FINNISH PHONOLOGY: FORM 1040 OR FORM 1040A

Frances E. Karttunen

June 1968
FINNISH PHONOLOGY: FORM 1040 OR FORM 1040 A?
Frances E. Karttunen*
The RAND Corporation
Santa Monica, California

This paper presents various characterizations of Finnish phonology and tries to demonstrate that an abbreviated form is not only adequate but highly desirable. The 'short form' involves generalizations which are not embodied in the larger 'structural' model, and it also accounts for certain asymmetries in the phoneme inventory and 'phonotactics' which are otherwise quite arbitrary.

There arises from this comparison the interesting question of whether the 'short form' approximates the correct psychological model, or whether the less abstract 'superficial' model is more in accord with the speaker's grammar. There appears to be some evidence that native speakers miss generalizations which can account for the phonological structure of the language and blissfully, guiltlessly, operate on perfectly arbitrary rules. This may be a mistaken impression. The speaker may command the most abstract generalizations subconsciously and yet fail to recognize them. In any case, arguments both for and against 'native intuition' will be presented in this paper.

*Any views expressed in this paper are those of the author. They should not be interpreted as reflecting the views of The RAND Corporation or the official opinion or policy of any of its governmental or private research sponsors. Papers are reproduced by The RAND Corporation as a courtesy to members of its staff.
A Note on Phonological Representation in this Paper

Sequences enclosed in square brackets [ ] indicate broad phonetic representation, a representation free of the fine diacritics of Finno-Ugric phonetic notation.

Sequences between slashes /// indicate underlying representations. Where the effects of a sequence of rules are demonstrated, the underlying representation will be given between slashes, the phonetic output in square brackets, and the steps between will be unencumbered with any sort of enclosure.

The relation of Finnish orthography to pronunciation is quite clear. To facilitate recognition of forms, the standard orthography will often be used here. The phonetic values of the Finnish graphs are given here:

i [i]   ii [i:]   p [p]   1 [l]   pp [p:
e [e]   ee [e:]   t [t]   r [r]   tt [t:
y [ü]   yy [ü:]   k [k]   j [j]   kk [k:
ö [ö]   öö [ö:]   d [d]   mm [m:
ä [æ̈]  ää [æ̈:]  m [m]   nk [ŋk]   nn [n:
u [u]   uu [u:]   n [n]   ss [s:
o [o]   oo [o:]   h [h]   ng [ŋ:]   ll [l:
a [a]   aa [a:]   v [v], [β]   rr [r:
s [s]   np [mp]

It is possible, from the viewpoint of autonomous phonemics, to postulate 37 phonemes for standard Finnish. Indeed, arguments for these 37 can be made that render it virtually impossible to reduce the inventory. If one takes into account common foreign loan words, one must add at least three more. Additionally, there is a peculiar
phenomenon known as 'aspiration' which, if recognized as a phoneme, must have as many allophones as there are consonant phonemes in the inventory.

\[
\{ [p]/ \mapsto /p/ \\
 [t]/ \mapsto /t/ \\
 [k]/ \mapsto /k/ \\
 [m]/ \mapsto /m/ \\
\ldots \\
\}
\]

The inventory of Finnish phonemes according to this view of phonology must be the following:

\[
/p/ /t/ /k/ \\
/\dot{a}/ \\
/m/ /n/ \\
/\nu/ /\nu/ /\nu/ \\
/\nu/ /s/ /h/ \\
/\nu/ \\
/r/ \\
/\j/ /\j/ (aspiration)
\]

Foreign

\[
/b/ /g/ /\varepsilon/ \\
/\vartheta/ /\vartheta/ /u/ \\
/\vartheta/ /\vartheta/ /\vartheta/ \\
/e/ /\ddot{\mathrm{e}}/ /o/ \\
/\ddot{\mathrm{e}}/ /\ddot{\mathrm{e}}/ \\
/a/ /a/ \\
\]

Arguments for this inventory are the following minimal pairs:

\[
/p/\# /p/:
\quad\text{tapaa} \ 'he meets' \quad\text{tappaa} \ 'he kills'
\]
\[
/t/\# /t/:
\quad\text{mato} \ 'snake' \quad\text{matto} \ 'rug'
\]
\[
/k/\# /k/:
\quad\text{kuka} \ 'who' \quad\text{kukka} \ 'flower'
\]
\[
/m/\# /m/:
\quad\text{tuma} \ 'nucleus' \quad\text{tumma} \ 'dark'
\]
sanan  gen. sana 'word'

sanan  gen. santa 'sand'

kansa 'people'
kanssa 'with'

tuli 'he came'
tulli 'tax'

viran  gen. virka 'office'
virran  gen. virta 'stream'

marja  # maria  'berry'  'Mary'

latva  # latus  'treetop'  part. latu 'ski track'

Foreign:

bussi 'bus'
pussi 'bag'

biologia  'biology'

filosofia  'philosophy'

tili  tiili  'account'

'trick'

tee  'tea'

tee

väsy  neg. väsyä 'to tire'
väsy  'he tires'
/ö/ /öː/ /ü/ /üː/ /õ/ /õː/ /o/ /oː/ /a/ /aː/

neliön neliöö

gen. neliö 'square'
illat. 'into the square'
kynä kynää

'pen'
part. kynä
tuli tuulil

'the wind'
tahto tahtoo

'will'
he is willing'
vakaas vaakaa

'steadfast'
part. vaaka 'scale'

In addition to the vowels and long vowels, the following diphthongs must be recognized:

ei  ie  eü
üi  úo  öü
öi  uo  äü
äi  eu
ui  ou
oi  su
ai

Note: teen 'I do' ≠ tein 'I did' ≠ tien gen. tie 'road'

Although /ŋ/ can be contrasted with /n/; no contrast can be demonstrated for /n/+/ŋ/. [ŋ] may be considered an allophone of a nasal occurring before /k/, although /ŋ/ must have autonomous phonemic status as demonstrated above. In fact, word-internally [m], [n], and [ŋ] are in complementary distribution:

[m] → [p], [n] → [t], [ŋ] → [k].
Clearly /m/ as /n/, since me 'we' ne 'those'. To assign [ŋ] as an allophone of /n/ occurring before [k] is arbitrary. It could as well be an allophone of /m/. In any case, /m/ and /n/ must be distinguished and [ŋ] assigned to one or the other. /m/, /n/ and /ŋ/ must all have phonemic status. 'Aspiration' has no phonetic manifestation of its own in isolation or when followed by a vowel. (Some claim a glottal stop or voiceless aspiration, but this is questioned by Lehtinen, and is not evident in the speech of informants.) When followed by a consonant, it doubles or lengthens the following consonant.

```
dee\' se [te:se]  'do it'
dee\' tam\=a [te:t tama]  'do this'
dee\' ruokaa [te:r ruoka:]  'make food'
dee\' iso [te:iso]  'make large'
is\={a}s\={a} veli [is\={a}ns\={a}v veli]  'his father's brother'
huone\' Joille [huonej joi:le]  'room to the Jokis'
```

(as in 'Porter, please show the room to the Jokis. ')

Examples from Lehtinen
p. xxxii

Since neither /h/ nor /k/ occurs word-finally and 'aspiration' occurs only there (internally only at compound juncture), we can assign 'aspiration' arbitrarily to one or the other, but in this case it would appear that the allophones of one of these phonemes would have to include every other possible word-initial consonant.
If we were to take these adjacent identical consonants yielded by aspiration plus consonant as long or geminate consonants (the [s s] of tee's see is not phonetically distinguishable from the [s:] of teessá [te:s:á] 'in the tea', and there is no release of the first [t] in tee támä [te:t támä] to distinguish it from [t:], etc.), then we must add /h:/, /v:/, and /j:/ to the phonemic inventory, although these geminate consonants do not occur anywhere but as the phonetic realization of /' h/, /' v/, and /' j/.

The diphthongs function exactly as long vowels and share with long vowels precisely the same length relation to short vowels in both citation forms and discourse, according to spectrographic analysis conducted under the direction of Bengt Sigurd at Indiana University, 1966 (see bibliography). The diphthongs listed and only these belong to the language. Tiut is monosyllabic, but teot is bisyllabic, etc. It appears to me that since not all VV sequences diphthongize, those which do must be given phonemic status, raising the inventory to at least 53.

I feel that this phoneme inventory is unwieldy and can be reduced. Moreover, I feel that by giving autonomous phonemic status to [d], [ŋ:] and indeed to all geminate consonants, one fails to recognize the pattern of consonant alternation which is a part of the language and fails to account for the restrictions on the occurrence of these segments. The diphthong list becomes completely arbitrary although there is a simple algorithm for deriving all and only the acceptable diphthongs. And the assignment of unitary phonemic status to long mid-vowels because of their regular occurrence in inflected forms does not explain or even
predict that—with the exception of recent loans such as tee 'tea'—
they do not occur in stems, while the peculiar diphthongs [ie], [uo], 
["œ"] do.

The phonological system I propose for Finnish* would consist of a
minimum of nine underlying consonants and five vowels for a total of
14 systematic phonemes. If we must add /j/ and /v/ to the consonants
and mark the vowel gravity in the phonology rather than with a morpheme
feature {FRONT}, then we have at most 19 systematic phonemes. These
'phonemes' are not significantly more abstract or 'at another level'
from the broad phonetic output (a reasonable representation of citation
forms free of diacritics; rather equivalent to the 'allophonic' level
of autonomous phonemics—certainly not 'phonetic' in acoustic or articulu-
atory terms).

The systematic phoneme, the matrix of features specifying /s/,
will receive the same collection of values represented by [s] in the
phonetic output at all times—indeed in all languages—by universal
phonological rules (Postal 1968: Chapter 8) unless something happens
to it. There is no need for language-specific rules to map /s/ onto
[s]. That is the natural outcome of universal phonetics. Language-
specific rules are necessary when /s/ is realized as [θ] or [n] or
whatever.

---

*I rather ambitiously present this analysis not merely for
Standard Finnish, but for Finnish in general in the belief that variations
in the following rules can account for dialectal variations.
Systematic Phoneme Inventory

/p/  /t/  /k/  /i/  /u/  (/u/  /u/)
/m/  /n/  /e/  /o/  (/o/  /o/)
(/w/)  /s/  /h/  (/ã/  /ã/)
/l/  /r/  /a/  (/ã/  /ã/)
(/i/)

Feature Specification

The Features

The features used here are in accord with the descriptions in 'My guess as of Nov. 26 as to what the right features are . . . ' (McCawley, 1967) except where noted otherwise.
Syll - Syllabic. This feature will be indispensable in deriving diphthongs and long vowels from vowel sequences and for treating the i-j and u-v alternations in Finnish.

Cons - Consonantal

Obs - Obstruent. This defines the natural class of the stops plus s which will be important in the rules below.

Lat - The way in which this feature is used here amounts to the statement that there are two non-nasal non-obstruents, one of which is a lateral, the other of which is not. I think that there should be some 'r-feature' one could supply by a redundancy rule to say what the non-lateral is. But if in articulatory terms, one takes lateral to mean that the tongue tip maintains a stable lateral position (as described by McCawley) then it would be reasonable to say that the trilled r is a segment in which this stability feature is absent, that is, the tongue vibrates.

Clos - Closure. Here the combination of $\text{[+ obs - closure]}$ seems more in keeping for s than [continuant], as s generally functions in a class with the stops rather than with the nasals and liquids.

Lab - Labial. This feature is not used as McCawley describes it, as here it can be either primary or secondary labialization. The use of Lab here is in agreement with Wiik (1967).

Bk - Back. This distinguishes the velar member of the stop series, p being distinguished by Lab.
High - as in McCawley
Low - as in McCawley
Front - This feature is not used by McCawley, Rice, or Wiik. I prefer it to Bk in the treatment of vowels. /a/ cannot really be taken as Bk by McCawley’s definition:

‘Rear part of body of tongue is raised relative to front part of body of tongue. The feature front will be used in deriving [ä], [ü], [ö] from /a/, /u/, /o/.

\[
\begin{array}{c|ccc}
\text{i} & \ddot{\text{u}} & \text{u} \\
\text{e} & \ddot{\text{o}} & \text{o} \\
\ddot{\text{a}} & & \text{a}
\end{array}
\]

I reject as counterintuitive the notion that the governing feature of this class is [+ flat] or [+ Lab] and that underlying [ä] is a low front rounded vowel. Although [a] stylistically may receive a degree of rounding, [ä] absolutely never does, and I consider this a surface phenomenon rather than evidence of underlying systematic rounding.

How does one go about reducing the phoneme inventory which is apparently justified by the contrasts given above? The first step is to interpret the long vowels and long (or geminate) consonants as sequences of identical segments.

An advantage of this interpretation is that diphthongs can be taken as sequences of non-identical segments in every way analogous to the sequences which yield long vowels. The experiments conducted with Dr. Sigurd support this claim. The nucleus-simplification rule makes the second segment [- syll] for long vowels and diphthongs.

\[
\text{Nuc-Simp} \quad [+ \text{ syll}] \rightarrow [- \text{ syll}]/[+ \text{ syll}] \quad \frac{1}{2} \quad \frac{2}{1} = 2 \text{ or } [+ \text{ high}] \\
\]

This yields all the long vowels and diphthongs except ie, uo and uo. These are derived from underlying mid-vowels. Redundancy rules specify /a/ as [+ low] and all other [+ syll] segments as [- low].

\[
\text{Mid-Vowel} \quad \begin{array}{c}
+ \text{ syll} \\
\text{- high}
\end{array} \rightarrow [+ \text{ high}] \quad \begin{array}{c}
- \text{ syll} \\
\text{- high} \\
\text{- low}
\end{array}
\]

(Note that Nuc-Simp must apply first while segment 1 is still identical to segment 2.)

Permissible long vowels and diphthongs

\[
\begin{array}{c}
+ \text{ high} \\
\text{- low}
\end{array}
\]

\[
\begin{array}{c}
\text{ii} & \text{ie} & \text{iu} \\
\text{ei} & \text{(ee)} & \text{eu} \\
\text{ui} & \text{uu} & \text{uo} \\
\text{oi} & \text{ou} & \text{(oo)} \\
\text{ai} & \text{au} & \text{aa}
\end{array}
\]

Long mid-vowels occurring phonetically in Finnish are the result of

a. inflectional reduplication

katsoo taloon

3rd. sing. katso- illat. talo
b. consonant deletion
   huoneen
   gen. huonehe-
   teen
   lst. sing. teke-

c. foreign loans
   tee
   'tea'

All other [+ syll] [+ syll] sequences constitute separate syllables, i.e. tuo is monosyllabic but tio is bisyllabic. pimea and saippua are trisyllabic.

There must be another rule close to the bottom of the phonological rules for standard Finnish which makes identical vowel sequences across syllable boundary as in b. into long vowels, but this late rule does not create diphthongs or feed into the Mid-vowel Raising rule.

The two rules given here must apply before the consonant gradation rules in standard Finnish. At least some speakers can make the distinction between joissa 'in the rivers' and joissa 'in all (pl.).'

1. a. /joke + issa/ → jokissa → jojissa → [jo:is'sa]
   joke- 'river' (e-deletion) (cons. grad) trisyllabic

   b. /jo + issa/ → [jois'sa]
   jo- 'every' (Nuc-Simp) bisyllabic

   In a, the -i- is [+ syllabic] and remains so because the intervening consonant prevents the Nuc-Simp rule from applying. In b, Nuc-Simp makes -i- [- syllabic].

2. a. /tek - en/ → teken → [teen]
   tek- 'do' (cons.grad)

   b. /tee + n/ → [tien]
   tie 'road' (Mid-Vow-Rsing)

   (But in certain dialects, the reverse ordering is apparently true, and both have the phonetic form [tien]).
The Back and Front Vowel Series

Vowel harmony is a feature of most Finno-Ugric, Turkic, and Mongol languages, so the question of how to handle it in terms of current phonological theory is certainly of general interest.

Having set aside for the moment the matter of long vowels and diphthongs, we can say that Finnish has eight vowels:

<table>
<thead>
<tr>
<th>Front</th>
<th>Back</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>Round</td>
</tr>
<tr>
<td>i</td>
<td>ü</td>
</tr>
<tr>
<td>e</td>
<td>ö</td>
</tr>
<tr>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>

In traditional schoolroom terms, vowel harmony is explained in this manner: Front vowels and back vowels cannot occur together in a word, but i and e are 'neutral' vowels and can occur with either front or back vowels. Finnish is a suffixing language, and all suffixed vowels must agree in frontness or backness with the vowels of the stem. With stems containing only the 'neutral' vowels such as tek- 'make, do', kivi 'store', tie 'road' one uses the front vowels, so i and e are not quite 'neutral' after all.

Halle ("On the Bases of Phonology", Struct. of Lang.) handles vowel harmony and the co-occurrence of i and e with both front and back vowels as an example of significant ordering. He postpones specifying the gravity of i and e until after making a statement on harmony:

\[
\begin{array}{cccccccc}
  i & e & ü & u & ö & o & ä & a \\
  \text{dift} & + & - & + & + & - & - & - \\
  \text{flat} & - & - & + & + & + & - & - \\
  \text{comp} & - & - & & & & & \\
  \text{grv} & + & - & + & - & + & - & - \\
\end{array}
\]
Morpheme structure rules.

4 Flat vowels are noncompact.

5 Compact vowels are nondiffuse.

| Harmony rule | In a word all vowels are either grave or nongrave depending on the nature of the stem morpheme. |

6 Noncompact nonflat vowels are nongrave.

This fails to account for the front vowels in the inflection of 'neutral' stems. The harmony rule would have to apply again after 6 for these.

McCawley in his 1964 paper The Morphophonemics of the Finnish Noun independently advocates a system proposed by the Finnish linguist Kettunen.* In this system you have an extra two vowels, i⁰ and e⁰, which are [+ grave], and these are the ones which co-occur with the back vowel series. Then all vowels in a word are adjusted in gravity to agree with the first vowel, which is then the only vowel specified for gravity in the dictionary. This is the rule:

\[
\begin{align*}
\left[ - \text{cons} \mid + \text{voc} \right] & \rightarrow [ \alpha \text{grave}] / \#C \left[ - \text{cons} [\alpha \text{grv}] \right] X \\
\end{align*}
\]

Where X is any sequence of segments with + juncture.

A late rule then makes all noncompact nonrounded vowels nongrave (Halle's rule 6).

* I have heard the tale that Kettunen so endeared himself to his informants that they invited him to be their king, which should be a lesson to us all to treat our informants graciously.
My most serious objection to this system is that if there are two vowels i₀ and e₀ with full systematic phonemic status, how is it that there are no stems containing only these such as */ki̯o'v'e₀/ or */ti̯o'e₀/ and taking back vowel harmony in their inflectional forms? There are only two words, meri 'sea' and veri 'blood', which have back harmony in their partitive forms, merta and verta. But even these two words, in all other inflectional forms have front vowels, meressä and veressä.

Another objection, which despite considerable dispute with students at Chicago I still hold, is that there is a certain circularity in specifying a first-occurring i or e for gravity on the basis of what follows in the stem. In the dictionary entry only the first vowel is specified for gravity. If this vowel is i or e, one checks to see if there are any back vowels in the stem, and if so, one marks the initial vowel [+ grave]. Otherwise it is marked [- grave]. Then the vowel harmony rule works to adjust the other vowels to the first. It seems to me that in doing this, one covertly adjusts the initial vowel to a later one, then by rule adjusts the later one to the initial one, and finally in the case of initial i or e returns the initial one to its phonetic gravity.

Harms ("The Measurement of Phonological Economy", Language, 1966) uses different feature specifications, using the feature [+ acute] as a natural class to separate i and e from the other vowels. (It could as well be done with Halle's choice of features by specifying ã, a as [+ flat] along with the other vowels that undergo vowel harmony and later making them [- flat]. This argument could be supported by the very reason that Harms prefers not to use the feature [flat], namely that Finnish /a/ often exhibits considerable rounding.
-17-

\[
\begin{array}{ccccccc}
  i & e & a & ä & u & ü & o & ö \\
  + & + & - & - & - & - & - & - \\
  \text{acute} & + & + & - & - & - & - & - \\
  \text{compact} & + & - & + & + & - & - & - \\
  \text{diffuse} & + & - & + & - & + & - & - \\
  \text{grave} & + & - & + & - & + & - & - \\
\end{array}
\]

Only the first nonacute vowel of each root is specified for gravity. Back vowel suffixes such as o in /møn=o/ (derivational suffix) are also specified as grave on their first vowel. Other suffixes are not specified for gravity (they happen to be the inflectional suffixes). Suffixes of the first type are preceded by the derivational morpheme boundary /=/, others by the morpheme boundary /+/.

\[
\begin{align*}
  B_1 \quad & [-\text{cons}] \rightarrow [\text{- grv}] + X \\
  B_2 \quad & [-\text{cons}] \rightarrow [\alpha_{\text{grv}}] \\
\end{align*}
\]

\[
\begin{array}{c}
  \begin{bmatrix}
    \text{-cons} \\
    \text{-act}
  \end{bmatrix}
\end{array}
\begin{array}{c}
  \begin{bmatrix}
    \text{-cons} \\
    \text{-act}
  \end{bmatrix}
\end{array}
\begin{array}{c}
  \alpha_{\text{grv}}
\end{array}
\]

\[
\begin{array}{c}
  X \text{ does not contain word boundary}
\end{array}
\]

\[
\begin{align*}
  B_1 & \text{ gives the front vowels after 'neutral' stems.} \\
  B_2 & \text{restores vowel harmony.}
\end{align*}
\]

To depart from Finnish for a moment, in his paper on classical Mongolian, Lightner rejects the treatment of vowel harmony as a sort of assimilation. That is to say, he objects to hanging gravity on one particular segment and adjusting all other vowels to agree with it. Finnish and Mongolian vowel harmony are much alike. If i and e are adjusted to [+ grave], another rule must de-adjust them, and an arbitrary [+ grave] i⁰ is required as an initial vowel for back vowels to assimilate to. Lightner argues, and I agree, that there is no formal reason to hang the determining feature of gravity on any one particular segment, the
first vowel any more than the last, especially since in Mongolian the
velar consonants also agree in gravity with the vowels—k and g being
palatalized with the front series. Naturally these consonants can pre-
cede the first vowel, so fronting would not be a strictly left-to-right
process. Lightner prefers to associate gravity with the entire stem,
being careful to distinguish this abstract marker \( \{ \pm \text{GRAVE} \} \) from the
phonological feature \( [\pm \text{grave}] \), which is properly assigned only to seg-
ments. Then the Mongolian nonflat noncompact vowels and velar consonants
\( \rightarrow [\alpha \text{grave}] \) with respect to the stem feature \( \{ \alpha \text{GRAVE} \} \). Lightner likens
this abstract marker GRAVE to the markers ANIMATE and TRANSITIVE. It
also has its analogy to MASCULINE, FEMININE, NEUTER in European languages.

On the other hand, McCawley has pointed out (UCLA, 1968) that Turkish
vowel harmony must at least in part be a matter of assimilation rather
than stem-marking. Unrounded vowels may occur in a Turkish stem up to
the first rounded vowel, but after this all other vowels must be rounded.
The mutual exclusion of front and back vowels in Turkish stems, however,
might be analogous to the Mongolian and Finnish harmony.

The morpheme feature solution has advantages for Finnish. There
really isn't any natural class that groups \( \ddot{a} \) and a with the rounded
vowels and excludes the front unrounded ones, if \( [+ \text{flat}] \) is rejected
for \( \ddot{a} \). With a morpheme feature regulating frontness, a five vowel system
is possible, the three nonfront

\[
\begin{array}{c}
i \\
e \\
o \\
a
\end{array}
\]
vowels being subject to fronting in front stems,

\[
\begin{align*}
/u/ & \quad /o/ & \quad /a/ \\
[\ddbar] & \quad [\ddot o] & \quad [\ddot a] \\
[u] & \quad [o] & \quad [a]
\end{align*}
\]

There are some facts aside from general gracefulness which seem to lend support to the solution of marking whole stems rather than the first vowel or the first grave vowel, or as Halle suggested recently, the last vowel.

1. Finnish speakers seem to feel that there are 'front words' and 'back words', and the whole word must be pronounced in the front or back of the mouth accordingly.

2 Individual stems differ in gravity among the Finnish dialects. A stem may have front vowels in one dialect and back vowels in another.

3. Very few pairs in a single dialect differ by gravity alone. Such pairs fall into the following groups:
   a. The pairs have different underlying structures:
      \[
      \begin{align*}
      \text{pelätä} & \quad /\text{pelkät} + \dddot a/ \\
      \text{pelata} & \quad /\text{pela} + \text{ta}/
      \end{align*}
      \]
   b. One of the two is an obvious recent loan:
      \[
      \text{tuuli} \ '\text{wind}' \ vs \ \text{tyyli} \ < \text{Sw.} \ '\text{style}'
      \]
   c. Both are onomatopoeic and have similar meaning:
      \[
      \begin{align*}
      \text{hymistä} & \quad '\text{humming sound}' \\
      \text{humista} & \quad '\text{wind sound}'
      \end{align*}
      \]
   d. Such pairs as are left generally belong to different grammatical classes such as noun vs. verb, adjective vs. verb, etc.
      \[
      \begin{align*}
      \text{työ} & \quad '\text{work}' \ \text{noun} \\
      \text{tuo} & \quad '\text{that}' \ \text{demonstrative}
      \end{align*}
      \]
syö 'to eat' verb
suo 'swamp' noun
myy 'to buy' verb
muu 'other' adjective/noun

e. The bilabial fricative (ultimately labio-dental [v]) which it is desirable to derive from an underlying high rounded vowel does not differ in quality in different stems as might be expected if it were derived from two underlying vowels with different points of articulation. There would have to be a rule to adjust bilabial \( \tilde{\beta} \) from underlying \( \ddot{u} \) already specified for gravity to match \( \beta \) derived from the corresponding back vowel. However, if we have a single phoneme \( \ddot{u} \) specified \(+\) syll \(+\) lab \(+\) high, then the bilabial fricative is generated by merely changing the value of [syll]. The \( \ddot{u} \rightarrow v \) rule would come before the 'fronting' rule, which would apply only to the remaining \(+\) syll segments. If we take a five vowel system and mark some of the stems \{FRONT\} and leave the others un-marked*, we must still account for the fact that the 'neutral' stems all take front vowels in their inflected forms. If we look at derivational affixation, however, it is clear that this rule does not apply. Certain derivational affixes

*Front stems comprise only 20% of the Reverse Word list. The sum of the front and neutral stems comprise about 27%. The ratio of front to back stems (excluding neutral stems) is less than 1/3.
have preferred harmony when attached to 'neutral' stems, although they must agree in harmony with front and back stems.

<table>
<thead>
<tr>
<th>root denotation</th>
<th>Back</th>
<th>Front</th>
<th>But harmony</th>
</tr>
</thead>
<tbody>
<tr>
<td>'life'</td>
<td>- o</td>
<td>- ä</td>
<td>lahtö</td>
</tr>
<tr>
<td>'ski'</td>
<td>elo</td>
<td>elä</td>
<td>alka</td>
</tr>
<tr>
<td>'cook'</td>
<td>hiihto-</td>
<td>hiihtä</td>
<td></td>
</tr>
<tr>
<td>'fly'</td>
<td>keitto</td>
<td>keittä</td>
<td></td>
</tr>
<tr>
<td>'bread'</td>
<td>lento-</td>
<td>lentä</td>
<td></td>
</tr>
<tr>
<td></td>
<td>leipo</td>
<td>leipä</td>
<td></td>
</tr>
</tbody>
</table>

There is also the 'neutral' derivational affix -ch yielding to front inflection by default as do the 'neutral' stems:

liikeh - liikkeessä
liitex - liitteessä
sideh - siteessä

u is problematical, however:

<table>
<thead>
<tr>
<th>Back</th>
<th>Front</th>
</tr>
</thead>
<tbody>
<tr>
<td>pesu</td>
<td>but</td>
</tr>
<tr>
<td>liikkku</td>
<td>levy</td>
</tr>
</tbody>
</table>

I believe that the front vowel in levy is an exception, and that the preferred harmony is back.
Note also that in inflectional harmony mixed stems such as psykologi take back vowels.*

Suppose that not only could stems be marked for \{\text{Front}\} but also affixes. The derivational affix - a would be \{\text{FRONT}\}, but the derivational affix - o and all inflectional affixes would be unmarked for fronting.

The neutral vowels i and e are specified [\text{+ front}] from the beginning, and there are no morpheme structure rules to prevent their combining with u, o, and a. [\text{+ front}] ü, ö, and ä are then produced by the effect of the morpheme feature \{\text{FRONT}\}. Inflectional affixes are unmarked for \{\text{FRONT}\} and will only yield to vowel harmony if all the vowels in the stem are [\text{+ front}].

---

*I think Halle's suggestion that the gravity of the last vowel of the stem determines the gravity of the inflectional affix must be motivated by examples like: men + ta mennå

but

meno + ssa menossa

but this is clearly not the case. In loans such as psykologi the suffix vowels are back vowels irrespective of the final stem vowel.
There is an order of precedence in vowel harmony as well as harmony preference. Stem marking is absolute. Derivational affix marking must yield to stem marking. Inflectional affixation must agree with the phonetic value of the stem vowels provided by redundancy rules to i and e and by \{\textsc{Front}\} to the other vowels in marked stems.

\[
\text{Stem} + \text{Deriv. affix} = \text{Inf. affix}
\]

\begin{align*}
\text{Stem} & \quad \text{Front} & \quad \text{Front} & \quad \text{Front} \\
\text{Precedence} & \quad \text{Front} & \quad \text{Back} & \quad \text{Front} \\
 & \quad \text{Front} & \quad \text{Neut} & \quad \text{Front} \\
\text{Derivational} & \quad \text{Back} & \quad \text{Front} & \quad \text{Back} \\
\text{Preference} & \quad \text{Back} & \quad \text{Back} & \quad \text{Back} \\
\text{Phonetic} & \quad \text{Neut} & \quad \text{Front} & \quad \text{Front} \\
\text{Determination} & \quad \text{Neut} & \quad \text{Back} & \quad \text{Back} \\
\end{align*}

Morpheme-marking for vowel harmony raises several questions:

a. Is the morpheme feature \{\textsc{Front}\} or \{\textsc{Grave}\} distinct from the phonetic feature \{\textsc{front}\} or \{\textsc{grave}\} as Lightner maintains?

b. Is it a binary feature, or a marker? That is, are all morphemes \{\textsc{Front}\}, or is it the case that only some stem and affixes are marked for \{\textsc{Front}\}?

c. If frontness can be assigned to a whole stem, can other features such as flatness? Is there, for example, a language in which all vowels in a stem agree in flatness?

d. Are there other cases of consonant harmony similar to Lightner's example of Mongolian in which a feature spreads out over consonant segments?
e. If we accept this solution, is there any constraint on morpheme-marking, and should there by?

Consider the three consonants which do not occur as geminates except as the realization of 'aspiration' plus consonant. We can think of the aspiration phenomenon as the situation \( C_1 \neq C_2 \), in which \( C_1 \) assumes the phonological properties of \( C_2 \), and thus we can have a sequential constraint \( C_1C_2, C_1 \neq C_2 \Rightarrow \{\bar{v}, j\} \). This, of course, is quite arbitrary, and we must find some explanation for it.

Beyond the fact that it does not occur as a geminate, \( h \) cannot be classed with \( j \) and \( v \). It may occur as the first element of a consonant cluster and after a nasal, which they cannot. \([h]\) is the phonetic realization of /k/ before all other consonants except /p/ and /s/. The sequence \([+\text{ clos}] [-\text{ lab}] [+\text{ clos}] [-\text{ lab}]\) is not permitted, and /k/ remains \( k \) before /s/. But phonetic \([h]\) is also the reflex of underlying /h/. \( kk \neq hk\): lakko 'strike' \# lahko 'order'. And initial and intervocalic \( h \neq k\): hakku 'hoe' \# kakku 'cake'; Tehi (name) \# teki 'he does'. The morpheme structure rules must specify that only \([+\text{ syll}]\) and \([+\text{ cons}]\) segments may occur in pairs.

The explanation of the non-occurrence of geminate \([j]\) and \([v]\), however, appears to lie in their derivation from /i/ and /u/, respectively. Let us consider \( i \rightarrow j \) first.

<table>
<thead>
<tr>
<th>tyttö</th>
<th>tyttöille</th>
<th>tyttöjen</th>
</tr>
</thead>
<tbody>
<tr>
<td>'girl'</td>
<td>'to the girls'</td>
<td>'the girls'</td>
</tr>
<tr>
<td>kirja</td>
<td>kirjoissa</td>
<td>kirjoja</td>
</tr>
<tr>
<td>'book'</td>
<td>'in the books'</td>
<td>'some books'</td>
</tr>
</tbody>
</table>

It is clear here that intervocally the plural -i- becomes -j-. But there appears to be a clear contrast in the pair marja 'berry' \# Maria 'Mary'. Moreover, maja 'cabin' \# Maija (name, feminine).

Suppose we accept \([j]\) in the phonetics after all and represent these contrasts as

\[
\begin{align*}
[\text{marja}] & \neq [\text{marija}] \\
[\text{maja}] & \neq [\text{maj:a}] 
\end{align*}
\]
The base forms of these stems would have no -j-'s in them at all, however. Given the ordered rules:

\[ i \to j \]

i.e. \[ i \to [\text{-syl}] \]

1. post-vocalically
   (including, of course, inter-vocally)

2. pre-vocalically

The base forms can be:

- maja /maia/
- maija /maia/
- marja /marja/
- maria /mariia/

\[ /\text{maia}/ \to [\text{maja}] \]

\[ /\text{maia}/ \to [\text{majo}] \]

\[ /\text{majo}/ \to [\text{majia}] \]

\[ /\text{majia}/ \to [\text{majja}] \]

\[ /\text{marja}/ \to [\text{marja}] \]

\[ /\text{mariia}/ \to [\text{mariia}] \]

\[ /\text{mariia}/ \to [\text{marija}] \]

Supporting this analysis is the fact that #ji- does not occur in Finnish. The underlying forms of Il (place name) and iilli 'leech' are:

\[ /i/ \to [ij] \]

\[ /iilli/ \to [ijli] \]

\[ /j/ \to [ji] \]

\[ /jilli/ \to [jili] \]

*This argument assumes that the correct phonetic representation of Maria is [marija]. If there were a *mariia to contrast with this pair, then the analysis would be demonstrably incorrect. But my informant is unable to pronounce this hypothetical form without shifting the stress to the second syllable, thus making it 'un-Finnish'. If the phonetic representation must be [maria] (trisyllabic), then the underlying representation is identical with that of marja, but rule 1. is blocked by the fact that Maria is a Latin name, and the contrast of the two words is merely bisyllabic vs. trisyllabic.
The loan jodi 'iodine' demonstrates rule 2. in effect. The word ionti 'ion' occurs in speech as both [ionti] and [joniti]. In the former its Greek origin is taken into account to block rule 2. In the latter, the rule operates.

The sequence #iV- where V ≠ i should always yield jV. The i→j rules, however, must come before the consonant gradation rules, as demonstrated here and in the next example below. The words iäinen, iäisyys, iäkäs, iäti are derived from the stem ikä. The /k/ is deleted by the consonant gradation rules, but its presence in the underlying form 'protects' the initial-i- from the i→j rule.

The contrast between joissa¹ 'in the rivers' and joissa² 'in all' was mentioned above in the discussion of diphthongs. The reason that joissa¹ remains trisyllabic is that the /k/ in the stem /joke/ blocks rule 1. before it is lost by gradation. The stem in joissa² is merely jo-, and rule 1. operates.

An argument for including j in the inventory of systematic phonemes is the word veli 'brother':

<table>
<thead>
<tr>
<th>Case</th>
<th>Stem</th>
<th>/lasi/</th>
<th>/kant/</th>
<th>/ove/</th>
</tr>
</thead>
<tbody>
<tr>
<td>nom.</td>
<td>veli</td>
<td>lasi</td>
<td>kansi</td>
<td>ovi</td>
</tr>
<tr>
<td>ger.</td>
<td>veljen</td>
<td>lasin</td>
<td>kannen</td>
<td>oven</td>
</tr>
<tr>
<td>past.</td>
<td>veljeän</td>
<td>lasia</td>
<td>kantta</td>
<td>ovea</td>
</tr>
<tr>
<td>iness.</td>
<td>veljessä</td>
<td>lasissa</td>
<td>kanessa</td>
<td>ovessa</td>
</tr>
</tbody>
</table>

The stem cannot be */veli/ because in regular -i stems such as lasi, no j appears in inflection. If we take the stem to be */velj/ with an underlying /j/ which becomes [+syl] in the uninflected form by the reverse of rule 2., then the difficulties are two-fold. First of all, the morpheme structure rules allow only for $\{r\}^t$ syllable-final clusters. j is scarcely an obstructant and occurs nowhere else in such clusters as *rj/, *nj/ is analogous to the permitted syllable-final cluster. Secondly, the partitive affix has the form /ta/ with consonant-final stems. With /kant/, this yields [kantta]. But what would the phonetic realization of */veljta/ be? The actual partitive is [veljeän].
On the model of the -e stems such as /ove/, the stem might be */velje/. Here the e-raising rule for the uninflected form would give nominative *[velji], for which another rule would be necessary to get the correct [veli].

Eliminating the /j/ from the inventory, we could do as well with /velie/. /velie/ → velje rule 2. All inflected forms are correctly generated by the standard rules, but, of course, one is still faced with doing away with the -e in the uninflected form. It might be done like this:

/velie/ → velii e-raising rule
velii → velij rule 1.
velij → veli simplification in unstressed position.

The last move is unique. No other stems end in -ie or -ii, so there is no model. This amounts to treating veli as an exception, which it is. But it demonstrates that its exceptionalness can be handled without adding the extra phoneme /j/ to the inventory.

Likewise, it is desirable to derive v from underlying u by rule 2. u and v have almost the same pattern of distribution as i and j. vuC does not occur. The diphthong uo, in the many vuo- words comes from an underlying long midvowel. #uV, V ≠ u, does not occur, except in ui-, where rule 1. makes i [-syll] before rule 2. can make u [-syll].

/ui/ → [uj] 1. *[vi]

The underlying form of vie is /uee/.

/uee/ → vee 2.
vee → [vie] midvowel raising rule

In the reverse word list, only one stem ends in -ua. This is saippua, where the syllable division is saip:pu:a. Reduction to bisyllabic ity with the cluster ppv is impossible. All other stems end in -va.
The step from u to w is easy and a common happening in phonology. I would want to characterize it as merely the step from [+syl] to [-syl]. Thus, rule 2. would have the form:

\[
\begin{align*}
&\begin{array}{c}
\text{[+syl]} \\
\text{+high}
\end{array}
\rightarrow
\begin{array}{c}
\text{[-syl]} \\
\text{-}
\end{array}
\begin{array}{c}
\text{[+syl]}
\end{array}
\end{align*}
\]

The step from w to \( \beta \) to v, however, is difficult to characterize in current phonological terms. It is a matter of adding friction in increasing degree with an accompanying alteration of point of articulation. In speech, the sound represented in the orthography by v is often \( \beta \), especially intervocalically, and in children's speech it is often the glide [w] with no friction at all.

\( [v] \) comes from two other sources as the result of consonant gradation. \( /p/ \rightarrow \beta \rightarrow [v] \) by the general gradation rule, and \( /k/ \rightarrow [v] \) by the gradation rules when it occurs intervocalically with high, rounded vowels.

\( V_1 \rightarrow V_2 \)

\( V_1, V_2 = \{ \text{u} \} \). The process is something like this:

\( /k/ \rightarrow \gamma \) / general consonant gradation environment

\( \gamma \rightarrow \beta / \begin{array}{c}
\text{[+high]} \\
\text{+lab}
\end{array} \rightarrow \begin{array}{c}
\text{[+high]} \\
\text{+lab}
\end{array} \) assimilation

\( \beta \rightarrow [v] \) general (optional) friction addition

In eliminating j and v from the phoneme inventory it becomes clear that the rules for deriving them from /i/ and /u/ can be combined with the diphthongization rules. The midvowel origin of ie, uo, yu have been demonstrated. All other diphthongs are of the form \( V_1V_2, V_2 \):

\( [\text{[+high]}] \)

This corresponds to i → j rule 1., which can now be extended to u;

1. \( \begin{array}{c}
\text{[+syl]} \\
\text{+high}
\end{array} \rightarrow [\text{syl}] \)

post-vocally

ex. \( /ai/ \rightarrow [\text{ai}] \) \( /au/ \rightarrow [aw] \)
2. \(
\begin{align*}
\text{[-syl1]} & \rightarrow \text{[+syl1]} \quad \text{pre-vocally} \\
\text{[+high]} & \rightarrow \text{[-syl1]} \\
/\text{ia}/ & \rightarrow \text{[ja]} \\
/\text{ua}/ & \rightarrow \text{[wa]}
\end{align*}
\)

3. \(
\begin{align*}
\text{[-syl1]} & \rightarrow \text{[+obst]} \quad \text{prevocally} \\
\text{[+lab]} & \rightarrow \text{[-lab]} \\
/\text{wa}/ & \rightarrow \text{[βa]} \rightarrow ([\text{va}])
\end{align*}
\)

Since this rule does not apply to the postvocalic \([w]\) in the diphthongs, incorrect forms such as \(*[\text{av}]*\) are not generated. In forms such as kauan, the underlying -k- in the stem /kauka/ prevents the friction rule from operating.

/1/ and /ɾ/ are not altered by any rules in the phonetic realization, although the homorganic stop /t/ assimilates to them by the consonant gradation rules.

The nasal-assimilation rule yields m/-p, n/-t, η/-k even across word boundary.

- on punainen 'it's red' [om punainen]
- on tumma 'it's dark' [on tumma]
- on keltainen 'it's yellow' [on keltainen]

The sequences /-mʃt-/ and /-mʃk-/ do not occur because of the final-nasal rule:

\[
\text{final-nasal rule \([+nasal] \rightarrow [-lab]\)}
\]

Stem-internally, the nasal assimilation rule allows only the clusters -mp-, -nt-, -ŋk-.

\[
\text{Nasal assimilation rule \([+nasal] \rightarrow [\text{lab}] \text{ back})}
\]

/h/ is realized as \([h]\) except word-finally. In word-final position, \(h\) assumes all the features of the following segment if that segment is \([+syl1]\). Otherwise it is deleted.
Aspiration rule 
\[
\text{[-syll]} \rightarrow \begin{cases} \text{[-segment]} \rightarrow \phi \\
\text{[-cons]} \end{cases}
\]

Stem-final /s/ becomes h in connection with the epenthesis rules and the illative case.

/mies/ → miehe- 'man'

In the stems ending in Vs, the epenthetic vowel becomes a replica of the preceding vowel, and the consonant is lost completely.

/sairas/ → sairahe- → sairaha- → [sairaa-] 'ill'

That the vowel adjusts before the h-deletion is evident in monosyllabic stems in the illative case.

/maa/ illat. maahan.

s → h rule \[
\begin{cases} \text{[+obs]} \rightarrow \text{[-syll]} \\
\text{[-clos]} \rightarrow \text{[-cons]} \\
\end{cases}
\]

h deletion rule \[
\begin{cases} \text{[-cons]} \rightarrow \phi \\
\text{[+syll]} \rightarrow \text{[-stress]} \\
\end{cases}
\]

(for both underlying /h/ and /s/).

The stop series in Finnish yields a great diversity of phonetic forms. Most of these are the result of 'consonant gradation'. Two which are not are k → h and t → s. k alternates with h in stems such as tek- tehdä'. If we examine occurring consonant clusters, we find that tt, st, nt, lt, rt, but no kt. Instead there is ht.

k → h rule \[
\begin{cases} \text{[+clos]} \\
\text{[+back]} \\
\end{cases} \rightarrow \begin{cases} \text{[-cons]} \rightarrow \phi \\
\text{[-clos]} \rightarrow \text{[-back]} \\
\end{cases}
\]

/t/ becomes [s] before [i] quite generally throughout Finnish. This rule comes after the final -e raising rule and accounts for the s in the nominative forms of käsi (kät-), kauneus (kauneut-),
kauneus-pl.), etc. The past tense of pita- (pisi), etc. and even the [s] in sinä (2nd pers. sing.).

In the latter case, if we examine the personal pronouns and verb inflections, it becomes clear that sinä has an underlying /t/.

<table>
<thead>
<tr>
<th>Pronoun</th>
<th>Verb Inf.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sing.</td>
<td>minä</td>
</tr>
<tr>
<td>1st</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>sinū</td>
</tr>
<tr>
<td>Pl.</td>
<td>me</td>
</tr>
<tr>
<td>1st</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>te</td>
</tr>
</tbody>
</table>

Many stems are exempt from internal application of this rule. Some are recent loans such as tiili 'tile'. Others are names such as Kati. (Names are also generally exempt from consonant gradation.)

The rule applies before the mid-vowel raising rule that creates the -ie- diphthong, but after the final-e raising rule:

tee→tie
kant + e→kante→kanti→kansi
(epenthetic vowel) (final-e raising rule)

CONSONANT GRADATION

Although these are often divided into two groups, gradation and assimilation groups, I will consider all of these alternations as the result of consonant gradation:

| pp→p | seppä/sepän | 'smith' |
| tt→t | matto/maton | 'rug'   |
| kk→k | kukka/kukan | 'flower'|
| p→v  | kylpy/kylvyn| 'bath'  |
| t→d  | mato/madon | 'worm'  |
| ht→hd| lehti/lehdén| 'leaf'  |
| (/kt/) |           |         |
| k→(v) | puku/puvun | 'suit'  |
| {j}   | solki/soljen| 'buckle'|
| {ø}   | joki/joen  | 'river' |
mp → mm
nt → nn
ŋk → ŋŋ
lt → _IL
rt → rr

camba/kaman
ranta/rannan
hanki/hangen
ilda/illan
virta/virran

comb'
'shore'
snow crust'
evening'
'stream'


Since syllable-final k becomes h except in geminate kk, there are no other stop clusters to consider.

Consonant gradation affects a member of the stop series when it occurs in a closed syllable after an identical stop, a vowel, h, or the non-obstruents l, r, m, and n.

\[
\begin{align*}
[ + \text{clos}] & \rightarrow \text{cons grad} / \\
& \{ [l] \} \\
\end{align*}
\]

The substance of consonant gradation may be represented as:

\[
\begin{align*}
[ + \text{clos}] & \rightarrow \\
& \begin{bmatrix}
-\text{clos} \\
\alpha \text{VC} \\
\alpha \text{nas} \\
\alpha \text{lat} \\
(\alpha \text{r-feature})
\end{bmatrix} / \begin{bmatrix}
\text{segment}
\end{bmatrix} \rightarrow \text{VC(C)}
\end{align*}
\]

That is, a stop becomes continuant and assimilates in voice, nasality, laterality to the preceding segment.

The output of this rule is:

\begin{align*}
\text{pp} & \rightarrow \beta \text{ mm } \text{ ll} \\
\text{tt} & \rightarrow \delta \text{ nn } \text{ rr} \\
\text{kk} & \rightarrow \gamma \text{ } \text{ } \text{''}
\end{align*}

In ht → hd, the voicing of the preceding vowel must 'jump over'

*sp occurs only in the loan name Espoo.
the h. In the discussion of epenthesis, it will be shown that many features must make this jump from segment to segment over intervening h.

It is questionable that pp, tt, and kk are easily pronounceable. The fact that they aren't seems to me a good justification for the immediately following rule:

\[
[-\text{clos}] \rightarrow \emptyset / [l]
\]

A stop which has become continuant after an identical stop is lost completely, giving the correct single p, t, k of the weak grade. In Estonian this loss brings about a slight compensatory lengthening of the preceding segment, producing the 'short geminate' which contrasts both with the 'overlong geminate' and the short consonant and is noticeably shorter than the Finnish geminate.

<table>
<thead>
<tr>
<th>Finnish</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>overlong</td>
<td>short</td>
<td>short</td>
</tr>
<tr>
<td>geminate</td>
<td>geminate</td>
<td></td>
</tr>
</tbody>
</table>

Finally, we must adjust the voiced continuants ð, ð, ð to the standard language.*

\( \alpha \) becomes ð between high, rounded vowels:

a. \( [+\text{cont} +\text{bk}] \rightarrow [+\text{lab}] / [+\text{syll} +\text{high} +\text{lab}] \rightarrow [+\text{syll} +\text{high} +\text{lab}] \)

Optionally ð becomes j between l, r, h and e (and in some dialects ð).

b. \( [+\text{con} +\text{bk}] \rightarrow [-\text{bk}] / [-\text{obs} -\text{nas}] \rightarrow [+\text{front} -\text{high} (-\text{low}) -\text{lab}] \)

Elsewhere ð is lost.

c. \( [+\text{cont} + \text{bk}] \rightarrow \emptyset \)

*These voiced continuants exist as such in some dialects, are adjusted differently from the standard language in others.
Stem | Cons. grad. | a. | b. | c.
-----|-------------|----|----|----
puku | 'suit' | pu\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textsuperscript{\textcircled{\textbf{u}}}} | pu\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textsuperscript{\textcircled{\textbf{u}}}} | 
kyky | 'ability' | ky\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textcircled{\textbf{n}}} | ky\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textcircled{\textbf{n}}} | 
ruko | 'haycock' | ru\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textcircled{\textbf{o}}} | ru\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textcircled{\textbf{o}}} | ruon
kulke | 'walk' | kul\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textcircled{\textbf{e}}} | **kuljen | kulen
härkä | 'ox' | här\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textcircled{\textbf{k}}} | här\textsuperscript{\textcircled{\textbf{g}}} \textsuperscript{\textcircled{\textbf{k}}} | **härän
vihkehe | 'hint' | vih\textsuperscript{\textcircled{\textbf{k}}} \textsuperscript{\textcircled{\textbf{e}}} | vih\textsuperscript{\textcircled{\textbf{k}}} \textsuperscript{\textcircled{\textbf{e}}} | viheh
vihko | 'notebook' | vih\textsuperscript{\textcircled{\textbf{k}}} \textsuperscript{\textcircled{\textbf{o}}} | vih\textsuperscript{\textcircled{\textbf{k}}} \textsuperscript{\textcircled{\textbf{o}}} | vihon
nahka | 'skin' | nah\textsuperscript{\textcircled{\textbf{k}}} \textsuperscript{\textcircled{\textbf{n}}} | nah\textsuperscript{\textcircled{\textbf{k}}} \textsuperscript{\textcircled{\textbf{n}}} | nahan

Combined into one rule, a, b, and c seem rather unwieldy.

\[
\begin{align*}
\text{[+cont]} & \Rightarrow \text{[\alpha \text{ lab}] / [\alpha \text{ bk}]} \\
\text{[-bk]} & \Rightarrow \text{[+syl] [+high [+lab]} \\
\text{[-obs]} & \Rightarrow \text{[+syl] [+front [-high [-lab)} \\
\text{[+friction]} & \Rightarrow \text{[+friction]}
\end{align*}
\]

Yet the generality one seeks to express by this rule is not so complex.  It is a 'marked' or 'expensive' or 'difficult' sound, and it is assimilated to adjacent segments or lost altogether.  It always assimilates to point of articulation with labials and may assimilate to alveolars with fronting.  Otherwise it is simply dropped.

The $\theta \rightarrow v$ rule applies to $\theta$ from underlying /p/ and also from the output of the $\theta \rightarrow \theta$ rule, and the $u \rightarrow \theta$ rule.  It amounts to adding more friction by making the sound labio-dental rather than bilabial.  $\theta$ often remains bilabial intervocically in children's speech.

\[
\begin{align*}
\text{[-clos] +lab} & \Rightarrow \text{[+friction]}
\end{align*}
\]

*Gradation of k after h is optional.  If there is gradation, the voicing from the preceding vowel comes across the h.  Otherwise, h functions in the same manner as s, preventing the gradation.

**Preferred form.
\( \phi \rightarrow d \) is a simple rule:

\[
\begin{bmatrix}
-\text{clos} \\
-\text{bk} \\
-\text{lab}
\end{bmatrix} \quad \rightarrow \quad \begin{bmatrix}
+\text{clos}
\end{bmatrix}
\]

This concludes the mapping of the systematic phonemes onto broad phonetic segments with the exception of certain syntactically governed sequences which will be discussed next. The mapping, including the \( a \rightarrow o, \phi \) rules below is as follows:

**Systematic**

```
p t k s h m n l r i e u o a
```

**Phonetic**

There is overlap in both directions.

```
/k/
\[
[k] [k] [v] [\phi]
\]
```

```
/p/
/k/ /u/
\[
[v]
\]
Epenthesis adds e to consonant-final stems before all inflectional affixes except the following nouns—positive, plural genitive; verbs—infinitives, participles, indefinites, formal and negative imperatives.

<table>
<thead>
<tr>
<th>Nouns</th>
<th>Epenthesis</th>
<th>No epenthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sisar 'sister'</td>
<td></td>
</tr>
<tr>
<td>nom</td>
<td>sisar</td>
<td></td>
</tr>
<tr>
<td>gen</td>
<td>sisaren</td>
<td></td>
</tr>
<tr>
<td>ess</td>
<td>sisarena</td>
<td></td>
</tr>
<tr>
<td>iness</td>
<td>sisaressa</td>
<td></td>
</tr>
<tr>
<td>elat</td>
<td>sisaresta</td>
<td></td>
</tr>
<tr>
<td>illat</td>
<td>sisareen</td>
<td></td>
</tr>
<tr>
<td>adess</td>
<td>sisarella</td>
<td></td>
</tr>
<tr>
<td>ablat</td>
<td>sisarelta</td>
<td></td>
</tr>
<tr>
<td>allat</td>
<td>sisarelle'</td>
<td></td>
</tr>
<tr>
<td>translat</td>
<td>sisareksi</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verbs</th>
<th>nous- 'rise'</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sg</td>
<td>pl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>nousen</td>
<td>nouseemme</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>nouset</td>
<td>nousette</td>
</tr>
<tr>
<td>3</td>
<td>nousee</td>
<td>nousevat</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The n of the inflectional affix assimilates to s.*
The underlying phonological forms of the inflectional affixes seem to be the following.

<table>
<thead>
<tr>
<th></th>
<th>nom</th>
<th>pl</th>
<th>part</th>
<th>ta</th>
</tr>
</thead>
<tbody>
<tr>
<td>gen</td>
<td>n</td>
<td>pl gen</td>
<td>ten</td>
<td></td>
</tr>
<tr>
<td>ess</td>
<td>na</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iness</td>
<td>ssa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>elat</td>
<td>sta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>illat</td>
<td>sen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adess</td>
<td>lla</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ablat</td>
<td>lta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>allat</td>
<td>lleh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>translat</td>
<td>ksi</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 n me
2 t te
3 v vat

inf 1. tah
pa 2. te
particip pst nut/neet
pst pass tu*
indef pres taan
past ttiin
imperat formal -kaa
neg -kkoh

---

*Lehtinen gives the affix with 'aspiration': -tu' but informants disagree and say there is no gemination with following consonants. If there were, the form would have to be /ttuh/.
There doesn't seem to be much that can be said for the non-
epenthesis group as a phonological class. The majority begin with t, 
but the plural marker for nouns in the nominative is also t and 
follows epenthesis:

sisar       kiel-
pl          sisaret  kielet
past        sisarta  kieltä

It also does not seem to have anything to do with open versus 
closed syllables, since both syllable-closing and non-syllable-
closing affixes occur in both groups:

epentheses                no epentheses
  syll- open   sisarena    sisarta
  syll- clos    meneväät    mennyt

Epenthesis does not occur when something intervenes between the 
stem and the affix. The plural marker, past tense marker, and super-
lative marker are all i. The conditional marker is isi. These stand 
between the stem and the inflectional affix, and epenthesis does not 
take place.

The epenthetic e is raised to i in the nominative singular by 
the e-raising rule which also operates on stem-final e:

stem-final e   epenthetic e
  ovi             kielů
  ovea            kieltä
  oven            kielen

The epenthetic e is lost altogether when it follows syllables 
with less than primary stress: kielů but sisar, eläin.
That the epenthetic e is added to the nominative forms of multisyllabic stems and undergoes the e-raising rule before deletion is demonstrated by the class of words ending in -us and having -ut- in the paradigm. Kauneus/kauneutta.

Here the i from the e-raising rule has provided the right condition for the t→s rule before its deletion. (These stems will be discussed further below.)

It seems that the conditions for epenthesis are part phonological and part syntactic. Ignoring the non-epenthesi group for a moment, it would be nice to say that the epenthetic vowel is placed between consonant-final stems and consonant-initial affixes. This would account for its nonoccurrence with plural, past tense, superlative, and conditional markers which all involve vowels. But it does not work for nominative singular where the epenthetic vowel is added to the stem, raised to i by the general final -e and finally, in certain circumstances, deleted as demonstrated above. Since the nominative singular obviously is unmarked by any affix, the conditions for epenthesis would apparently rest entirely with the stem, but this is obviously not the case as we have sisarena but sisarta.

Syntactic conditions must be stated. Positing a different sort of juncture before the partitive, plural genetive, and the several verb affixes is exactly equivalent to listing these in the rule. The rule must look something like this:

Epenthesis rule:

\[ \begin{array}{c}
\text{-syl}1 \\
\text{-high}
\end{array} \rightarrow \begin{array}{c}
1. \text{is stem final} \\
2. \text{is not partitive, plural gen, infinitive, participle, indefinite, or imperative formal or neg.}
\end{array} \]
Some sequential mutations:

u, o (back and front) remain unchanged before i.

katu/kaduilla  sano/sanoin  helppo/helpoin

stem-final e drops before i.

mäke-/mäille  luke-/luin, luisin

stem-final -i dissimilates and becomes -e before plural and superlative

-i but drops completely in verbs.

kuppi/kupeilla; kiltti/kiltein but sopi/sovin

stem-final ä drops before -i.

ystävä/ystävillä  käyttä/käytin  ikävä/ikävin

stem-final a drops in unstressed position when [+syll] u or o occurs
in preceding syllable.

kukka/kukissa

poika/pojissa  but  rauha/rauhoissa

Notice that the way this condition operates justifies making the
second element of the diphthong the [-syll] element. The o of poika
allows the a to drop, but the u of rauha does not.

stem final a always drops before superlative -i.

Elsewhere stem-final a is raised and rounded to o. It may be
dropped optionally in the third syllable or beyond, (omenoilla and
omenilla are both acceptable). The final vowel of the derivational
affixes ija, la, tta, kka is always raised and rounded. Fronting to
agree in harmony with the stem comes after this raising, so the vowel
is not dropped as it would be if it were independently a front vowel
ystävä/ystävillä but tekijä/tekijöillä.
It seems obvious that rule set B is to be preferred to set A.

A.

\[
\begin{align*}
a & \rightarrow \emptyset / \_+i \\
    & \rightarrow o / \_+i \quad (i \neq \text{superl})
\end{align*}
\]

B.

\[
\begin{align*}
\hat{a} & \rightarrow \emptyset / \_+i \\
a & \rightarrow o / \_+i \quad (i \neq \text{superl})
\end{align*}
\]

\[
\begin{align*}
\{ija\} & \rightarrow \{\text{FRONT}\} / \{\text{FRONT}\} \\
\{latt\} & \rightarrow \_ \\
\{kka\} & \rightarrow \_ \\
\end{align*}
\]

The fact that a does not become o before the so-called second plural genitive is because the -in of this form is not properly analyzed as plural i plus n. That a juncture of a different order than affixal juncture occurs between the stem and the 2nd genitive affix -in is not only demonstrated by the failure of a to become o but by the lack of consonant gradation.

<table>
<thead>
<tr>
<th>nom.</th>
<th>2nd gen.</th>
<th>plur. iness</th>
</tr>
</thead>
<tbody>
<tr>
<td>ilta</td>
<td>iltain</td>
<td>illoissa</td>
</tr>
</tbody>
</table>

**THE COMPARATIVE AND SUPERLATIVE OF ADJECTIVES**

<table>
<thead>
<tr>
<th></th>
<th>Adj.</th>
<th>Comp.</th>
<th>Superl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nom.</td>
<td>helppo 'easy'</td>
<td>helpompi</td>
<td>helpoin</td>
</tr>
<tr>
<td>Iness.</td>
<td>helpossa</td>
<td>helpommassa</td>
<td>helpoinmassa</td>
</tr>
<tr>
<td>Past</td>
<td>helppoa</td>
<td>helpompaa</td>
<td>helpointa</td>
</tr>
</tbody>
</table>

The comparative affix is -npa. To form the superlative -i- is inserted before -npa.
pa $\rightarrow$ $\emptyset$ / superl. nom. and positive singular
pa $\rightarrow$ pi / comp. nom. singular
n $\rightarrow$ m, p (standard nasal assimilation rule)

The loss of -pa in the superlative nominative and genitive may be compared with the dropping of -nsa in the possessive. But here there is no compensatory lengthening, and the dropping is obligatory, not optional. The raising of -a all the way to -i in stem-final position is notable.

THE WORD PITKÄ:

The comparative and superlative of pitkä, together with the 'abstract noun' form of the stem reveal that the adjective form contains something extra.

| adj.  | pitkä    | 'long' |
| comp. | pitempi  | 'longer' |
| superl. | pisín    | 'longest' |
| abst. noun | pituus | 'length' |

The stem is obviously /pit/.

pit + npa $\rightarrow$ pitempi (epenthesis, nasal assim., a - raising)

pit + i + npa $\rightarrow$ pisín (t $\rightarrow$ s, nasal assim. pa drop)

pit + uus $\rightarrow$ pituus (note that it is not front)

The kä is extra and carries its own fronting.

TRIPLE VOWEL SIMPLIFICATION RULE:

When by consonant gradation or inflectional affixation, there arise three adjacent vowels, the following simplification occurs:
$V_1V_2V_3$

maa + i + ssa $\rightarrow$ maissä

voi + i + ssa $\rightarrow$ voissa

This simplification occurs before the mid-vowel raising rule:

tie:  tee + illä $\rightarrow$ teillä

*tee + illä $\rightarrow$ *tie + illä $\rightarrow$ *tiillä

yo:  öö + illa $\rightarrow$ öilla

*öö + illa $\rightarrow$ *yö + illa $\rightarrow$ *yilla

**NOUN STEMS IN -S AND THE ILLATIVE CASE:**

<table>
<thead>
<tr>
<th>Nom</th>
<th>Mies</th>
<th>Kangas</th>
<th>Kallis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT</td>
<td>Miestä</td>
<td>Kangasta</td>
<td>Kallista</td>
</tr>
<tr>
<td>Gen</td>
<td>Miehen</td>
<td>Kankaan</td>
<td>Kalliis</td>
</tr>
<tr>
<td>Iness</td>
<td>Miehessä</td>
<td>Kankaassa</td>
<td>Kalliissa</td>
</tr>
</tbody>
</table>

In these stems s $\rightarrow$ h before the epenthetic vowel and is lost completely after a syllable with less than primary stress. The epenthetic e is assimilated to the preceding vowel to make a long vowel. This opens the stem-final syllable and removes the conditions for consonant gradation.

It would make sense to have the assimilation take place after the deletion, and there seems to be evidence for this in myös 'also', myöhemin 'later'. But this paradigm is not useful as there also exists the form myöhä 'late'. Evidence for the opposite order comes from the illative case.

Here it is clear that the vowel of the affix becomes a copy of the preceding vowel before the loss of h.

<table>
<thead>
<tr>
<th>Nom.</th>
<th>Talo</th>
<th>Lasi</th>
<th>Maa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illat.</td>
<td>Taloon</td>
<td>Lasiin</td>
<td>Maaian</td>
</tr>
</tbody>
</table>
STEMS IN -t:

Noun: nom. kevänt
      part. kevättä
      gen. kevään

Verb: pelät-
      1st sing. pelkään
      participle pelännyt*

In the s- stems, the weakening of s to h and final h- deletion is part of the general scheme of the language, found not only in inflectional affixation but also in the illative case. The loss of stem-final t in these stems is completely comparable but has no similar counterpart elsewhere in the language.

The epenthetic vowel in t stems becomes a copy of the vowel of the preceding syllable unless the stem vowel is high and rounded.

kevänt → kevään     but   olut → oluen
         kevät → kevyn

Two derivational affixes which seem much alike, then rather dissimilar, and finally not so different after all.

*By assimilation pelännyt becomes pelännyt.
example:

korkea 'high'
korkeus 'height'

pitkä 'long'
pituus 'length'

kaunis 'beautiful'
kauneus 'beauty'

hyvä 'good'
hyvyys 'goodness'

terve 'healthy'
terveys 'health'

Meri Lehtinen, in her Basic Course in Finnish warns that one should not confuse these abstract nouns formed from adjectives with nouns in -musk- in singular and plural. (BCF 334)

But, in fact, it is not only the -mus stems, from which these abstract nouns differ in phonology, but from -os, -aus, -us, -nus, -tus, stems, at least some of which are not clearly derived from verbs. (see Reverse alphabetical word list under -ks)

Consider the following paradigms:

"Abstract Noun from Adjective"

Sg. Pl.

pituus pituudet
pituuden pituukset
pituutta pituuskia
pituudesa pituuskessa
pituuteen pituuskiin

' -mus stem from verb'

sopimus sopimuksset
sopimusen sopimuksien

sopimusta sopimuksia
sopimuksessa sopimuksissa
sopimuksseen sopimuksin

While Lehtinen's text book is by far the best and most useful Finnish grammar available in English, it has some significant omissions. As noted above, she warns only of the forms of the -mus stems with the umu stems, failing to note the opposite situation with the -mus stems which behave in the same manner. In her Appendix of paradigms, she does not include the 'abstract noun from adj.' paradigm at all. Moreover, the dictionary is clearly redundant. Adequate dictionary entries for
the latter three stems would be merely

sopimuks-
kerroks-
henkayks-

The epenthesis rule which adds -e to all consonant stems, and the cluster simplification rule which reduces syllable-final clusters by weakening the -k to Ø would give the correct vowel and consonant stems.

One might argue that Lehtinen's glossary is for the use of students beginning their study of the language, and redundancy is helpful and desirable. But the rules which yield the consonant and vowel stems of these forms are so general in Finnish phonology that a student must come to terms with them immediately. Listing multiple forms and making two different derivational affixes look so much alike (with, however, so many exceptions, listed case for case in sing. and pl.,) is a grave disservice to the student. It is not merely confusing; it forces the student to learn paradigms where it should be possible for him to manage only with a base form and the most general rules of the language.

If the proper base form of all stems under consideration except the 'abstract' ones is .....ks-, what is the underlying form and what are the rules which will give us the proper paradigm of the 'abstract' stems?

I believe that the underlying final cluster of the affix should be kt. The k which may appear before continuant s in the -ks stems is suppressed throughout the singular by the presence of the stop t. It only appears where t → s by the rule which always changes t to
s before i. The i provided here is the plural i, which is why the
plural of kt stems looks exactly like the plural of ks stems.

The epenthetic -e added to the stem in the sing. to form the
vowel stem, is raised to -i in the nom. sing. by the general -e
raising rule. This also induces t → s, and the final -i is lost,
leaving word-final s. Elsewhere in the sing. paradigm the k is sup-
pressed, and the t grades normally giving a paradigm much like

yksi (colloq. yks )
yhden
yhtä
yhdessä
yhteen

(The weakening of k only to h, and the retention of nom. sing. -i is
a matter of stress -- ykt is monosyllabic -- having full stress.)

STEMS ENDING IN m :

<table>
<thead>
<tr>
<th>'penninsula'</th>
<th>'snow'</th>
<th>'animal'</th>
<th>'heart'</th>
</tr>
</thead>
<tbody>
<tr>
<td>nom.</td>
<td>niemi</td>
<td>lumi</td>
<td>eläin</td>
</tr>
<tr>
<td>part.</td>
<td>nienta</td>
<td>lunta</td>
<td>eläintä</td>
</tr>
<tr>
<td>gen.</td>
<td>niemen</td>
<td>lumen</td>
<td>eläimen</td>
</tr>
<tr>
<td>illat.</td>
<td>niemeen</td>
<td>lumeen</td>
<td>eläimeen</td>
</tr>
</tbody>
</table>

The epenthesis rule adds -e to all those consonant-final stems
except before the partitive affix. With the partitive affix the
nasal assimilation rule yields -nt-. The e-raising rule yield -i-
in the nominative, but the epenthetic vowel is dropped after an
unstressed syllable, so eläimi and sydäm(m)i become once again con-
sonant final. m → n in word-final position.

The rule sequence is:

epenthesis
epenthetic vowel raising
epenthetic vowel loss after unstressed syllable
delabialization of final nasal.
The base forms of niemi, lumi, and elain are /niem/, /lum/ and /elaim/.

Except for sydän, the rules above generate all the correct inflectional forms of stems ending in /m/. Sydän is unique, and any treatment of it is equivalent to treating it as an exception.

McCawley and Wiik both postulate the base form /sytäm/.

This yields sydämme- by the consonant gradation and epenthesis rules. Although orthographically there is a single -m- in the inflected forms, they are generally pronounced with a geminate.

Unfortunately for this solution, no other stems in Finnish end in double consonants. Not only would a morpheme structure rule be violated, but a rule simplifying -mm to -m such that the delabialization rule would yield -n would be required for this word alone.

There are, however, nasal-stop clusters.

<table>
<thead>
<tr>
<th>kant</th>
<th>'lid</th>
<th>tuhant</th>
<th>'thousand'</th>
<th>kolmant</th>
<th>'third'</th>
</tr>
</thead>
<tbody>
<tr>
<td>nom.</td>
<td>kansi</td>
<td>tuhat</td>
<td>kolmas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>part.</td>
<td>kantta</td>
<td>tuhatta</td>
<td>kolmatta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gen.</td>
<td>kannen</td>
<td>tuhannen</td>
<td>kolmannen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>illat.</td>
<td>kanteen</td>
<td>tuhanteen</td>
<td>kolmanteen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On these models we could postulate a base form * /sytäm/ .

This would yield both the -d- and the -mm-, but sydän would still be an exception to general rules. Kansi retains the epenthetic vowel in the nominative from because it is a monosyllabic stem. The others drop it by the stress-rule. But whereas tuhant and kolmant simplify the final cluster in nominative and partitive alike by dropping the
nasal, *sydäm would simplify by dropping its final stop and undergoing the word-final delabializing rule in the nominative and the nasal-assimilation rule in the partitive. Moreover, the strong consonant grade in the illative case reveals the nasal-stop sequence in kansi-kanteen, tuhat-tuhanteen, and kolmas-kolmanteen, but does not reveal one in sydämmeen.

Another way of looking at this word is to assume that the gemination of -m- is the speaker's compensation for the apparent weak grade -d-. If we assume that the word is peculiar because it really contains a -d-, not an underlying -t-, then we can go along with the orthography's single -m- and say that the speaker's geminate is a (mistaken) attempt to bring a peculiar word into line with his phonology. In this case the base form would be /sydäm/. The m-stem rules generate all the correct orthographic forms.

Any one of these solutions treats sydän as the exception to Finnish phonotological rules that it is. If it is possible to evaluate degree of exceptionalness, I would think the last solution suggested would be the most economical. It assigns to the segment [-lab]
[+back]
[+close]
the feature [+voice] in exception to the general rule [+obst]
→ [-voice]. I don't believe that this is equivalent to adding the systematic phoneme /d/ to the inventory. That the peculiar voiced segment leads to a compensatory lengthening of m, with its attendant complications, is good reason not to include it in the systematic inventory. This is analogous to the exclusion of foreign
/b/ from the inventory in spite of the pair bussi 'bus' and pussi 'sack'. In speech the b is generally devoiced, and the pair become homophones.

Postulating a final geminate nasal violates a morphene structure rule and requires a final-geminate simplification rule, and an underlying -mp- would both require a separate cluster simplification rule and fail to generate the correct illative case form.
-NEN WORDS:

There is a very productive slang suffix -(i)s as in baikis (bicycle), likas (flicka = Sw. 'girl'), telkis (telka = television), and many, many more. I think it may be the same as the underlying nominalizing suffix of the old -nen words. Suppose it went this way:

<table>
<thead>
<tr>
<th>stem</th>
<th>affix</th>
<th>epenthetic -e</th>
<th>case</th>
</tr>
</thead>
<tbody>
<tr>
<td>puna 'red'</td>
<td>is</td>
<td>e</td>
<td>1la</td>
</tr>
<tr>
<td>sini 'blue'</td>
<td>is</td>
<td>e</td>
<td>1la</td>
</tr>
<tr>
<td>karttu 'stock'</td>
<td>s</td>
<td>e</td>
<td>1la</td>
</tr>
<tr>
<td>hetki 'moment'</td>
<td>s</td>
<td>e</td>
<td>1la</td>
</tr>
</tbody>
</table>

This yields punaisella, sinisellä, karttusella, hetkisellä and likewise the correct forms with all the other cases except the nominative singular.

This derived form adds -e like other consonant stems (eläin, eläime-; pien-, piene-; tuul-, tuule-) rather than dropping the -s and lengthening the preceding vowel as in lammas, lampaa-; taivas, taivaa-; etc.

Why the -nen form of the nominative singular? It may be a case of dissimilation. The -nen words are often (in some dialects quite generally) used in the genitive before a noun --

Karttusen rouva instead of rouva karttunen, for instance. I suspect that this was once universally true - a sort of attribution. Instead of punainen talo 'a red house', it was punainen talo 'a house
possessed of the quality of redness.'

But this genitive construction has been transformed into an adjectival one (in many cases, but not all -- more in some dialects than in others), just as the participle constructions have. (2) The old genitive singular -sen from a single underlying -s split to yield nominative and genitive. To distinguish the two, the nasality is carried over the syllable in the new nominative.

I think that this is exactly equivalent to saying that there is a class of words with -nen in the nominative singular and -se- elsewhere. But it's a more amusing way of getting there.

By the way, the modern slang -(i)s doesn't induce consonant gradation, either.

*hypothetical original and dialect | standard language
---|---
talo | punainen talo
| punaisen talon
punaisen | punaisessal talossa
| punaiseen taloon etc.

talossa
taloon etc.

(1) What the conditioning factor for (i) is, I don't know.
It has the same erratic appearance with (i)kko, (i)sto, and others. It seems to be the plural morpheme.

(1.5) This may very well be the same nominalizing -s found in company with -uk as in ajatus, ajatukse-, where the underlying affix is apparently -uks-
Example: kūu
väsy 'to tire, to become weary'
väsynyt, väsynytt - the past participles singular and plural but väsynytt- is used as an adjective with all the inflections, hence the ambiguity:

\[
\begin{align*}
\text{Tytöt ovat väsynytt} & \quad \text{The girls have become tired.} \\
\text{(-sylil)} & \quad \text{(-syll)} \\
\text{The girls are tired.}
\end{align*}
\]

Many participles do this, but it is not yet a general rule of the language.

\[
\begin{align*}
\text{(+consonant)} & \quad \text{(-obst)} \quad \text{is followed by a word-initial consonant, the participle and adjectival constructions (all current)} \\
\text{Tytöö on väsynyt.} & \quad \text{The girl is tired.} \\
\text{(-sylil)} & \quad \text{(-syll)} \quad \text{(obviously nearly synonymous)} \\
\text{Tytöt ovat väsynytt.} & \quad \text{The girls have (become) tired.} \\
\text{Tytöö ovat väsynytt.} & \quad \text{The girls are tired.} \\
\text{Tytöö jää ovat väsynytt.} & \quad \text{Some girls have (become) tired.} \\
\text{Tytöö jää ovat väsynyttiä.} & \quad \text{Some girls are tired.}
\end{align*}
\]

These clusters simplify, dropping the first consonant. (Sophists)

nom. väsynyt tytöö 'The tired girl'
ligin, län, gen. väsynen tytön 'The tired girl'
addess. väsynettä tytölä 'The tired girl'

Geminates consonants arise from sequences of like consonants. Long vowels are the result of sequences of like vowels either in morpheme-structure ma + a → ma; or by consonant gradation.

SUMMARY

The systematic phoneme inventory of basic Finnish is the following:

* Underlying standard Finnish and the dialects except in case a dialect has changed to the point of making the underlying grammar irrecoverable, in which case it has become a different, related language.
second vowel is [+high]. The diphthongs ie, üö, uo arise from the raising of the first midvowel. It is the second vowel of the sequence which becomes [-syll]. In vowel triples, long vowels and diphthongs simplify by dropping the [-syll] second element.

h is somehow 'transparent'. Voicing and assimilation in point of articulation are carried across it.

j and v are the systematic [-syll] reflexes of i and u (v also arises from p and k). This is probably not true for the individual speaker, yet accounts for the absence of sequences *j:, *v:, *ji, *vu. In loan words such as viikko (sv. vecka), Juhanni (Sw. Johann), the v and j do not come from underlying u and i.

The front vowels ü, ö, ä are the result of "fronting" of whole morphemes and are greatly outnumbered by their back counterparts.

Consonant gradation is the result of 'weakening' stops by assimilating them in continuance and voicing to their immediate context. The psychological justification of 'simplifying' t: to tø, etc., has been raised, but since these affixes are immediately simplified to single stops, this doesn't seem to be a serious argument.

A convention for 'duplication' seems necessary. The epenthetic vowel becomes a copy of the vowel of the preceding syllable, and the 3rd sing. person marker is a duplicate of the preceding vowel.
Much syntactic information seems necessary in Finnish phonology. For example, the i- rules differ in respect to nominals, verbals, and superlatives:

\[
\begin{align*}
  &i &\rightarrow e &\quad i &\quad \text{verb} \\
  &a &\rightarrow o &\quad i &\quad \text{superl.,} \\
  & & &\quad \text{2nd genitive}
\end{align*}
\]

Epenthetic -e becomes -i in word-final position and is to be deleted after a syllable with less than primary-stress, but stem-final -i is not deleted.

\[
\begin{align*}
  \text{sisar} &+ e &\quad \text{sisari} &\quad \text{sisar} \\
  \text{suutar} & &\quad *\text{sutar}
\end{align*}
\]

This is by no means a complete treatment of Finnish phonology. It is a somewhat more informed phonology than McCawley's 1964 paper. I must rest it here and wait for suggestions before expanding the paper to its final version. All criticism and questions will be useful in shaping the forthcoming fuller treatment of the subject. Please address comments to the author at the Department of Linguistics, University of Texas, Austin, Texas 78712.
Selected Bibliography


Lehtinen, Meri, Basic Course in Finnish, Bloomington, 1964.


----My Guess as of November 26 as to What the Right Features Are, (unpublished), Chicago, 1967.


Setälä, E. N., Suomen Kielioppi, Helsinki, 1920.
