ON THE RELATION BETWEEN VOWEL HEIGHT AND FRONT-BACK:
A COMMENT ON ELI FISCHER-JØRGENSEN'S PAPER "SOME
BASIC VOWEL FEATURES, THEIR ARTICULATORY CORRELATES
AND THEIR EXPLANATORY POWER IN PHONOLOGY"


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Eli Fischer-Jørgensen (1983) has given an interesting contribu-
tion to the symposium on "Phonetic Explanation in Phonology"
during the Tenth International Congress of Phonetic Sciences,
Utrecht, August 1-6, 1983.  In this comment, I shall refer to
the extended and revised version of her contribution, which is
printed on the preceding pages of this volume.

Eli Fischer-Jørgensen in her contribution (to which the reader
is referred for general references) argues in favour of what is
basically the traditional front-back and high-low distinction
in vowels, cf. the following quotation:

> "if tenseness is considered a separate dimension and
> height is taken to mean the relative distance between
> the articulating part of the tongue and the palate
> within each series of rounded or unrounded, tense or
> lax, front or back vowels, most of the inconsistencies
> between these traditional labels and the articulatory
> facts disappear" (this volume, p. 261).

While I agree on almost every point with Eli Fischer-Jørgen-
sen's criticism of alternative proposals which have been ad-
vanced, and also find her general conclusions convincing, I
shall in this comment briefly consider the relation between
the two traditional articulatory features for the vowel space,
viz. vowel height and front-back.  I shall use (primarily)
Danish r-colouring and (secondly) Nordic i-Umlaut as evidence
for what I take to be a slightly different conception of the
distinctive feature front-back, viz. for the way I have used
it in a description of Modern Danish (cf. Basbøll and Kristen-
sen 1975: 273ff, Basbøll 1981:48f).

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Eli Fischer-Jørgensen argues:

> "There are, however, a few cases where the feature
> pharyngeal for vowels might perhaps give a simpler
> and more explanatory formulation, i.e. in the cases
> of assimilation of vowels to pharyngeal or uvular
> consonants, as found in Greenlandic before /ʁ/ and
> /q/ (mentioned by Wood). However, as /æ/, which be-
> comes [ɑ] in this position, is considered by Wood to
> be pharyngeal already, whereas this is not true of
> /i/ and /u/, the formulation will not be simple.
> The same reasoning is valid for the ʁ-colouring of
> Danish vowels ... Perhaps it is just as acceptable
> to say that vowels may be retracted and lowered be-
> fore pharyngeal consonants" (this volume, p. 265).

This formulation could be made even more precise: the feature
pharyngeal must be multivalent if $r$-colouring in Modern Danish
should be accounted for by means of this feature since this
term in Danish covers a whole productive and systematic (and,
of course, language specific) series of changes in vowel qual-
ity, both before and after /ʁ/ (cf. Basbøll 1972:202ff, and
Basbøll and Wagner, forthcoming: ch. IV, sect. 7). The con-
ception of the feature pharyngeal as multivalent seems incon-
sistent with Wood's proposals according to which it should de-
note articulation at a certain (although not completely in-
variable) point. On the other hand, nor do I see any reason
to treat $r$-colouring of /æ/ (i.e. [æ] → [ɑ]) as backing, and
all other cases of $r$-colouring (i.e. [e] → [ɛ], [ɛ] → [æ],
[ø] → [œ], [œ] → [ɶ]) as lowering, as the normal use of the
feature front-back would force one to do (cf. Colman and Ander-
son (1983:187): *"the proposals we are aware of would all assign
the [ɑ] → [æ] and [æ] → [e] shifts to different dimensions
(backness vs. height)"*).

The problem is, of course, whether [ɑ] (or [æ]) should be con-
sidered as a maximally low and maximally front vowel (as ex-
pressed in the placement of [a] at the lower left corner of
Daniel Jones' Cardinal vowel quadrangle, cf. the fact that just
four X-ray pictures have determined the geometrical shape of
the Cardinal Vowel Diagram). I do not think any phonetician
would like to argue for a particular "corner" at [a]. Acous-
tically and perceptually this is rather clear, I think, and as
far as articulation is concerned, [a] cannot be considered a
phonetically "extreme" vowel - able to become a phonetic con-
sonant in one little move, so to speak - like [i u ɑ] (this is
not to deny that different configurations of muscles may be in-
volved, however). I would describe the situation so that,
phonetically speaking, the "horizontal aspect" of front-raising
has much more relative weight, as compared to the "vertical
aspect", when we go from [ɑ] to [æ], and that the relative
weight of the "horizontal aspect" is continually diminishing
when we go further towards [i] (so that the "vertical aspect"
is clearly most important in the distinction between [e] and
[i]). The important thing to me is that no "corner" at [æ]
or [a] can be argued for on general grounds, in contradistinc-

tion to [i], [ɑ] and (partly) [u] (it should be remembered
that Cardinal Vowels [i] and [u] are the highest possible
vowels at their place of constriction, and Cardinal Vowel [ɑ]
the lowest possible one, whereas the notion "lowest possible
front vowel" has no precise meaning in phonetic terms). It
seems to me that some consequences for the feature system must
be drawn from this fact. I therefore use the feature label
"front" as referring to vowels which lie on the (curved) (i.e.
elliptic, cf. Jones' earlier drawings of the Cardinal Vowel
Diagram) line from [i] to [ɑ] (and, similarly, "back" for the
vowels from [u] to [ɑ], but this is less controversial, of
course). After this slight re-definition of the distinctive
feature term front-back, $r$-colouring can be described as simply
consisting in moving one step in the direction towards [ɑ],
and it seems to me that this account of the whole set of sys-
tematic and productive $r$-colouring effects is phonetically and
phonologically more adequate than any alternative account one
can think of. Notice that this description presupposes that
the vowel-height feature is multivalent (I have used the feature
"distance" instead (see Basbøll and Kristensen 1975:273ff with
figure 1 (reproduced here)), expressing distance from (an ex-
treme) [ɑ] towards either (an extreme) [i] (in "front"-vowels)
or (an extreme) [u] (in "back"-vowels)).

What exactly is the difference, if any, between the traditional
use (or uses) of the feature front-back, including Eli Fischer-
Jørgensen's use, as far as I have understood her, and my use
of it? Phonetically, I think there is none. Phonologically,
the traditional use might be illustrated by the following quo-
tation from Eli Fischer-Jørgensen (this volume, p. 261), a pro-
pos Jones' primary cardinal vowels:

> *"But from the point of view of a general system of*
> *vowel features, [ɑ] does not belong in this series*
> *((viz. [u o ɔ ɑ]/HB)), but in the series of unrounded*
> *back vowels [ɯ ɤ ʌ ɑ]".*

I draw from this the (not logically necessary!) inference that
[ɑ] does not, according to Eli Fischer-Jørgensen, belong to
the series of unrounded front vowels [i e ɛ æ] (in any case,
this is the view encoded in traditional feature systems). On
the other hand, I would rather say that [ɑ] enters into two
series of unrounded vowels, viz. both the "front" series (in
a perhaps not too felicitous terminology) [i e ɛ æ a ɑ] and
the back series [ɯ ɤ ʌ ɑ] (notice that only the dimensions are
crucial, not the individual symbols for non-extreme vowels).
According to the traditional conception, [ɑ] is phonologically
a back vowel (not a front vowel), and the difference [ɑ]-[æ]
is, phonologically, one of "backness" and not of height (al-
though, phonetically, it is both). According to my conception,
on the other hand, the phonological distinction front-back is
in a broad sense "neutralized" in, i.e. does not apply to, [ɑ],
and the difference [ɑ]-[æ] is, phonologically, one of "height"
and not backness (although phonetically it is both). (By the
term 'phonological' I do not refer to contrasts in any specific
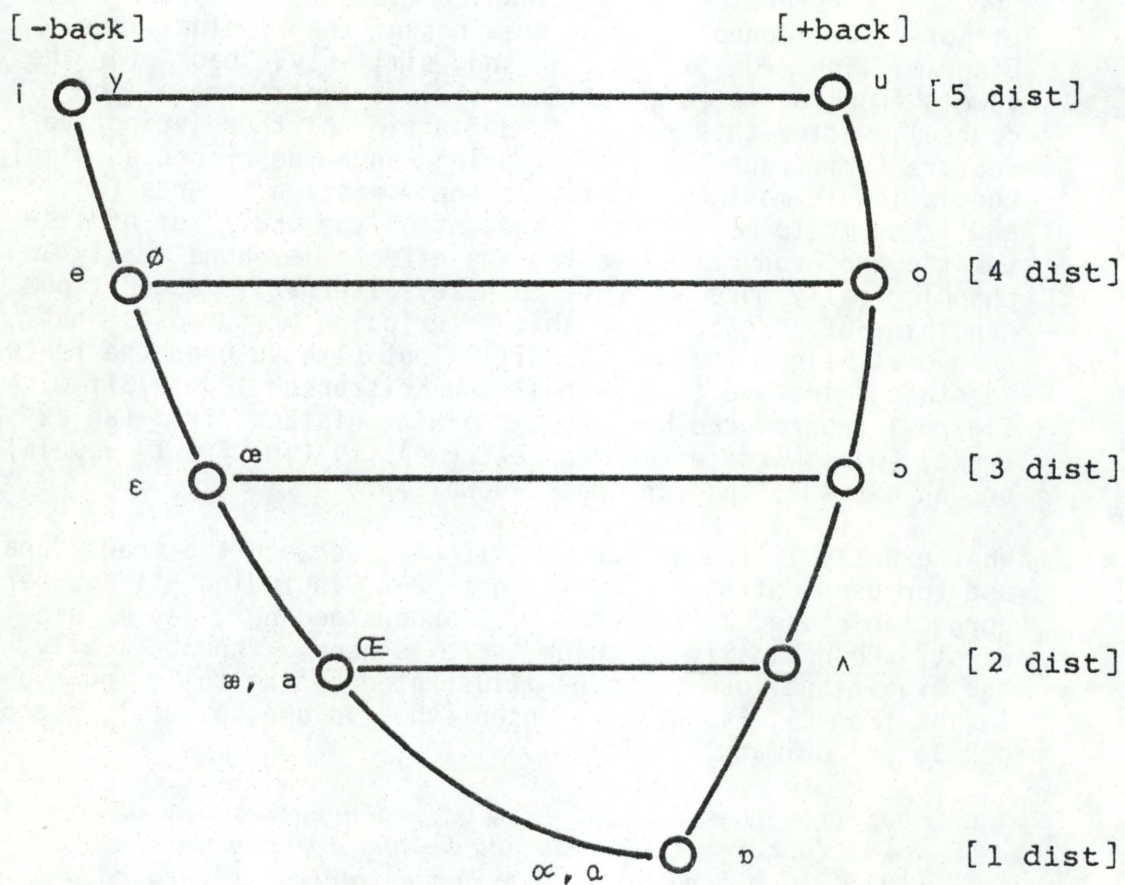language but only to a certain level of abstractness encoded

*Figure 1*

*Schematic drawing showing the relationships
between the vowels in terms of the features
[back] and [distance] (...)*

by means of distinctive features with discrete values; this
cannot be discussed here, however.)  In my view, one could
even say that [ɑ] might be raised in two directions, viz.
"front-raised" (towards [æ]-[i]) and "back-raised" (towards
[ʌ]-[ɯ], cf. [ɔ]-[u]).  (In a sense, this view corresponds to
some types of "vowel triangle", so the tradition is still there,
of course!)  Notice that if the change [æ] → [ɑ] is seen as
involving backing phonologically, the same reasoning could also
be applied to the change [e] → [æ], for example.

At this point, a brief informative note on *r*-colouring in Danish
might be useful.  Diachronically, it appears at first sight to
be the result of two different changes, viz. a lowering of cer-
tain front vowels adjacent to /r/, and a "front-raising" of *a*
except when adjacent to /r/.  This does not really change the
unity of *r*-colouring, however, since there has been a general
"front-raising" of long *a* (and of certain cases of short *a*),
which has been prevented, however, by an adjacent /r/ (cf.
Brink and Lund 1975:67ff, 96ff).  Thus the adjacency of /r/ is
in the former case of *r*-colouring a positive condition, in the
second a negative one, but apart from this difference the effect
of *r*-colouring is similar.  Synchronically it is, as far as I
can see, a productive process which - certainly without being
innate - is normally unconscious, but which sometimes can be-
come conscious, and be subject to hypercorrections and stigma-
tizations.  In sum, I find the process of *r*-colouring in Modern
Danish very well suited as an illustrative case of phonological
vowel features.

I thus conclude that a unified and explanatory description of
*r*-colouring in Modern Danish, by means of distinctive features,
necessarily leads to considering [i e ɛ æ a ɑ] as one phono-
logical dimension, one argument being that any account in terms
of [æ] → [ɑ] as backing will necessarily lead to a "corner" at
[æ] or [ɑ], as far as I can see; and this consequence I find
phonetically as well as phonologically unsound.  In the basic
phonetic vowel system [ɑ] is, within the framework argued for
here, necessarily the lowest unrounded vowel (in actual vowel
systems this need not be the case, however, since a language-
specific [ɑ] need not be so low as cardinal vowel [ɑ]).  Fur-
thermore (still within this system), the movement from [ɑ] to
[æ] is (as already noted) just the first step of a "front-
raising" and therefore of the same basic type as the "front-
raising" from [ɛ] to [e], etc.  According to such an interpre-
tation, a quadrangular vowel system will thus be "less natural"
than a triangular one, everything else being equal, since a
triangular vowel system in the sense used here does not presup-
pose the specification of a "lowest front vowel", viz. of a
"corner" at [æ] or [ɑ].  Nevertheless, the two elliptic lines
seem to allow such a specification (based upon phonological
arguments), for a specific language, as a codification of the
fact that the "front-raising line" becomes increasingly less
vertical when we move from [i] towards [ɑ], and ends by being
nearly horizontal.

The explicit rule for *r*-colouring in Modern Danish, within a framework such as the one which has been argued for here, is given in Basbøll and Wagner forthcoming (ch. VI, sect. 7; basically: "front-vowels are lowered" or, alternatively!: "vowels are "front-lowered"", i.e. lowered along the dimension [i]-[ɑ]).  Its simple formulation is there compared to the much more complex formulations which are necessary within alternative frameworks of distinctive features-analysis, both the traditional use of front-back and an analysis by means of the features palatal, velar and pharyngeal (which are used in that work within a consistent binary framework related - but not identical - to Wood's use of them).

Now, it seems to me that this way of looking at the feature front-back may perhaps also contribute to an interesting account of Nordic *i*-Umlaut.  I should emphasize that there are several crucial differences between the evolution of *i*-Umlaut in different Germanic languages/dialects, so what I suggest for Nordic is not necessarily relevant outside Scandinavia (which is of course not a homogeneous area either).  Furthermore, the status of the so-called *i*-Umlaut of short /e/ is highly controversial.  One reason to choose Nordic *i*-Umlaut as an example is that "Norse developed vowel mutation very extensively, virtually to the limit ..." (Prokosch 1938:110, cf. 107ff).

If we start with a purely descriptive statement, the main pattern of Nordic *i*-Umlaut seems to me to be the following: Rounded vowels are fronted, and unrounded vowels are "raised" in the sense that they move away from [ɑ] along the line on which the front vowels are placed, i.e. towards [i].  In this way the raising of [e] to [i] is placed on the same footing as [ɑ] to (say) [æ] or [ɛ].  (The change from [e] to [i] certainly also involves fronting, in the usual phonetic sense, but the traditional feature-analysis cannot capture its relation with other cases of *i*-Umlaut.  Anderson and Jones (1977:53ff) argue in the same direction, although within another theoretical framework, viz. dependency phonology.)  It should be emphasized, however, that rounding in itself has of course nothing to do with the underlying mechanism of *i*-Umlaut, but that it only serves to define the set of back vowels which do not lie on the "front-raising" line, viz. the one between [i] and [ɑ].

I think one clear reason can be given for the phonological naturalness of the description of *i*-Umlaut proposed here: *i*-Umlaut is a kind of assimilatory process between vowels, and the vowels which lie on the line from [i] and down - and that is exactly the unrounded vowels - move in the direction of [i], which is the conditioning factor.  The rounded vowels, on the other hand, lie on the line between [ɑ] and [u], and if they follow that line this will not take them anywhere near [i].  So they move in the other - i.e. "horizontal" - dimension, which means that they are being fronted (both phonetically and phonologically).  In short, the rule accounting for the effect of Nordic *i*-Umlaut may be stated informally like this: "front-raise" or front ("horizontally") the vowel in question! (since

the sets of vowels which are a priori eligible for "front-raising" and ("horizontal") fronting are non-overlapping, the rule does not have to be specified as to priority between its two parts). Chronologically, the order was probably front-raising first rather than last (i.e. *e* was not affected later than *α*, and *α* not later than rounded back vowels).

What is common to all the cases of *i*-Umlaut, under the present interpretation, is thus that <u>the vowel to be changed is assimilated to [i], but only with respect to one single feature</u> (and only one phonological degree, in the case of multivalent features). The vowels on the "front"-line must assimilate in the <u>only</u> feature in which they differ from [i] (i.e. in "distance", as I say, or in height, traditionally speaking). The rounded vowels, on the other hand, differ from [i] in two features: rounding and front-back. Rounding is a separate dimension which classifies the vowels into two, in the old Germanic languages at least, basic series, it seems, and the vowels thus adjust in vowel-space-position (or in place of articulation in its <u>broadest</u> sense) just like the unrounded vowels.

Of course, I do not claim that this in any way explains the mysteries of the *i*-Umlaut (for my personal view, see Basbøll 1982, further cf. Skomedal 1980 and Benediktsson 1982). It seems to me, however, that the conception of the feature front-back as presented here, indeed allows an interesting account of one aspect of its phonology, and that it is by no means inferior to other alternative accounts, by means of distinctive features, of which I am aware.

One final remark. I do not want to deny that e.g. Turkish and Finnish vowel harmony, as argued by Eli Fischer-Jørgensen, speak in favour of considering the distinction between [æ] and [ɑ] as one of front-back in those languages (although the treatment of loanwords suggests that these cases of vowel harmony are - at least to-day - not productive processes in the same strong sense as Danish *r*-colouring). How can this be conciliated with the conclusions of the present comment? If we are not to simply accept the weak (but not unreasonable!) position that two different sets of features may both be relevant in such cases, I shall again point to the fact that the back vowels which cannot be ("horizontally") fronted are exactly those which can be "front-raised", i.e. "front-raising" may be considered a complementary way of fronting which takes place instead of ("horizontal") fronting in certain well-defined cases, by convention. This is at present nothing but an airy suggestion, of course.

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