FINAL WEAKENING AND RELATED PHENOMENA

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 opposite 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), 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 [bUnt] [bUnd]. However Vennemann (1968 159-63 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-tᴱle] '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 *skyēt > OLat. sied 'would be'.

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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 motivated by language-particular pause and boundary conditions. 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 evidently addresses itself merely to the question 'What happens most naturally word-finally (or syllable-finally), 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 prepausal position is a plausible phonetic environment, namely for (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.

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 *ot to *od in dialectal Common Slavic was the result, not of the usually recognized process of final voice neutralization, but of final tenseness neutralization. Just as in final voice neutralization, it is the unmarked value of the feature [+voice], namely [-voice], which appears in the unmarked word-final position, so in final tenseness neutralization, 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 > k, dУ > 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 'phonemic', 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 [puk] '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 voicing 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

[+ stop] --> [a voice] / ___ # [a voice]

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

[+ stop] --> [a voice] / ___ [ostr:]

is found, with voicing sandhi applying only before [M voice] segments. Thus, externally we find Skt
/vāk#asya/ realized as vāgasya 'his speech' vs. internal /vāk-as/ --> vācas 'of speech'. It is only before obstruent that external and internal sandhi agree, as in /vāk-bhis/ --> vāgbhis 'by speeches' = /vāk#dhiyate/ --> vāgdhiyate '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, final obstruents were neutralized in terms of the feature [+ 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

\ [+ stop] \rightarrow \ [\wedge \text{tense}] / ____ [\dagger \text{tense}]

to external sandhi conditions. Note that as a consequence 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 [+ voice].

2.6 Though synchronically, Andersen's and Szemerényi's analysis may well be correct, I am not convinced that it must be correct also historically.

2.6.1 First of all, as I hope to have shown elsewhere (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 analogical generalization of final devoicing, reinterpreted as voice neutralization. Such a neutralization can then be manifested through the rule

\ [+ stop] \rightarrow \ [\checkmark \text{voice}] / ____ # [\checkmark \text{voice}]

by overgeneralization of the internal voicing rule

\ [+ stop] \rightarrow \ [\checkmark \text{voice}] / ____ [\dagger \text{obstr}.].

'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 evidence for a similar generalization in Slovak, as in (*šmi vod(o)q >) s vodou [z vodou] 'with water'. Relics of an earlier stage, in which there was no such overgeneralization of voice assimilation are found in expressions containing personal or anaphoric pronouns, as in s nami [s nami] 'with us'.

It is then possible to argue that this overgeneralization 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 manifestation of stops, and to generalize them, presumably reinterpreted as [- tense] stops, to all environments. This would account for the Italic, Celtic, and Germanic situation.

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

Moreover, the analysis here proposed as a possible alternative has the advantage that, unlike that of Andersen and Szemerényi, it offers a phonetically motivated 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 /pad##/ --> pät 'foot') would be more compatible with an analysis 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 >
[*ulv-] 'wolves') and final devoicing (as in pre-OE
hlaef > 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 'FD, 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 describes 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. 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 t > θ / ___# (Ewert 1943 74-5, 76-7)
Old Irish ḗ > ɣ / ___# (Pedersen 1909 430)
Cornish t > s / ___# (ibid.499-500)
Cf. also 3.1 below.

3.1.2: Word-final voicing.

Old Irish θ > ɣ / ___# (Pedersen 1909 133)
Cf. also section 2 above (?).

3.1.2: Word-final gliding.

Italian s > z / ŭ ___# (via -h?) (Grandgent 1927:76-7)
pre-Sanskrit (s >) h > y / ___#[+ voice]
(Allen 1962:71 and 101-8)

3.1.4: Word-final rhotacism

Elean Greek s > r / ___# (Schwyzer 1939 410)
"New" Umbrian s > r / ___# (von Planta 1892
3.1.5. Word-final flapping:
Old Latin (*t/d >) d > r / _____# [−syll.
(Safarwicz 1969 102)

3.1.6. Word-final feature depletion
Eastern Arabic t > h / _____# (Gauthiot 1913 17)
(via 3 QE ?)
dialectal Oscan d > h / _____# (von Planta 1892 577-8, Buck 1904 84)
Finnish t > ? / _____# (Gauthiot 1913 102-6)
Finnish k > ? / _____# (ibid)
Chinese dialects [+ stop] > ? / _____# (Chen 1973)
Sanskrit s > h / _____# (Gauthiot 1913:113-21, Allen 1962 71, 101-8)
Spanish dialects s > h / _____# (Alarcos 1961 271, Malmberg 1948 393-7)

3.1.7. Word-final loss
Class Lat. (*t/d >) d > Ø / V _____# (Safarwicz 1969 102)
Arabic dialects t > Ø / _____# (Gauthiot 1913 17)
Finnish (t, k >) ? > Ø / _____# (ibid 102-6)
Chinese dialects (+ stop) > ? > Ø / _____# (Chen 1973)
Italian s > Ø / [- V act.] _____# (Grandgent 1927 76-7)
later OFrench œ > Ø / _____# (Ewert 1943 74-7)
Spanish dialects (s >) h > Ø / _____# (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 evidence 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, Fouche 1927 59) and again, more recently, in Spanish (Alarcos 1961 178-9, Hooper 1973 70-102, Malmberg 1948 393-7 and 1952 409-12, Navarro Tomàs 1918 61-79). Moreover, it is found in Greek (Martinet 1970 335, Schwytzer 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 fricativization, in Spanish (cf. the references in 3.2.1).

3.2.4: Syllable-final gliding

This process is found, as a continuation of fricativization, 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 (Petersen 1909 75, 93, 123, 429-30).

3.2.5: Syllable-final root-acid

Compare dialectal Spanish desde > derde (Alarcos 1961 271)

3.2.6: Syllable-final feature depletion

This is found in Spanish dialects with s > h (Alarcos 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 compensatory lengthening).

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

3.3.1 Terms like 'weakening' are frequently employed 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 'debilitamiento', and Chen (1973) refers to the common development of final stops in Chinese dialects of the type \( t \rightarrow ? > ? > \emptyset \) as 'feature depletion'.

3.3.2 Similarly, Allen (1953 70 and 1962 98) argues that the word-final stops of Sanskrit have a 'lax' or weak articulation (of the type \( [e, i, o, \emptyset] \)). This explanation in his view explains the fact that there had been a considerable controversy among the Sanskrit grammarians as to whether final stops are voiced or voiceless. Moreover, he finds support for this assumption in a 'somehow abstrusely stated' (1953 70) passage of the Atharva Prātiṣākhya, as well as in the fact that in Middle Indo-Aryan, final obstruents are lost,12 a similar, 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 weakening changes 'feed' one another (such as \( k > ? > \emptyset \) or \( k > x > h > y > \emptyset \)), thus establishing that they are intimately 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 theory 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 $t > ? > \emptyset, t > d, t > s, s > h$, is the normal development of final "implosives".

3.3.3.2: This theory was further extended and motivated by Halmberg (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 segments of increasing aperture, followed by a sequence of implosive segments of decreasing aperture, where the degrees of aperture are defined as follows.

- (1) $\emptyset$-aperture stops
- (2) aperture 1 fricatives
- (3) aperture 2 nasals
- (4) aperture 3 liquids
- (5) aperture 4, 1, 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 independently proposed by Jespersen (1904 186), although Jespersen's discussion of the concept of the syllable (185-203) betrays a much more agnostic attitude concerning the possibility of adequately defining it. Still, Pedersen did propose that between a given segment 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
These two theories were combined and further modified 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 'decreasing' ('décroissants'). In addition, there is an aperture hierarchy of the following sort.

\[
\begin{array}{cccc}
\emptyset & \text{stops} \\
1 & \text{spirants} \\
2 & \text{nasals} \\
3 & \text{liquids} \\
4 & \text{semivowels} \\
5 & \text{high vowels (including $\tilde{V}$ and h)} \\
6 & \text{mid vowels} \\
7 & \text{low vowels}
\end{array}
\]

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

Following this (refined) theory of Grammont's, and on the basis of a rich collection of Spanish data illustrating 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-

(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
ment de la partie finale est propre [comme tendance] à chaque 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 synchronically, they do show their validity in historical change. While the frequently occurring #st violates Jespersen's theory concerning the sequence of sonorities, historical changes, such as Lat #st > 1st/est in Romance, confirm the ultimate validity of this theory. Similarly, the common weakening or loss of final implosives 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 While Gauthiot's and Malmberg's theories go a long way toward providing a general, coherent theory of final weakening (in terms of syllable structure), 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 summed 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, significant relationship between these processes. This impression is reinforced by the fact that, except for the occurrence of final devoicing, these processes are transitive and irreversible: Examples of reverse shifts (of, say, fricative to stop) are not normally found in this environment.
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. 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.)

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 released in final position. This is true at least optionally for many varieties of English and seems to be the rule for many varieties of German (at least in careful 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 process. This is no doubt what is meant by the notation \( \ddot{t} > \ddot{e} > ? > \emptyset \) found in Chen 1973 and similarly in Miranda 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 (\( m? \)) often referred to as lenition. The same types of processes can happen in \( m\dot{w} \) as in \( m\dot{v} \).

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), British 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 history of Latin (martinet 1970 335-69), French (E'ert
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 (Hartinet 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 [boʊtl] 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 various 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 MFW, cf. Romance, Celtic, Iranian (Younger Avestan).
4.3: As a consequence it is not surprising that some linguists have—implicitly or explicitly—considered F'V and M'V to be a single, unitary process.

Thus, Pedersen (1909, 427-30) refers to Celtic M'V and F'V as lenition. Martinet (1970, 335-69) subsumes both types of changes in his general discussion of weakening processes. Similarly, Halmberg (1952) discusses both sets of phenomena side by side. And Andersen (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 attempted to provide a general theory concerning the identity of the two processes, as well as the reason and condition for this identity. Defining F'V as final consonant depletion, loss, and devoicing ('most common'), Hyman continues to argue that M'V occurs intervocalically and F'V 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 F'V is to be included in F'V (but cf. section 5 below), F'V and M'V 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, M'V may take place not only in intervocalic environment, but in any voiced medial environment (except, usually, after nasals), cf. Span. guardar [gvar'dar] 'guard' (but andar [andar] 'go'). And in such environments it (normally) applies to syllable-initial segments, i.e. in a position which is clearly opposed to the syllable-final environment for F'V.
Perhaps more important than these general considerations, however, is the fact that even in languages which have both \( MW \) and \( FW \), the two processes may not have identical manifestations \( \text{v.i.s.-} \text{v.i.s.} \) given segments. Thus, in the prehistory of Old Irish, \( SFW \) changed PIE \( *p \) to \( *b \) before liquids, and to \( *y \) before nasals. On the other hand, \( MW \) changed (voiceless) stops to (voiceless) fricatives, cf. Thurneysen 1961 74,139,140. In addition, the fact that \( (*pr, *pl >) *br, *bl \) would up as 'lenited' \( \beta_s, \beta_r \) 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. Mean Greek has \( WFW \) of \( s \) to \( r \), but no \( MW \). Similarly, Oscan-Umbrian shows \( SFW \) (of stops to fricatives), 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 phonetically identical, the evidence of their specific applications suggests that they are conceptually 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 conformity 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 adumbrated in Hyman 1972) that Fw and lV, except for the subvariety of loss, can be considered assimilatory developments, namely assimilations to the more sonorous or 'open' nature of the surrounding segments—in the case of NW—, or of the preceding segments—in the case of FW. On the other hand, WFD—while also an assimilatory process—would differ from NW and FW by being an assimilation to the following, less sonorous environment 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/A) to voiceless obstruents (such as b) before obstruents in emphatic or careful speech, but to voiced or lax ones (a or A) in more normal speech, cf. Navarro Tomás 1918:61-79, 107-10 and Alarcos 1961:179-919.

What is interesting in this respect is that also in my native dialect of German, SFD occurs more frequently in emphatic, careful speech than in normal speech where instead there is a shift in the syllable boundary; cf. normal Redner [ße śdinag] vs. emphatic or careful [ße tšnaːg] 'speaker'. This matter will be further 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 difference 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 occurs, namely Spanish and German, and what is interesting...
about the SFD of these languages is that it occurs under 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 $s > r/\_\#$) in which FW applies only word-finally. Cf. similarly Skt. $s > h (> y/w) / \_\$#, but not /\_\$.

If the natural domain of FW were indeed the syllable, and never the word, then we would expect it to occur in all syllable-final environments, in all languages 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. Similarly, 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 position 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) assimilatory change. If this view is correct, those rare instances 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 position, 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 sonority and/or aperture) may occur a priori, the fact that anticipatory assimilation is generally more common than lag assimilation would, in this more specific environment, provide for a greater incidence of devoicing than of weakening.

6.4: Even this hypothesis, however, cannot be considered entirely satisfactory. For like the hypothesis of 6.1 above, it fails to account for the fact that some languages have \( \text{FW} \) without having a general process of SF\( \text{FW} \).

Moreover, any theory of \( \text{FW} \) operating with the concept 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 phonetic plane, assimilation may not be prominently involved 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 how \( \text{FW} \) affects syllable structure and how the way it affects syllable structure correlates with the behavior of other syllable structure changes involving consonants.

While there is no general consensus among linguists on the phonetic criteria which define syllables and especially their boundaries (cf. the discussion in 3 3 3 2 above and note also the very agnostic position taken by Kim 1971.66-76), there is a good deal of evidence, such as \( \text{FJ} \) and \( \text{FD} \), 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 encountered 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 division, 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 unprincipled, but that they follow a very definite, hierarchical pattern.

7.1 A hierarchy of syllabication.

While the determination of the hierarchy of syllabication, 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 $V [+ \text{stop}] [- \text{syll}] V$ sequences.20,21

\begin{align*}
1 & 2 & 1 & 2 & 12 \\
[+ \text{stop}] & [+ \text{stop}] & \Rightarrow & \Rightarrow & \Rightarrow \\
[+ \text{fric}] & [+ \text{nas}] & \Rightarrow & \Rightarrow & \Rightarrow \\
[+ \text{liqu}] & \Rightarrow & \Rightarrow & \Rightarrow & \Rightarrow \\
y, w & \Rightarrow & \Rightarrow & \Rightarrow & \Rightarrow
\end{align*}
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 $l$2 for the whole hierarchy (and for all CC clusters).

According to one phonetic treatise, however, the Rāk Prātiśākhya, both $1$2 and $31$2 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 kārtṣṇya will be written

\[
\text{kārtṣṇya} = \text{kā} + \text{ṛṇyā}
\]

Finally, the Taṇṭārīya Prātiśākhya gives the following syllabifications.

\[
\begin{align*}
[+ \text{stop}] & \ G & [+ \text{stop}] \\
[+ \text{stop}] & \ G & [+ \text{nas.}] \\
& \ G & [+ \text{stop}] [+ \text{fric.}] \\
& \ G & [+ \text{stop}] [+ \text{liqu.}] \\
& \ G & [+ \text{stop}] [+ \text{glide}]
\end{align*}
\]

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 syllabication, suggested by metrical evidence, is 122 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 122, first apparently in the case of [+ stop] $t$, later also in the case of [+ stop] $l$.

For even later periods, there is metrical evidence that tautosyllabic CN clusters were becoming (optionally) acceptable, at least in the case of $pN$ 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 syllabication 122 for the entire hierarchy, except for qu which has 122 (no doubt due to the fact that this sequence usually goes back to the Proto-Indo-European single segment *kU*). Note that there are no other occurrences of y and w in the environment [- syll] [+ syll].

In later Latin, 122 is optionally possible also for [+ stop] [+ liqu.].

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

The syllabication is 122 from [+ stop][+stop] through [+ stop][ + nas.]. It is 122 for [+stop][+liqu] (except for $tl$, $dl$, cf. fn 22 above) and for stop plus glide
7.1.5: **German** (my dialect)

The syllabication always is $\text{I}2$ in the case of $[+ \text{stop}] [+ \text{stop}] [+ \text{fric.}]$ through $[+ \text{stop}] [+ \text{liqu.}]$ (a) in compounds, as in $\text{Abfall} [\text{?ap\$fal}]$, and (b) elsewhere in emphatic or very careful speech, as in $\text{Apfel} [\text{?ap\$fel}]$ vs. more normal $[\text{?ap\$fll}]$, otherwise it is $\text{I}12$. In $[+ \text{stop}] y$ the syllabation is $\text{I}2$ in compounds (as in $\text{ab-jagen} [\text{?ap\$ya ? gr}]$), and $\text{I}12$ elsewhere in normal speech (as in $\text{Abkaze} [\text{?a\$ka-\$tsy\$e}]$); in emphatic or careful speech $\varepsilon [+ \text{stop}] $ $\text{IyV}$ occurs instead of normal $\varepsilon [+ \text{stop}] yV$ (as in $[\text{?a\$ka.\$tsi\$ye}]$). (Words with $w$ are extremely rare and are basically $[+ \text{foreign}]$.)

7.2: A hierarchy of syllable-final weakening

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

$[+ \text{stop}] [+ \text{stop}]$ $[+ \text{fric.}]$ $[+ \text{liqu.}]$ $[+ \text{nas.}]$

\begin{align*}
\text{I.e. SF' of stops is most likely to occur before} \\
\text{stops, and least likely before glides}
\end{align*}

7.2.1 **Late Classical/Byzantine Greek** (cf. Schwyzer 1939:211)

$\text{SFV}$ occurs before $[+ \text{stop}]$ and $s$ (the only relevant friction continuant). The fricativization of $p$ and $k$ before $s$, however, ceases to be a productive process in Modern Greek.

7.2.2 **Oscan-Umbrian** (cf. e.g. Martinet 1970 337)

$\text{SFV}$ occurs before $[+ \text{stop}]$ and $s$ (the only friction continuant occurring after stops)

7.2.3 **Spanish** (cf. Alarcos 1961 178-9, Navarro Tomás 1918 61-74, 107-10)

In Modern Spanish, $[+ \text{stop}]$ undergoes $\text{SFV}$ before
[+ stop] through [+ nasal]. It also occurs in t, d before l, i.e. in the environment in which Spanish inserts a syllable boundary between stop and liquid.

7.2.4  **Celtic** (cf. Pedersen 1909 430, Thurneysen 1961 74, 135, 136, and especially 139 and 140)

SFW occurs before [+ stop] through [+ liquid], except that *dr normally develops into geminate *ddr.

7.2.5  **Iranian** (cf. Reichelt 1909 38 and passim)

In voiceless stops, SFW occurs throughout the hierarchy. In voiced stops it is found only before [+ fric], at least in Gāthāavestan. Regarding this situation, the following two comments need to be made.

(a) "SFW" of voiceless stops occurs not only in genuine syllable-final positions, but also after #. However, note that similarly the MW of (Western) Romance seems to have originally applied across #, and still does in some dialects, although in many dialects it has been subjected to various levelings, cf. Lausberg 1967 passim. Similarly, Celtic 'lenition' originally applied across word boundary, and continues to do so in (most of) the Celtic languages, albeit in a morphologized fashion. It is thus not unlikely that also in pre-Iranian, SFW took place across #, and that its historical occurrence even after ## is due to similar levelings.

(b) The fact that SFW of voiced stops occurs only before friction continuants (namely before z) is reminiscent of the fact that also in one variety of Sanskrit syllabification, [+ stop] and [+ nasal] act the same, thus disrupting the normal hierarchy, cf. 7.1.1 above.

7.3  **A hierarchy of gemination**

Note that this discussion is concerned only with the gemination frequently encountered in the first member of the clusters under discussion. Other geminates, especially those involving assimilations (as well as "spontaneous" or "expressive" geminations), may follow completely different 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.

\[
\begin{array}{c}
[+ \text{stop}] \\
[+ \text{fric.}] \\
[+ \text{nas.}] \\
[+ \text{liqu.}]
\end{array}
\begin{array}{c}
y, w
\end{array}
\]

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 \(w\). Moreover, the only stops which are geminated in this environment 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.


Almost all consonants (except \(s, r, n,\) and \(l\)) geminate before \(y\) (including \(y < l\)). Note that \(ssy\) seems to have undercong degemination (or SFW), becoming \(s\) (vs. \(sy > ʃ\)). Consonants also generally geminate before "secondary" \(w\), i.e. before \(\tilde{u} < u / C \tilde{v}\).

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 \(y\). Before \(y\), gemination is found only in the (homorganic) velars. Before liquids, only \(p, t, k\) are found to geminate. Gemination is rare before nasals, but does seem to
occur in p, t, k, and q.

7.3.5 **Sanskrit** (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 $2$ throughout the hierarchy as the original pattern of (Proto-) Indo-European. It is above all the dynamic evidence of Greek and Latin which suggests that this pattern was later subject to a syllable boundary shift (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 $2$ 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 $12$ and SFW, down to the fact that $t$ and $d$, which exceptionally syllabicize as $12$, also exceptionally undergo SFW. Compare further the striking correlation between the syllabication patterns of Sanskrit and the 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 $r$. This seems to be true also for Italian, to the extent that it had SFW, cf. Lat supra. It. sovra (beside sopra) vs Lat fabru-. It. fabbro. 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 $12$ to $2$. 
Finally, note that Sanskrit, which offers $l2$ and $g12$ 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 $l,w,r, l,m,n$ 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 possible. 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 considered acceptable.

### 7.4.3.2. According to Fouché, gemination before $r,l,w$ 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 explanation 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 propos.

### 7.4.3.3. One interpretation which might readily suggest itself can easily be dismissed, namely an interpretation 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, especially in the lower spectrum of the hierarchy. Such ambisyllabic stops can be observed in many varieties of German, as in rattle [raˈtʌltə]. However, if such ambisyllabic stops really were the source of gemination, then one would expect gemination of originally single segments to occur most frequently in intervocalic environments where ambisyllabicity is most readily found, as in GerMan _rette [rɛtə] or [rɛtə]. 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 SFN 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 SFN and $12 is suggestive of a special relationship. This impression is reinforced by the fact that where Spanish opposes normal SF,t to emphatic/careful SF, German opposes normal $12 to emphatic/careful SF, (except for [+ stop] [+ stop] and compounds) In addition, note that historically, $12 seems to be secondary, 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 SFN, the functional relationship between the two phenomena becomes clear.

Both SBS and SF,t (at least, if carried through to its ultimate conclusion, namely loss) lead to open-syllable 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 *sedzlo 'seat' > sedzlo, sedzlo, or sedzlo depending on the dialect.
Notice additionally that this interpretation permits a principled explanation for the problem discussed in 6.2 and 6.4 above, namely the question as to why some languages have WF\textsubscript{W} without also having a general SF\textsubscript{W}. For while internally, SBS is in many cases a viable alternative to SF\textsubscript{W} in producing open syllables, in absolute final, i.e. prepausal environment, there is no such alternative—only WF\textsubscript{W} can produce open-syllable structures 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 consonants) or, as a result of SBS, shift them into an environment in which they are less clearly perceptible. For the hearer, it is rather the structure $\text{1}$ which provides the optimal acoustic clues concerning the identity of these underlying segments.

7 4.4.3. This functional interpretation of the changes SF\textsubscript{W} and SBS and of their difference from the pattern $\text{1}$ now permits a principled explanation of gemination and its pattern similarity to $\text{1}$ (and SF\textsubscript{W}), an explanation reminiscent of, but not identical to Fouché's

Gemination may be conceived of as a reaction to SBS (from $\text{1}$ to $\text{1}$) and its effects on the hearer, namely as a phonological 'blending' between the speaker-favored pattern $\text{1}$ and the hearer-favored original pattern $\text{1}$, yielding a compromise pattern $\text{1}$.

This would most readily explain why gemination occurs most commonly in those clusters which also most commonly have (SBS to) $\text{1}$ (and so forth, with decreasing 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 secondary, 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 languages it may, apparently secondarily, be used with a particular function, namely as an emphatic or careful alternative to either final weakening or syllable boundary 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 process of gemination may be the result of analogical, rather than primary, purely phonetic development, namely of the blending of an older, hearer-favored pattern with an innovated, speaker-favored 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 obstruents, which, if they are pronounced at all, are characteristically devoiced. Unfortunately, Stampe does not provide any examples for this development.
Throughout this paper, the symbol $\emptyset$ will be used to indicate syllable boundary.

4Cf. the fact that [- tense] obstruents become [- voice], but remain [- tense] in the environment [+ tense] $\emptyset$, as in hat sie [hat$\emptyset$zi] vs. nim$\emptyset$ sie [nIm$\emptyset$zi].

5The 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.)

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

7Even Szemerényi (1973.70) finds Andersen's explanation 'surprising.'

8No such neutralization is found, however, in final fricatives. This is interesting in light of the observation of Andersen (1972 16-8 v fn 9) that in East Sorbian final devoicing 'the segments which are unmarked with respect to the feature [+ continuous], /d b/, become unmarked for voicing [chronologically] earlier than the marked segments, /z ژ/. What this combined evidence suggests is that, as Andersen already suspected, there may be a hierarchy of susceptibility to FD.

9For reasons of space I will in the following refrain 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.)

10These two changes apparently were chronologically separate from each other; cf. Gauthiot 1913 102-5 with earlier references.

11For environmental restrictions beyond (i.e. following) the syllable boundary, cf. ?2 below.

12According 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.

13Vennemann offers the interesting argument that the peculiar voicing sandhi of Sanskrit is due to the fact that (1) word-final oral stops may become unreleased, unaspirated, and weakened, and that (11) lexical 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 explanations discussed earlier in this paper, further, independent evidence would seem to be required to make credible Vennemann's hypothesis that underlying forms are identical with 'pronunciation in isolation' forms'.

14There is one major class of exceptions, namely dissimilatory developments of the type OHG [oxso] > NMG [oksø]. However, as OIcel. einn > NIcel. [eign] shows, such developments are not limited to (syllable-) final environments. They do thus provide no cogent counterevidence to the assumption that in the specifically syllable- or word-final processes of weakening, the individual developments are transitive and irreversible (except for voicing, if devoicing is considered a case of F', but cf the subsequent discussion)
This is not to say that nasals may not be weakened. However, in such weakenings (such as \[m\] > \[n\] > \[w\]), the relevant processes seem to be parallel to the above (oral) hierarchy. It is true, they may eventually merge into this oral hierarchy, by denasalization (as in \[\tilde{m}\] > \[\tilde{n}\]). However, the converse change, from oral to nasal hierarchy, does not seem to occur in final weakening processes.

Notice in this respect the apt remarks in de Saussure 1916:72.

Also Middle Persian seems to have had \[\tilde{m}\], \[\tilde{n}\].

That the changes of \(p\) to \(b\) / \(\big/ \tilde{r}, l\), or to \(\tilde{u}\) before nasal (and similarly to \(x\) before voiceless obstruents) 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 \(*\text{penk}^\text{Ve} '5' > \text{Oir. c6ic}, where \(p\), of course, underwent distant assimilation to the following \(k^\text{W}\) prior to its general loss.)

Note that 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.

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 universal definition of syllables. Hooper proposes the following rules for syllabication.

(a) \(\emptyset \rightarrow \emptyset / [+ \text{syl} ] [\text{ } ] [- \text{syl} ] [+ \text{syl} ]

(b) \(\emptyset \rightarrow \emptyset / [+ \text{syll} ] [-\text{syll}] [\text{ } ] [-\text{son} ] [+\text{son} ] [+\text{syl}]

In addition, she proposes a set of rules permitting possible exceptions

(1) \(\emptyset \rightarrow \emptyset / [+ \text{son} ] [\text{ } ] [-\text{son} ] [+\text{lat} ] \text{ hence } \text{d}3\text{l}, \text{t}3\text{l}
(11) $\emptyset \rightarrow \emptyset / [-\text{son.} + \text{cor.} + \text{cont.} + \text{strid}]$ hence $s\emptyset l, s\emptyset r$

(111) $\emptyset \rightarrow \emptyset / [-\text{son.} + \text{cor.} + \text{strid}] \{ [+\text{cons.}] [+\text{voc.}] [+\text{lat.}] \}$ hence $\emptyset s t, \emptyset s p, \emptyset s k$, $\emptyset s l$

As the hierarchy in 71 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 hierarchies have been proposed also by Fouche (1927 3-14) and Hooper (1972 533-8 and 1973 70-102). That is especially 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 Zachary 1972 for a hierarchy governing various phenomena in English allegro speech, such as $\text{a}$-syncope and other $\text{a}$-deletions, $\text{r}$-syllabification, and (stop) evanthesis. Similarly, Hankamer and Aissen (1974 with earlier references) argue for the need for sonority hierarchies to account for Pāli and Hungarian assimilations. The fact that these hierarchies have turned out to be useful, as well as necessary, in so many different theoretical and pragmatic contexts, seems to strongly suggest that there must be some linguistic validity to them.

22 This chronological difference may be the result of a 'solidarity' of all $[+\text{stop}] l$ clusters with the $t\emptyset, d\emptyset$ clusters, which are universally disfavored (even if not impossible) in tautosyllabic environment. (Cf. also Hooper's rule (1) in fn. 20 above.)
Cf. the introductory remarks in 7.1 above.

De Saussure's argument concerning the Proto-Indo-European merger of \( tt \) and \( t \) in this environment, however, appears reasonable enough. Given a syllabication \( \text{S2} \), it is indeed conceivable that /met-tro-/ and a sequence like /met-ro/ would have been realized identically as \( \text{mettro} \). However, such a neutralization evidently need not be assumed in languages with \( Z12 \), where the two could easily be distinguished as \( \text{metstro} \) vs \( \text{mestro} \).

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