Journal of Germanic Linguistics **15.1** (2003):1–26.

Legacy Specification in the Laryngeal Phonology of Dutch

Gregory K. Iverson

University of Wisconsin–Milwaukee

Joseph C. Salmons

University of Wisconsin–Madison

Dutch consonant cluster assimilations have come to play a central role in the debate over whether laryngeal features are restrictedly privative (single-valued) or must be encoded as binary (marking both positive and negative values). It has been argued, in particular, that the negative specification [–voice] is necessary in order to capture the difference in directionality of assimilation between stop-final and fricative-final clusters in Dutch as well as to accommodate the contrary behavior of the past suffix *-de*. Under the dimensional theory of laryngeal representation, the present paper provides a fresh analysis of the Netherlandic facts without reference to negative feature values, focusing on the role of phonetic enhancement versus phonology proper. The exposition is anchored in the history of Dutch as a Germanic language that is to a great extent Romance-like in its laryngeal phonology, and takes into consideration evidence from dialects and experimental phonetics.*

1. Introduction.

Representational systems employing privative or monovalent specification (Lombardi 1991/1994, Iverson and Salmons 1995, Avery 1996) characterize laryngeal contrasts with various combinations of just three features: [voice], [spread], and [constricted]. A number of synchronic as

* An earlier version of this paper was presented to the Eighth Germanic Linguistics Annual Conference (GLAC 8) at Indiana University, Bloomington, April 26–28, 2002, and a related paper, "Privativity and the Laws of Enhancement," was held at a Linguistics Student Organization Colloquium, University of Wisconsin–Madison, in March 2002. In addition to two anonymous reviewers for this journal, we owe thanks to Anthony Buccini, Rob Howell, Monica Macaulay, Bert Vaux, and the audiences at both presentations for valuable input. The usual disclaimers apply.

well as diachronic explanatory returns grow out of this circumscribed approach to laryngeal distinctions, but a recent paper by Wetzels and Mascaró (2001) has identified cases in which it appears that the negative value of [voice] spreads from one sound to another, thus requiring reference to the absence of the feature as well as its presence (the positive value undergoes assimilatory spread elsewhere). If valid, this conclusion would necessitate positing a binary feature [±voice], and so vitiate the privativity hypothesis. The present paper surveys these cases and shows that reference to [–voice] is actually neither necessary nor useful, because at the level of contrastive phonology more adequate analyses are available that engage the privative feature [spread] rather than [–voice], and at the level of phonetic enhancement, the singulary gesture [stiff] (Halle and Stevens 1971) replaces [–voice].

The case that Wetzels and Mascaró defend most strongly as supportive of the specification [–voice], however, rests on the mixed pattern of laryngeal assimilation exhibited by stops as compared to fricatives in Dutch. Along with the contrary behavior specifically of the past inflection *-de*, for which we develop an account that does not involve [–voice], they present the Dutch data as a definitive demonstration of the need to refer to both positive and negative values of the same phonological feature. Refuting these arguments, we show that laryngeal feature representation can be properly restricted to the occurrence of articulatory organizing nodes and monovalent phonetic gestures, that is, that the laryngeal features are in fact privative.

The key to accounting for these synchronic patterns privatively requires reference to the hybrid nature of Dutch laryngeal phonology: Netherlandic obstruents look in their basic phonetics much like those of Romance—with modal voicing of /b, d/, etc., and no aspiration in /p, t, k/, an articulatory set that, as we will see below, may well be traceable to contact between (pre-)Dutch speakers and speakers of some variety or varieties of Romance. At the same time, Dutch reveals its Germanic laryngeal legacy in the patterns of obstruent voice assimilation: Dutch has a mixed system, we argue, in which the stop phonology and phonetics are largely Romance-like, whereas the fricatives retain distinctly Germanic, non-Romance traits.

The paper is organized as follows. In the next section, we lay out the case against privativity in laryngeal features, that is, the ostensible need to posit [–voice], and we sketch the relevant parts of the descriptive framework adopted here, the dimensional theory of laryngeal representation as developed by Avery and Idsardi (2001, forthcoming). We also

present our understanding of phonological privativity and its relationship to phonetics. Section 3 details the patterns of laryngeal assimilations in Dutch, while section 4 deals with the unique voicing of the past suffix *-de*, a classic problem in Dutch phonology. In section 5, we turn to the question of how these patterns could have arisen historically, with a focus on the possible role of language contact in changing the Netherlandic base of articulation. We also sketch some relevant patterns of geographical and other variation. Section 6 concludes the paper with a review of our general observations about phonological representation and phonetic enhancement in Dutch.

2. Theoretical background and the putative necessity of [–voice].

The privative conception of feature structure is that negatively valued features simply do not exist, with the result that only the presence, not the absence, of a feature quality may be referred to, as illustrated momentarily. For some features, like [nasal], privativity is a relatively uncontroversial notion, since, as an anonymous reader notes, [–nasal] does not establish a natural class of segments. Moreover, there is no known need to refer to [–nasal] in order to account for phonological behavior in the languages of the world. Restricting possible phonological representations in this way, if it can be done, is desirable in accordance with the fundamental principles in science of parsimony and simplicity. We argue here that at least laryngeal features, including [voice], can be handled in privative terms.[1]

The conventional description of the simple two-way laryngeal contrast found in many of the world's languages pits a series of voiceless stops, marked [–voice], against a series of voiced stops, marked [+voice]. This particular binary opposition has formed something of a procrustean bed into which languages have been forced phonologically even when their phonetic properties are noticeably different. Thus, it has long been appreciated that the voice onset time (VOT) values of Romance and Slavic languages, on the one hand, and most Germanic languages, on the other, are quite different: the voiced stops of French are thoroughly voiced, but those of English are often not voiced at all at the beginning of a word, causing many phoneticians to consider the English type to be "lenis" rather than truly voiced (cf. Iverson and Salmons forthcoming on

[1] But see Coleman 1998:22–24 on the problem of notation vs. denotation in phonology as it relates to privativity.

https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

"passive voicing"). Similarly, the voiceless stops of French are produced with relatively early VOT after their release, whereas the VOT of the English voiceless series is considerably delayed, with the result that French voiceless stops are regularly "unaspirated," while those of English are aspirated. Taking the feature [spread] to be the phonetic transmitter of aspiration and its absence, as per current practice, the scheme outlined in 1 then serves as the historical standard for marking the English- versus French-type differences.

(1) Conventional description of a "voice" contrast: binary [±voice] and [±spread]

English, German		French, Dutch	
/t/	/d/	/t/	/d/
[–voice]	[+voice]	[–voice]	[+voice]
↓	↓	↓	↓
[+spread]	[–voice] (initially) [–spread]	[–spread]	[–spread]
[t^h], [t]	[d̥], [d]	[t]	[d]

Note that since [±spread] is a redundant property in both types of language under this system, allophonic rules or other forms of distribution statement are required in order to characterize the English/German phonemically voiceless stops as aspirated in syllable-initial environments, that is, as [+spread], and all other stops in both types of language as [–spread]. Additionally, the English/German phonemically voiced stops are actually voiceless in certain environments, especially initially.

The modern turn toward privative representation replaces negatively valued features with representational absence; positive values are then encoded by the presence of the features. This results in considerable descriptive simplification, because features with negative values are not represented at all. As illustrated in 2, the privative description is symbolically more parsimonious than the binary alternative given in 1, because there is no need (or possibility) to refer to [–spread] or [–voice].

https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

(2) Conventional description of a "voice" contrast: privative [voice] and [spread]

English, German		French, Dutch	
/t/	/d/	/t/	/d/
[ ]	[voice]	[ ]	[voice]
↓	↓		
[spread]	∅ (initially)		
[tʰ], [t]	[d̥], [d]	[t]	[d]

Given that two features are at play here, however, [voice] and [spread], it is possible to suppose that the relevant underlying property is not voicing or its absence in all cases, but rather in some cases glottal spread. This is particularly appealing in analysis of the fortis/lenis type of language, and has the advantage of encoding a systematic difference in articulation between the two types into the representation itself, as shown in 3.

(3) Phonetically more informed description: binary [±voice] and [±spread]

English, German		French, Dutch	
/tʰ/	/d̥/	/t/	/d/
[+spread]	[–spread]	[–voice]	[+voice]
↓	↓	↓	↓
[–voice]	[+voice] (medially)	[–spread]	[–spread]
[tʰ], [t]	[d̥], [d]	[t]	[d]

Translation of the binary system of 3 into its more restrictive privative equivalent, given in 4, maintains the basic distinction between English as a fortis/lenis language and French as a voiceless/voiced language, but with considerably less machinery since, as in 2, negatively valued features simply are not there. This is the mode of representation we adopt here and elsewhere, with but a single privative feature (albeit a different one) marking the two types of two-way laryngeal contrast.[2]

[2] See Iverson and Salmons 1995 for an elaboration of how and why stops marked by [spread] are realized phonetically without aspiration in certain environments (in consonant clusters, foot medially).

https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

(4) Phonetically more informed description: privative [voice] and [spread]

English, German			French, Dutch	
/t^{h}/	/d̥/		/t/	/d/
[spread]	[ ]		[ ]	[voice]
	↓			
	[voice]	(medially)		
[t^{h}], [t]	[d̥], [d]		[t]	[d]

In our terms, this means that English and German are "aspiration languages," whereas French and Dutch are "voice languages." The distinction is borne out not just in the phonetics ("voiceless" stops aspirated in the former, unaspirated in the latter; "voiced" stops only contextually voiced in the former, consistently voiced in the latter), but also in the phonology, where morphophonemic laryngeal assimilation is biased toward the fortis articulation of voicelessness (open glottis) in English and German but toward voicing in French and Dutch (Iverson and Salmons 1995, 1999). For aspiration languages, then, the feature [voice] is phonologically just not active—indeed, it merely gets in the way—hence its absence under the scheme in 4 is doubly welcome, phonetically as well as phonologically.

In fact, apparent support for distinctive [–voice] at any level evaporates with wholesale replacement of the feature [voice] by the Halle and Stevens-derived glottal tension gestures [slack] vs. [stiff], as laid out in more detail below.[3] In a trivial sense, then, there can be no specification [–voice] (or, for that matter, [+voice]) because there is no feature [voice] to begin with if voicing and its absence are accounted for in terms of specification along the glottal tension dimension. As Halle and Stevens (1971) perspicaciously point out, this way of representing voicing is explanatory from articulatory as well as phonological points of view, enabling, in particular, an otherwise unavailable connection to be drawn between the level of pitch in sonorants and the incidence of voicing in obstruents: both low pitch and obstruent voicing are implemented via slack vocal folds; high pitch and obstruent voicelessness are

[3] Lombardi (1996) acknowledges that negative values like [–voice] play a role in the postlexical phonology, but only there, as features in the lexical component of the phonology are consistently privative. We follow a similar line of reasoning here, albeit with privative [stiff] standing in for postlexical [–voice].

implemented via stiff vocal folds. The implications of this correlation for tonogenesis are obvious and direct, and furthermore lead to a deeper understanding of the phonetics and phonology of early Germanic, particularly of the Verner's Law phenomenon (Iverson and Salmons forthcoming). Though Wetzels and Mascaró (2001) present a number of illustrations that nonetheless appear to call for reference specifically to [–voice], privative alternatives using the Halle and Stevens features readily offer themselves. For example, one of the Wetzels and Mascaró illustrations comes from an aspiration language, regional British English: "In the Yorkshire dialect, all voiced obstruents become voiceless before a voiceless consonant across word boundaries (including compound boundaries). Under the same conditions, voiceless consonants are not regressively voiced" (p. 227). Examples are cited in 5.

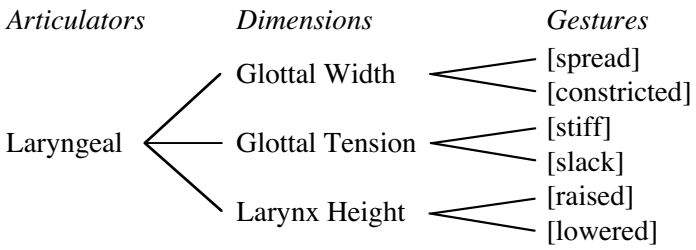
(5) Yorkshire English "devoicing"

bed-time	be[tt]ime
subcommittee	su[pk]ommittee
headquarters	hea[tk]uarters
frogspawn	fro[ks]pawn
a big piece	a bi[kp]iece
live performance	li[fp]erformance
wide trousers	wi[tt]rousers (cf. whi[tt]rousers *white trousers*)
white book	whi[tb]ook (not *whi[db]ook)

As Wetzels and Mascaró themselves recognize, however, postlexical assimilation in forms like *be*[tt]*ime* for *bed-time* can instead be expressed as leftward extension of the feature [spread], following the analysis of English laryngeal phonology worked out by Iverson and Salmons (1995, 1999). We recapitulate this view here in the framework of dimensional theory (Avery and Idsardi 2001, forthcoming), which distinguishes laryngeal contrasts according to the three "dimensions" of Glottal Width, Glottal Tension, and Larynx Height. The dimensions in turn implicate phonetically antagonistic "gestures," which are essentially the same entities as the phonological features of conventional theories. Schematically, the dimensions and gestures relate to each other as in 6, all implemented under the "articulator" Laryngeal.

https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

(6) Geometry of laryngeal representation in dimensional theory (Avery and Idsardi 2001)



Only one member of an antagonistic gestural pair is generally used contrastively in a given system, though the other member may be invoked as a phonetic embellishment, or "enhancement," of a contrast. Thus, [spread] and [constricted] form an antagonistic pair under the dimension of Glottal Width, so only one of these typically is phonologically active, as is the case in English (which contrasts [spread] voiceless aspirated stops with laryngeally unmarked lenis stops). Similarly, [stiff] and [slack] constitute the antagonistic pair that is subordinated under Glottal Tension, hence just one of these usually functions phonologically in a given subsystem (as in French, whose [slack] voiced stops contrast with laryngeally empty voiceless unaspirated ones). The default selection among these dimensions is such that Glottal Width normally implicates [spread], and Glottal Tension typically implicates [slack]. The Larynx Height dimension, which implicates either [raised] (ejectives) or [lowered] (implosives), will not figure further into the present discussion.

The relationship here between phonetics and phonology is straightforward. Simply put, laryngeal features are privative in the phonology, an abstract, minimal set of instructions needed to produce surface forms, so that Dutch /t/, for instance, has no laryngeal specification at all, but acquires its surface phonetic characteristics later (if one assumes a derivational model) in the course of implementation, often specifically to enhance the contrasts flagged by the phonology. These phonetic characteristics are still largely consistent and predictable, and accounting for them is obviously a central part of understanding sound systems. One advantage of dimensional theory for present purposes is that it expressly provides for "enhancement," where the richness of phonetic detail supplements the bare machinery of the phonology. The architecture of grammar must contain, in our view, highly constrained abstract representations (phonology) that relate directly and systematically to the

complete, concrete realization of sounds (phonetics). From a purely phonological point of view without consideration of phonetics, or from a purely phonetic point of view without consideration of phonology, this might seem like having one's cake and eating it too—of course, the phonetics and the phonology are not entirely independent of one another, but rather interact in determinative ways, some of which are identified below.

As another example, Wetzels and Mascaró (2001:227–228) cite postlexical obligatory regressive devoicing in Parisian French (a voice language) as necessitating reference to [–voice] because of the assimilation toward voicelessness that is exemplified in the clusters listed in 7.

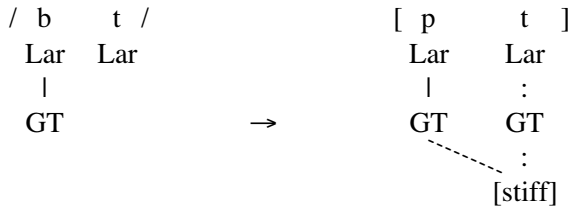
(7) Parisian French regressive devoicing (obligatory, postlexical)

distin[kt]if	'distinctive'	(cf. distin[g]uer])
su[pt]tropical	'subtropical'	(cf. su[b]alpin])
pro[ʃt]er	'throw'	(cf. pro[ʒ]ette])
a[ps]or[ps]ion	'absorption'	(cf. absor[b]er)
a[ps]sor[pt]if	'absorptive'	(cf. absor[b]er)

But rather than make crucial reference to [–voice], Parisian French postlexical assimilations to voicelessness like *su*[pt]*ropical* 'subtropical' can be defined on the [stiff] property that is present phonetically (albeit not phonemically) among voiceless stops in this voice language. Regressive absorption of redundant [stiff] into voiced ([slack]) obstruents in turn forces displacement of [slack], as [stiff] and [slack] are mutually incompatible gestures, and results directly in the surface voicelessness of phonemically voiced stops without reference to [–voice]. In 8, a comparison is presented of a Parisian French heterogeneously voiced cluster at the phonemic level versus its realization at the phonetic level. Phonemically, the Glottal Tension dimension marks the voiced obstruent /b/, implicating the gesture [slack] by default, whereas the obstruent /t/ is laryngeally unmarked. Phonetically, however, Glottal Tension accrues also to [t] as an enhancement of the two-way contrast, simultaneously implicating [stiff]—a gesture inhibitory of voicing in obstruents—in maximal differentiation with the [slack] posture of [d], which is facilitative of voicing. Postlexical regressive devoicing is then effected via the leftward spread of [stiff] from [t] into the Glottal Tension dimension of /b/, thus devoicing it to [p].

https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

(8) Parisian French underlying vs. derived surface laryngeal representation: /b+t/ → [p+t]



As stiffness is an inhibitor of vocal-fold vibration, the voicelessness emerging in Parisian French clusters need have nothing to do with a putative [–voice] specification; instead, it can and arguably should be attributed to the regressive extension of redundant [stiff], which causes cessation of vocal-fold vibration under the low transglottal airflow conditions of an obstruent.[4] Notably, this adjustment is necessarily superficial, or postlexical, as the [stiff] property is not available for manipulation in the contrastive portion of the phonology. In this sense, the replacement of [–voice] by privative [stiff] can hardly be claimed to be a notational variant, for in a voice language like French the gesture [stiff] is strictly an enhancement of the contrast with voiced obstruents that are marked by the phonemic Glottal Tension dimension (with its default phonetic gesture [slack]). Reference to [stiff] is thus available only in the superficial portion of the phonology, not throughout, as would be either value of the binary feature [±voice]. The prediction is that assimilation to voicelessness in a voice language like French will exhibit postlexical properties (exceptionlessness, phonological phrase domain), not lexical ones (morphological restrictedness, word domain). This correlation entirely escapes a [–voice] analysis, and Wetzels and Mascaró categorize Parisian French as exhibiting "postlexical voicelessness" by stipulation rather than by prediction.

Wetzels and Mascaró (2001:228–230) go on to present Ya:thê (Macro-Jê, spoken by the Fulniô Indians in northeastern Brazil) as another language calling for the phonemic status of voicelessness in the form of [–voice], but they contend also that the Halle and Stevens (1971)

[4] As "gestures" like [slack] first come into play in the phonetics, the statement in 8 is made somewhat simpler by holding off the default provision of [slack] in /b/ until more specific adjustments (viz., the leftward extension of [stiff]) have been effected. This obviates the need to displace [slack] in the rule, which would be automatic in any case in view of its incompatibility with [stiff].

feature system can give a more insightful account of the laryngeal assimilations, largely because devoicing takes place also before inherently aspirated or [spread] stops, which are redundantly also [stiff]. Recast in privative terms, the Halle and Stevens features obviate binary [±voice] entirely, making available singulary [slack] and [stiff] as descriptively adequate replacements in cases like these for [+voice] and [–voice], respectively. In combination with [spread] (under Glottal Width), it turns out that the gesture [stiff] (under Glottal Tension) accommodates all of the facts Wetzels and Mascaró cite for Ya:thê, and by their own description does so in a more explanatory way. Thus, Ya:thê offers no definitive support for [–voice], and in fact confirms the more restrictive alternative hypothesis of privative representation as embodied in dimensional theory.

Wetzels and Mascaró (2001:235–237) also analyze Bakairi (southern Carib, State of Mato Grosso, Brazil) as another language that makes crucial reference to [–voice]. Though difficult to evaluate in view of the apparent complexities, their description is suggestive of a Germanic-like alternative employing [spread] as the marked property:

> "The general pattern of voicing is the following: word-initially, only voiceless obstruents can appear; in other positions, i.e., intervocalically, only voiced obstruents appear, except for one single position, where obstruents may appear as voiceless. This position can be the first or the second intervocalic position in root initial words ... or the first or second position counting from the left edge of the root if there are prefixes ..." (Wetzels and Mascaró 2001:235).

Without better knowledge of the language's sound system, it would perhaps be premature to substitute [spread] for [–voice], but so would it be to take its alternations as definitive confirmation of lexical [–voice].

3. Dutch cluster assimilations.

The apparently strongest argument Wetzels and Mascaró proffer for phonemic [–voice], however, is from the phonology of Dutch, a Germanic language whose obstruent system, at least with respect to stops, has the quality of a Romance-type voice language. As we argue in section 5 below, this may well be because of intense contact with early Romance dialect(s) at some point before we have solid records. In consequence, Glottal Tension is marked in Dutch voiced stops, voiceless stops are unmarked, and phonological voicing extends regressively, as

https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

exemplified in the forms presented under 9, adapted from van Rooy and Wissing 2001.

(9) Dutch regressive voice assimilation triggered by a stop (in part from Zonneveld 1983:299)

dwar/s+d/raad	[zd]	'cross-wire'
ka/s+b/oek	[zb]	'cash book'
mee/t+b/and	[db]	'tape-measure'
slui/t+b/alk	[db]	'gate'
smel/t+b/eker	[db]	'melting-pot'
ee/t+b/aar	[db]	'edible'
ka/s+p/ost	[sp]	'cashbook entry'
		[inherently voiceless cluster]
kaa/z+p/ers	[sp]	'cheesepress'
		[devoiced initial in the cluster]

When the final obstruent in the cluster is a fricative, however, it appears that assimilation moves in the opposite direction, progressively devoicing the fricative irrespective of any voicing inherent in the trigger obstruent, which ultimately must be voiceless in any event due to the effects of syllable-final devoicing.[5] Some examples of apparent devoicing in fricative final clusters are given in 10, also taken from van Rooy and Wissing 2001.

(10) Dutch (apparent) progressive voice assimilation affecting a fricative

boe/k+v/orm	[kf]	'book form'
har/t+z/eer	[ts]	'sadness'
han/d+v/at	[tf]	'taking hands'
drij/v+z/and	[fs]	'quicksand'

Wetzels and Mascaró distinguish the stop vs. fricative devoicings in Dutch as quoted here, implying a regressive rule triggered by stops, but a progressive rule affecting fricatives:

> It is [a] well-known fact that Dutch stop-final and fricative-final obstruent clusters show different voice effects. Fricative-final clusters are always voiceless (*o*/p + v/*allen* [pf] 'strike'), whereas

[5] Note that under our analysis, final devoicing in [GT] languages like Dutch or Polish is a different phonological process from final fortition in [GW] languages like German. The two processes are, however, prosodically unified under the notion of laryngeal-feature edge marking, following Holsinger 2000.

> stop-final clusters can be either voiced or voiceless, predictable from the rightmost obstruent in the cluster (*ka*/s + b/*oek* [zb] 'cash book', *hui*/z + k/*amer* [sk] 'living room'). Traditionally, the voicelessness of fricative-final clusters is explained as postlexical progressive assimilation of a [–voice] coda obstruent, which can be underlying, or derived by syllable-final devoicing. The process is postlexical because it also applies across word boundaries: *vij*/v/ /z/*onen* → *vij*/f/ /s/*onen* 'five sons', *laa*/t/ /v/*rij* → *laa*/t/ /f/*rij* 'set free'. (Wetzels and Mascaró 2001:231–232)

Inspired by an insight due to van Rooy and Wissing (2001), however, we suggest that the difference between the two types of obstruent clusters in Dutch need not be attributed to different assimilation rules operating in opposite directions, but rather can be seen to follow from a key, motivated difference in the representations. Thus, while Dutch stops and voiced fricatives generally have taken on the Romance-like qualities of a voice language, voiceless fricatives appear to have retained their Germanic aspiration-language heritage, marking fortis fricatives via the Glottal Width dimension. On this interpretation, the hybrid Dutch obstruent system has the phonemic laryngeal characteristics laid out in 11, in which voiceless stops are laryngeally empty, and voiced obstruents and fortis fricatives are laryngeally specified.

(11) Phonemic laryngeal representation of Dutch obstruents (Romance-like stops, Germanic-type fortis fricatives)

/t/	/d/	/z/	/s/
Lar	Lar	Lar	Lar
	|	|	|
	GT	GT	GW

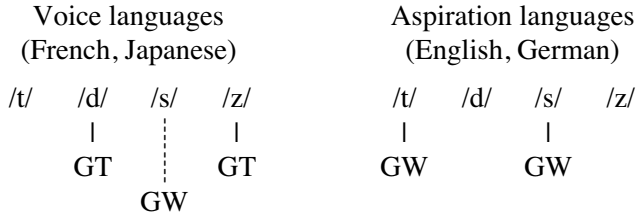
As elsewhere, Glottal Tension implicates [slack] by default, and Glottal Width implicates [spread]. But in retaining the Germanic system marking Glottal Width in fortis fricatives, the fricatives of Dutch become overspecified: either Glottal Tension or Glottal Width needs to be marked in order to distinguish the two series, but not both. The emergence of Glottal Tension in the system, which replaces Glottal Width in the stops, can be attributed to historical effects on Dutch from its Romance neighbors, presumably; and an explanation for why particularly the fricatives should have retained the now redundant Glottal Width marking can be found in the operation of a generalization governing voiceless fricatives in voice-language systems. Known as

Vaux's Law (per Avery and Idsardi's adaptation of Vaux 1998), this generalization is a phonetic enhancement, or over-differentiation, that provides a noncontrastive dimension to the unspecified member in a contrasting pair, much as described above in connection with the enhancement of stop distinctions in Parisian French. Vaux's Law affects just fricatives, however, ascribing to them the Glottal Width dimension whenever Glottal Width is not contrastive in the system. Thus, if a system contrasts a Glottal Tension (voiced) fricative with a laryngeally unmarked (voiceless) fricative, as in French /z/ vs. /s/, Vaux's Law entails that the unmarked fricative (/s/) will acquire the dimension of Glottal Width, the default gesture of which is [spread]. This generalization takes the form of the redundancy expressed in 12.

(12) Vaux's Law:
Laryngeally unspecified fricative in a Glottal Tension system → Glottal Width
(in systems contrasting fricatives without reference to [GW])

Postulated on the survey of fricative phonetics presented in Vaux 1998, this embellishment assures that voiceless fricatives in voice systems like French or Japanese will be articulated as fortis (that is, with an open glottis) even though voiceless stops in the system are unaspirated. For an aspiration language such as English or German, conversely, in which voiceless stops are heavily aspirated but so-called voiced stops are often not voiced at all, the Glottal Width dimension is contrastive in the fricative system as well, with the result that voiceless fricatives are inherently rather than derivatively fortis, whereas, parallel to the voiced series of stops, voiced fricatives are lenis and only weakly or coincidentally voiced. The two types of laryngeal systems, already alluded to, are schematized in 13 with the effect of Vaux's Law indicated by the dotted line.

(13)

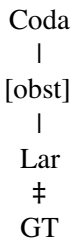


With respect to voicing, then, the phonetic difference between these contrasting phonological systems, which the theory captures directly, is

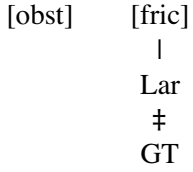
that voiced stops are thoroughly voiced in the voice languages because in these the Glottal Tension dimension is present (implementing its default gesture [slack]), whereas voiced (more accurately, lenis) stops are only partially or weakly voiced in the aspiration languages because these are not marked as having any inherent laryngeal qualities. Similarly, voiced fricatives in the two systems vary between consistently voiced (Glottal Tension present) and partially or derivatively voiced (Glottal Tension absent). But the phonetic effect of Vaux's Law is to render voiceless fricatives laryngeally largely the same across the two types, both marked by the Glottal Width dimension in association with its default gesture [spread]. The hybrid system of Dutch described in 11 is then precisely that of a voice language in which the Vaux's Law effect has been phonemicized—or rather has remained phonemic, since Glottal Width was already contrastive in the Germanic parent. The phonemic over-differentiation of voiceless fricatives in Romance-influenced Dutch is thus a representational legacy of the language's Germanic heritage, buttressed by the phonetic equivalence between laryngeally marked (Germanic) and unmarked (Romance) fricatives in the two systems that is engendered by Vaux's Law.

As a result of this redundant phonemicization, or "legacy specification," clusters in which the last obstruent is a fricative emerge as voiceless throughout because Dutch syllable-final neutralization devoices the first obstruent, and a similar neutralization affects fricatives that follow other obstruents. Rather than attribute the fricative neutralization to a special progressive (de)voicing assimilation rule, as is traditionally assumed (see 10, above), we consider that the special property of Dutch fricatives is that they lose their laryngeal marking when following another obstruent. Alongside the familiar syllable-coda laryngeal neutralization charted in 14, then, there is also post-obstruent neutralization of fricatives as shown in 15.

(14) Syllable-coda laryngeal neutralization

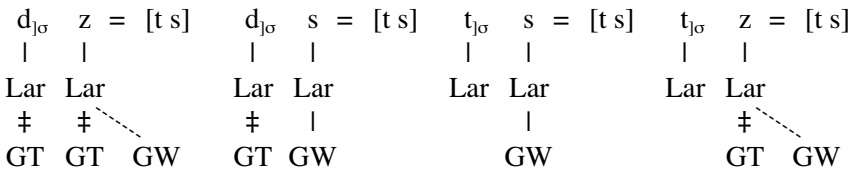


(15) Post-obstruent fricative neutralization



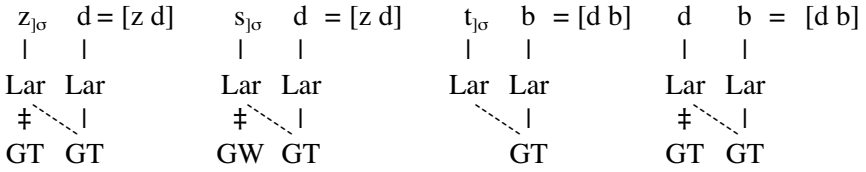
It thus appears that voice assimilation is progressive when the final obstruent in the cluster is a fricative, but on the assumption of 15 rather than of a progressive assimilation rule affecting clusters that end in fricatives, there is no assimilation among words like those in 10 at all. Instead, there is familiar syllable-final laryngeal neutralization in tandem with post-obstruent fricative neutralization, which, in turn, invokes Vaux's Law in Dutch, as illustrated in 16.

(16) Syllable-coda laryngeal neutralization and post-obstruent fricative neutralization remove Glottal Tension; Vaux's Law adds Glottal Width to derivatively unmarked fricatives



When the final obstruent in the cluster is a voiced stop, however, assimilation does take place, with the Glottal Tension dimension extending regressively into the preceding obstruent's vacant (or vacated) Laryngeal articulator, as shown in 17, while the general regressive assimilation process is developed in the coming section and formalized in 20 below.

(17) Syllable-final Laryngeal content delinks, triggering regressive spread of Glottal Tension



Thus, the entire range of regular (both real and apparent) laryngeal assimilations that Wetzels and Mascaró present for Standard Dutch is

https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

directly and elegantly describable without reference to [–voice], in full conformity with the hypothesis of privativity.

4. The behavior of *-de*.

There is one suffix that runs counter to these regular patterns of assimilatory distributions, however, which Wetzels and Mascaró take as the most persuasive motivation for reference to negatively valued [–voice] within the lexical component of the phonology. This is the past suffix *-de*; some examples illustrating its contrary directionality in laryngeal assimilation are listed in 18, along with infinitive, 2nd/3rd person present indicative singular and singular/plural imperfect forms given for comparison (from Wetzels and Mascaró 2001:232). After stems ending in a vowel, sonorant consonant, lenis fricative, or voiced stop, the stop initiating the suffix is voiced; but after stems ending in a voiceless stop or a fortis fricative it is voiceless.

(18)

INFINITIVE	PRES INDIC	IMPERFECT	PAST PARTICIPLE[6]	GLOSS
ma/k/+en	maa[k+t]	maa[k+t]e(n)	ge+maa[k+t]e	'make'
sto/p/+en	sto[p+t]	sto[p+t]e(n)	ge+sto[p+t]e	'stop'
kra/b/+en	kra[p+t]	kra[b+d]e(n)	ge+kra[b+d]e	'scratch'
ku/s/+en	ku[s+t]	ku[s+t]e(n)	ge+ku[s+t]e	'kiss'
ra/z/+en	raa[s+t]	raa[z+d]e(n)	ge+raa[z+d]e	'rage'
kno/r/+en	knor+[t]	knor+[d]e(n)	ge+knor+[d]e	'grunt'
ka/m/+en	kam+[t]	kam+[d]e(n)	ge+kam+[d]e	'comb'
kano+ën	kanoo+[t]	kano+[d]e(n)	ge+kano+[d]e	'canoe'

This pattern is just the reverse of that exhibited by other stop-final clusters, as exemplified by the selection of words in 9. In these cases, a syllable-final stop is subject to nonassimilatory devoicing, as are word-final stops (*han*[t] 'hand', *han*[d]*en* 'hands', etc.), but voicing that is present in a following stop will cause the entire cluster to be voiced (*han*[db]*al* 'handball'). The *-de* inflection is different, however: here /d/ gives up rather than propagates its voicing when preceded by an underlyingly voiceless obstruent. Wetzels and Mascaró (2001:232) conclude about this phonologically aberrant morpheme that: "The most straightforward analysis posits a rule of progressive [–voice] assimilation which specifically targets the past tense suffix, lexically represented as /də/. From this perspective, the Dutch past tense provides *prima facie*

[6] Note that Wetzels and Mascaró use the "inflected" or prenominal form of past participles.

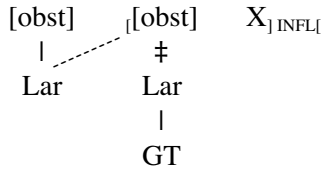
https://doi.org/10.1017/S1470542703000242 Published online by Cambridge University Press

evidence for lexical [–voice] spreading." Without actually writing the rule, they summarize this viewpoint more explicitly:

> The Dutch past suffix presents the only exception to the generalization that in stop-final clusters the rightmost obstruent determines the voice value of a cluster. The vowel-final verb stems show that the past tense suffix starts with a voiced consonant underlyingly: *kano+de* 'canoed-SG'. The most straightforward way to account for the voiceless variants like *schraa*[pt]*e* in a derivational analysis is to assume that there is a process of progressive [–voice] spreading. This process, which is restricted to the morphological category "past," or maybe just to inflection, is necessarily a lexical rule. (Wetzels and Mascaró 2001:234)

But under a theory that has no access to [–voice], an ad hoc rule such as that envisioned in this quote would have to take on a different form. In the privative framework of dimensional theory, an analysis accounting for the alternations in 18 would similarly posit /d/ as initial in the *-de* suffix, and then subject it to the simple (albeit morphologically restricted) rule in 19, Dutch Progressive Assimilation.

(19) Dutch Progressive Assimilation (restricted to inflectional syllables, i.e., *-de*)



In inflectional syllables, Dutch Progressive Assimilation abandons the Laryngeal articulator of a suffix-initial voiced obstruent in favor of that which occurs in the preceding obstruent. If the preceding obstruent is marked for Glottal Tension, so will be the /d/ (= [d]) in *-de*; but if the preceding obstruent is not marked for Glottal Tension, neither will be the /d/ (that is, it will be [t]). Elsewhere, of course, namely after sonorants, /d/ remains [d]. Thus, the /d/ of *-de* emerges as voiceless after voiceless stops and fortis fricatives, neither of which is marked for Glottal Tension

in Dutch, otherwise the /d/ remains voiced.[7] This is every bit as "straightforward" as the lexical rule alluded to in the quotation above, but 19, notably, makes no mention of the specification [–voice]. In fact, rather than spread features per se, this lexically restricted form of progressive assimilation extends from one segment (as it delinks in the other) the dimensional organizing node Laryngeal, an independently necessary constituent in the geometry that, when subordinating Glottal Tension under the scheme laid out in 11, represents the marked voiced stop type in Dutch, but when empty represents the unmarked voiceless type. In this way, via spread and delinking of the Laryngeal articulator, the oddness of the *-de* suffix is accommodated directly, with no reference to [–voice].

In view of the Elsewhere Condition (Kiparsky 1973, 1982), moreover, the specific rule 19 takes precedence over the general regressive voicing assimilation rule operating at the dimensional level, which is presented in 20, so that forms like *gestop+de* 'stopped' emerge as *gesto*[pt]*e* via 19, not **gesto*[bd]*e* via 20.[8] In short, the Dutch facts obtain on this analysis just as they have been described by Wetzels and Mascaró (2001), quite without reference to [–voice] or any other binary feature.[9]

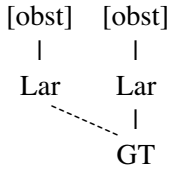
---

[7] In the manner described by Iverson and Salmons (1995, 1999), the [spread] quality of a fortis obstruent is consumed by the composite duration of the members of a cluster in which it is shared, so that no open glottis property is left over to leach into a following vowel following a cluster such as /sp/—hence, the stop in the cluster is not "aspirated" even though the glottis is specified as [spread].

[8] The Autosegmental Linking Condition (Hayes 1986) blocks syllable-coda neutralization in voiced clusters affected by lexically specific progressive laryngeal assimilation, as in *gekra*[b+d]*e* 'scratched' (Laryngeal node is shared due to [vacuous] progressive assimilation), hence the coda obstruents in these medial cases retain their voicing. Structures affected by general regressive laryngeal assimilation, as in *ka*[z+b]*oek* 'cash book', come to have a shared Laryngeal node too, but apparently only after the coda neutralization process has taken effect, that is, /z+b/ → /s+b/ → /z+b/; syllable-coda neutralization is not reapplicable then again by virtue of the Autosegmental Linking Condition. In uninflected *gekra*[p+t], however, the applicational precedence of syllable-coda neutralization affects both stops, presumably independently, at which point there is no GT element available to spread regressively, hence final /b+d/ → /p+t/.

[9] The solution proposed in Booij 1995 idiosyncratically underspecifies the /d/ of this suffix, which then adopts the voicing of the stem-final segment, even when this is a sonorant consonant or a vowel. We do not assume idiosyncratic under-

(20) Regressive Assimilation (general)



5. History, geography, and variation.

The discussion to this point has focused on the synchronic grammar of Algemeen Beschaafd Nederlands (ABN), or Standard Dutch. While that is obviously a legitimate object of study, Robinson's (2001) insightful investigation of German *ich*/*ach* assimilations reminds us of the need to look beyond standard languages to dialects and colloquial varieties, as well as to language history, in order to understand synchronic phonological phenomena. Thus, we turn now briefly to the question of how the Dutch system might have arisen diachronically, and then cast a glance at laryngeal assimilations beyond the standard language.

5.1. The history of Dutch laryngeal phonology.

Historically, the Netherlandic system evolved from a Germanic system where laryngeal distinctions were built on Glottal Width ([spread]); see Iverson and Salmons 1995, 1999. How, then, did Netherlandic move from such an aspirated-unaspirated (or fortis-lenis) system marking Glottal Width to a voiced-voiceless system marking Glottal Tension instead? Specialists have long speculated or presumed that contact with some variety or varieties of Romance led Netherlandic speakers to convert to a [voice]-oriented laryngeal phonology, perhaps as a substratal effect when former Romance speakers adopted a Germanic language and imposed their stop phonetics on the new variety.[10] And there is a pattern of highly suggestive evidence for Romance influence on Dutch pronunciation: Kloeke (1954), for instance, argues that not only the unaspirated character of the voiceless stops (which he calls a "curiously un-Germanic

---

specification here, and so cannot appeal to this type of solution, which at this contrastive level in our framework could not refer in any case to redundant voicing in vowels or other sonorants.

[10] Note that Yiddish underwent the same shift, under contact with [voice]-based Slavic languages. There too, we suggest, study of laryngeal assimilations will reveal phonological aspects of the Germanic heritage of Yiddish.

habit," 1954:5), but also the unconditioned fronting of <û> to [y:], vocalization of /l/ in codas (cf. Dutch *oud* vs. English *old,* German *alt*), and other features of Netherlandic pronunciation derive from what is sometimes called the *franse expansie*. The velar or uvular /r/ of Dutch has likewise been attributed to earlier French or Romance contact (Weijnen 1958:262–263), and some regional features of Netherlandic dialects almost certainly have Romance origins, like *h*-loss in the southwest or the presence of nasalized vowels (even outside of French loans) in some areas, see van Coetsem 1988:144–162.[11] Van Haeringen regards these Romance-like sound changes in Dutch as too numerous to be coincidental—though not secure enough to provide a smoking gun (1934:109–110)—but argues that such changes began in southern dialects, an area of intense contact and thus "een ideale sfeer voor ontlening" [an ideal realm for loaning] (1934:97). From there, he argues that these Romance-influenced innovations spread to the north and east. Other scholars have suggested that pre-Germanic substrate languages helped shape Netherlandic in a variety of ways, such as Gijsseling (1981) on "Belgic," but such work is yet more speculative. Just when and how contact might have led to the laryngeal characteristics of Dutch stops, or what languages might have been the source, is unclear, though, and a topic beyond the scope of the present paper. In short, we will not pursue speculation here about the nature of prehistoric language contact and shift; we merely note that the present account would fit particularly well with a Romance origin of Dutch stop phonetics and phonology.

Still, under almost any scenario of how this change in the Dutch "base of articulation" (cf. Iverson and Salmons forthcoming) from aspiration-language stops to voice-language stops took place, the attested mixed pattern retaining aspiration-language fricatives could have arisen even without assuming language contact. For speakers starting from a typical Germanic Glottal Width system in stops and moving toward a typical Romance Glottal Tension system, the difference in fricatives would not have been so salient. The basic phonetics of fricatives (that is, the relative ease of maintaining voicing in fricatives as compared with the difficulty of maintaining it in stops) in combination with the impact of Vaux's Law (which provides Glottal Width to underlyingly laryngeally unmarked fricatives in a system like this) brings about the result that both systems have relatively similar surface realizations. Where a

[11] But see Howell 1987, 1991 for arguments against Romance origins of uvular rhotics in Germanic.

difference would have been more apparent is in patterns of stop+fricative and fricative+stop assimilation. Here Dutch speakers of the time—either the generation caught up in the change or a later one—could have heard and learned patterns of assimilation more like those attested in the modern standard, a language codified from eclectic origins and built from an admixture of different dialects. But let us turn away now from such enigmatic questions, and toward the patterns of variation in attested Dutch.

5.2. Dialectal and stylistic variation, change in progress.
The kind of mixed system described earlier in this paper is naturally learnable, but, of course, overly marked. If marked systems are historically unstable, then one would expect a range of possible resolutions of this complex system in the dialects. The dialects, in fact, reflect the range of predictable solutions to the problem of systemic laryngeal change in the history of the language. For example, in compounds, dialects show a richer range than the standard: clusters of two dental stops, like *hand+doek* 'hand towel', reflect progressive assimilation in some dialects (*han*[t]*oek* in Antwerp), but regressive in others (*han*[d]*oek* in Limburg and North Brabant dialects, cf. Weijnen 1991).

Similar variability is attested with the preterite suffix *-de* as well. In some areas (e.g., Twente), regressive voicing wins out everywhere, like *wizde* 'knew' (standard *wiste*). Weijnen (1991) presumes, in fact, that there is a historical dynamic to the regressive vs. progressive patterns: progressive assimilation had its base region in Flanders, but regressive assimilation has expanded geographically over time. While this is often regarded as a morpheme-specific oddity in the standard language, the general pattern has been extended in some of the dialects. In voiced environments, for example, numerous dialects (Brabants, Flemish, Zeeuws) realize the 3sg. pres. *-t* as [d], according to Weijnen (1991:176), as exemplified in forms like the one given in 21.

(21) hij kom**d** al
'he's already coming'

Finally, even in Standard Dutch, the widely repeated "well-known facts" about stop-fricative vs. fricative-stop cluster assimilations are far less straightforward than the presentation by Wetzels and Mascaró suggests. Slis (1986:323) concludes his study of the phonetics of Dutch obstruent cluster assimilations as quoted here:

> The general phonological rule that obstruent-stop clusters show regressive assimilation … is not confirmed by the measurements of experiment I. On the basis of these results we conclude that if any preference for regressive assimilation exists in obstruent-stop clusters, this preference cannot be generalized into a rule.

In fact, Slis maintains that in carefully controlled experiments, progressive and regressive assimilation are roughly equally common, both within and across words, and that the position of stress before or after the cluster is a more important factor in determining the direction of assimilation than is continuancy of the obstruents.[12] The present framework is well suited to capturing such basic variability, in which the patterns of cluster assimilation are relegated to low-level enhancement and fully exposed to the vicissitudes of rapid speech and related factors. Of course, real generalizations can be made about the Standard Dutch data, as laid out here, but an appropriate account will also allow for variability in just this area of phonetic implementation, as revealed by our cursory glance at the historical and areal record along with instrumental phonetic evidence from standard speakers.

At the same time, the overly marked laryngeal system of the standard language shows signs of being leveled out. As one reviewer reminds us, in contemporary Dutch the initial contrast between /z/ and /s/ is marginal at best, and indeed many speakers have neutralized the distinction in favor of [s] (so that *zee* 'sea' and *c* '[the letter] c' are both pronounced [se:], much as many German dialects (southern and central) have only initial [s]. If /z/ loses voicing, that is to say, its Glottal Tension specification, then Vaux's Law will automatically supply Glottal Width to it (since Glottal Tension is then the only marked dimension in the system), which accounts for the fortis quality of the neutralized fricative. The pattern of merger is not limited to /z/, in fact, but appears to be spreading over time and space: Van de Velde, Gerritsen, and van Hout (1995:441) bring evidence showing that "[t]ussen 1935 en 1993 worden Nederlands stemhebbende fricatieven meer en meer stemloos uitgesproken"

[12] One more pattern of variability is the progressive devoicing in phrasal phonology, like *Is dat juist, op die manier?* 'Is that OK in that manner?', where *dat* and *die* are both realized with initial [t], not [d] (Booij 1995:61). We regard these as postlexical processes of just the sort illustrated above for Parisian French. The broader pattern of laryngeal assimilations in casual spoken Dutch has recently been investigated in depth by Ernestus (2000).

[between 1935 and 1993, Dutch voiced fricatives have increasingly been pronounced as voiceless]. This is especially true in initial position, but it is happening in medial position as well, they point out. Likewise, though contrary to their original hypothesis, the change is not limited to the Netherlands but is taking place even in Flanders, albeit only to a limited extent.

In summary, work on the historical development of Netherlandic suggests that the Romance-like stop system of the modern language is Romance-influenced. Buttressed by many previous studies, our analysis points to the laryngeal phonology of fricatives as an over-differentiated oddity in Standard Dutch phonology. The issue of fricative over-differentiation appears to have been resolved in many of the dialects, however, and changes underway in the modern standard language suggest that the marked patterns of fricative voicing are simplifying there as well.

6. Conclusions.

A number of conclusions emerge from the foregoing considerations.

First, single-valued, privative representation provides a more economical, parsimonious and constrained way of describing the patterns of laryngeal feature distribution in the world's languages. None of the arguments brought by Wetzels and Mascaró necessitates giving up those advantages, because equally or more insightful alternatives are available in which negatively valued features play no role.

Second, a well-defined role for phonetic implementation is central to maintaining the descriptive adequacy of privative representation. The analysis of Dutch developed here in the framework of dimensional theory provides further support for such an understanding of phonology, especially "enhancement" in the sense of Vaux, Avery and Idsardi, and Iverson and Salmons.

Third, diachronic and dialect data reveal persuasive support for "legacy specification" in Netherlandic, namely, the clear trace of Germanic aspiration-language laryngeal configurations in the fricative system while the stop system has evolved into a distinctly non-Germanic voice-language system, perhaps due to Romance language contact.

Finally, the patterns of variation found in Standard Dutch and its dialects underscore the validity of understanding cluster assimilations throughout the language in terms of the differing phonological specification between stops and fricatives, whose structural volatility emerges under conditions of phonetic implementation.

REFERENCES

Avery, J. Peter. 1996. The representation of voicing contrasts. Doctoral dissertation, University of Toronto.
Avery, J. Peter, and William Idsardi. 2001. Laryngeal dimensions, completion, and enhancement. In Hall, 41–70.
Avery, Peter, and William Idsardi. Forthcoming. Laryngeal phonology. Cambridge: Cambridge University Press.
Booij, Geert E. 1995. The phonology of Dutch. New York: Oxford University Press.
Coleman, John. 1998. Phonological representations: Their names, forms, and powers. (Cambridge Studies in Linguistics, 85.) Cambridge: Cambridge University Press.
Ernestus, Mirjam. 2000. Voice assimilation and segment reduction in casual Dutch: A corpus-based study of the phonology-phonetics interface. Doctoral dissertation, Vrije Universiteit Amsterdam. (Published 2000. Utrecht: LOT.)
Gijsseling, Maurits. 1981. Substraatinvloed in het Nederlands. Taal en Tongval 33.76–79.
Hall, Tracy Alan (ed.). 2001. Distinctive feature theory. Berlin: Mouton de Gruyter.
Halle, Morris, and Kenneth Stevens. 1971. A note on laryngeal features. Quarterly Progress Report of the Research Laboratory of Electronics 101.198–213.
Hayes, Bruce. 1986. Inalterability in CV phonology. Language 62.321–351.
Holsinger, David J. 2000. Lenition in Germanic: Prosodic templates in sound change. Doctoral dissertation, University of Wisconsin–Madison.
Howell, Robert B. 1987. Tracing the origin of uvular *r* in the Germanic languages. Folia Linguistica Historica 7.317–349.
Howell, Robert B. 1991. Old English breaking and its Germanic analogues. Tübingen: Max Niemeyer.
Iverson, Gregory K., and Joseph C. Salmons. 1995. Aspiration and laryngeal representation in Germanic. Phonology 12.369–396.
Iverson, Gregory K., and Joseph C. Salmons. 1999. Glottal spreading bias in Germanic. Linguistische Berichte 178.135–151.
Iverson, Gregory K., and Joseph C. Salmons. Forthcoming. Laryngeal enhancement in early Germanic.
Kiparsky, Paul. 1973. "Elsewhere" in phonology. A festschrift for Morris Halle, ed. by Paul Kiparsky and Stephen R. Anderson, 93–106. New York: Holt, Rinehart, and Winston.
Kiparsky, Paul. 1982. Lexical morphology and phonology. Linguistics in the morning calm, ed. by In-Seok Yang, 3–91. Seoul: Hanshin.
Kloeke, Gesinus G. 1954. De overgang van Hollands naar noordoostelijk Nederlands. De Nieuwe Taalgids 47.1–17.

Lombardi, Linda. 1991. Laryngeal features and laryngeal neutralization. Doctoral dissertation, University of Massachusetts at Amherst. (Published 1994. New York: Garland Press.)
Lombardi, Linda. 1996. Postlexical rules and the status of privative features. Phonology 13.1–38.
Robinson, Orrin W. 2001. Whose German?: The *ach/ich* alternation and related phenomena in standard and colloquial. Amsterdam and Philadelphia: John Benjamins.
Slis, Iman H. 1986. Assimilation of voice in Dutch as a function of stress, word boundaries, and sex of speaker and listener. Journal of Phonetics 14.311–326.
van Coetsem, Frans. 1988. Loan phonology and the two transfer types in language contact. Dordrecht: Foris.
van de Velde, Hans, Marinel Gerritsen, and Roeland van Hout. 1995. De verstemlozing van de fricatieven in het Standaard-Nederlands: Een onderzoek naar taalverandering in de periode 1935–1993. De Nieuwe Taalgids 88.422–445.
van Haeringen, C. B. 1934. Romaanse invloed door zuidnederlandse bemiddeling. De Nieuwe Taalgids 28.97–111.
van Rooy, Bertus, and Daan Wissing. 2001. Distinctive [voice] implies regressive voicing assimilation. In Hall, 295–334.
Vaux, Bert. 1998. The laryngeal specification of fricatives. Linguistic Inquiry 29.497–511.
Weijnen, Antonius A. 1958. Nederlandse dialectkunde. Assen: van Gorcum.
Weijnen, Antonius A. 1991. Vergelijkende klankleer van de Nederlandse dialecten. The Hague: SDU Uitgeverij.
Wetzels, W. Leo, and Joan Mascaró. 2001. The typology of voicing and devoicing. Language 77.207–244.
Zonneveld, Wim. 1983. Lexical and phonological properties of Dutch voicing assimilation. Sound structures: Studies for Antonie Cohen, ed. by Marcel van den Broecke, Vincent van Heuven, and Wim Zonneveld, 297–312. Dordrecht: Foris.

Department of Foreign Languages and Linguistics
University of Wisconsin–Milwaukee
Milwaukee, Wisconsin 53201 U.S.A.
[iverson@uwm.edu]

Department of German
University of Wisconsin–Madison
Madison, Wisconsin 53706 U.S.A.
[jsalmons@wisc.edu]