An Outline of the Phonology of Modern Icelandic Vowels
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AN OUTLINE OF THE PHONOLOGY OF MODERN ICELANDIC VOWELS*

Modern Icelandic displays a rich variety of vowels in the surface forms of words. In stressed\(^1\) syllables these include the following:

<table>
<thead>
<tr>
<th>Phonetic</th>
<th>Orthographic</th>
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<tbody>
<tr>
<td>[ij]</td>
<td>i, y</td>
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<tr>
<td>[I]</td>
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<td>[a]</td>
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<thead>
<tr>
<th>Phonetic</th>
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<td>[uw]</td>
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<tr>
<td>[e]</td>
<td>ei, ey</td>
</tr>
<tr>
<td>[öü]</td>
<td>au</td>
</tr>
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</table>

In unstressed syllables only i, u, and a are found. All of these vowels and diphthongs can occur with or without phonetic length; this length is clearly a surface phonetic fact, assigned by the following very late rule:

\[
V \rightarrow \left[ +\text{long} \right] / \sim C_0^1 \left\{ \left[ +\text{son} \right] +\text{cnt} \right\} \left\{ V \right\} \#
\]

Other late rules may insert glides after vowels before velars (ŋ, gi > ji, gj > j) and devoice the final mora of vowels and diphthongs before geminate voiceless stops and certain stop/sonorant clusters. These rules are of little interest phonologically and will not be discussed further.

Concerning the distributions of these vowels, it will immediately be noticed that there are systematic alternations between certain sets of vowels in morphologically related forms. Consider the following forms:

<p>| | |</p>
<table>
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<th></th>
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<tbody>
<tr>
<td>a.</td>
<td>b.</td>
</tr>
<tr>
<td>svangur ‘hungry’, svengri ‘hungrier’</td>
<td>hár ‘high’, hærri ‘higher’</td>
</tr>
</tbody>
</table>

* This work was supported in part by contract number AF 19 (628) 5524 to Brandeis University. I have benefited greatly from discussions with Morris Halle, Paul Kiparsky, and especially Roy Wright during the course of this work. As usual, they are to be dissociated from errors appearing in it. The theory of phonology assumed in this work is essentially that of Chomsky and Halle (1968).

\(^1\) Stress in Icelandic is basically on the first vowel of a word, and on the first element of a compound. Secondary stress appears on other vowels in certain forms, however; especially in loan words. Most Icelandic morphemes are mono-syllabic, and I have simply assumed the assignment of stress as required in those few forms showing secondary and lower stress, all of which count as [+ stress].

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S. R. ANDERSON

c. ofan ‘(from) above’, efri ‘higher above’
d. stór ‘big’, stærri ‘bigger’
e. fullur ‘full’, fyllri ‘fuller’
f. mjúkur ‘soft’, mýkri ‘softer’
g. austur ‘easterly’, eystri ‘more easterly’

This alternation, which will be discussed much more extensively below, will be called *i*-umlaut, and appears to be conditioned by the presence or absence of an /i/ in the syllable after the vowel in question. We can say then that the vowels in the positive forms in 2 are basic, and are converted into the vowels in the comparative forms by the rule of *i*-umlaut.

But it is immediately obvious that this statement alone is wildly inadequate. For instance, the large majority of masculine and neuter strong nouns have a dative singular ending in /-i/, but most of these do not show umlaut, e.g.:

(3)  
  a. hattur ‘hat’, d.sg. hatti
  b. hlátur ‘laughter’, d.sg. hláti
  c. borði ‘table’, d.sg. borði
  d. blóm ‘flower’, d.sg. blómi
  e. fundur ‘discovery’, d.sg. fundi
  f. hús ‘house’, d.sg. húsi
  g. draumur ‘dream’, d.sg. draumi.

Case endings are of course always unstressed; if we remember that only a, i, and u can occur in this position, we see that we could account for these instances of *i* which do not produce umlaut by representing them with some other vowel in their underlying forms, and then adding a rule at some point after the umlaut rule has applied converting this other vowel to *i* in unstressed position. Unless some other phonological property of these vowels becomes manifest which would motivate some other choice, the logical candidate is a vowel which differs from *i* by as few features as possible. The vowel *e* differs from *i* by only one feature; we will therefore represent the dative singular ending of these nouns, as well as other instances of surface *i* which do not produce umlaut as *e*.

This is still not the end of the problems raised by the umlaut rule, however; a number of cases appear to show umlaut, but have no *i* in the surface forms. For example:

(4)  
  a. mann ‘man (acc. sg.)’, menn (acc. pl.)
  b. gás ‘goose (NAD sg.)’, gæs ‘geese’
  c. hnot ‘nut’, hnetur ‘nuts’
  d. bók ‘book’, bækur ‘books’
  e. múþ ‘mouse’, múþ ‘mice’.
We could claim at this point that umlaut is not predictable in Icelandic, and must be indicated by some *ad hoc* feature in the lexicon, as suggested for German by Zwicky (1965). Since this would involve an enormous cost, however, another solution would certainly be desirable. In fact, we could represent the umlauted forms in 4 as containing an *i* which is later deleted; this solution requires that all instances of *i* be marked with some diacritic feature indicating whether they are subject to the deletion rule. This solution is not much better, and may even be more costly than the purely *ad hoc* umlauting feature solution. However, as we shall see, it is possible to save it.

To see how, we must first consider the system of vowels in more detail with respect to their underlying feature composition. Considering only the vowels represented in the orthography by a, o, u, e, and i (y), we see that they differ from the vowels represented by the corresponding symbols with an acute accent primarily by the addition of a glide. Considerable economy can be achieved, therefore, if we represent them as differing from the vowels represented by the symbols with the acute accent only by the presence of some single feature, which will cause some later rule to insert the glides in the appropriate segments. Since the phonetic difference between these two classes of vowels is one of tenseness as well as diphthongization, let us use the feature [±tense].

While there are some generalizations that can be made about the distribution of the feature [tense] in underlying forms, its value in syllables that will receive the stress is generally unpredictable. In unstressed syllables, however, as we have noted, only [−tense] vowels occur. In order to capture this generalization, the grammar will have to contain at some point a rule such as:

\[(\text{II}) \quad \text{[− stress]} \rightarrow \text{[− tense]} / \left[\begin{array}{c} \ \text{V} \ \end{array}\right] \]

But now note that we have available a feature that can be used to differentiate those instances of *i* that are subject to the deletion rule from those that are not. If we represent the *i*’s that are to be deleted as [− tense], and those that

---

2 The two cases in which the vowel with the accent is marked different from the vowel without plus a glide are: a. ō which is phonetically [je], about which more below, and b. u/ú, where the lax member of the pair is fronted to [ü]. This is a late phonetic fact which will be mentioned below.

3 In a great many forms, tenseness could be assigned by a rule much like I. This is not true of all forms, by any means, however, and I do not know what generalizations can be extracted about tenseness in the modern language. This situation arises because something like rule I has always been part of the grammar; originally it assigned vowel length, which was later re-interpreted as distinctive tenseness when the second more of long vowels became glides. At this point a new value of non-distinctive length was evidently re-introduced, which is the situation today.
are not [+tense], and order rule II after the deletion rule, the correct results will be obtained.

It should be noted here that not all unstressed lax i’s (and u’s as well, as will be pointed out shortly) are subject to deletion; this rule applies only in certain environments. In other environments the distinction of tenseness in unstressed vowels is irrelevant, as is reflected by the application of rule II to these vowels after the others have been deleted. The situation with regard to the deletion of vowels and the other fates they may suffer will be discussed in greater detail after the umlaut rules have been elaborated, since their evidence is clearly crucial.

Another widespread type of alternation is between a and ō:

(5) fata ‘pail’, fōtu ‘pail (Gen., dat., acc. sg.)’

In general, this alternation appears to be conditioned by the presence of a u in the following syllable. But this formulation leaves much to be accounted for: first, many nouns which end in /−ur/ in the nom. sg. do not show the alternation (henceforth u-umlaut): e.g.

(6) dalur ‘valley’, akur ‘field’, faraldur ‘epidemic’ etc.

One could, of course, represent these endings as containing some vowel other than u (e.g. o) which does not otherwise occur in unstressed position and then change it to u after u-umlaut has applied, in much the same way that the non-i-umlauting i’s were produced from e; however, this will lead to loss of generality. After nouns whose stem ends in a vowel, the nom. sg. ending is simply /−r/:

(7) læknir (<lákni + r) ‘doctor’, snjör (<sneo + r) ‘snow’ etc.

thus, if the nom. sg. ending is represented as /−or/ a rule will be needed to delete the o after a vowel. Furthermore, in nouns whose stem ends in a dental sonorant (r, l, or n) or s, the nom. sg. ending is assimilated to the final consonant of the stem (also rr > r, ss > s). Thus we get these nom. sg. forms:


Thus the rule would also have to delete o after these segments. If, however, we derive all these forms from a single ending /−r/, and incorporate in the grammar the rule:

(III) 0 → u / C---r \{C\} #

56
OUTLINE OF THE PHONOLOGY OF MODERN ICELANDIC VOWELS

which applies after both the assimilation discussed for the forms in 8 and the
u-umlaut have applied, the correct forms will be obtained, as well as the
generalization that Cr sequences do not occur before either C or #.

As with the i-umlaut rule, there exist forms which seem to show u-umlaut
without a u being present in the surface forms:

(9)alfal `child (n. sg.)', börn `children (n. pl.)', blæð `newspaper',
blöð `newspapers', tagl `horsetail', tôgl `horsetails'

A solution similar to that outlined for the analogous cases of i-umlaut seems
to be available here; i.e., unstressed u may be either tense or lax; in certain
positions lax u will be deleted, while tense u will remain, being laxed by rule II.

The a/ð alternation is not the only one produced by the u-umlaut rule;
in unstressed position the u-umlaut of a is u. Thus, parallel to the forms
in 5 and 9, we have forms such as:

(10)meðal `drug, medicine (nom. sg.)', meðulum (dat. pl.), meðul
(nom. acc. pl.), hérað `region (nom. sg.)', héruðum (dat. pl.),
héruð (nom. acc. pl.)

In addition, if an a has been uumlauted to u, an a in the preceding syllable
may also be uumlauted to ð, but if a stressed syllable intervenes, the a which
precedes it will not be uumlauted. Thus:

(11) a. fatnað `suit of clothes (acc. sg.)', fótntuðum (dat. pl.)
but b. almanak `calendar (nom. sg.)', almanöð (nom., acc. pl.)

4 For certain classes of borrowed words, I assume a lexical representation involving a
stressed vowel. Almanak, for example, is represented in the lexicon with primary stress
on the final a. When the normal stress rule applies to these forms, it will assign primary
stress on the first syllable, lowering the lexically given stress to secondary by convention.
A late phonetic rule will delete all but the highest stress within a word or part of a com-
 pound. While this solution is at first sight something less than esthetic, it can be shown
to be perfectly plausible. In the first place, the posited lexical stress is always found to be
on a syllable which bears the stress in the language from which the word is borrowed;
thus, almanak has final stress in German. The rule which erases subordinate stresses at the
end of a derivation is necessary in any case, since the second element of an underlying
diphthong has the behavior of a stressed vowel (as will be noted below), and this stress
must be removed from the phonetic form. It will also be noted that the exceptional behavior
of these forms is precisely what would be expected of forms with extra stressed vowels.
Note that the final vowel of almanak prevents u-umlaut from applying to the preceding a
vowels, while unstressed a can normally intervene between an a and u which uumlauts it.
Also this vowel does not reduce to u, despite its phonetically unstressed nature; if it were
stressed at the point where the reduction rule applies, there would be no question of its
being subject to it. A final point is that this treatment allows us to explain some of the
puzzling diversity of the dative plural of banana in Icelandic. The expected form, bónunum,
does indeed occur, but su also does the form barnum. This is what would be expected
if the form had lexical stress on the second vowel. There is in fact a third form of this word:
some speakers can say banum. This is a totally irregular form; I propose diffidently

57
There appear to be only two exceptions to this rule – the nouns:

(12) kafald ‘blizzard’, pl. köföld
     hafald ‘lifting gear, jack’, pl. höföld

Note that the a/u alternation is exactly what would be expected in unstressed syllables, since only a, i, and u occur in this position. If we permit unstressed a to go to ō as well as stressed a, it will be converted to u by the same rule that converts unstressed e to i, which apparently must be:

(IV) $[-\text{low}] \rightarrow [+\text{high}] / [\text{a} \text{round} \quad \text{a} \text{back}]$
     $\quad [\text{a} \text{back} \quad -\text{stress}]$
     $\quad \text{V}$

The two forms in 12 can be treated as exceptional with respect to this rule. Note that if the intervening vowel is other than an a, whether stressed or not, the earlier a will not be umlauted:

(13) akkeri ‘anchor (nom. sg.)’, akkerum (dat. pl.)

These facts suggest that the rule of $u$-umlaut should be stated as in (V):

(V) $[+\text{low}] \rightarrow [\text{+round} \quad -\text{back}] / [\text{+tense} \quad \text{V}]$ $(\begin{array}{c} C_0 \quad \text{V} \\ \text{+low} \quad -\text{stress} \quad \text{V} \end{array})_0 C_0 \quad \text{V} \quad +\text{high} \quad +\text{back}$

Since the $(C_0 a)_0$ portion of this rule represents the abbreviation of a potentially infinite schema, it will apply to as many instances of a as possible simultaneously.

At this point we might consider the possibility of an alternative formulation of the change performed by this rule. As a statement of the facts it is adequate, but its somewhat complex form leads us to seek an explanation of the change in terms of more general phenomena. The rule actually performs three operations; the conversion of low vowels into rounded, then non-low, then non-back. Let us consider each of these steps in detail.

First we note that there are no other vowels with the features $[+\text{low}, \text{round}]$. That it can be derived by assuming that the vowel-reduction rule is allowed to apply to the second vowel, even though it has a secondary reduction which blocks the $u$-umlaut. The reason for this appears to be the strong feeling of Icelandic speakers that ō does not appear in synchronically foreign words. This appears to be a purely surface constraint on phonetic forms which would be violated in any regular derivation of the dative plural of banana.

5 As will be noted below, there do not exist forms which would provide a crucial test of this assumption about schemata. I merely state it in conformance with the convention proposed by Chomsky and Halle (1968).
+round]. If we were to allow the u-umlaut rule to simply round the vowels in question, they would be unambiguously marked, so that a later rule would be able to convert them to non-low front vowels. There is, in fact, some reason to believe that at least part of the change from a to ð is the product of a later rule: the rule of velar fronting, which will be mentioned again below, applies generally before front vowels produced in several ways, but not before ð (from a) or û < u. This leads us to postpone at least the fronting of the vowel until after the application of velar-fronting.

We can also note that, as a late phonetic fact, the lax vowel o is pronounced [o]. The grammar will thus require a rule at some point to provide this vowel with the feature [+low]. If we complicate this rule by the addition of only one feature, we can cause it to raise those instances of [a] obtained by our reformulated rule of u-umlaut as well, a change which will require the expenditure of one feature at some point in the grammar in any case:

\[
\begin{array}{c}
V_a \\
[+\text{round}] \rightarrow [\ddot{\text{a}}]\in \text{low} \\
\end{array}
\]

At this point, umlauted a has been rounded and raised, and only remains to be fronted. But there is another late phonetic rule in Icelandic which fronts lax u to û; an obvious generalization of this rule from [+high] vowels to [−low] ones will account for this fact at no extra cost in features:

\[
\begin{array}{c}
V_b \\
[+\text{round}] \rightarrow [−\text{back}] \\
\end{array}
\]

With the addition of rules Va and Vb, the u-umlaut rule can be reformulated in a much more intuitive fashion:

\[
\begin{array}{c}
V_c \\
[+\text{low}] \rightarrow [+\text{round}] \\
\end{array}
\]

We have thus succeeded in explaining the change from a to ð in terms of generalizations of rules which are needed in the grammar in any case.

The ordering of this rule with respect to others presents an interesting situation. There exists a rule in Icelandic (which will not be extensively discussed here) which deletes a final vowel before one consonant followed by an ending beginning with a vowel under certain conditions. Thus, one gets
forms such as:

(14) hamar 'hammer (nom. sg.)', hamri (dat. sg.),
     fifill 'dandelion (nom. sg.)', fifli (dat. sg.),
     gimbur 'ewe (nom. sg.)', gimbrar (gen. sg.)

Forms such as:

(15) alin 'ell, measure of cloth (nom. sg.)', ölnum (dat. pl.),
     ketill 'kettle' (d. sg. katli), költum (d. pl.)

indicate that this rule must apply before the *u-umlaut* rule, since otherwise
a vowel other than *a* (e.g. *e*) would intervene between the *a* and the umlauting
*u*. But other forms, such as:

(16) djöfull ‘devil (nom. sg.)’, djöfla (gen. pl.)

indicate that the *u-umlaut* must apply before the syncope rule, since in this
case it is the *u* which causes umlaut which is syncopated. In all such cases
the *u* belongs to the stem; the apparent contradiction in rule ordering could
be resolved in one of several ways. One might assume that the rules of
umlaut and syncope apply in a cyclic fashion, applying in this order first
to the stem alone and then to the entire word. The disadvantages of this
solution are apparent; aside from the lack of motivation for positing a
significant level of bracketing around the stem alone, this would be the only
segmental rule known which is cyclic. It seems desirable to restrict the
tremendous potential power of cyclic application to rules of stress assign-
ment and the like, and to find a weaker hypothesis capable of accounting
for the segmental facts.

Notice that every argument which has ever been given for the existence
of a segmental cycle in the phonology of any language is of just this form:
given two rules R1 and R2, there are some forms to which they must apply
in that order, while there are other forms to which they must apply in the
order R2 and then R1. As Kiparsky has pointed out (pers. comm.), no cases
are known in which more than two rules are involved (except by extension
of ordering relationships which involve only two rules at a time; that is,
there are no known cases of rules R1, R2 and R3 which must apply in the
order R1, R2, R3, R1, R2, R3 for reasons internal to the formulation of the
rules themselves). There are also no cases in which several cycles are neces-
sary, two passes through the rules being sufficient to account for the facts.
Most of the potential power of the cycle seems to be going to waste. Let us
make the weaker claim (which, being less powerful, restricts the class of
possible grammars in a more interesting way) that some rules in the phon-
ology can apply at more than one point in the derivation (up to some
specified point; here, the vowel reduction rule); i.e., that there are some
pairs of rules whose ordering is not specified relative to each other. Under this convention, we can apply the umlaut rule to forms like 16 before the syncope, and are not prevented from applying it to forms like 15 after the syncope.

Cases such as this provide empirical evidence relevant to recent discussion of the problem of ordering in a grammar. Chomsky (1967) has discussed the claims made by the assertion that the phonological rules can be ordered, and has assumed that they therefore are ordered (note that this question is logically independent of the issue of whether or not the rules have to apply sequentially in the course of a derivation). This is of course the more restrictive, and hence more interesting claim; cases such as that discussed above indicate that it probably cannot be maintained. In fact, the rules of a grammar are apparently not ordered with respect to one another in all cases; some rules are unspecified for position in the ordering and apply at several points. Equivalently, one can say that the set of ordering relationships between rules is not necessarily consistent with a single linear order.

This convention on ordering is in the spirit of traditional discussions of ‘euphonic laws’ in pre-structuralist grammars. In grammars such as those of the Handbook of American Indian languages, Whitney’s Sanskrit Grammar, and much of Sapir’s work, the euphonic laws are stated without indication of ordering relationships except in those cases in which the data provide some definite indication of a specific order.

It is clear that this can be avoided by simply building the environment for the syncope rule into the u-umlaut rule, so that a vowel to be deleted may optionally be skipped over. This environment is by no means simple, however, and duplicating it in this way is a very expensive procedure. The fact that the environment for syncope per se clearly has nothing to do with the process of u-umlaut increases the clearly counter-intuitive nature of this solution. The evidence in favor of the unordered nature of the u-umlaut rule thus seems to be both clear and obvious.

The traditional explanation of the operation of the u-umlaut (Einarsson, 1945; Gordon, 1957; Heusler, 1964) claims that umlaut of unstressed a to u took place first, and these secondary u’s then caused umlaut of preceding stressed a to ŏ. The problems with this solution are at least three: first, it requires two separate, otherwise unmotivated rules to account for the changes. Secondly, it claims that the change in unstressed syllables is completely independent of that in stressed syllables; it could equally well have been the case that a>i in this position, for example. The solution proposed above preserves the unitary effect of the change, and accounts for the surface dissimilarity of effect in terms of an otherwise motivated rule. Thirdly, the traditional solution would make it much more difficult to account for the
exceptional forms 12; rather than being simple exceptions to a general rule, they would require a special minor rule to account for them. The crucial examples for deciding between these two solutions would be words in which three a’s, the last two of which are unstressed, are unumlauted; the traditional solution would predict that the last would become u but that the first two would remain unchanged, while the proposal above would claim that all three vowels would be affected. Unfortunately, no forms appear to exist which can be shown unambiguously to have this shape.

So far as can be told, all instances of the vowel ṭ in words subject to productive morphological processes (nouns, verbs, and adjectives) should be derived as the u-umlauted forms of words containing an underlying vowel a. The phonetic nature of the first element of the diphthong represented au is also produced by the operation of this rule.6

Let us now consider the alternations in the stem vowels of strong verbs traditionally subsumed under the label ablaut. These verbs are generally grouped into seven classes depending on the vowel alternations in the standard reconstruction of proto-Germanic, a division whose appropriateness for the modern languages is certainly questionable. However, since a complete survey of the strong verb is considerably beyond the scope of this paper, a sampling of representatives of these classes will suffice to give an idea of the sorts of alternations encountered:7

(17)  
i. bita ‘bite’ beít bitum bitinn
       miga ‘piss’ meig migum miginn
ii. drjúpa ‘drop’ draup drupum dropinn
       hnjóta ‘stumble’ hnaut hnutom hnotinn
iii. serða ‘copulate with’ sarð surðum sorðinn
       spinna ‘spin’ spann spunnnum spunninn
iv. bera ‘spin’ bar bárum borinn

6 As will be noted below, the phonetic character of the u element of this diphthong (iü) is identical with the normal form of stressed lax u. This fact can be accounted for naturally if we assume that the stress rule applies secondary stress to the second element of a diphthong which receives primary stress. This stress will prevent the reduction of these elements to glides and permit them to behave as ordinary u. The rule which removes these secondary stresses (actually all stresses subordinate to the highest within the range of the word) serves also to account for irregularities in the behavior of some borrowings, as has been mentioned above (fn. 4).

7 The diversity of patterns in strong verbs in the modern language is vastly greater than can be indicated here, since these alterations are still controlled by apparently productive rules which have produced numerous changes since the Old Norse and especially the proto-Germanic periods. Icelandic may well be the only modern language showing ablaut as a productive process. The principle parts shown here are, in order, the infinitive, the preterite singular, the preterite plural, and the past participle. Since the intent of this discussion of the strong verb is simply to provide motivation for rule VII below, it will be fragmentary in the extreme, leaving most of these problems unsolved.
stela 'steal' stal stálum stolinn
v. gefa 'give' gaf gáfum gefinn
biðja 'ask' bað báðum beðinn
vi. grafa 'bury' gróf grófum grafinn
taka 'take' tók tókum tekinn
vii. leika 'play' lék lékum leikinn
falla 'fall' fell félúm fallinn

Considering first verbs like serða, we see that the structure appears to be [sVrð] where the vowel is e, a, u, or o, depending on the tense. Spinna shows different vowels from serða in the infinitive and past participle, but these can be regularized if we note that all verbs with n + C after the vowel have this shape. Thus, for strong verbs only, we have the rule:

\[
(VI) \quad [-\text{low}] \rightarrow [+\text{high}] / \left[ \begin{array}{c} \text{V} \\ \text{n} \end{array} \right] [-\text{cont}]
\]

Class iii contains all verbs with sonorant plus consonant after the root vowel, including a few in which the consonant is a voiceless stop, which causes a preceding nasal to assimilate completely, as in drekkja 'drink', from underlying [drenk + a]. The assimilation precedes rule VI.

The verbs of class ii could be assumed to be similar if we considered the vowels to be jú/jó, au, u, o. If we note that jó appears only before dentals, and derive this by a rule, we have simply jú, au, u, and o. If we further consider the o of the past participle to be derived from u, we have the alternation jú, au, u, u. This last is possible because no verbs have u in the past participle except those for which it is derivable by rule VI. We can then take the underlying vowel of class iii verbs, as well as class ii, to be u; a rule of inflection applies at some stage very early to produce o. Note that all other vowels (a, e, and i) appear in the PP of at least some verb. At this point it appears that the u can be considered part of the root,8 and the V position in the formula [drVup] to be filled, alternatively, by j, a, 0, and 0.

If we consider the verbs of class i to have basic shapes like [bVit], the third and fourth forms will again be with θ vocalism. The preterite sing. appears to be different, with e rather than a, but it will be remembered that e is the i-umlaut of a, produced by a following i. Thus this form conforms to the same pattern. What, then of the infinitive of these verbs? If the vocalism were either e or i we could regularize class i as being the same as either class ii or class iii. Consider the fact that all ei’s appearing in surface forms can be produced from ai by the regular rule of i-umlaut. What then is the reflex of a hypothetical underlying ei sequence? Let us assume that a rule like

8 I must assume the tenseness of the infinitives of these forms is an ad hoc morphological fact, though it may well be possible to formulate a rule to account for it.
rule VI also applies to raise e to i before i (this rule is probably part of the
\textit{i-umlaut}, though this aspect of the problem of umlaut is somewhat unclear
and will not be discussed further here); this will then give the sequence \textit{ii},
which (as will be discussed below) is the same as \textit{i}.

We now have the basic forms and alternation patterns shown in 18:

\begin{equation}
(18) \quad \begin{array}{l}
i. \text{CViC where } V = e, a, \emptyset, \emptyset \\
ii. \text{CVuC where } V = j, a, \emptyset, \emptyset \\
iii. \text{CVSC where } V = e, a, u, u
\end{array}
\end{equation}

The \textit{u} of class iii and the \textit{\emptyset} of classes i and ii can clearly be taken to be the
same vocalism, distributed before consonants and vowels respectively. This
alternation between \textit{\emptyset} and \textit{u} can undoubtedly be accounted for as a generaliza-
tion of rule III which produces epenthetic \textit{u} before \textit{r} in endings. If so, the
epenthesis rule must clearly apply before the stress rule in order for the
vowels of the preterite plural and past participle of class iii verbs to be stressed.
The stress rule probably applies early and cyclically, since stress is relevant
to many of the rules of the segmental phonology, and seems to be assigned
cyclically as in English. Thus, the \textit{u-epenthesis} must apply both early in the
derivation and late; it appears to be unordered. Since the \textit{u-umlaut} must
not apply after it, we have here a case of an ordering constraint between
two otherwise unordered rules.

At this point only the \textit{j} of the infinitive of class ii verbs prevents us from
considering all three classes as showing the same basic alternation, with
variations predictable on the basis of tense form together with phonological
shape by reasonably plausible rules. But in fact, \textit{e} never occurs as the first
element of a morpheme internal diphthong in any forms except where it
arises from \textit{a} by umlaut. If the \textit{j} in the infinitives of class ii verbs were taken
to be from a basic \textit{e}, and we were to assume the existence of a rule to shift
the stress from \textit{e} to a following vowel, the \textit{e} would be converted into \textit{j} by
otherwise general rules which convert unstressed vowels into glides before
other vowels, as will be discussed below. Since \textit{j} is the glide corresponding
to \textit{e}, the positing of this vowel allows us to describe the vowel alternations
in the first three classes of strong verbs as \textit{e}, \textit{a}, \textit{\emptyset}, \textit{\emptyset}. Another rule to account
for the unexpected \textit{\textit{a}} of the preterite plural of class iv permits us to extend
the regularity of this alternation to that class as well. Class v is more complex,
but \textit{e} and \textit{a} can be posited for the infinitive and pret. singular in this class
as well. All of this lends considerable support to the rule VII, since it allows
us to regularize most of the ablaut forms of the vast majority of strong
verbs: 9

9 Though I have given no evidence to support the shift of tenseness as part of the stress
shift, further examples given below will provide examples.

64
Some additional evidence for rule VII can be obtained from the declension of nouns with final \( \dot{e} \), such as \( \text{fé} \) 'money'. The genitive singular of this noun is formed by the addition of /+ar/, one of the two regular genitive endings for strong nouns. The actual genitive form, however, is \( \text{fjár} \), exactly what would be expected if rule VII applies to \( \text{fé}+\text{ar} \). Other forms with tense \( \dot{e} \) in the cases with null endings, such as \( \text{tré} \) 'tree', \( \text{hné} \) 'knee', and \( \text{hlé} \) 'shelter' have dative plurals with vocalism \( \dot{j} \): \( \text{trjár}, \text{hnjár}, \text{hljár} \). Let us assume that these forms have an underlying root vowel \( e \). In final position this vowel will be automatically tensed; stressed final vowels cannot be lax in Icelandic. In the dative plural \( e \) will be broken to \( \dot{a} \) as discussed below; then rules for the coalescence of vowel sequences over morpheme boundary will convert the sequence \( a+u \) to tense \( \dot{a} \). The stress shift will then give the desired forms.

Another phenomenon of Icelandic phonology which has received a great deal of attention from scholars is the alternation called breaking, whereby a lax stressed \( e \) alternates with \( ja \) before \( a \) in the next syllable or \( jö \) before \( u \) in the next syllable, as in:

\[
\begin{align*}
\text{i. gjöf} & \text{ ‘gift’} \\
& (< \text{gef}+u, \text{cf. gefa} \text{ ‘to give’}) \\
& \text{gjafar} \text{ GSg} \text{.} (< \text{gef}+\text{ar}) \\
& \text{gjöfum} \text{ DP1} \text{.} (< \text{gef}+\text{um}) \\
\text{ii. gjalda} & \text{ ‘to pay’} \\
& \text{geld} \text{ 1 sg. pres. indic.} \\
& \text{gjöldum} \text{ 1 pl. pres. indic.}
\end{align*}
\]

The conditions under which this change takes place are quite complicated, and it is not intended to discuss them other than to note the presence of \( a \) or \( u \) in the following syllable. It will be seen immediately that the two changes are in fact the same, \( jö \) being derived from intermediate \( ja \) by \( u\)-umlaut. Both represent a change from \( e \rightarrow ja \), apparently quite ad hoc. By keeping rule VII in mind, however, we see that if we assume that the breaking rule simply inserts a short \( a \), the sequence \( ea \) will be converted to \( ja \) automatically (and thence to \( jö \) before \( u \)). This provides additional support for rule VII, since it permits us to state the breaking rule much more simply and naturally.
If, now, we consider the vowels written with acute accent, which have been called tense here (à, ó, ú, é, í), we see that with the exception of é, each consists of a simple vowel plus a high glide of the same frontness. If we were to consider that the rule creating these glides did so by adding a non-low copy of the vowel in question, the correct output would be obtained. These vowels (being unstressed) would all be raised to [+high] by rule IV, and then converted to glides.

(20)  
i. á > ao > au > aw  
ii. ó > oo > ou > ow  
iii. í > ii > ij  
iv. ú > uu > uw  

This process is perfectly natural from the historical point of view; the tense vowels developed from original long vowels, and the change could thus be explained as the conversion of the second mora of an original bimoric vowel into the corresponding glide.

Note now that if we allow this rule, which can be stated as follows:

(VIII) \[
\begin{array}{c|c}
V & \emptyset \\
\hline 
+\text{tense} & 1 \\
\end{array}
\]

\[
\begin{array}{c|c}
1 & 2 \\
\hline 
-\text{tense} & 1 \\
-\text{low} & 1 \\
\end{array}
\]

to apply to é as well as the other tense vowels, the sequence ee will be obtained. But then rule VII will apply to this, so that the glide rule that applies will be the one converting the first e (after it is raised to i by rule IV) to j, since this is now unstressed and in position before a stressed vowel. This gives the correct output of [je], a value which must otherwise be regarded as highly unnatural. This explanation of an otherwise irrational aspect of the vowel system is evidence of the strongest sort for the correctness of rule VII.

The forms in 2 illustrate the alternation known as i-umlaut; evidence from forms other than adjective comparison includes the following derivatives:

(21)  
a. kerling ‘crone’ (karl ‘old man’)  
b. bæklingur ‘pamphlet’ (bók ‘book’)  
c. yrðlingur ‘cub’ (urð ‘hole’)  
d. ðvegill ‘cleaner’ (þvo ‘to wash’)  

In addition the alternation can be observed regularly in the infinitive vs. the

10 The glide corresponding to a is made round by a marking convention which assimilates backness and rounding in non-low vowels.  
11 These examples are taken from Valfells, 1967.
present tense (sg.) of strong verbs, the preterite vs. the present of class I weak verbs, and at other places in the verbal system. The correspondences between the surface forms of unumlauted and umlauted vowels are:

(22) Unumlauted vowel  Umlauted vowel
    a            e
    á           æ
    o            e
    ò            æ
    u            y (= phon. i)
    ú           ý (= phon. i)

Let us consider the form of this rule. It is of course primarily an alternation between front and back vowels, and it applies to stressed vowels followed in the next syllable by a high front vowel. The front/back pattern appears to be destroyed, however, by the umlauted vowel æ, corresponding to both á and ò, since it is phonetically [æi]. There is, however, another rule in Icelandic whereby velars are fronted before vowels. This rule applies before æ as well as phonetically front vowels; consequently, it would be simplified if æ were also a front vowel at the point where it applies. Let us assume that the umlaut of á is in fact a tense low front vowel, which is later backed. This will also account for the glide associated with it, which will be assigned correctly by rule VIII if that rule also applies before the backing rule.

The rule should then make all vowels [−back] if it applies; should it also make them [−round]? The marking conventions will not do this, since the vowel æ is also produced in the output of the rule in addition to vowels which are [−low], and the marking convention will only cause rounding to agree with backness if the vowels are all [−low]. Apparently, then, we need to state that the output of the umlaut rule is [−round].

What, now, are the umlauts of the non-high back vowels? Tense á correctly goes to tense æ, and lax o to lax e (thus expressing the fact that there is no surface lax vowel corresponding to tense æ). What of tense ò? It is possible to write a rule which will take this directly to tense æ:

\[
(X) \quad \begin{cases} \text{V} & \text{[−back]} \\ + \text{back} & \text{[−round]} \end{cases} \rightarrow \frac{\text{[−high]} \ (\text{where E is the environment for the rule})}{\text{[−low]} + \text{tense}}
\]

This rule is not entirely satisfactory, however, and a treatment which involved
the lowering of tense \( \ddot{a} \) in some way might be preferable. I leave the matter of the formulation of the change at the stage of rule X.

It has been noted that the presence of an \( i \) in the next syllable is a possible condition for the application of this rule; it also applies if the vowel is followed immediately by a velar plus \( e \), as in the dative singular of dagur, which is degi.\(^{13} \) It will be remembered that the dative singular ending is \( e \), raised to \( i \) only after the umlaut rule has applied. The fact that it is a velar followed by a front vowel which produces the umlaut is suggestive; remembering that velars followed by front vowels become fronted, as noted above, we see that the features which distinguish these segments are \([+ \text{ high}, - \text{ back}]\), exactly the features which distinguish the vowels producing umlaut. We are thus tempted to formulate the environment for the rule as follows:

\[
(Xa) \quad (\text{i-umlaut}) / \quad \longrightarrow \quad \langle C_0 \rangle \begin{bmatrix} + \text{ high} \\ - \text{ back} \\ \langle - \text{cons} \rangle \end{bmatrix}
\]

A problem arises with this formulation, however; vowels which are produced by umlaut cause velar fronting, and so this rule must follow the umlaut rule. In order to preserve the formulation of the environment in Xa, however, the velar fronting rule must precede the umlaut rule. No cyclic solution appears possible here, since the umlaut vowels which cause fronting may be produced on the highest cycle, as may the fronted velar that causes umlaut. Unless we assume that there is at least one cycle beyond the word level, there appears no alternative but to allow velar + \( e \) as an environment for rule X in addition to the environment before a high front vowel. If there were any forms in which vowels other than \( e \) which cause velar fronting but not umlauting, such as \( a \), appeared after a velar after an umlautable vowel, we could determine whether in fact velar fronting plays some role in the umlauting process as suggested by the formulation Xa. To state this environment as two separate and unrelated facts would miss the generalization that high front vowels and high front consonants in fact form a natural class, and that the umlaut is the same process in both cases. We might be tempted to argue that velars are in some sense ‘more transparent’ to frontness assimilation than other consonants, and that any front vowel can cause umlaut after them, and not simply high ones. But this would be incorrect; a sequence of velars will not produce umlaut when followed by \( e \), and though there are no forms in which the relevant sequences appear, it is

\( \text{is no reason to derive it from the umlaut of } u, \text{ since it belongs to a class of nouns that do not generally show umlaut. If this is in fact correct, a rule would be needed in the grammar to unround front vowels anyway, and the umlaut rule might well be written differently.} \)

\(^{13} \text{The umlaut before velars affects only the vowel } a, \text{ but the process is clearly the same as that which occurs before } i \text{ and is traditionally so described.} \)
intuitively unlikely that a sequence like *ae*, in which there is no consonant at all, would show umlaut. This would lead us to the conclusion that single velars are more transparent to frontness assimilation than nothing at all.

If we assume, however, that the rule of velar fronting is not part of the grammar of Icelandic at all, but rather one of the universal marking conventions, we see that this ordering dilemma is resolved; at any point where a sequence of velar plus front vowel appears, the convention will front the velar. Note that this is not simply an assimilation of a velar to the backness of a following vowel; when the vowel *e* becomes [æi] this does not cause the velar to be retracted. This appears to be a case in which particular language data give very precise indications of the content of a universal markedness convention.

It was noted earlier that *i*'s which do not cause umlaut can be represented as underlying *e*, and that the feature of tenseness is available to differentiate two sorts of *i* which do cause umlaut, those that are later deleted and those that are not. Parallel to forms like (sg. nom. maður) *mann/menn* 'man/men' and *hnot/hnetur* 'nut/nuts' which require a disappearing *i* in the plural, there are forms like:

(23)  
   a. meðal 'medicine', nom. pl. meðöl, -ul
   b. barn 'child', nom. pl. börn
   c. gjöf 'gift' (stem gjaf, cf. gen. sg. gjafar)

which require a disappearing *u*. The same feature is obviously available to differentiate those *u*'s causing *u-umlaut* which disappear from those which remain.

The majority of the *i*'s and *u*'s which are deleted are in final position. Forms like *bók/bækur* 'book/books' show that a final *r* does not prevent the *i* from being deleted; genitive forms like *Söngs* (stem *sang + u*) show that *s* does not prevent deletion either. Before some vowels, \(^{14}\) however, these lax vowels remain, appearing as glides: the nom. pl. of *söngur* is *söngvar*, where the *v* is the reflex of *u*. Since this *v* is distributed in every way parallel with *j* (<*i*), we will assume that it is developed from *w* by a very late rule.

The vowel of the dat. pl. ending of strong nouns must be assumed to be lax *u*, since it causes both *breaking* and *u-umlaut*. Thus some consonants must be assumed to prevent the deletion of final syllabic lax high vowels;

\(^{14}\) The distributions of some vowels are affected by morphological rules. Thus, most nouns which show a theme vowel between the stem and the ending do not have it in the dative and genitive. These facts are largely unpredictable on a phonological basis, as far as I can tell, since many of the same nouns do show a theme vowel before the genitive singular ending * ár*. This excludes the generalization that the themes are lost before endings beginning with *a* or *u*.
let us say that only a dental may intervene between the vowel and the bound-
ary:

\[(XI) \quad C \left[\begin{array}{c}
V
+ \text{high} \\
- \text{tense} \\
- \text{stress}
\end{array}\right] \rightarrow \emptyset / \quad [+ \text{coronal}]_0 \neq \]

After the application of this rule, the rule laxing all unstressed vowels applies, since tenseness is no longer relevant for these vowels. All remaining vowels which stand in position before another vowel are now converted to glides (if unstressed):

\[(XII) \quad V \rightarrow [- \text{vocalic}] / \quad [- \text{stress}] / \quad V\]

The second environment on the right makes the second elements of diphthongs into glides.

Not all of these glides appear in the output, however; in fact, glides are found before the vowels of endings in only two cases: after (stressed) syllables ending in a velar, and after lax syllables ending in only one consonant. Thus, we can write the following rule to delete other glides:

\[(XIII) \quad [- \text{voc} - \text{cns}] \rightarrow \emptyset / \quad \left[\begin{array}{c}
V
+ \text{stress}_1 \\
- \text{tense}_2
\end{array}\right] \quad \left[C\right]_2 \quad C_0 \left[\begin{array}{c}
\quad C
- \text{high}_1
\end{array}\right]\]

Examples of the presence and absence of these glides are:

\[(24) \quad\]

a. stöð ‘station’ nom. pl. stöðvar (stem stað + u; lax V plus one C)

b. pöntun ‘order’ gen. sg. pöntunar (stem pantan + u; unstressed syllable)

c. veggur ‘wall’ gen. sg. veggjar (stem vagg+i; stem ends in velar)

d. læknir ‘doctor’ nom. pl. læknar (stem lákní; stem ends in cons. + non-velar C)

These rules appear to permit all instances of umlaut to be derived from the presence of a high vowel (front for i-umlaut, back for u-umlaut), and the great majority of glides to be derived from underlying vowels. It appears, in fact, as if glides can be dispensed with in the underlying segment inventory.

The rules outlined in this paper can only be assumed to apply to forms that take part in sufficient morphological processes to be subject to alternation. In invariant forms, such as the adverb mjög ‘very’ there is no reason to assume that the ö comes from the u-umlaut of a, though there is nothing to prevent it from being so derived. Similar remarks apply to all vowels in
OUTLINE OF THE PHONOLOGY OF MODERN ICELANDIC VOWELS

such positions as to be impervious to the effects of any morphological processes, which should be assumed to have values in the lexicon which are quite close to their surface phonetic values. This proposition has recently been given support by Kiparsky's observation that forms in certain German dialects which are invariant are affected by sound changes as if they had their surface shape at all points.

In morphemes subject to productive processes, however, the following will be seen to represent the vowel system (including glides):

(25)  
\[
\begin{array}{|c|c|c|c|}
\hline
& \text{tense} & \text{lax} & + \\
\hline
i & \hat{u} & i & u \\
\hline
\tilde{e} & \tilde{o} & e & o \\
\hline
\ddash & \ddash & \ddash & \ddash \\
\hline
[\text{high}] & [\text{low}] & \\
\hline
diphthongs: ai, au \\
\end{array}
\]

All other values are derivable by general processes outlined above.

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Since doing the analysis embodied in this paper, I have had the opportunity to read Sigrid Valfells' thesis (1967 below), which contains a much more complete analysis of many phenomena than I could hope to attain here. The reader is referred to this work for a more extensive discussion of Icelandic phonology, as well as an excellent survey of the previous literature on the subject. Some of the conclusions reached here were reached independently by her, and I hope to have justified above those points on which our analyses differ.

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