text{lat} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ \text{cor} \\ -\text{cont} \\ +\text{voi} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\textbf{high} \\ -\text{low} \\ -\text{rd} \\ -\text{back} \end{bmatrix}$$

$\longrightarrow$
feature-copying

(b)

As this presentation illustrates, different harmony patterns result from different parameterizations on a language's harmony system, and using this framework I explore in the following sections what mechanisms underlie the different forms of harmony and disharmony found in Old Norwegian. Key to this analysis is a reinterpretation of the harmony neutral *æ–ǫ* vowels, as discussed in the following section.

2.2. Representational assumptions

As shown above, the basic harmony patterns in (2) can be straightforwardly analyzed. The main challenge posed by the Old Norwegian harmony patterns in section 1 is to uncover what property in contrast to other [+low] vowels makes *æ–ǫ* neutral to height harmony. I argue that this is not possible with existing Old Norwegian vocalic representations since harmony neutral *æ–ǫ* vowels are featurally identical to harmonic *ǽ–ǿ* in models like that in (1)—i.e. *æ–ǽ* [−high, +low, −back, −rd] and *ǫ–ǿ* [−high, +low, +back, +rd]—and the differing harmony patterns between short [+low] harmonic *a* and non-harmonic *æ–ǫ* vowels can only be derived by very complex and ad hoc mechanisms. In order to reconcile these issues, I have reinterpreted harmony neutral *æ–ǫ* vowels as [−low, −ATR] /ɛ, ɔ/. The full monophthong inventory and corresponding graphic representations for *The Legendary Saga of St. Olav* manuscript are presented in (9). The earlier distinction between normalized Old Norse *á* /aː/ and *ǫ́* /ɒː/ was lost by the time of this manuscript's writing—e.g. normalized *ráð*-SG. <rað> vs. *rǫ́ð*-PL. <rað> "counsel"—and the result of this merger is represented here by standard /ɒː/, but all other representations remain the same. Thus, according to this model, in stressed (initial) syllables mid-13th-century Old Norwegian featured eleven qualitatively distinctive monophthongs, asymmetrically contrastive in length.

(9) Revised Old Norwegian vowel inventory

[−bk, −rd]		[−bk, +rd]		[+bk, −rd]		[+bk, +rd]		
/i, iː/	<i>	/y, yː/	<y>			/u, uː/	<u>	[+hi, −lo, +ATR]
/e, eː/	<e>	/ø, øː/	<œ>			/o, oː/	<o>	[−hi, −lo, +ATR]
/ɛ/	<æ, e>					/ɔ/	<o, a>	[−hi, −lo, −ATR]
/æː/	<æ>			/a/	<a>	/ɒː/	<a>	[−hi, +lo, −ATR]

The harmonic behavior of Old Norwegian vowels provides the main motivation for these representational revisions, which is further explored in section 3, but before entering in on the harmony analysis, in the following sections I will first demonstrate that these featural changes are consistent with and help explain more general aspects of these vowels' phonology and orthographic behavior.

The primary argument for previously interpreting short and long normalized Old Norse orthographic *æ/ǽ–ǫ/ǿ* as featurally identical is that they have a common origin via the leftwards fronting and rounding (*i/j*- and *u/w*-umlaut) of Proto-Norse **a* and **aː* as shown in (10). This would allow for the economical characterization of these processes in Proto-Norse simply as the leftwards spreading of [−back] and [+round], respectively, without any references to any other vowel features.

(10) Umlaut origins of *æ/ǽ–ǫ/ǿ* vowels

Old Norse		Proto-Norse	
sætja	<	**satjan*	set-VERB.INF.
mǽgð	<	**maːgiþu*	affinity by marriage-NOM.F.SG.
sǫðull	<	**saðulaʀ*	saddle-NOM.M.SG.
skǿl	<	**skaːlu*	bowl-NOM.F.SG.

These correspondences might indeed have been so uniform when *i/j*- and *u/w*-umlaut were productive harmony systems in Proto-Norse, but the phonemicization of umlaut-effects precedes the current period under discussion by many centuries (Birkmann 2002), and there are several indications that West Norse vowel inventories did not remain so symmetric. First, there is to my knowledge no positive phonological evidence that *æ–ǽ* and *ǫ–ǿ* were featurally identical (e.g. in the way of synchronic lengthenings or shortenings). Second, as illustrated in (11) subsequent vowel mergers over the course of the 12th–14th centuries across West Norse varieties do not align with the presentation in (10) (Schulte 2005).

(11) Vowel mergers in West Norse varieties

	Old Norse	>	Mod. Norw.	Mod. Ice.	Mod. Far.	
o–ǫ	*brodda*	>	*brodde*	*brodda*	*brodda*	put on barbs
	hǫggva	>	*hogge*	*höggva*	*høgga*	chop
á–ǿ	*ráð*	>	*råd*	*ráð*	*ráð*	council
	skǿl	>	*skål*	*skál*	*skál*	bowl
e–æ	*renta*	>	*rente*	*renta*	*renta*	income
	sænda	>	*sende*	*senda*	*senda*	send
é–ǽ	*fé*	>	*fe*	*fé*	*fæ*	cattle
	sǽra	>	*sære*	*særa*	*særa*	wound

Though there are differences in the mergers above, there is a consistent vowel height asymmetry between short and long vowels across all West Norse dialects: the short/long counterparts *æ/ǽ–ǫ/ǿ* never collapse, *æ–ǫ* always merge with mid vowels, and low *ǿ* always merges with low *á*. While these patterns are not expected or motivated by traditional uniform [+low] reconstructions—*æ/ǫ–ǽ/ǿ*—the inventory I propose in (9), which reinterprets these vowels as mid /ɛ, ɔ/ and low /æː, ɒː/, correctly predicts these differences. For example, in Old Norwegian, given these featurally distinct interpretations, it is not surprising that we find mergers between [−low] /ɛ/–/e/ and /ɔ/–/o/ while [+low] vowels behave differently.

In summary, the evidence cited here suggests that the traditional assumption of symmetrical length contrasts in Old Norse *æ/ǽ–ǫ/ǿ* vowels is an oversimplification which is not supported by the independent development of short and long vowels across Nordic varieties, and reinterpreting orthographic *æ–ǫ* as [−low, −ATR] /ɛ, ɔ/ provides a novel explanation for the different trajectories long and short vowels have taken down to modern dialects.

Patterned spelling variation in Old Norwegian orthography provides a second motivation for these reinterpretations. Across medieval Norse textual material, it is well-known that the graphic representations of [ɛ, ɔ] are consistently more variable than other vowels (Seip 1955: pp. 148–50; Hreinn Benediktsson 1964, 1963). For instance, in manuscripts such as *The Legendary Saga of St. Olav* (De la Gardie 8, 70v–110v — c. 1225–50), while other non-high vowels are orthographically consistently represented by typically mid <e, o> and low <æ, a> vowel graphs, the written representation of [ɛ, ɔ] is significantly more variable as shown in (12).

(12)   Patterned /ɛ, ɔ/ spelling variation:
The Legendary Saga of St. Olav (De la Gardie 8, 70v–110v — c. 1225–50)

Graphically	ɛ	<mærki, merki>	[mɛrki]	*mark*-NOM./ACC.N.PL.
variable		<gængit, genginn>	[gɛngit/nn]	*walk*-PRET.PART.ACC.N./NOM.M.
	ɔ	<fiotri, fiatri>	[fjɔtri]	*fetter*-DAT.M.SG.
		<hofði, hafði>	[hɔfði]	*head*-DAT.N.SG.
Graphically	o	<koma, kona, orð>	[koma, kona, orð]	*come, woman, word*
non-variable	oː	<goðr, storr, mot>	[goːðr, stoːrr, moːt]	*good, big, meeting*
	e	<gefa, kveða, drepa>	[gefa, kveða, drepa]	*give, speak, kill*
	eː	<retta, fe, lettr>	[reːtta, feː, leːttr]	*make right/straight, cattle, light*
	æː	<mæla, ætla, klæða>	[mæːla, æːtla, klæːða]	*speak, mean, clothe*
	ɒː	<rað, ar, mal>	[rɒːð, ɒːr, mɒːl]	*counsel, year, case*

This kind of [ɛ, ɔ] spelling variation is not only found in copied manuscripts where it might be the result of copying influence; the same overlapping <æ>/<e> and <o>/<a> spelling variation is also found in both original charters and runic inscriptions, indicating that there is a genuine linguistic basis to this variation.

(13)   [ɛ] spelling variation in original charters

Ívarr Auðunarson	<sæʦí>	[sɛtti]	place-3.SG.PRET.INDIC.	DN III 139
	<seʦí>	[sɛtti]	place-3.SG.PRET.INDIC.	DN IV 168
	<ængu>	[ɛngu]	none-DAT.N.SG.	DN IV 168
	<engín>	[ɛnginn]	none-NOM.M.SG.	DN I 166

(14)   [ɔ] spelling variation in original charters

Þorgeirr Tófason	<loghū>	[lɔɣum]	law-DAT.N.PL.	DN II 100/V 58
	<lagum>	[lɔɣum]	law-DAT.N.PL.	DN VII 91
	<hoþðu>	[hɔfðu]	have-3.PL.PRET.INDIC.	DN VII 91
	<haþuð>	[hɔfuð]	head-NOM.N.SG.	DN XXI 19
	<joʐð>	[jɔrð]	earth-ACC.F.SG.	DN I 132
	<jarðuɲ>	[jɔrðum]	earth-DAT.F.PL.	DN III 110

For example, in the original, signed charters above written by the royal scribes Þorgeirr Tófason (fl. 1303–*c.* 1330) and Ívarr Auðunarson (fl. 1320–35), who are otherwise orthographically consistent, we find similar [ɛ, ɔ] spelling variation.[4] And the longest runic inscription found at Bryggen,

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[4]I have collected these forms from the original charters, which are cited according to their volume and document number in the *Diplomatarium Norvegicum*. These are digitally accessible in the Dokumentasjonsprosjektet: `http://www.dokpro.uio.no/dipl_norv/diplom_felt.html`. For facsimile transcriptions, see Sandstedt (2014).

Bergen (N 648 – *c* 1300) displays the same asymmetry by which [e]/[eː] is consistently written <ᛅ> (**e**) while [ɛ] is variably spelled <ᛅ, ᛅ, ᛅᛁ> (**e, æ, æi**) (Olsen & Liestøl 1957: p. 97).

(15) [ɛ] spelling variation in runic orthography (N 648 – *c* 1300)

      [e]/[eː]   <ᛅ>   (**e**)

[er]	ᛅᚱ	**er**	which
[ek]	ᛅᚴ	**ek**	I
[en]	ᛅᚾ	**en**	and
[ef]	ᛅᚠ	**eu**	if
[feːlag]	ᚠᛅᛚᛅᚵ (2)	**felag**	partner
[meːr]	ᛘᛅᚱ	**mer**	me
[veːtta]	ᚢᛅᛏᛅ	**vetta**	wight/being

      [ɛ]   <ᛅ, ᛅ, ᛅᛁ>   (**æ, e, æi**)

[krɛf]	ᚴᚱᛅᚠ (2)	**kræf**	require-IMP.
[kvɛðju]	(ᚴ)ᛅᛁᚦ:ᛁᚾ	**(k)æiþiu**	greetings
[sɛndir]	ᛁᛅᚾ:ᛅᛁᚱ	**sen dir**	send-PRES.INDIC.
[sɛnd]	ᛁᛅᚾ	**sen**	send-IMP.
[ɛggja]	ᛅᚵᚵᛅ	**egga**	urge
[ɛkki]	ᛅᚴᛁ / ᛅᚴᚴᛁ	**eki/ekki**	not
[hɛnne]	ᚼᛅᚾᛁᛅ	**henne**	her

    These spelling variations have traditionally been interpreted as the products of a variety of factors. Overlapping <æ>/<e> spellings for [ɛ] may be an indication of the ongoing /ɛ/–/e/ merger described above (Hreinn Benediktsson 1964). And [ɔ] is usually interpreted as being orthographically identifiable with both <o> and <a> since the distinction between /ɔ/–/a/ is often neutralized due to so-called "younger" *u*-umlaut (/a/→[ɔ]/__C$_o$[u]) (Hreinn Benediktsson 1963; Kristoffersen & Torp 2016: pp. 120–21). Because of this, scribes often display an inverse spelling relationship whereby [ɔ] is most frequently identified as <a> before a subsequent [u]—since its rounding in this position was predictable due to *u*-umlaut—and written as <o> elsewhere (e.g. <joᴙð>–[ˈjɔrð] but <jarðuɱ>–[ˈjɔrðum]). While the revised inventory in (9) is compatible with these possibilities, it also provides a more principled explanation for this kind of variation.

    First and foremost, the Old Norwegian graphemic inventory, both in roman and runic writing, was insufficient for representing the full range of its vowels—e.g. four non-high letters <e, æ, a, o> or runes <ᛅ, ᛅ, ᛅ, ᛅ> to potentially ten non-high vowels [e, eː, ɛ, æː, a, aː, ɔ, ɒː, o, oː]. Representing all these vowels therefore necessarily resulted in non-unique graphic–phonetic correspondences: e.g. <o>–[o, oː, ɔ] and <a>–[a, aː, ɒː, ɔ]. As diagrammed in (16–17) the variable spelling representations of [ɛ, ɔ] in both roman and runic writing are therefore a natural product of Old Norwegian intersegmental relations since the [−low, −ATR] vowels /ɛ, ɔ/ differ from mid /e, eː, o, oː/ and low /æː, a, aː, ɒː/ vowels with regard to one feature each. [ɛ, ɔ] could therefore be represented in writing by both typically mid <e, o, ᛅ, ᛅ> and low <æ, a, ᛅ, ᛅ> vowel characters. And where we do find diacritic or digraphic spellings—e.g. <ę, ꜷ, ᛅᛁ>—these can be interpreted as the combination of both low and non-low vowel graphs—i.e. <ꜷ> = <a>+<o> and <ę> = <e>+<a>.[5]

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[5]This is in fact the very explanation given in the *First Grammatical Treatise* (AM 242 fol. 36v$^{26-29}$) for the structure of the corresponding 12th-century Icelandic <ǫ, ę> characters, and these explanations are accompanied by articulatory descriptions consistent with the revised inventory above (translated by Hreinn Benediktsson 1972: pp. 210–11):

    Ǫ has the loop from *a* and the circle from *o*, because it is a blending of the sounds of these two,

(16) Non-unique phonemic–graphemic correspondences in roman writing

	[−back]	[+back]		
< e>	eː/e	oː/o	<o >	[−**low**, +ATR]
<æ e>	ɛ	ɔ	<o a>	[−**low**, −**ATR**]
<æ >	æː	ɒː	< a>	[+low, −**ATR**]

(17) Non-unique phonemic–graphemic correspondences in runic writing

	[−back]	[+back]		
< ᛁ>	eː/e	oː/o	<ᛁ >	[−**low**, +ATR]
<ᛏ ᛁ>	ɛ	ɔ	<ᛁ ᛁ>	[−**low**, −**ATR**]
<ᛏ >	æː	ɒː	< ᛁ>	[+low, −**ATR**]

Following this analysis—given the limitations of the Old Norwegian graphemic inventory—these regular spelling variations are not only orthographic exceptions in need of exceptional explanations; this recurring spelling variation can rather be seen as an accurate representation of the intermediary position /ɛ, ɔ/ held in the Old Norwegian vowel space. The phonological representations /ɛ, ɔ/ are thus consistent with the available philological evidence and in fact help explain patterned spelling variation in medieval Norwegian textual material. The inventory I propose in (9) therefore corresponds well with what else is known about the phonology and orthographic behavior of these vowels. As I demonstrate in the following sections, these featural reinterpretations also align much more elegantly with Old Norwegian height harmony patterns and allow for a straightforward analysis of previously unexplained neutral harmony patterns.

3.   ANALYSIS

3.1.   Formalizing height harmony in Old Norwegian

A basic formalization of height harmony in Old Norwegian can be defined using Nevins' (2010) Search procedure and its parameters as in (18), repeated from (8). This states that unstressed (non-initial) vowels which are unspecified for the feature [high] will initiate a leftwards search for the closest donor bearing this feature. Once a licit value-source is found, its [±high] specification is copied, resulting in rightwards height harmony like that in (19). I assume that this formulation is generalized for all harmonizing suffixes and that vowels in strong (stressed) positions are underlyingly specified for the harmony feature as indicated by non-harmonizing inherently stressed syllables such as the second element in compounds or strong derivational suffixes discussed in greater detail in section 3.3.1.

(18)   Old Norwegian unstressed vowels must:
    High-Harmonize: δ = left, F = [(+)high]

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pronounced with the mouth less open than *a*, but more than *o*. Ę is written with the loop of *a*, but with the full shape of *e*, just as it is composed of the two, with the mouth less open than *a*, but more than *e*.

Ǫ hefir lykkju af *a*i, en hringinn af *o*i, því at hann er af þeira hljóði tveggja saman blandinn, kveðinn minnr opnum munni en *a*, en meirr en *o*. Ę er ritinn meðlykkju *a*s, en meðǫllum vexti *e*s, sem hann er af þeim tveim samfeldr, minnr opnum munni en *a*, en meirr en *e*.

(19)   Height harmonic [-um]/[-om] alternations
     a.   /ˈflyːj-Um/   [ˈflyːjum]   \<ꝼlẏū\>   flee-PRES.INDIC.I.PL.
     b.   /ˈsigl-Um/   [ˈsiglum]   \<ſiglum\>   sail-PRES.INDIC.I.PL.
     c.   /ˈer-Um/   [ˈerom]   \<erō\>   be-PRES.INDIC.I.PL.
     d.   /ˈskjoːt-Um/   [ˈskjoːtom]   \<ſkıotō\>   shoot-PRES.INDIC.I.PL.
     e.   /ˈlɒːt-Um/   [ˈlɒːtom]   \<latom\>   let-PRES.INDIC.I.PL.
     f.   /ˈsæːtt-Um/   [ˈsæːttom]   \<sæꞇom\>   reconcile-PRES.INDIC.I.PL.

The forms in (19ef) constitute examples of partial height harmony (Parkinson 1996) since stressed [+low] vowels do not feature complete height correspondence (e.g. [±low] [ˈsæːttom], not [−low] *[ˈsæːttɒm]). This indicates that the relevant harmony feature in Old Norwegian is [±high], and both mid and low vowels accordingly result in the same [−high] correspondence (19c–f). The examples above illustrate the basic harmony patterns that occur when underspecified suffixes are immediately preceded by viable [±high] value sources. In the following sections, I examine what happens when these circumstances are not met.

3.2.   *Neutral harmony patterns*

One of the primary focuses of this paper is how harmonization under different circumstances can actually result in surface disharmony. In Old Norwegian we find some very interesting and intricate examples bearing on this question in which the harmony procedure is limited by vowel contrastivity/sonority, locality, and featural under/specification to generate several kinds of neutral harmony behaviors. In this study, I focus on two basic neutral harmony types: transparency and blocking (20). *Transparency* or the lack of harmonization is caused when feature-copying for whatever reason fails to occur. If no suitable donor is available, underspecified segments can resort either to default-value insertion or harmonic skipping to ensure that they satisfy feature-valuation requirements. *Blocking* on the other hand describes a phenomenon where some intervening featurally-specified segment—which cannot undergo harmonization—prevents an underspecified segment from harmonizing with some more canonical donor further downstream. Old Norwegian displays interesting examples of both types of neutral harmony.

(20)   Neutral harmony types
    Transparency   Default-value insertion V_y–$V_{[\,]}$ → V_y–$V_{\mathbf{z}}$
                           Skipping V_z–V_y–$V_{[\,]}$ → $V_{\mathbf{z}}$–V_y–$V_{\mathbf{z}}$
    Blocking V_z–V_y–$V_{[\,]}$ → V_z–$V_{\mathbf{y}}$–$V_{\mathbf{y}}$

3.3.   *Transparency*

Harmonization like that in (19) does not occur following all Old Norwegian vowels. As was discussed above in section 1.2, in contrast to harmonic [−high, +ATR] [e, o], height harmony fails to occur following [−low, −ATR] [ɛ, ɔ] in (21). These latter patterns following [ɛ, ɔ] constitute an example of transparency, and the lack of height harmonization in these cases can be concisely accounted for using the Search-and-Copy procedure.

(21) Transparent [ɛ, ɔ] and non-transparent [e, o] patterns
    a.   /ˈmess-U/   [ˈmesso]   <meſſo>   mass-DAT.F.SG.
    b.   /ˈkon-U/   [ˈkono]   <kono>   woman-DAT.F.SG.
    c.   /ˈsegl-I/   [ˈsegle]   <ſegle>   sail-DAT.N.SG.
    d.   /ˈborð-I/   [ˈborðe]   <boꝛðe>   table-DAT.N.SG.

    e.   /ˈskɛpn-U/   [ˈskɛpnu]   <ſkæpnu>   shape-DAT.F.SG.
    f.   /ˈjɔrð-U/   [ˈjɔrðu]   <ɪarðu>   earth-DAT.F.SG.
    g.   /ˈkvɛld-I/   [ˈkvɛldi]   <kƥællðɪ>   evening-DAT.N.SG.
    h.   /ˈhɔfð-I/   [ˈhɔfði]   <ɦoꝼðɪ>   head-DAT.N.SG.

Within Nevins' (2010) framework, transparency like this is interpreted as the result of relativization of the search domain to particular segments while eliminating others. These excluded segments are "pruned away" so to speak from the search domain as irrelevant items which therefore do not count as suitable sources of the harmony feature, resulting in no feature copying: i.e. /ˈskɛpn-U/→[ˈskɛpnu], not *[ˈskɛpno]. One of the most common cross-linguistic causes of transparency is due to the relativization of the search procedure to segments which are *contrastive* for the harmony feature, to the exclusion of *non-contrastive* segments (Calabrese 1995). Contrastivity for the purpose of harmony systems can be defined as below:

(22)   Definition of *contrastive* (Nevins 2010: p. 70)
      A segment S with specification αF in position P is *contrastive* for F if there is another segment S′ in the inventory that can occur in P and is featurally identical to S, except that it is $-\alpha$F.

Essentially, segments which differ only with regard to the harmony feature are contrastive or what Baković (2003) calls "harmonically paired" for that feature: e.g. /i/ [+**high**, −low, −back, −round] and /e/ [−**high**, −low, −back, −round] in a height harmony system. The lack of feature-copying in (21e–h) indicates that Old Norwegian height harmony was relativized to harmonically contrastive vowels (F = [contrastive: (+)high]): e.g. [+high] /i, y, u/ and [−high] /e, ø, o/. This relativization excludes non-contrastive [−high, −ATR] /ɛ, ɔ/ which lacked [+high, −ATR] */ɪ, ʊ/ harmonic counterparts. The revised representations I propose in (23), repeated from section 2.2, therefore provide a non-arbitrary explanation for the transparency of /ɛ, ɔ/ vowels.

(23)   Revised Old Norwegian vowel inventory

[−back, −rd]	[−back, +rd]	[+back, −rd]	[+back, +rd]	
i / iː	y / yː		u / uː	[+high, −low, +ATR]
*ɪ			*ʊ	[+**high**, −low, −ATR]
e / eː	ø/ øː		o / oː	[−high, −low, +ATR]
ɛ			ɔ	[−**high**, −low, −ATR]
æː		a	ɒː	[−high, +low, −ATR]

Similar contrastive relativization is cross-linguistically very common and causes the transparency of the harmonically unpaired vowels [−back] [i, e] in Finnish palatal harmony (Ringen 1975), [+ATR] [i, u] in Ifẹ Yoruba (Niger-Congo) [ATR] harmony (Ọla Orie 2001), and [+low] vowels [a, aː] in Kisa (Bantu) height harmony (Hyman 1999: p. 238), to name a few. In these languages, the harmony system is only sensitive to segments where the harmony feature makes a contrastive distinction, and Old Norwegian displays a straightforward example of this.

An interesting feature of Old Norwegian transparency is that it occurs in derived environments because of *u*-umlaut (/a/→[ɔ]/__Cₒ[u]). In a form like /ˈmarg-U/, leftwards *u*-umlaut and rightwards height harmony are overlapping, and the chronologically older *u*-umlaut bleeds height

harmony: e.g. /ˈmarg-U/→[ˈmɔrgu], not *[ˈmɔrgo] or *[ˈmargo] (24). As was discussed in section 2.2.2, it is important to note here that because there was no unique letter corresponding to [ɔ] in the Old Norwegian graphemic inventory, [ɔ] in this environment is variably but most frequently represented as <a> since its roundness in this context is predictable from the subsequent [u]: e.g. [ˈɔðru] <oðₐu, aðₐu>, [ˈorrɔstu] <orroſtu, orraſtu>. However, regardless the variable spellings of [ɔ], the transparency pattern following this vowel is thoroughly consistent.

(24)   [ɔ] transparency in *u*-umlaut-derived environments

a.	/ˈaðr-U/	[ˈɔðru]	*[ˈɔðro]	<oðₐu>	other-DAT.N.SG.
b.	/ˈmarg-U/	[ˈmɔrgu]	*[ˈmɔrgo]	<margu>	many-DAT.N.SG.
c.	/ˈskamm-U/	[ˈskɔmmu]	*[ˈskɔmmo]	<ſkaṁu>	short-DAT.N.SG.
d.	/ˈbjart-U/	[ˈbjɔrtu]	*[ˈbjɔrto]	<bıarᴛu>	bright-DAT.N.SG.
e.	/ˈorrast-U/	[ˈorrɔstu]	*[ˈorrɔsto]	<orroſtu>	battle-DAT.F.SG.

Because of the interaction between rightwards height harmony and leftwards *u*-umlaut, we can see in (25) that Old Norwegian height harmony was bounded to adjacent syllables. Harmonic skipping is not allowed in Old Norwegian: i.e. [ˈæːtlɔðu], not *[ˈæːtlɔðo]. In this case, the inflectional vowel /-U/ searches leftwards to the adjacent syllable for a contrastive value-source to copy from, but encountering only non-contrastive [ɔ] the search procedure comes up empty handed, and the vowel surfaces as default [+high] [u]. Additionally, because [−high] [ɔ] has no corresponding [+high] *[ʊ] harmonic counterpart, it does not undergo harmonization either: i.e. [ˈdyːrkɔðu], not *[ˈdyːrkʊðu].[6]

(25)   Syllable adjacency requirement blocks long-distance harmony

a.	/ˈdyːrk-að-U/	[ˈdyːrkɔðu]	<dẏrkaðu>	worship-PRET.INDIC.-3.PL.
b.	/ˈundr-að-U/	[ˈundrɔðu]	<unðraðu>	wonder-PRET.INDIC.-3.PL.
c.	/ˈbloːt-að-U/	[ˈbloːtɔðu]	<blocaðu>	worship with sacrifice-PRET.INDIC.-3.PL.
d.	/ˈɛggj-að-U/	[ˈɛggjɔðu]	<æggıaðu>	egg on-PRET.INDIC.-3.PL.
e.	/ˈstɔðv-að-U/	[ˈstɔðvɔðu]	<ſtoðꝥaðu>	stop-PRET.INDIC.-3.PL.
f.	/ˈæːtl-að-U/	[ˈæːtlɔðu]	<æᴛlaðu>	intend-PRET.INDIC.-3.PL.
g.	/ˈkall-að-U/	[ˈkallɔðu]	<kallaðu>	call-PRET.INDIC.-3.PL.

Similar syllable-adjacency bounding is found in Lamba (Bantu) nasal harmony (Odden 1994) and Shona (Bantu) vowel harmony (Beckman 1997). Shona features rightwards height harmony similar to Old Norwegian but with transparent [+low] vowels (26ef). In transparent cases, like in

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[6]In some Old Norwegian varieties, umlaut-derived inflectional alternations such as [-að-]/[-ɔð-] were analogically levelled to [-að-] across the paradigm. For example, this is evident from [−high] harmonizing [-aðo] examples in the West Norwegian law manuscript Holm perg 34 4° − *c* 1300: e.g. [ˈskipaðo] <ſkıpaðo> "arranged" (17v¹³), [ˈviðaðo] <ꝥıðaðo> "furnished wood" (59r¹⁴), or [ˈkallaðo] <kallaðo> "called" (13v⁶). Transcriptions and facsimiles of this manuscript are available from the Medieval Nordic Text Archive (http://www.menota.org/) and the National Library of Sweden (http://www.kb.se/). For reference, the relevant paradigms in De la Gardie 8 70v–110v and Holm perg 34 4° are provided below.

(i)   *kalla* "call"-PRET.INDIC.

DG 8,	70v-110v		Holm	perg 34 4°	
	SG.	PL.		SG.	PL.
1.	kall-að-a	kall-ɔð-**um**	1.	kall-að-a	kall-að-**om**
2.	kall-að-er	kall-ɔð-**uð**	2.	kall-að-er	kall-að-**oð**
3.	kall-að-e	kall-ɔð-**u**	3.	kall-að-e	kall-**að-o**

Old Norwegian, Shona height harmony cannot copy at long distances, and when no viable [±high] source is found, non-initial vowels surface as default [+high] (26gh).[7]

(26) Shona (Bantu) height harmony and transparency (Beckman 1997: pp. 1–2)
   a. /ip-Ira/   [ipira]   be evil for
   b. /bvum-Isa/   [bvumisa]   make agree
   c. /per-Ira/   [perera]   end in
   d. /om-Isa/   [omesa]   cause to get dry

   e. /shamb-Isa/   [shambisa]   make wash
   f. /pamh-Isa/   [pamhisa]   make do again
   g. /cheyam-Isa/   [cheyamisa]   make be twisted
   h. /pofomadz-Ira/   [pofomadzira]   blind for

An updated formulation of Old Norwegian height harmony is provided in (27). As the examples in this section illustrate, the harmonic search domain in Old Norwegian was relativized to segments contrastive for the harmony feature (F = [contrastive: (+)high]) and the search procedure was bounded to adjacent syllables (β = 1 syllable).

(27) Old Norwegian unstressed vowels must:
      High-Harmonize: δ = left, β = 1 syllable, F = [contrastive: (+)high]

While the lack of height harmony following [ɛ, ɔ] in Old Norwegian has long defied a proper solution, it is under this account a natural product of the application of the harmony procedure in (27) to the featural interpretations I proposed in (23). Both phenomena are cross-linguistically well-attested, and the harmony neutral behavior of [ɛ, ɔ] in Old Norwegian is a typologically normal case of transparency.

3.3.1. Stress and blocking

The examples above illustrate cases where harmony fails to occur due to a lack of a viable feature donor, but various other conditions can block [high] harmony in Old Norwegian even when feature-copying does take place. This occurs frequently because not all non-initial elements are unspecified for the harmony feature. Vowels in primary or secondary stressed positions are invariably specified for the harmony feature in Old Norwegian and therefore do not undergo harmony. For instance, harmonization never occurs across root boundaries in prefixed or compound words since root-initial vowels are inherently stressed (28): e.g. [ˈnɒː-ˌvistar], not *[ˈnɒː-ˌvestar]—[ˈoː-ˌtiːmi], not *[ˈoː-ˌteːme] or *[ˈuː-ˌtiːmi].

(28) Disharmony in prefixed and compound words
   a. /ˈoː-ˌtiːm-I/   [ˈoːˌtiːmi]   <otími>   the wrong time (=un+time)-NOM.SG.
   b. /ˈoː-ˌθokk-I/   [ˈoːˌθokke]   <oþokce>   disgust (=un+thought)-NOM.SG.
   c. /ˈhirð-ˌmenn/   [ˈhirðˌmenn]   <þırðmēn>   king's men-NOM.PL.
   d. /ˈnɒː-ˌvist-ar/   [ˈnɒːˌvistar]   <nauɪſtar>   presence (=now+dwelling)-GEN.SG.

Similar blocking is caused by several derivational suffixes as illustrated below using the [−high] adjectivizing suffix /-ˌleg-/ and the [+high] substantivizing suffix /-ˌynd-/. Like related modern Icelandic (Kristján Árnason 1987, 2005, 2012) there were two classes of derivational suffixes in Old Norwegian: so-called class I or unstressed suffixes which can undergo harmony (29a–d), and class II or stressed suffixes which do not (29e–h).

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[7]Like many Eastern and Southern Bantu languages, Shona features penultimate lengthening as a reflex of predictable stress placement which for simplicity's sake is omitted here (Hyman 2009; Beckman 1997: p. 36, note 11).

(29) Harmonizing and non-harmonizing derivational suffixes

  a. /ˈhyrn-Ing-r/   [ˈhyrnɪngr]   <hẏrnɪnḡ>   horned man (=horned+SUBS.)-NOM.SG.
  b. /ˈbæːs-Ing-r/   [ˈbæːsengr]   <bæſenǥ>   bastard (=born in a stall+SUBS.)-NOM.SG.
  c. /ˈsynd-Ug-t/   [ˈsyndukt]   <fẏnðuct͛>   sinful (=sin+ADJ.)-ACC.SG.
  d. /ˈbloːð-Ug-a/   [ˈbloːðoga]   <bloðoga>   bloody (=blood+ADJ.)-DAT.SG.

  e. /ˈreːtt-ˌynd-Um/ [ˈreːttˌyndum] <reͨẏnðum>   justice (=just+SUBS.)-DAT.PL.
  f. /ˈsann-ˌynd-Um/   [ˈsannˌyndum]   <ſannynðū>   truth (=true+SUBS.)-DAT.PL.
  g. /ˈdyːr-ˌleg-U/   [ˈdyːrˌlego]   <ðyrlego>   glorious (=glory+ADJ.)-DAT.N.SG.
  h. /ˈvirði-ˌleg-U/   [ˈvirðiˌlego]   <ꝥðɪlego>   worthy (=worth+ADJ.)-DAT.N.SG.

Class II suffixes were historically compounds (e.g. /-ˌleg-/ < Proto-Norse *-liːkaʀ "body, corpse"). Being stressed these suffixes are underlyingly fully specified for the harmony feature and are viable feature donors. In other words, stressed derivational suffixes behave in the same way as second components in compounds and can therefore block [+high] or [−high] harmony: e.g. [ˈreːttˌyndum] and [ˈdyːrˌlego], not *[ˈreːttˌøndom] and *[ˈdyːrˌligu]. These examples where an unspecified segment has in principle two viable potential feature donors indicate that value-seekers always search leftwards for a specified value-source—e.g. /ˈvirðI-ˌleg-U/ → [**ˈvirði**ˌlego], not *[ˈvirðeˌlego]—and again that value-seekers must copy from adjacent syllables—e.g. [ˈreːttˌ**yndu**m], not *[ˈreːttˌynd**o**m].[8]

A more complex interaction between harmonization and intervening featural specification is found in Old Norwegian definite enclitics. The definite article *hinn* or *enn* in Old Norwegian was used independently in modified environments such as <þess **ens** hælga mannz> "this the holy man"-GEN. but is most often encliticised elsewhere: e.g. <mannzens> /ˈmanns-ens/ "the man"-GEN.SG.-DEF. (Nygaard 1905, Faarlund 2004). Variation in the harmony patterns of definite enclitics leads Hagland (1978b: p. 90) to claim that definite enclitics do not undergo harmony as other unstressed suffixes in Old Norwegian, but this is incorrect. The forms in (30a–d) do illustrate examples of [+high] harmony as well as transparency consistent with the other patterns presented above. However, Paulsen (2015) made the interesting observation that there are unexplained systematic exceptions in other declensional patterns like in (30e–h).

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[8]There is a similar dichotomy in modern Icelandic between unstressed derivational suffixes on the one hand and stressed suffixes/compounds on the other. For example, the affixation of weak or class I suffixes in Icelandic may trigger vowel shortening–preaspiration or the occlusion of [ɣ] before /n/ or /l/, but class II suffixes and compound elements do not trigger these processes (ii): e.g. [ˈsjuːk̟ˌlɛɣʏr̥] and [ˈhaɣˌniːta], not *[ˈsjuhk̟ˌlɛɣʏr̥] and *[ˈhak-ˌniːta]. For a list of both suffix types, see Kristján Árnason (2012: p. 303).

(ii)   Preaspiration and occlusion (non-)triggering suffixes in Icelandic (Kristján Árnason 2005: pp. 259–62)

Class I	*sjúk-lingur*	[ˈsjuhkliŋkʏr̥]	patient
	hag-naður	[ˈhaknaðʏr̥]	profit
Class II	*sjúk-legur*	[ˈsjuːk̟ˌlɛɣʏr̥]	sickly
	hag-legur	[ˈhaɣˌlɛɣʏr̥]	well made, handy
Compounds	*út#nes*	[ˈuːtˌnɛs]	peninsula (=out+headland)
	hag#nýta	[ˈhaɣˌniːta]	utilize (=handy+use)

(30) Harmonizing and non-harmonizing definite suffixes
    a.   ['hyrnunni]   *['hyrnonne]   \<hẏrnūní\>   (axe)point-DAT.F.SG.DEF.
    b.   ['hurðunni]   *['hurðonne]   \<ƕurðuñı\>   door-DAT.F.SG.DEF.
    c.   ['viðinum]   *['viðenom]   \<ʋıðınū\>   wood-DAT.M.SG.DEF
    d.   ['hɛllinum]   *['hɛllenom]   \<ƕællınū\>   cave-DAT.M.SG.DEF.

    e.   ['hirðenne]   *['hirðinni]   \<ƕırðenne\>   king's men-DAT.F.SG.DEF.
    f.   ['urðenne]   *['urðinni]   \<urðenne\>   heap of stones-DAT.F.SG.DEF.
    g.   ['hugenom]   *['huginum]   \<ƕugenom\>   mind-DAT.M.SG.DEF
    h.   ['hɛrrenom]   *['hɛrrinum]   \<ƕærrenō\>   multitude-DAT.M.SG.DEF.

Following the definition of height harmony in (27), these apparently contradictory harmony behaviors can be naturally explained if we assume that definite suffixes in Old Norwegian begin with an underlyingly fully-specified [e] while subsequent vowels are unspecified for [high]: e.g. /-en-nI/-DEF.-DAT.F.SG. or /-en-Um/-DEF.-DAT.M.SG. This constitutes a consistent correspondence to other non-harmonic West Norse varieties such as Old Icelandic where these suffixes are specified as [+high] throughout. To avoid unstressed hiatus, the second vowel is elided in both varieties. For clarity, the definite suffix is underlined and inflectional vowels are marked in bold.

(31) Old Icelandic masculine singular inflections

	INDEF.	DEF.	INDEF.	DEF.	INDEF.	DEF.	
NOM.	hug-r	hugr<u>inn</u>	við-r	við<u>r</u>inn	bardag-**i**	bardag<u>inn</u>	/-inn/
ACC.	hug-	hug<u>inn</u>	við-	við<u>inn</u>	bardag-**a**	bardag<u>ann</u>	/-inn/
DAT.	hug-	hug<u>inum</u>	við-**i**	við<u>inum</u>	bardag-**a**	bardag<u>anum</u>	/-inum/
GEN.	hug-**ar**	hugar<u>ins</u>	við-ar	viðar<u>ins</u>	bardag-**a**	bardag<u>ans</u>	/-ins/

(32) Old Norwegian masculine singular inflections

	INDEF.	DEF.	INDEF.	DEF.	INDEF.	DEF.	
NOM.	hug-r	hugr<u>enn</u>	við-r	við<u>r</u>enn	bardag-**e**	bardag<u>enn</u>	/-enn/
ACC.	hug-	hug<u>enn</u>	við-	við<u>enn</u>	bardag-**a**	bardag<u>ann</u>	/-enn/
DAT.	hug-	hug<u>enom</u>	við-**i**	við<u>inum</u>	bardag-**a**	bardag<u>anom</u>	/-enUm/
GEN.	hug-**ar**	hugar<u>ens</u>	við-ar	viðar<u>ens</u>	bardag-**a**	bardag<u>ans</u>	/-ens/

Because value-seeking elements copy from the closest contrastive source of [±high], the deletion of the potential donor [−high] [e] has obvious effects on the resulting harmony patterns. Where a hiatus occurs, [e] is deleted, and /-nUm/ surfaces in harmony with the leftwards inflectional vowel (33a–c). When no hiatus occurs, [e] is not deleted. In these cases, as predicted by the harmony procedure in (27), [high] unspecified /-U/ searches leftwards for the closest contrastive donor of [±high] to copy from. The Search-and-Copy procedure therefore finds and copies [−high] from [e], regardless any vowels further downstream (33de).[9] Following this account, hiatus deletion must precede height harmony in the derivation: i.e. 'viðIenUm → 'viðInUm → 'vi**ð**inum; not 'viðIenUm → 'vi**ð**ienom → *'vi**ð**inom.

    [9] As an anonymous reviewer notes, we find similar half-harmonizing disyllabic affixes in Turkish; for example, the progressive suffix /-Iyor-/ (Clements & Sezer 1982: p. 231). Similar to Old Norwegian, the initial syllable of /-**I**yor-/ is unspecified for the harmony features [back, round] and consistently harmonizes to preceding syllables (e.g. gel-iyor-um "come"-PRES.PROG.-1.SG.) while the second vowel in /-Iy**o**r-/ is underlyingly specified [+back, +round]. The second vowel is therefore non-alternating—i.e. *gel-iy**e**r-im—and is a viable value-source to the following underspecified inflectional suffix /-Im/—e.g. gel-iyor-**u**m). Like the Norwegian examples in (30e–h), this partial feature specification in a disyllabic suffix can result in word-medial mixed harmony.

(33) Hiatus avoidance conditions differing harmony patterns in /-enUm/
    a. /ˈvið-I-enUm/   → [ˈviðinum]   \<ᵽıðınū\>   wood-DAT.M.SG.-DEF
    b. /ˈiːs-I-enUm   → [ˈiːsinum]   \<ıſınū\>   ice-DAT.M.SG.-DEF.
    c. /ˈhɛll-I-enUm/   → [ˈhɛllinum]   \<ђællınū\>   cave-DAT.M.SG.DEF.
    d. /ˈhug-enUm/   → [ˈhugenom]   \<ђugenom\>   mind-DAT.M.SG.DEF
    e. /ˈhɛrr-enUm/   → [ˈhɛrrenom]   \<ђærrenō\>   multitude-DAT.M.SG.DEF.
    f. /ˈbardag-a-enUm/ → [ˈbardaganom] \<barðaganō\> battle-DAT.M.SG.-DEF.

From the example in (30f), we can further infer that *u*-umlaut derivationally precedes both hiatus resolution and height harmony. If by contrast the hiatus were deleted prior to *u*-umlaut— i.e. *ˈbardag-a-enUm → *ˈbardag-**a**-nUm—then we would expect *u*-umlaut subsequently to round /a/→[ɔ] and to bleed height harmony—i.e. *ˈbardag-**a**-nUm → ˈbardagɔ**num**, but this is not attested, either in Old Norwegian nor in Old Icelandic. A step-by-step illustration is provided in (34). Harmonizing pairs are marked in bold.

(34) Ordered application of *u*-umlaut, hiatus resolution, and height harmony

Underlying	/ˈvið-I-enUm/	/ˈhug-enUm/	/ˈbardag-a-enUm/
U-umlaut (vacuous)	ˈviðIenUm	ˈhugenUm	ˈbardagaenU̱m
Hiatus resolution	ˈviðInUm	ˈhugenUm	ˈbardaganUm
Height harmony	ˈvið**inum**	ˈhug**enom**	ˈbardag**anom**
Orthography	\<ᵽıðınū\>	\<ђugenom\>	\<barðaganō\>

These patterns illustrate how intervening featural specification can account for many common harmony blocking behaviors, and I have shown that the unique behavior of Old Norwegian definite enclitics can be explained by a simple interaction between partial featural specification and hiatus deletion.

3.3.2. *[+low] blockers*

In the previous sections we have seen common examples of how harmonization can be limited by vowel contrastivity, locality, and intervening featural specification. In addition to these regular kinds of neutral harmony, there are rare cases whereby harmony patterns are restricted by vowel sonority—so-called *sonority hurdles* (Nevins 2010: pp. 168–90)—and the blocking behavior of [+low] vowels in Old Norwegian represents a new example of this.

(35) [−high] harmony following [high] non-contrastive low vowels
    a. /ˈundr-a/   [ˈundra]   \<unðra\>   wonder-PRES.INDIC.3.PL.
    b. /ˈdyːrk-a/   [ˈdyːrka]   \<dẏrka\>   worship-PRES.INDIC.3.PL.
    c. /ˈhaf-I/   [ˈhave]   \<ђaᵽe\>   have-PRES.SUBJ.I.SG.
    d. /ˈvæːnt-I/   [ˈvæːnte]   \<ᵽænᴛe\>   expect-PRES.INDIC.I.SG.
    e. /ˈvæːnt-Um/   [ˈvæːntom]   \<ᵽænᴛō\>   expect-PRES.INDIC.I.PL.
    f. /ˈlɒːt-I/   [ˈlɒːte]   \<laᴛe\>   let-PRES.SUBJ.I.SG.
    g. /ˈlɒːt-Um/   [ˈlɒːtom]   \<laᴛom\>   let-PRES.INDIC.I.PL.
    h. /ˈundr-að-I/   [ˈundraðe]   \<unðraðe\>   wonder-PRET.INDIC.-3.SG.
    i. /ˈdyːrk-að-I/   [ˈdyːrkaðe]   \<ðẏrkaðe\>   worship-PRET.INDIC.-3.SG.

In contrast to the other patterns cited in this paper, the harmonic behavior of [+low] vowels is unique in Old Norwegian height harmony (35). Since the featural combination *[+high, +low] is by definition not possible, low vowels are never contrastive for the feature [high] and cannot undergo [+high] harmony (35ab). Like the Shona patterns in (26), low vowels therefore very often behave transparently in [high] harmony systems (Hyman 1999). Though they lack [+high] harmonic pairs,

unlike other [high] non-contrastive vowels, Old Norwegian low vowels do not behave transparently (35c–g) and can block [+high] harmony in non-initial positions: e.g. [ˈdyːrkaðe], not *[ˈdyːrkaði] (35hi). In other words, despite the relativization of the harmony system only to contrastive visibility in Old Norwegian, there is an asymmetric relationship among nonrelativized segments wherein [−low] [ɛ, ɔ] behave transparently while [+low] [a, æː, ɒː] block harmony patterns and result in feature-copying.

Since there is a correlation between vowel height/sonority and harmony blocking, neutral harmony patterns like these may be interpreted as a sonority threshold effect in which nonrelativized segments over a certain sonority level nevertheless count as viable value-sources for the purposes of harmonic feature-copying.[10] Building on the work of Parker (2002), these kinds of sonority-derived blocking effects in vowel harmony systems are formalized in Nevins' (2010) framework using the following sonority hierarchy (36).

(36)   Implicational sonority hierarchy(Nevins 2010: p. 171)

Segments	Sonority level (ζ)	Relevant features
a,æ,ɒ	8	[+low, −ATR]
ə	7	[+low, +ATR]
ɛ,ɔ	6	[−low, −ATR]
e,o	5	[−low, +ATR]
ɪ,ʊ	4	[+high, −ATR]
i,u	3	[+high, +ATR]
j,w	2	[+high, +ATR, −voc, −cons]
sonorant consonants	1	[+son, +cons]

The idea here is that each language selects some sonority level cut-off point to which its grammar is sensitive, and items which exceed this threshold will block the harmony procedure and cause feature-copying. This pattern whereby high sonority can turn otherwise nonrelativized items expected to be transparent into blockers of harmony is attested in a small typological class of unrelated harmony languages in (37). As predicted by the hierarchy above, we find a consistent implicational pattern in each of these cases in which it is always the highest-sonority members (marked in bold) of the class of nonrelativized non-contrastive or unmarked vowels ([c:/m: F]) which block the harmony procedure and behave non-transparently. Harmony blocking in Old Norwegian represents the most common pattern—a sonority threshold of ζ = 7—where harmonically unpaired [+low] vowels behave non-transparently (37).

(37)   Cross-linguistic high sonority exceptions to transparent classes

Wolof	[c: ATR]	[i, u, iː, uː, **aː**]	7	Archangeli & Pulleyblank (1994)
Classical Manchu	[m: ATR]	[i, u, **ə**]	6	Zhang (1996)
Ifẹ Yoruba	[c: ATR]	[i, u, **a**]	7	Ọla Orie (2001)
Finnish	[m: back]	[i, y, e, ö, **ä**]	7	Campbell (1980)
Hungarian	[c: back]	[i, iː, eː, ɛ, **ɒ, aː**]	5	Vago (1975)
Old Norwegian	[c: high]	[ɛ, ɔ, **a, æː, ɒː**]	7	

While sonority threshold effects like these represent an empirically very specific and well-defined pattern, their function and motivation in harmony systems is not yet well understood. The rarity of this phenomenon is to be expected because the development of such sonority hurdles requires a very strict set of circumstances: *a)* a harmony system which *b)* is relativized by vowel contrastivity or markedness to the exclusion of a class of segments which *c)* crucially differ

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[10]Similar sonority threshold effects are found in other phonological processes; for example, in variation in differing adjacent coda–onset sonority requirements (Gouskova 2004).

in sonority. Under these conditions, speakers may generalize different harmony behaviors for high and low sonority items, but the subset of languages which fulfill all these conditions is obviously a very limited group. The [+low] vowel blocking patterns displayed in Old Norwegian therefore constitute an important and relevant example of sonority hurdle-type behavior which is typologically consistent with the other attested patterns in (37) and the implicational predictions of the sonority hierarchy in (36). A final harmony formulation for Old Norwegian height harmony which accommodates [+low] vowel blocking is provided in (38).

(38)   Old Norwegian unstressed vowels must:
        High-Harmonize: δ = left, β = 1 syllable, ζ = 7, F = [contrastive: (+)high]

This states that unstressed (non-initial) vowels which are unspecified for the feature [high] will initiate a leftwards search of the adjacent syllable for the closest contrastive donor bearing this feature and that the harmonic search is halted by any intervening high-sonority [+low] vowels.

4.   CONCLUSIONS

In this paper, I have tackled a number of previously unexplained neutral patterns in Old Norwegian height harmony. I have shown that traditional assumptions about Old Norwegian vowels and vowel harmony are inconsistent with the phonological and orthographic patterning of the short neutral vowels *æ*–*ǫ*. Interpreting these vowels as featurally identical short counterparts to the long vowels *ǽ*–*ǿ* makes false predictions about their harmony behavior and later diachronic developments in West Norse varieties. To reconcile these problems, I have proposed the revised representations [−low, −ATR] /ɛ, ɔ/, and I have shown that these vowels' neutral harmony behavior follows naturally from these representations. A broader examination also shows that these interpretations are consistent with what else is known about the phonology of these vowels, and these revisions help explain systematic spelling variation across medieval Norwegian textual material.

I provide a new harmony analysis in which I demonstrate that Old Norwegian height harmony patterns can be efficiently and straightforwardly accounted for with these new representations. Old Norwegian featured several kinds of transparency and blocking. I have argued that Old Norwegian height harmony was relativized to [high] contrastive visibility and bounded by high-sonority elements, resulting in the transparency of [high] non-contrastive [ɛ, ɔ] and blocking by high-sonority [+low] vowels [a, æː, ɒː]. Trisyllabic data indicate that height harmony in Old Norwegian was bounded to adjacent syllables, and I have shown how intervening featural under/specification can explain the variably dis/harmonic behavior of definite enclitics. This analysis and the problems it addresses illustrates that philologically-informed linguistic analysis can provide accurate phonological models of historical sound patterns which are of both typological and theoretical value. This study also shows that linguistically-informed philological analysis can help refine our understanding of intricate orthographic patterns in historical textual material and reveals that our textual records are far more reliable and accurate linguistic witnesses than might otherwise have been assumed.

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