FINAL WEAKENING AND RELATED PHENOMENA[1]

Hans Henrich Hock
University of Illinois at Urbana-Champaign

1: Final devoicing (FD)

1.1. In generative phonology, it is a generally accepted doctrine that, since word-final devoicing (WFD) is a very common and natural phenomenon, the obverse phenomenon, namely word-final voicing, should not be found in natural language. Compare for instance Postal 1968 184 ('in the context ___# the rules always devoice rather than voice'), Stampe 1969 443-5 (final devoicing comes about as the result of a failure to suppress the (innate) process of final devoicing),[2] Vennemann 1972 240-1 (final voicing, defined as a process increasing the complexity of affected segments, 'does not occur.').

1.2 One of the standard examples for WFD is that of German, cf. Bund   Bunde [bŪnt]   [bŪndə]. However Vennemann (1968 159-83 and in later publications) and, following him, Hooper (1972 539) and Hyman (1975 142) have convincingly demonstrated that in German, this process applies not only word-finally, but also syllable-finally, as in radle [ra·tɡlə][3] 'go by bike' (in some varieties of German). The standard view thus must be modified so as to recognize at least one other process, namely syllable-final devoicing (SFD). (For a different explanation of this phenomenon compare section 2.3 below.)

2· Final voicing (or tenseness neutralization)

2 1 A more important argument against the standard view, however, is that, as anyone with any training in Indo-European linguistics can readily tell, there is at least one group, namely Italic, where there is evidence for the allegedly impossible final voicing, cf PIE *siyēt > OLat. sied 'would be'.

2 2   According to Miller (1973 692), this is an
example of 'an "unnatural" or "less natural" rule',
FD being more natural--although the most 'natural
thing is for nothing to happen in final position (as
in English, French, etc.).   There is no reason for a
boundary to condition either voicing or devoicing The
presence of either of these rules will be <u>motivated</u>
by language-particular pause and boundary <u>conditions</u>.'
At pauses, of course, 'the vocal cords must be open
which will predict devoicing, if pause is anticipated '
(fn 2, p   711).

Though Miller is, of course, correct in stating
that nothing may happen at all, this is not a cogent
argument against the claim that FD (or final voicing)
may be a natural development   For this claim evident-
ly addresses itself merely to the question   'What
happens most naturally word-finally (or syllable-final-
ly), if there is any change at all?'

On the other hand, Miller's argument that word
boundary is not a plausible phonetic environment for
final (de)voicing is well taken, as is his claim that
<u>prepausal</u> position <u>is</u> a plausible phonetic environment,
<u>namely for</u> (anticipatory) devoicing (assimilation). As
I have argued elsewhere (Hock, In press §5.1 w. fn 14),
word-final devoicing, then, is to be explained as the
result of (rule) generalization.

However, this still would not account for final
voicing

2 3   To my knowledge, it was Andersen (1969a,b)
who first proposed an explanation of final voicing (not
in Italic, but in early Slavic) within the generative
phonological paradigm. According to Andersen, the
change of the preposition *<u>ot</u> to *<u>od</u> in dialectal Com-
mon Slavic was the result, <u>not</u> of <u>the</u> usually recognized
process of final voice neutralization, but of final
tenseness neutralization   Just as in final voice neu-
tralization it is the unmarked value of the feature
[± voice], namely [- voice], which appears in the un-
marked word-final position, so in final tenseness neu-
tralization, the unmarked value of [± tense] appears,
namely [- tense]. And it was the feature [± tense]

which was 'phonemic' in early Slavic   This is shown,
in Andersen's view, by the fact that there was lenition
(of g > h, dy > dž > ž) in early (dialectal) Slavic.

   This explanation, though effective for early Slavic
*ot > *od, however, evidently causes problems in the
case of a language like German where [+ tense] is 'pho-
nemic',[4] but where it is [+ tense] which appears in the
word- or syllable-final position of neutralization (cf
1.2 above). To account for this phenomenon, Andersen
(1972 44-5) assumes that unlike word-final position,
the syllable-final position is 'marked', and that in
this 'marked' environment it is the marked value of the
feature [+ tense], i.e. [+ tense], which appears.

   2.4: This explanation of German SFD was accepted
also by Anttila (1972:199-200) who argues that the
syllable learning process in child language acquisition
(first CV, then CVC, then VC, and finally V) shows that
syllable-final environment is indeed 'marked in respect
to syllable-initial position.' Moreover, he argues
that 'Voicing is learned earlier in syllable-initial
position, for example, when an English-speaking child
can already produce [buk] 'book' he goes on saying
[pɪk] 'pig' ...'

   2.5   A further boost for the hypothesis that
final "voicing", i.e final laxing, may be a genuine
alternative to FD came with Szemerényi's paper of 1973.

   Szemerényi first established that the final voi-
cing of Italic has direct counterparts in Germanic and
Celtic. Moreover, he showed that there are early
Iranian and Slavic counterparts to the rather unusual
external voicing sandhi of Sanskrit

$$[+ \text{stop}] \longrightarrow [\alpha \text{ voice}] / \_\_ \# [\alpha \text{ voice}]$$

with voicing sandhi across word boundary applying both
before [M voice] and before [U voice] segments, while
internally, the more natural assimilation

$$[+ \text{stop}] \longrightarrow [\alpha \text{ voice}] / \_\_ [\begin{smallmatrix}+ \text{ obstr.}\\ \alpha \text{ voice}\end{smallmatrix}]$$

is found, with voicing sandhi applying only before
[M voice] segments. Thus, externally we find Skt

/vāk#asya/ realized as v̲ā̲g̲a̲s̲y̲a̲ 'his speech' vs. intern-
al /vāk-as/ --> v̲ā̲c̲a̲s̲ 'of speech'. It is only before
obstruent that e̲x̲t̲e̲r̲n̲a̲l̲ and internal sandhi agree, as
in /vāk-bhis/ --> v̲ā̲g̲b̲h̲i̲s̲ 'by speeches' = /vāk#dhīyate/
--> v̲ā̲g̲d̲h̲ī̲y̲a̲t̲e̲ 'speech is meditated (upon)'.

     Apparently without being aware of Andersen's (1969
a,b) similar argument for early Slavic, Szemerényi then
proposed to explain both of these sets of 'unusual'
phenomena by assuming that in Proto-Indo-European, fin-
al obstruents were neutralized in terms of the feature
[$\pm$ tense], in favor of the unmarked value, [- tense].

     Italic, Celtic, and Germanic would then retain the
resulting final [- tense] obstruents, while in Sanskrit,
early Iranian, and early Slavic there must have been a
generalization of the internal sandhi rule

$$[+ \text{stop}] \longrightarrow [\alpha \text{ tense}] / \_\_\_ [^{+ \text{ obstr.}}_{\alpha \text{ tense}}]$$

to external sandhi conditions. Note that as a conse-
quence of this analysis, Sanskrit winds up with a more
natural and 'usual' 'voicing assimilation' in external
sandhi than under the traditional analysis in terms of
the feature [$\pm$ voice].

, 2.6   Though synchronically, Andersen's and Szeme-
rényi's analysis may well be correct, I am not con-
vinced that it must be correct also historically

     2.6.1   First of all, as I hope to have shown else-
where (Hock, In press.§5.1), it is possible to account
for the external voicing sandhi of Sanskrit (as well as
of early Iranian and Slavic) as the result of an ana-
logical generalization of final devoicing, r̲e̲i̲n̲t̲e̲r̲p̲r̲e̲t̲e̲d̲
as v̲o̲i̲c̲e̲ ̲n̲e̲u̲t̲r̲a̲l̲i̲z̲a̲t̲i̲o̲n̲. Such a neutralization can then
be manifested through the rule

$$[+ \text{stop}] \longrightarrow [\alpha \text{ voice}] / \_\_\_ \# [\alpha \text{ voice}]$$

by o̲v̲e̲r̲g̲e̲n̲e̲r̲a̲l̲i̲z̲a̲t̲i̲o̲n̲ of the internal voicing rule

$$[+ \text{stop}] \longrightarrow [\alpha \text{ voice}] / \_\_\_ [^{+ \text{ obstr.}}_{\alpha \text{ voice}}].$$

'As a generalization (of voice neutralization before
all (') instances of word boundary), this process is
not bound by the same conditions of phonetic natural-

ness as a purely phonetically conditioned change.'
There is ample evidence supporting this assumption,
both in terms of other sandhi (over)generalizations in
Sanskrit, and in terms of parallel developments in
Polish dialects (cf Vaillant 1950 101 and 209)

It is interesting to note that Andersen (1969b
302-3 w. earlier literature) provides conclusive evid-
ence for a similar generalization in Slovak, as in
(*sŭ vod(oɟ)ǫ >) s vodou [z vodou] 'with water'. Relics
of an earlier stage, in which there was no such over-
generalization of voice assimilation are found in ex-
pressions containing personal or anaphoric pronouns, as
in s nami [s nami] 'with us'.

It is then possible to argue that this overgener-
alization may have occurred in Proto-Indo-European and
that, because of the resulting occurrence of voiced
stops in most environments, it was possible to take
these voiced stops as the basic word-final manifesta-
tion of stops, and to generalize them, presumably re-
interpreted as [- tense] stops, to all environments.
This would account for the Italic, Celtic, and Germanic
situation.

Note that this explanation thus removes the dif-
ficulties of Brugmann (1897 883-4, 885-6) who was in-
clined to view the Sanskrit external sandhi pattern as
analogical,[5] but felt that in light of Italic *-t > -d,
it may have been inherited from Proto-Indo-European,[6] thus
presumably precluding an analogical origin.

Moreover, the analysis here proposed as a possible
alternative has the advantage that, unlike that of An-
dersen and Szemerényi, it offers a phonetically motiv-
ated starting point for the phenomena under discussion,
namely (prepausal) FD. (But cf also section 3 below.)

Finally, it might be argued that the evidence of
the extant Sanskrit texts, where the prepausal form of
final obstruents invariably is voiceless (as in /pād##/
--> pāt 'foot') would be more compatible with an analy-
sis which postulates voicing, rather than tenseness
neutralization. However, as the subsequent discussion

in this paper will show, the Sanskrit facts are open
to various interpretations.

2.6.2   There are difficulties also with Ander-
sen's attempt to explain German SFD as natural in a lan-
guage with "phonemic" [+ tense].

First of all, German shows this neutralization also
word-finally, i.e. in 'unmarked' environment, contrary
to Andersen's (and Szemerényi's) analysis which would
predict [- tense] for this environment   Notice that
the supportive evidence from child language acquisition
adduced by Anttila, at closer investigation, turns out
to be equally damaging as the evidence from German
For Anttila's examples of monosyllabic words show that
[+ tense] (or [- voice]) is natural not only syllable-
finally, but, again, also word-finally.

In addition, note that there are languages where
both [- tense] and [+ tense] obstruents can appear as
the realization of neutralized final obstruents.   Thus,
Danish offers a free variation of voiceless tense and
voiceless lax stops, both for final voiced stops and
for final voiceless stops, as in tab [-b/p] and tak
[-g/k], cf. Arnholtz and Reinhold 1936 59-60 [8] (A si-
milar situation may have obtained in some varieties of
Sanskrit, for Pāṇini (8.4.56, cf 8 2 39, 8 4 53-55)
allows both voiceless and voiced final stops before
pause.   But, as pointed out earlier, the Sanskrit facts
are open to various interpretations.)   Should we claim
that languages of this sort have both "phonemic"
[+ tense] and "phonemic" [+ voice]?!

2.6.3   Also Andersen's argument that the occur-
rence of lenition in early Slavic indicates that Slavic
had "phonemic" [+ tense] is open to doubt.   For as Old
English, with medial voicing (as in PGmc. *wulfōs/z >
['wulvas] 'wolves') and final devoicing (as in pre-OE
hlaiβ > OE hlāf 'loaf') shows, "lenition" or--as I pre-
fer to call it--medial weakening (for which cf. section
4 1-2 below) may well occur in languages with VFD, i.e
in languages which according to Andersen's interpreta-
tion should be considered to have "phonemic" [+ voice].

3:   Final weakening (FW)

Moreover, there is reason to believe that final
voicing or laxing--where it is a genuine, rather than
secondary development--may conceptually belong to a
larger, more general set of possible final developments,
namely final weakening   This would indicate that the
concept of final (tenseness) neutralization merely de-
scribes the results of a historical change, rather than
(the motivation of) the change itself.

3.1   Though languages with word-final weakening
(WFW) are probably not as numerous as languages with
WFD, an impressive array of languages with WFW can be
found.9   They can be conveniently arranged under the
following headings.

3.1.1:   Word-final fricativization:

        Italic (or Osco-Umbrian) t > s / n ___ #
(Gauthiot 1913:135; von Planta 1892:582)
        Old French t̲ > θ / ___# (Ewert 1943 74-5, 76-7)
        Old Irish d̲ > ð̲ / ___# (Pedersen 1909 430)
        Cornish   t̲ > s̲ / ___# (ibid.499-500)
Cf. also 3.1 below.

3.1.2:   Word-final voicing·
        Old Irish θ̲ > ð̲ / ___# (Pedersen 1909 133)
Cf. also section 2 above (?).

3.1.2:   Word-final gliding.
        Italian s̲ > i̲ / V́ ___ # (via -h̲?) (Grandgent
1927:76-7)
        pre-Sanskrit (s̲ >) h̲ > y̲ / ___#[+ voice]
(Allen 1962:71 and 101-8)

3.1.4:   Word-final rhotacism
        Elean Greek s̲ > r̲ / ___# (Schwyzer 1939 410)
        "New" Umbrian s̲ > r̲ / ___# (von Planta 1892

582)

3 1.5   Word-final flapping:

Old Latin (*t̲/d̲ >) d̲ > r̲ / ___#$[^{-syll.}_{+lab}]$
(Safarewicz 1969 102)

3.1.6.   Word-final feature depletion

Eastern Arabic t̲ > h̲ / ___# (Gauthiot 1913 17)
(via -θ̲ ?)

dialectal Oscan d̲ > h̲ / ___# (von Planta 1892
577-8, Buck 1904 84)

Finnish t̲ > ? / ___#[10] (Gauthiot 1913 102-6)

Finnish k̲ > ? / ___#[10] (ibid)

Chinese dialects [+ stop] > ? / ___# (Chen
1973)

Sanskrit s̲ > h̲ / ___# (Gauthiot 1913:113-21,
Allen 1962.71, 101-8)

Spanish dialects s̲ > h̲ / ___# (Alarcos 1961
271, Malmberg 1948 393-7)

3 1.7   Word-final loss

Class Lat. (*t̲/d̲ >) d̲ > ∅ / V̄ _# (Safarewicz
1969 102)

Arabic dialects t̲ > ∅ / ___# (Gauthiot 1913 17)

Finnish (t̲,k̲ >) ? > ∅ / ___# (ibid 102-6)

Chinese dialects ([+ stop] >) ? > ∅ / ___#
(Chen 1973)

Italian s̲ > ∅ / [$_-$ $^{V}_{acct.}$] ___# (Grandgent 1927
76-7)

later OFrench θ̲ > ∅ / ___# (Ewert 1943 74-7)

Spanish dialects (s̲ >) h̲ > ∅ / ___# (Alarcos
1961 271, Malmberg 1948 393-7)

This change is, of course, widely attested in many
other languages

3 2.   The same set of phenomena can also be found
in syllable-final environment. That is, there is evid-
ence for syllable-final weakening (SFW) [11]

3.2.1: Syllable-final fricativization

This process is found in Western Romance (Alarcos
1961 234, Ewert 1943 71, Fouché 1927 59) and again,
more recently, in Spanish (Alarcos 1961 178-9, Hooper
1973 70-102, Malmberg 1948 393-7 and 1952.409-12, Nava-
rro Tomás 1918.61-79). Moreover, it is found in Greek
(Martinet 1970.335, Schwyzer 1939 211), Celtic (Peder-
sen 1909:75, 93, 123, 429-30, Thurneysen 1961 135, 136,
139, 140), and in Iranian (Reichelt 1909 38 and passim,
cf. also the discussion in 7.2.5 below).

3.2.3· Syllable-final voicing

This process is found, combined with fricativiz-
ation, in Spanish (cf. the references in 3.2.1).

3 2 3   Syllable-final gliding

This process is found, as a continuation of fric-
ativization, in Western Romance (cf. 3 2.1 above), in
Spanish dialects (Hooper 1973 70-102, Malmberg 1948
393-7 and 1952.409-12), and in British Celtic (Peder-
sen 1909 75, 93, 123, 429-30).

3 2 4. Syllable-final rhotacism

Compare dialectal Spanish desde > derde (Alarcos
1961 271)

3.2.5   Syllable-final flapping

This is perhaps found in OLat (ad- >) arvorsum,
arfuisse , if the univerbation of prefix and verb stem
preceded Old Latin flapping.

3.2 6   Syllable-final feature depletion

This is found in Spanish dialects with s > h (Alar-
cos 1961 271, Malmberg 1948.393-7 and 1952 409-12) and
in Oscan-Umbrian (*k,p >) *x > h (Diver 1953. chapter 5,

Martinet 1970:337). Considering that in Finnish, word-
final ? combines with following [- syll.] segments into
geminates, it is possible to include in this category
also developments like Lat. octō > It. otto.

3.2.7   Syllable-final loss (with or without com-
pensatory lengthening)·

This change is found in later Oscan-Umbrian h > Ø
(cf. 3.2.6), as part of the Slavic open-syllable con-
spiracy (Martinet 1970 349, cf. also 7.4 4.1 below),
and in innumerable other languages.

3.3.1   Terms like 'weakening' are frequently em-
ployed in traditional historical linguistic publications
in reference to phenomena like those above. Thus, Buck
(1904 84) refers to the dialectal Oscan word-final
change of d to h as a 'weakening', Alarcos (1961) refers
to the Western Romance shift of Lat kt, ks to pre-Span.
yt, ys as a 'tendencia .   debilitadora'(234), and to
the change of s > h in dialectal Spanish as a 'debilita-
miento', and Chen (1973) refers to the common develop-
ment of final stops in Chinese dialects of the type t
> t' > ? > Ø as 'feature depletion'.

3.3 2   Similarly, Allen (1953 70 and 1962 98) ar-
gues that the word-final stops of Sanskrit have a 'lax'
or weak articulation (of the type [g̣,ḍ,ḅ]. This explan-
ation in his view explains the fact that there had been
a considerable controversy among the Sanskrit grammari-
ans as to whether final stops are voiced or voiceless.
Moreover, he finds support for this assumption in a
'somewhat abstrusely stated' (1953 70) passage of the
Atharva Prātiśākhya, as well as in the fact that in
Middle Indo-Aryan, final obstruents are lost.[12]   A sim-
ilar, but apparently independent interpretation of the
Sanskrit facts is found in Vennemann 1974·360-6, as the
motivation for the 'unnatural' external voicing sandhi
of Sanskrit [13]

3.3.3   However, the fact that many of these weak-
ening changes 'feed' one another (such as k > ? > Ø or
k > x > h > y > Ø , thus establishing that they are in-
timately related to each other, seems to require a

general coherent theory.

3 3 3.1·   The first such theory known to me is
that of Gauthiot (1913).   Accepting de Saussure's theo-
ry that syllable-final (or preconsonantal, prepausal)
obstruents are (naturally) "implosive", i.e. unreleased
(1889, cf   also the posthumously published 1916.79-93),
Gauthiot proposed that word-final weakening, of the type
t > ? > Ø, t > d, t > s, s > h, is the normal develop-
ment of final "implosives".

3.3.3.2:   This theory was further extended and mo-
tivated by Malmberg (1948 393, 396, and 1963 68)

As already de Saussure (1916 79-93 with 71-6) had
postulated, the syllable is a sequence of explosive seg-
ments of increasing aperture, followed by a sequence of
implosive segments of decreasing aperture, where the de-
grees of aperture are defined as follows.

      (1) Ø-aperture   stops
      (2) aperture 1   fricatives
      (3) aperture 2   nasals
      (4) aperture 3   liquids
      (5) aperture 4.   i, u, u (including their
voiceless counterpart, h)
      (6) aperture 5.   e, o, o (including their
voiceless counterpart, h)
      (7) aperture 6   a (including its voiceless
counterpart, h)

A similar ranking of 'sonority' had been indepen-
dently proposed by Jespersen (1904 186), although Jes-
persen's discussion of the concept of the syllable
(185-203) betrays a much more agnostic attitude con-
cerning the possibility of adequately defining it
Still, Pedersen did propose that between a given seg-
ment and the peak of the syllable (which is definable),
only segments of the same, or of a higher sonority are
tolerated. (191).

      (1) voiceless (a) stops
              (b) fricatives
      (2) voiced stops

(3) voiced fricatives
(4) voiced (a) nasals
          (b) laterals
(5) voiced r-sounds
(6) voiced high vowels
(7) voiced mid vowels
(8) voiced low vowels

These two theories were combined and further modi-
fied by Grammont (1939 38,39,43-5,98-100). According
to Grammont, we must distinguish between explosives and
(syllable- or word-final) implosives. In explosives,
muscular tension increases, they are therefore referred
to as 'increasing' ('croissants'). Implosives, in which
muscular tension decreases, are referred to as 'decreas-
ing' ('décroissants') In addition, there is an aper-
ture hierarchy of the following sort.

```
\  Ø   stops
   1   spirants
   2   nasals
   3   liquids
   4   semivowels
   5   high vowels (including Ṽ and h)
   6   mid vowels  (    "    π̃  "  π̃)
   7   low vowels  (    "       "  "  ")
```

The syllable is then defined as 'a sequence of increas-
ing apertures followed by a sequence of decreasing aper-
tures'(99). Syllable-initial stops are explosive and
'increasing', syllable-final stops, implosive and 'de-
creasing'(98).

Following this (refined) theory of Grammont's, and
on the basis of a rich collection of Spanish data illus-
trating syllable- and word-final weakening, Malmberg
(1948) proposed the theory that

'La place après le support syllabique est plus
"faible" qu'ailleurs. Il est donc normal que la
distinction régulière et consciente des différences
phoniques soit réalisée plus difficilement qu'à
l'initiale de la syllabe où la force articulatoire
est concentrée.'(393) 'C'est là évidemment un
phénomène de phonétique générale. Cet affaiblisse-

ment de la partie finale est propre [comme ten-
dance] à chacque syllabe indépendamment de la
langue.'(396).

Similar arguments can be found in Malmberg 1963
46-9. While the concepts of de Saussure, Jespersen,
and Grammont may not always be applicable synchronical-
ly, they do show their validity in historical change
Thus, while the frequently occurring #st violates Jes-
persen's theory concerning the sequence of sonorities,
historical changes, such as Lat #st > ist/est in
Romance, confirm the ultimate validity of this theory
Similarly, the common weakening or loss of final im-
plosives illustrates the essential correctness of the
theories of de Saussure and Grammont

Malmberg's theory has subsequently been approved
by Pulgram (1970 74-5) and, in (natural) generative
phonology, by Hooper (1973 90-102).

3.3.3 3   While Gauthiot's and Malmberg's theories
go a long way toward providing a general, coherent
theory of final weakening (in terms of syllable struc-
ture), they are not without their weaknesses

First of all, what is left undefined and vague is
the concept of weakening itself.

As the presentation in sections 3.1 and 3.2 has
shown, there are at least seven different processes sub-
sumed under this notion, namely fricativization, voicing,
gliding, rhotacism, flapping, feature depletion, and
loss. As mentioned earlier, the fact that (many of)
these processes 'feed' each other (in the same, constant
environment) suggests that there is some strong, signi-
ficant relationship between these processes   This im-
pression is reinforced by the fact that, except for the
occurrence of final devoicing, these processes are tran-
sitive and irreversible: Examples of reverse shifts
(of, say, fricative to stop) are not normally found in
this environment.14

Moreover, it is possible to account for most of the weakening developments, except loss, in a principled, general fashion by postulating the following (tentative) combined hierarchy of aperture and sonority.

(1) voiceless stops

(2) voiceless fricatives (higher aperture than (1)) and voiced stops (higher sonority than (1))

(3) voiced fricatives (higher aperture and sonority than (1)), voiceless glides including h (higher aperture than (2) and than voiced fricatives, but sonority of (1)), flaps (shorter reduced aperture than (1) or voiced stops, and higher sonority than (1)), glottal stop (maximal oral aperture, but sonority of (1))

(4) liquids (higher aperture than (1), (2), or voiced fricatives and flaps, and higher sonority than voiceless glides and glottal stop)

(5) voiced glides (higher aperture than (1), (2), fricatives, flaps, (4), and higher sonority than voiceless glides and glottal stop)

It can then be argued that 'weakening' (other than loss) consists of a 'downgrading' of articulation along this combined sonority/aperture scale.

(Note that the omission of the nasals in this scale is motivated not only by the fact that nasals do not seem to figure in the weakenings discussed.[15] It is motivated also phonetically, namely by the fact that nasals are [+ nasal] stops--i.e in this respect high up in the hierarchy--, whose relative sonority is a consequence not of oral resonance, as in the other segments, but rather of nasal resonance.[16])

3.3.3 4   Perhaps even more important is the fact that there is reason to believe that the notion of 'implosive' articulation of final obstruents does not provide for a sufficiently motivated ultima ratio of final

weakening. For if 'implosive' is defined as unreleased,
it is hard to see how this term has any relevance for
the weakening of friction continuants like s

Even more important, even stops may well be re-
leased in final position. This is true at least op-
tionally for many varieties of English and seems to be
the rule for many varieties of German (at least in care-
ful speech). This suggests that 'implosion' or lack of
release, rather than being a universal phenomenon and
thus the possible cause of final weakening (in stops),
simply is the first step of such a final weakening pro-
cess. This is no doubt what is meant by the notation
$\underline{t} > \underline{\overset{c}{t}} > \underline{?} > \emptyset$ found in Chen 1973 and similarly in Miran-
da 1974·53.

That is, just like the concept of final (tenseness)
neutralization, the concept of final 'implosion' of
stops merely describes the result of a change, not the
(motivation of the) change itself.

4.   Final weakening and medial weakening ('lenition')

4.1: In its phonetic effects and results, final
weakening appears to be identical with the very common
process of medial weakening (MW) often referred to as
lenition. The same types of processes can happen in
MW as in FW.

4.1.1: Medial fricativization.

This process has been observed in the history of
French (Ewert 1943.74-7), Spanish (in voiced stops,
Malmberg 1952), Tuscan (Izzo 1972 passim, esp.173-5),
Irish (Thurneysen 1961.74, Pedersen 1909 427-30), Bri-
tish Celtic (in voiced stops, Pedersen 1909 ibid),
Younger Avestan (in voiced stops, Reichelt 1909 passim),
Hebrew (Martinet 1970 270 w. references).

4.1.2. Medial voicing

This process, which frequently may apply to the
outcome of medial fricativization, is found in the his-
tory of Latin (Martinet 1970 335-69), French (Ewert

1943 74-7), Spanish (Malmberg 1952), Italian dialects
Grandgent 1927 81-2, 99, cf. also Lausberg 1967.passim),
British Celtic (in voiceless stops, Pedersen 1909·427-
30), American English dialects (as in latter [lædər]),
Middle Indo-Aryan dialects (in voiced stops, Bloch 1934
77-8), cf. also 2 6.3 above

   4 1.3   Medial gliding

   The (*voiceless and *voiced >) voiced stops of
Middle Indo-Aryan may appear as y or v in some of the
later Middle Indo-Aryan dialects (Bloch 1934 77-8).

   4 1 4   Medial rhotacism

   Compare Lat. (*s >) z > r (Martinet 1970 335-69),
similarly, the outcome *z of Verner's Law (generally)
becomes r in West and North Germanic.

   4 1.5   Medial flapping

   Compare American English dialects latter [lætər].

   4.1 6   Medial feature depletion

   Cf. English dialectal bottle [bɔʔɬ] and note that
in the Irish 'lenition' process, s becomes h (> Ø)
(Thurneysen 1961·74 and passim).

   4.1.7.   Medial loss:

   This change is found in the historical development
of French (Ewert 1943·74-7), Spanish (Malmberg 1952),
Irish (cf. 4.1.6), Middle Indo-Aryan dialects (Bloch
1934 77-8).

   4 2   In addition, the relationship between these
various processes is analogous to that between the vari-
ous varieties of FW (for which cf. 3.3.3.3).   That is,
it is transitive and irreversible.

   Moreover, many languages or language groups which
have FW also have MW, cf. Romance, Celtic, Iranian
(Younger Avestan).[17]

4.3:   As a consequence it is not surprising that
some linguists have--implicitly or explicitly--consid-
ered FW and MW to be a single, unitary process

Thus, Pedersen (1909.427-30) refers to Celtic MW
and FW as lenition   Martinet (1970 335-69) subsumes
both types of changes in his general discussion of
weakening processes. Similarly, Halmberg (1952) dis-
cusses both sets of phenomena side by side. And Ander-
sen (1969a 167-9) considered the evidence of early
Slavic lenition probative for his claim that early
Slavic had final tenseness neutralization, cf 2 3
above.

However, only Hyman (1975 168-9) seems to have at-
tempted to provide a general theory concerning the
identity of the two processes, as well as the reason
and condition for this identity. Defining FW as final
consonant depletion, loss, and devoicing ('most common'),
Hyman continues to argue that MW occurs intervocalically
and FW word- and syllable-finally, the common property
of both of these positions being postvocalic   This,
then, must in his view be the 'position of weakness '

4.4:   Although Hyman's explanation is interesting
and illuminative in some respects (cf 5 2.2 below), it
cannot be considered acceptable.

First of all, if FD is to be included in FW (but
cf. section 5 below), FW and MW cease to be completely
parallel (or identical) processes. For devoicing is
certainly not a natural development in medial voiced
environment.

Moreover, contrary to Hyman's belief, MW may take
place not only in intervocalic environment, but in any
voiced medial environment (except, usually, after
nasals), cf. Span. guardar [gwarðar] 'guard' (but an-
dar [andar] 'go'). And in such environments it (nor-
mally) applies to syllable-initial segments, i e in
a position which is clearly opposed to the syllable-
final environment for FW.

Perhaps more important than these general consider-
ations, however, is the fact that even in languages
which have both MW and FW, the two processes may not
have identical manifestations vis-à-vis given segments.
Thus, in the prehistory of Old Irish, SFW changed PIE
*p to b before liquids, and to *v before nasals. On
the other hand, MW changed (voiceless) stops to (voice-
less) fricatives, cf. Thurneysen 1961 74,139,140. In
addition, the fact that (*pr, *pl >) *br, *bl wind up
as 'lenited' ʌʂ, ʌʌ in Old Irish (ibid 139) shows that
SFW and MW were two chronologically different processes,
with the latter applying later, and to the 'output' of
the former.[18]

Finally, note that there are languages which have
one of these processes without the other   Thus, Old
English has MW (of fricatives), but WFD, not WFW, cf.
2.6.3 above. Elean Greek has WFW of s to r, but no MW
Similarly, Oscan-Umbrian shows SFW (of stops to fric-
atives), but seems to have no evidence for MW (except
for s > z in some of the dialects)

4 5   It can thus be concluded that while--from
a general point of view--FW and MW are <u>phonetically</u>
identical, the evidence of their specific applications
suggests that they are <u>conceptually</u> different, as well
as conditioned by different environments.

5   Final devoicing and final weakening

5.1   As mentioned in 4.3 above, Hyman (1975 169)
considered FD a subvariety of FW.   Similar claims have
been made by Fouché (1927 62) and Schane (1972 210-1)
These claims, however, are subject to several objections

5.2.1   First of all, FD (and as a result, final
voicing) would be the only change which is not in con-
formity with the transitive, irreversible pattern of the
FW changes noted in 3 3.3.3 above   Moreover, although
MW is not functionally identical, it is phonetically
identical with what normally has been called FW.   If
there were in fact a devoicing variety of FW, one should
expect to find a similar variety of MW.   However, as

noted in 4.4 above, such a change does not seem to be a
natural development in medial voiced environment

5.2.2   In addition, it might be argued (as ad-
umbrated in Hyman 1972) that FW and MW, except for the
subvariety of loss, can be considered assimilatory de-
velopments, namely assimilations to the more sonorous
or 'open' nature of the surrounding segments--in the
case of MW--, or of the preceding segments--in the case
of FW. On the other hand, WFD--while also an assimila-
tory process--would differ from MW and FW by being an
assimilation to the following, less sonorous environ-
ment of pause. Cf. also section 6 below

5.2.3· Finally, there are at least some languages
in which (S)FD has a very different function from (S)FW.
Thus, Spanish shows neutralization of the voiceless and
voiced obstruents (such as p and b/ß) to voiceless ob-
struents (such as p) before obstruents in emphatic or
careful speech, but to voiced or lax ones (ß or ß̞) in
more normal speech, cf. Navarro Tomás 1918.61-79,107-10
and Alarcos 1961 179-9.[19]

What is interesting in this respect is that also
in my native dialect of German, SFD occurs more fre-
quently in emphatic, careful speech than in normal
speech where instead there is a shift in the syllable
boundary; cf. normal Redner [ʀe ∅dnəə] vs. emphatic or
careful [ʀe t∅nəə] 'speaker'   This matter will be fur-
ther pursued in section 7 below.

6   Two tendencies. WFD and SFW?

6.1. If FD and Fw are different processes, the
question arises as to whether there is a general differ-
ence in function and/or domain between the two processes

One possible hypothesis which might suggest itself
is that they differ in their respective domains, with
FW having as its domain the syllable, and FD, the word
This might be considered to be supported by the fact
that (internal) SFD seems to occur only rarely   I am
aware of only two languages in which this process oc-
curs, namely Spanish and German, and what is interesting

about the SFD of these languages is that it occurs un-
der very special, "emphatic" or "careful" conditions,
cf. 5.2 3 above and 7.1.5 and 7.4.4.1 below. On the
other hand, though WFW is by no means rare, it does not
seem to occur as frequently as WFD. (The reason that
it may occur at all would, of course, be due to the
fact that word boundary often (especially prepausally)
coincides with syllable boundary.)

6.2   However, this hypothesis probably is too
facile and does not entirely agree with the facts. For
there are languages like Elean Greek (with $\underline{s} > \underline{r}/\_\#$)
in which FW applies only word-finally. Cf. similarly
Skt. $\underline{s} > \underline{h}$ ($> \underline{y/w}$) / $\_\#$, but not / $\_\$$.

If the natural domain of FW were indeed the syl-
lable, and never the word, then we would expect it to
occur in all syllable-final environments, in all lan-
guages in which it occurs.

6.3. A more plausible hypothesis would therefore
be the following.

In section 5.2.2 above it has been shown that FW
can be looked upon as an assimilatory process (except
for loss), namely as a lag assimilation (in terms of
sonority and/or aperture) to preceding segments. Simil-
arly, it can be argued that (prepausal) FD is an
anticipatory process, not (of course) to 'silence', but
to the rest position of the vocal cords which, even if
not identical, is more similar to their devoicing posi-
tion than to their voicing position.

This would explain why SFD is so rare, for unlike
pause, syllable boundary is not a phonetic environment
and thus could not condition any (anticipatory) assimil-
atory change.-- If this view is correct, those rare in-
stances where SFD is found would have to be considered
the result of the secondary generalization of prepausal
devoicing not, as happens usually, to word-final posi-
tion, but to syllable-final environment.

At the same time, this hypothesis might be taken
to explain why WFW is comparatively rare. For while in

prepausal position, both anticipatory assimilation (i.e
devoicing) and lag assimilation (i.e. increase in so-
nority and/or aperture) may occur a priori, the fact
that anticipatory assimilation is generally more common
than lag assimilation would, in this more specific en-
vironment, provide for a greater incidence of devoicing
than of weakening.

6.4:   Even this hypothesis, however, cannot be con-
sidered entirely satisfactory. For like the hypothesis
of 6.1 above, it fails to account for the fact that some
languages have \FW without having a general process of
SFW.

Moreover, any theory of FW operating with the con-
cept of (sonority/aperture) assimilation will fail to
plausibly account for the "ultimate" weakening, namely
final loss   To account for this development would seem
to require a different, more functionally oriented
theory. (This is not to say, however, that on the pho-
netic plane, assimilation may not be prominently in-
volved in the majority of weakening processes.)

7.   Syllabication, final weakening, and gemination

It seems that such a theory can be found by looking
more carefully at now FW affects syllable structure and
how the way it affects syllable structure correlates
with the behavior of other syllable structure changes in-
volving consonants.

While there is no general consensus among linguists
on the phonetic criteria which define syllables and es-
pecially their boundaries (cf. the discussion in 3 3 3 2
above and note also the very agnostic position taken by
Kim 1971.66-76), tnere is a good deal of evidence, such
as FW and FD, which strongly indicates the need for the
concept of the syllable in phonological discussions, cf
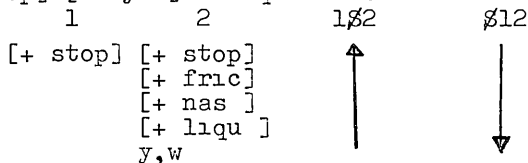especially Hooper 1972

Moreover, some of the difficulties so far encounter-
ed in defining the syllable may be due to the fact that
some languages (such as English) have very poor phonetic

correlates of syllabication, even in fairly normal
speech   In these languages, syllables may appear only
in very careful, slow, almost unnatural speech. On the
other hand, however, in many languages such difficulties
arise only in fairly informal, allegro speech, while in
normal speech, syllabic divisions are quite clear, both
to the speaker and to the hearer. Even if also in these
cases, phoneticians may not always be certain about the
acoustic clues and articulatory bases for syllabic di-
vision, this should not prevent us from proceeding with
our analysis, on the basis of the intuitive knowledge of
both the hearer and the speaker.

Finally, some of the difficulties which so far
have been encountered in defining the (scope of the)
syllable may be the result not so much of a general
inability to do so, but rather of an inability to do
so in a fashion which is generally applicable to all
languages. This perhaps very subtle distinction will,
I hope, become clear from the subsequent discussion
which shows that different languages, at different times
(and sometimes even at the same time) may syllabicate
identical sequences in very different ways. I further
hope that the subsequent discussion will show that these
differences (by and large) are not random and unprin-
cipled, but that they follow a very definite, hierarchi-
cal pattern.

7.1   A hierarchy of syllabication.

While the determination of the hierarchy of syllabi-
cation, accounting for all possible segment sequences,
would be both beyond the scope of the present paper and,
I believe, irrelevant for the present argument, it is
possible to establish a hierarchy for the syllabication
of V [+ stop] [- syll] V sequences.[20,21]

1	2	1⌀2	⌀12
[+ stop]	[+ stop]	⬆	⬇
	[+ fric]		
	[+ nas]		
	[+ liqu]		
	y,w		

I.e. [+ stop] [+ stop] is most likely to be separated by syllable boundary, while [+ stop] [+ glide] is most likely to be tautosyllabic, with syllable boundary preceding the entire cluster   Compare the following evidence.

7.1.1   Sanskrit (cf Allen 1953 82 and 85)

The syllabication recognized by the majority of the Sanskrit grammarians, as well as indicated by the evidence of metrical conventions, is 1∅2 for the whole hierarchy (and for all CC clusters).

According to one phonetic treatise, however, the Rik Prātiśākhya, both 1∅2 and ∅12 are possible alternatives for the entire hierarchy (and for all other CC clusters). The latter syllabication finds support in the structure of the essentially syllabic writing systems of India, such as the devanāgarī   To the extent that this is graphemically possible, all consonant letters in a cluster are combined into one symbol, together with the necessary vowel modifications. Thus kārtsnya will be written

कात्स्र्य   = का kā + त्स्र्य rtsnya

Finally, the Taittirīya Prātiśākhya gives the following syllabications.

$$
\begin{array}{ll}
[+ \text{ stop}] \; \emptyset \; [+ \text{ stop}] & \\
 & \emptyset \; [+ \text{ stop}] \; [+ \text{ fric.}] \\
[+ \text{ stop}] \; \emptyset \; [+ \text{ nas.}] & \\
 & \emptyset \; [+ \text{ stop}] \; [+ \text{ liqu }] \\
 & \emptyset \; [+ \text{ stop}] \; [+ \text{ glide}]
\end{array}
$$

This syllabication is somewhat unusual and does seem to require a few comments   As adumbrated in 3 3 3 3 above, the nasals are somewhat 'uncomfortable' in hierarchies of this sort, since on the one hand they are stops (just like the oral stops), but on the other hand they do have a relatively high degree of sonority due to their nasal resonance   While the usual pattern in the syllable structure hierarchies discussed in this

section seems to focus on this latter fact, a minority
pattern apparently focuses on the fact that nasals are
stops and, accordingly, treats nasals and stops alike;
cf. similarly in section 7 2.5 below--significantly
again in Indo-Iranian.

7.1.2. Greek (cf. Schwyzer 1939 237 w. references)

The earlies, Homeric and Lesbian, pattern of syl-
labication, suggested by metrical evidence, is 1∅2 for
the whole hierarchy (except for the fact that y and w
do not occur after consonants).

In later, Attic-Ionic Greek, however, [+ stop]
[+ liqu.] occurs metrically as ∅12, first apparently in
the case of [+ stop] r, later also in the case of
[+ stop] l.[22]

For even later periods, there is metrical evidence
that tautosyllabic CN clusters were becoming (optional-
ly) acceptable, at least in the case of ŋN and mn.

7.1.3 Latin (cf. Hale and Buck 1903.6,14 and
Schwyzer 1939 237)

The metrical evidence of Old Latin indicates a syl-
labication 1∅2 for the entire hierarchy, except for qu
which has ∅12 (no doubt due to the fact that this se-
quence usually goes back to the Proto-Indo-European
single segment *kʷ). Note that there are no other oc-
currences of y and w in the environment [- syll] ___
[+ syll.].

In later Latin, ∅12 is optionally possible also
for [+ stop] [+ liqu.].

7 1.4 Spanish (cf. Alarcos 1961 178-9 and passim)

The syllabication is 1∅2 from [+ stop][+stop]
through [+ stop][+ nas.]. It is ∅12 for [+stop][+liqu]
(except for tl, dl, cf. fn 22 above) and for stop plus
glide

7.1.5: <u>German</u> (my dialect)

The syllabication always is 1$2 in the case of
[+ stop] [+ stop]. It is 1$2 in [+ stop] [+ fric.]
through [+ stop] [+ liqu.] (a) in compounds, as in <u>Ab-</u>
<u>fall</u> [ʔap$fal], and (b) elsewhere in emphatic or very
careful speech, as in <u>Apfel</u> [ʔap$fəl] vs. more normal
[ʔa$pf}], otherwise it is $12. In [+ stop] y the syl-
labation is 1$2 in compounds (as in <u>ab-jagen</u> [ʔap$ya $
gn]), and $12 elsewhere in normal speech (as in <u>Akazie</u>
[ʔa$ka·$tsyə]); in emphatic or careful speech $ [+ stop]
I $yV occurs instead of normal $ [+ stop] y V (as in
[ʔa$ka.$tsI$yə]). (Words with <u>w</u> are extremely rare and
are basically [+ foreign].)

7.2: A hierarchy of syllable-final weakening[23]

The evidence given in 7.2.1-5 suggests a hierarchy
of the following sort.

$$[+ \text{stop}] \quad \begin{array}{l} [+ \text{stop}] \\ [+ \text{fric.}] \\ [+ \text{nas.}] \\ [+ \text{liqu.}] \\ y, w \end{array} \quad \Big\uparrow$$

I.e. SFW of stops is most likely to occur before
stops, and least likely before glides

7.2.1   Late Classical/Byzantine <u>Greek</u> (cf. Schwy-
zer 1939·211)

SFW occurs before [+ stop] and <u>s</u> (the only (rele-
vant) friction continuant). The fricativization of p and
к before <u>s</u>, however, ceases to be a productive process
in Modern Greek.

7.2.2   <u>Oscan-Umbrian</u> (cf e.g Martinet 1970 337)

SFW occurs before [+ stop] and <u>s</u> (the only friction
continuant occurring after stops)

7.2.3   <u>Spanish</u> (cf. Alarcos 1961 178-9, Navarro
Tomás 1918 61-74, 107-10)

In Modern Spanish, [+ stop] undergoes SFW before

[+ stop] through [+ nasal]. It also occurs ın t,d be-
fore l, ı.e. ın the envıronment ın whıch Spanısh ınserts
a syllable boundary between stop and lıquıd.

7 2.4   Celtıc (cf. Pedersen 1909 430, Thurneysen
1961 74,135,136, and especıally 139 and 140)

SFW occurs before [+ stop] through [+ lıquıd], ex-
cept that *dr normally develops ınto gemınate *ddr

7.2.5.   Iranıan (cf Reıchelt·1909 38 and passım)

In voıceless stops, SFW occurs throughout the hıer-
archy In voıced stops ıt ıs found only before [+ frıc],
at least ın GāthaAvestan. Regardıng thıs sıtuatıon, the
followıng two comments need to be made.

(a) "SFW" of voıceless stops occurs not only ın
genuıne syllable-fınal posıtıons, but also after #.
However, note that sımılarly the MW of (Western) Romance
seems to have orıgınally applıed across #, and stıll
does ın some dıalects, although ın many dıalects ıt has
been subjected to varıous levelıngs, cf Lausberg 1967
passım. Sımılarly, Celtıc 'lenıtıon' orıgınally applıed
across word boundary, and contınues to do so ın (most of)
the Celtıc languages, albeıt ın a morphologızed fashıon
It ıs thus not unlıkely that also ın pre-Iranıan, SFW
took place across #, and that ıts hıstorıcal occurrence
even after ## ıs due to sımılar levelıngs.

(b) The fact that SFW of voıced stops occurs only
before frıctıon contınuants (namely before z) ıs remınıs-
cent of the fact that also ın one varıety of Sanskrıt
syllabıcatıon, [+ stop] and [+ nasal] act the same, thus
dısruptıng the normal hıerarchy, cf. 7 1 1 above.

7.3   A hıerarchy of gemınatıon[23]

Note that thıs dıscussıon ıs concerned only wıth
the gemınatıon frequently encountered ın the fırst mem-
ber of the clusters under dıscussıon. Other gemınates,
especıally those ınvolvıng assımılatıons (as well as
"spontaneous" or "expressıve" gemınatıons), may follow
completely dıfferent patterns.

The following hierarchy seems to be suggested by
the evidence discussed in 7.3.1-5, even if the evidence
is not quite as straightforward, and the pattern as
"neat", as in 7.1 and 7.2.

$$
\begin{array}{ll}
\text{[+ stop]} & \text{[+ stop]} \\
 & \text{[+ fric.]} \\
 & \text{[+ nas.]} \\
 & \text{[+ liqu]} \\
 & \text{y,w}
\end{array}
\Bigg\downarrow
$$

I.e stops are most likely to be geminated before
y and w, and least likely before stop

7 3 1   Old Norse (cf Krahe 1966 104-6)

Gemination is found only before y and w   more-
over, the only stops which are geminated in this en-
vironment are k and g, i.e. the stops homorganic with
y and w.

7 3 2   Old Irish (cf. Thurneysen 1961 74)

Gemination applies only before r.   And only the
homorganic stop d is geminated in this environment

7.3.3   Italian (cf. Grandgent 1927 99-108, Laus-
berg 1967 46-66)

Almost all consonants (except s, r, n, and l) gemin-
ate before y (including y < l). Note that ssy seems to
have undergone degemination (or SFW), becoming It š
(vs. sy > ž). Consonants also generally geminate before
"secondary" w, i.e. before w < u / C ___ V.

Before r, the only remaining liquid in inherited
words, only b (and f) geminate, other consonants do not

7.3.4.   West Germanic (cf. Krahe 1966 104-6, Braune-
Mitzka 1959 94-6 with 104, 149)

All consonants (except r) geminate before y Be-
fore w, gemination is found only in the (homorganic)
velars. Before liquids, only p, t, k are found to gemin-
ate. Gemination is rare before nasals, but does seem to

occur in p̲, t̲, k̲, and θ̲.

7.3.5   S̲a̲n̲s̲k̲r̲i̲t̲ (cf Wackernagel 1896·112-4)

Gemination may occur throughout the hierarchy, but various authorities deny this, or limit or extend it in its scope.

7.4   Interpretation.

7.4.1   As far as syllabication is concerned, it is noteworthy that the available evidence strongly supports the assumption of 1∅2 throughout the hierarchy as the original pattern of (Proto-) Indo-European. It is above all tne dynamic evidence of Greek and Latin which suggests that this pattern was later subject to a s̲y̲l̲-l̲a̲b̲l̲e̲ b̲o̲u̲n̲d̲a̲r̲y̲ s̲h̲i̲f̲t̲ (SBS) working its way "up" through the hierarchy The most radical instance of SBS would seem to be found in the variety of Sanskrit which permits ∅12 throughout the hierarchy

7.4 2   Concerning SFW, it is remarkable how closely the pattern of this process agrees with that of syllabication and SBS. Notice specifically the tight fit between Span 1∅2 and SFW, down to the fact that t̲l̲, d̲l̲, which exceptionally syllabicate as 1∅2, also exceptionally undergo SFW. Compare further the striking correlation between the syllabication patterns of Sanskrit and tne SFW patterns of Iranian, i.e. of the two major branches of Indo-Iranian.

7.4 3   What is remarkable and seems to be in need of an explanation is the fact that also the pattern of gemination, though much less "neat", seems to correlate significantly with the patterns of syllabication (and SBS) and of SFW. Thus, Celtic gemination begins precisely in the environment where SFW leaves off, namely before r̲. This seems to be true also for Italian, to the extent that it had SFW, cf. Lat s̲u̲p̲r̲a̲ . It. s̲o̲v̲r̲a̲ (beside s̲o̲p̲r̲a̲) vs Lat f̲a̲b̲r̲u̲- . It. f̲a̲b̲b̲r̲o̲. Moreover, this seems to correlate with the fact that the environment before liquid is the only environment in which Latin, the ancestor language, had SBS from 1∅2 to ∅12.

Finally, note that Sanskrit, which offers 1∅2 and ∅12 in
the entire hierarchy, is also the only language with
possible gemination throughout the hierarchy

7.4.3.1. The earlier views of de Saussure (1889)
and Fouché (1927 81-91) do not seem to account for this
correlation.

According to de Saussure, it is only before y,w,r,
l,m,n that gemination should be possible, because in
that environment there can be no distinction between
single and geminate (dental) stops, both being realized
as 'implosive' stops followed by 'explosive' stops in
the next syllable (at least after short vowels). In
other environments, geminates are said not to be poss-
ible. Considering the evidence of Sanskrit in favor of
gemination also before obstruents, and considering the
Italian (pattern) contrast between sovra/sopra and
fabbro, neither of de Saussure's claims can be consid-
ered acceptable.[24]

7.4.3 2· According to Fouché, gemination before
r,l,y,w is the result of an 'articulatory difficulty'
[with clusters of this sort]. This may be alleviated
through simplification (loss), prothesis, anaptyxis,
metathesis, or syllabification of the second member of
the cluster. But in order to preserve the 'explosive'
stop of the clusters, the language may 'reinforce the
articulation of the former' by increasing its duration.
(181-91, a completely different and highly doubtful ex-
planation is given ibid 46-60.)

Again, also Fouché's analysis suffers from being
incomplete, by not considering the fact that gemination
is possible also "higher up" in the hierarchy However,
some of Fouché's ideas will turn out to be quite à pro-
pos.

7.4.3.3 One interpretation which might readily
suggest itself can easily be dismissed, namely an inter-
pretation focusing on the fact that the observed pattern
of gemination might be considered the result of the fact
that in many languages one can find "ambisyllabic" stops,

such that syllable boundary seems to occur somewhere in
between the closure and the release of the stop, especi-
ally in the lower spectrum of the hierarchy. Such ambi-
syllabic stops can be observed in many varieties of
German, as in rattle [ra^t∅tlə]. However, if such ambi-
syllabic stops really were the source of gemination,
then one would expect gemination of originally single
segments to occur most frequently in intervocalic en-
vironments where ambisyllabicity is most readily found,
as in Germ rette [rɛ∅tə] or [rɛ^t∅tə]. However, this
is precisely the environment where such gemination is
found most rarely

   7.4.4   A more likely explanation would seem to be
possible within a more general theoretical framework
which considers the functional relationship of SFW and
SBS to each other, to the syllabication pattern 1∅2, and
to gemination

   7.4 4.1   The great similarity in hierarchical
patterning between SFW and ∅12 is suggestive of a special
relationship   This impression is reinforced by the fact
that where Spanish opposes normal SFW to emphatic/care-
ful SFD, German opposes normal ∅12 to emphatic/careful
SFD (except for [+ stop] [+ stop] and compounds)   In ad-
dition, note that historically, ∅12 seems to be second-
ary, coming about as the result of SBS.

   If we assume that it is this process of SBS (rather
than the pattern ∅12) which is related to the process of
SFW, the functional relationship between the two phenome-
na becomes clear

   Both SBS and SFW (at least, if carried through to
its ultimate conclusion, namely loss) lead to open-syl-
lable structures I e , both changes (ultimately) produce
the pattern which seems to be most favored on the
speaker's end of the speech process (given the prior
existence of 1∅2 patterns) Note in this regard that
both processes figure prominently in the Slavic open-
syllable conspiracy, as in *sed∅lo 'seat' > se∅lo,
sě∅lo, or se∅dlo depending on the dialect.

Notice additionally that this interpretation per-
mits a principled explanation for the problem discussed
in 6.2 and 6.4 above, namely the question as to why
some languages have WFW without also having a general
SFW. For while internally, SBS is in many cases a viable
alternative to SFW in producing open syllables, in abso-
lute final, i.e. prepausal environment, there is no such
alternative--only WFW can produce open-syllable struc-
tures in this position.

7.4.4.2. On the other hand, however, in producing
open-syllable structures, the two processes either
weaken or delete underlying stops (and other conson-
ants) or, as a result of SBS, shift them into an en-
vironment in which they are less clearly perceptible.
For the hearer, it is rather the structure 1ø2 which
provides the optimal acoustic clues concerning the
identity of these underlying segments.

7 4.4.3. This functional interpretation of the
changes SFW and SBS and of their difference from the
pattern 1ø2 now permits a principled explanation of
gemination and its pattern similarity to ø12 (and SFW),
an explanation reminiscent of, but not identical to
Fouché's

Gemination may be conceived of as a reaction to
SBS (from 1ø2 to ø12) and its effects on the hearer,
namely as a phonological 'blending' between the speaker-
favored pattern ø12 and the hearer-favored original
pattern 1ø2, yielding a conpromise pattern 1ø12.

This would most readily explain why gemination oc-
curs most commonly in those clusters which also most
commonly have (SBS to) ø12 (and so forth, with decreas-
ing likelihood, 'up' through the hierarchy). It would
also explain why the pattern of gemination is so much
less "neat" than the other patterns observed As a
scondary, analogical process, it need not be expected
to be regular.

8   Conclusion

While final weakening may, at least in most of its
stages, be considered (lag) assimilation, its ultimate
function seems to be comparable to that of syllable
boundary shift, namely to bring about (speaker-favored)
open-syllable structures

On the other hand, final devoicing seems to be more
clearly assimilatory, although at least in some lan-
guages it may, apparently secondarily, be used with a
particular function, namely as an emphatic or careful
alternative to either final weakening or syllable bound-
ary shift. Considering that syllable-final devoicing
seems to be exceedingly rare and considering its very
special function in the two languages where it has been
found, it may perhaps not be idle to speculate that it
is only under such special, functional conditions that
devoicing may have the syllable, rather than the word,
as its domain.

Finally, it appears likely that at least one pro-
cess of gemination may be the result of analogical,
rather than primary, purely phonetic development , name-
ly of the blending of an older, hearer-favored 1ø2
pattern with an innovated, speaker-favored ø12 pattern.

NOTES

[1]Research on this paper was in part supported by a
1975/76 grant from the University of Illinois Research
Board

[2]Especially interesting is Stampe's claim that even
languages with exclusively CVCV structure have word-
final devoicing, 'but without overt manifestation. This
claim appears to be supported by the pronunciation, in
such languages, of foreign words with final voiced ob-
struents, which, if they are pronounced at all, are
characteristically devoiced '(445) Unfortunately,
Stampe does not provide any examples for this developmet.

[3]Throughout this paper, the symbol ∅ will be used
to indicate syllable boundary.

[4]Cf. the fact that [- tense] obstruents become
[- voice], but remain [- tense] in the environment
[+ tense] ∅ ___, as in <u>hat sie</u> [hat∅zı] vs. <u>nimm sie</u>
[- voice]
[nImɣzı].

[5]The fact that insights of this sort--whether they
may ultimately turn out to be factually correct or not--
can be found in traditional, neogrammarian writings
should lay to rest any notions that such fairly abstract
analogical developments as rule generalization cannot be
captured by traditional historical linguistics, but only
by generative phonological theory. Evidently, they
could. (What is true, however, is that they could not
be captured as easily or readily)

[6]Note that Brugmann (ibid) mentions the fact that
there are also German dialects (Seifhennersdorf, Soest)
which show a pattern similar to that of Sanskrit

[7]Even Szemerényi (1973.70) finds Andersen's ex-
planation 'surprising.'

[8]No such neutralization is found, however, in final
fricatives   This is interesting in light of the observ-
ation of Andersen (1972 16-8 w fn 9) that in East Sor-
bian final devoicing 'the segments which are unmarked
with respect to the feature [+ continuous], /d b/, be-
come unmarked for voicing [chronologically] earlier than
the marked segments, /z ž/ ..' What this combined
evidence suggests is that, as Andersen already suspect-
ed, there may be a <u>hierarchy</u> of susceptability to FD.

[9]For reasons of space I will in the following re-
frain from giving individual examples for the various
changes, but rather refer the reader to works in which
such examples can be found--except where I have not been
able to find such sources or where the facts are too
well known to require such reference. I hope that this
listing will show how generally known these phenomena
are in traditional historical literature. (Note that

this listing is by no means complete.)

[10]These two changes apparently were chronological-
ly separate from each other; cf. Gauthiot 1913 102-6
with earlier references.

[11]For environmental restrictions beyond (i.e fol-
lowing) the syllable boundary, cf. 7.2 below.

[12]According to Allen (1962 98) this Middle Indo-
Aryan loss is a 'complete assimilation to silence, as
stops before another stop are completely assimilated to
it.' In light of the fact that similar weakening losses
may occur also internally, in syllable-final position
(where no 'silence' follows), this explanation cannot
be considered acceptable.

[13]Vennemann offers the interesting argument that
the peculiar vocing sandhi of Sanskrit is due to the
fact that (i) word-final oral stops may become unre-
leased, unaspirated, and weakened, and that (ii) lexic-
al representations, in his opinion, consist of the
'pronunciation in isolation' forms of given words. It
is this weakness, then, and not word boundary, which in
his view accounts for the fact that word-final stops
follow a different voicing sandhi rule from the 'normal'
internal stops.-- Considering the alternative explan-
ations discussed earlier in this paper, further, inde-
pendent evidence would seem to be required to make
credible Vennemann's hypothesis that underlying forms
are identical with '"pronunciation in isolation" forms'.

[14]There is one major class of exceptions, namely
dissimilatory developments of the type OHG [oxso] >
NHG [ɔksə]. However, as OIcel. einn > NIcel. [eidn]
shows, such developments are not limited to (syllable-)
final environments They do thus provide no cogent
counterevidence to the assumption that in the specific-
ally syllable- or word-final processes of weakening,
the individual developments are transitive and irrevers-
ible (except for voicing, if devoicing is considered a
case of FW, but cf the subsequent discussion)

[15]This is not to say that nasals may not be weakened. However, in such weakenings (such as [m] > [m̃]
> [ṽ] or [n] > [ñ]) the relevant processes seem to be
parallel to the above (oral) hierarchy. It is true,
they may eventually merge into this oral hierarchy, by
denasaliztion (as in [w̃] > [w]). However, the converse
change, from oral to nasal hierarchy, does not seem to
occur in final weakening processes.

[16]Notice in this respect the apt remarks in de
Saussure 1916 72.

[17]Also Middle Persian seems to have had MW.

[18]That the changes of p to b / ___ r,l, or to w
before nasal (and similarly to x before voiceless ob-
struents) must be very early changes is indicated by
the fact that in other positions, PIE *p was lost in
all of Celtic, i e presumably in Proto-Celtic   (An
'exception' to this loss would be forms like PIE
*penkʷe '5' > OIr. cóic, where p, of course, underwent
distant assimilation to the following kʷ prior to its
general loss.)

[19]Note tnat Navarro Tomás's statement that before
s, p is regular even in normal speech if the preceding
vowel is accented, is not necessarily incompatible with
this statement--if we permit a possible equation of
accented and emphatic environments.

[20]It may be noted that this hierarchy would seem
to necessitate certain revisions in the recent attempt
of Hooper (1972 533-8) to propose a unversal definition
of syllables Hooper proposes the following rules for
syllabication.

(a) $\emptyset$ --> $\emptyset$ / [+ syll] ___ [- syll] [+ syll]

(b) $\emptyset$ --> $\emptyset$ / [+ syll.] $[-syll]_0$___$[- son]$ $[^{+son}_{-nas}]$ $[+syll]$

In addition, sne proposes a set of rules permitting pos-
sible exceptions

(1) $\emptyset$ --> $\emptyset$ / $[^{-}_{+}$ $^{son.}_{cor}]$ ___ [+ lat] hence dø̸l, tø̸l

$$(11) \quad \emptyset \longrightarrow \not{s} \ / \ \begin{bmatrix} - \text{ son.} \\ + \text{ cor.} \\ + \text{ cont.} \\ + \text{ strid.} \end{bmatrix} \ \underline{\quad} \ [^{+\ \text{cons}}_{+\ \text{voc}}] \ \text{hence} \ \underline{s\not{s}l}, \underline{s\not{s}r}$$

$$(111) \quad \emptyset \longrightarrow \not{s} \ / \ \underline{\quad} \ \begin{bmatrix} - \text{ son.} \\ + \text{ cor.} \\ + \text{ strid} \end{bmatrix} \ \begin{Bmatrix} [+ \text{ cons.}] \\ [^{+\ \text{voc.}}_{+\ \text{lat.}}] \\ [^{-\ \text{voc.}}_{-\ \text{voice}}] \end{Bmatrix} \ \text{hence} \ \underline{\not{s}st}, \\ \underline{\not{s}sp}, \underline{\not{s}sk}, \\ \underline{\not{s}sl}$$

As the hierarchy in 7 1 shows, the number of 'possible
exception' rules must be considerably increased, as
well as ranked in terms of the degree of 'possibility'.

[21]It should come as no surprise that the hierarchy
(of the second members) in the clusters here examined
is very similar to the earlier sonority or aperture
hierarchies discussed in 3.3.3.2 above. Similar hier-
archies have been proposed also by Fouché (1927 3-14)
and Hooper (1972 533-8 and 1973 70-lo2). That is es-
pecially interesting in this respect is the fact that
similar hierarchies have been found to be supported
also by other evidence which is not obviously connected
with the syllable structure phenomena here discussed
Compare Zwicky 1972 for a hierarchy governing various
phenomena in English allegro speech, such as ə-syncope
and other ə-deletions, r-syllabification, and (stop)
epenthesis Similarly, Hankamer and Aissen (1974 with
earlier references) argue for the need for sonority
hierarchies to account for Pāli and Hungarian assimil-
ations   The fact that these hierachies have turned out
to be useful, as well as necessary, in so many differ-
ent theoretical and pragmatic contexts, seems to strong-
ly suggest that there must be some linguistic validity
to them

[22]This chronological difference may be the result
of a 'solidarity' of all [+ stop] l clusters with the
tl, dl clusters, which are universally disfavored (even
if not impossible) in tautosyllabic environment. (Cf.
also Hooper's rule (1) in fn. 20 above.)

[23]Cf. the introductory remarks in 7.1 above.

[24]de Saussure's argument concerning the Proto-Indo-
European merger of t̲t̲ and t̲ in this environment, how-
ever, appears reasonable enough Given a syllabication
1S2, it is indeed conceivable that /met-tro-/ and a
sequence like /met-ro/ would have been realized identic-
ally as metS̸ro. However, such a neutralization evident-
ly need not be assumed in languages with S̸12, where the
two could easily be distinguished as metS̸tro vs meS̸tro.

BIBLIOGRAPHY

Alarcos Llorach, Emilio. 1961. Fonología española.
    3rd rev. ed. Madrid Editorial Gredos.

Allen, W. Sidney. 1953. Phonetics in ancient India.
    London Oxford University Press.

-----. 1962. Sandhi. The Hague and Paris Mouton.

Andersen, Henning. 1969 (a). Indo-European voicing
    sandhi in Ukrainian. Scando-Slavica 16 157-69.

-----. 1969 (b). The change of *ot to *od a central
    Slavic innovation. Die Welt der Slaven 14.315-30.

-----. 1972. Diphthongization. Language 48.11-50.

Anttila, Raimo. 1972. An introduction to historical
    and comparative linguistics. New York Macmillan.

Arnholtz, A., and C. A. Reinhold. 1936 Einfuhrung in
    das danische Lautsystem. Leipzig Harrassowitz.

Bloch, Jules. 1934. L'indo-aryen du véda aux temps
    modernes. Paris Adrien-Maisonneuve

Braune-Mitzka = Wilhelm Braune. 1959. Althochdeutsche
    Grammatik. 9th "Auflage", revised by Walther Mitz-
    ka. Tübingen Niemeyer.

Brugmann, Karl. 1897. Grundriss der vergleichenden
    Grammatik der indogermanischen Sprachen, 1 Strass-
    ourg Trübner.

Buck, Carl Darlin. 1904. A grammar of Oscan and Umbri-
    an. Boston. Ginn.

Chen, Matthew Y. 1973   Cross-dialectal comparison a
    case study and some theoretical considerations.
    Journal of Chinese Linguistics 1.38-63. [Non vidi]

Diver, William   1953. The relation of Latin and Osco-
    Umbrian   Columbia University Ph.D dissertation
    [Non vidi]

Ewert, Alfred   1943. The French language. 2nd ed
    London Faber & Faber.

Fouché, Pierre   1927. Études de phonétique générale.
    Paris   Les belles lettres

Gauthiot, Robert. 1913, La fin du mot en indo-européen.
    Paris   Geuthner

Grammont, Maurice. 1939. Traité de phonétique. 2nd
    revised ed   Paris   Delagrave.

Grandgent, Charles H. 1927. From Latin to Italian.
    Cambridge Harvard University Press.

Hale, William Gardner, and Carl Darling Buck. 1903.
    A Latin grammar. Reissued 1966, University, Ala-
    bama   University of Alabama Press.

Hankamer, Jorge, and Judith Aissen. 1974. The sonority
    hierarchy. Papers from the Parasession on Natural
    Phonology, 131-45. Chicago Chicago Linguistic
    Society.

Hock, Hans Henrich (In press.) Review of Anttila 1972
    To appear in Language.

Hooper, Joan B. 1972   The syllable in phonological
    theory   Language 48.525-40.

-----   1973. Aspects of generative phonology. UCLA
    Ph D dissertation. Reissued 1974, Bloomington
    Indiana University Linguistics Club. [References
    are to the 1974 reissue.]

Hyman, Larry M   1975   Phonology theory and analysis
    New York et alibi   Holt, Rinehart and Winston.

Izzo, Herbert J   Tuscan and Etruscan.   Toronto   Uni-
    versity of Toronto Press.

Jespersen, Otto   1904   Lehrbuch der Phonetik   Author-

ized transl. from the Danish by H. Davidsen
Leipzig and Berlin   Teubner.

Kim, Chin-Wu. 1971. Experimental phonetics   A sur-
vey of linguistic science, 16-128, ed. by W. O.
Dingwall. College Park, MD   Linguistics Program,
University of Maryland.

Krahe, Hans. 1966. Germanische Sprachwissenschaft, 1.
(Sammlung Goschen, 238.) Berlin   de Gruyter.

Lausberg, Heinrich. 1967. Romanische Sprachwissen-
schaft, 2. 2nd ed. (Sammlung Goschen, 250.)
Berlin . de Gruyter.

Malmberg, Bertil. 1948. La structure syllabique de
l'espagnol. Boletim de filologia 9.99-102. Re-
printed in Bertil Malmberg 1971.389-404. [Ref-
erences are made to the pagination of Malmberg
1971.]

-----. 1952. Occlusion et spirance dans le système
consonantique de l'espagnol   Mélanges de philolo-
gie romane offerts à Karl Michaelsson, 356-65
Göteborg. Reprinted in Malmberg 1971 405-13
[References are to the pagination of the reprint]

-----. 1963. Phonetics. New York   Dover.

-----. 1971. Phonétique générale et romane   The Hague
Mouton

Martinet, André. 1970. Économie des changements
phonétiques. Berne   Francke.

Miller, D Gary. 1973. On the motivation of phonolog-
ical change. Issues in linguistics   papers in
honor of Henry and Renée Kahane, 686-718, ed by
B B Kachru, et al. Urbana, Chicago, London
University of Illinois Press

Miranda, Rocky V. 1974. Sound change and other phono-
logical change. Minnesota Working Papers in Lin-
guistics and Philosophy of Language, 1974 2 49-81

Navarro Tomás, Tomás. 1918. Manual de prononciación
española. Madrid   Centro de Estudios Históricos

Pedersen, Holger. 1909. Vergleichende Grammatik der
keltischen Sprachen, 1. Gottingen   Vandenhoeck

und Ruprecht

von Planta, Robert   1892   Grammatik der oskisch-um-
    brischen Dialekte   Strassburg   Trubner

Postal, Paul M.   1968   Aspects of phonological theory
    New York   Harper & Row.

Pulgram, Ernst   1970   Syllable, word, nexus, cursus.
    The Hague and Paris   Houton.

Reichelt, Hans.   1909.   Awestisches Elementarbuch.
    Heidelberg   Winter

Safarewicz, Jan   1969   Historische lateinische Gram-
    matik.   Halle   VEB Niemeyer.

de Saussure, Ferdinand.   1889.   Sur un point de la
    phonétique des consonnes en indo-européen   MSL
    6 246-57.

-----.   1916   Cours de linguistique générale   4th,
    slightly revised reissue, 1949.   Paris   Payot.

Schane, Sanford.   1972.   Natural rules in phonology.
    Linguistic change and generative theory, 198-229,
    ed. by R. P. Stockwell and R.K.S. Macaulay. Bloo-
    mington and London: Indiana University Press

Schwyzer, Eduard   1939.   Griechische Grammatik, 1.
    Munchen   Beck

Stampe, David   1969   The acquisition of phonetic
    representation.   Papers from the 5th Regional
    Meeting of the Chicago Linguistic Society, 443-54.

Szemerényi, Oswald   1973   Marked-unmarked and a problem
    of Latin diachrony.   Transactions of the Philologic-
    al Society 1973 54-73

Thurneysen, Rudolf   1961.   A grammar of Old Irish.   Re-
    vised and enlarged ed., transl   by D. A. Binchy
    and O. Bergin   Dublin   The Dublin Institute for
    Advanced Studies

Vaillant, André.   1950   Grammaire comparée des langues
    slaves, 1   Lyon   IAC.

Vennemann, Theo   1968.   German phonology.   UCLA Ph.D.
    dissertation   [Non vidi.]