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Diachronic evidence in segmental phonology: the case of obstruent laryngeal specifications

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1. Introduction

One point has been expressed in many different ways in many different phonological models: there are two competing methods of modelling the types of laryngeal contrasts which are most frequently encountered in series of obstruents. In this paper,[1] I show how hitherto little-known diachronic data from the histories of non-reference varieties of English and German[2] weighs crucially on the issue as to which of these two traditions of analysis is correct. I show that the two sets of data are only interpretable on the assumptions of one of these two traditions, and I conclude that this tradition should therefore be retained, and the other rejected. As well as setting out a case for the adoption of one of two well known analytical traditions, and examining two intriguing sets of phonological data, this paper also illustrates how historical data can play a decisive role in phonological theorising. It is also of note that the two case studies investigated here both illustrate a little-discussed process type, which I call 'delaryngealisation'. Standard models of segmental structure predict that this type of process must exist, but this is often not properly

recognised. The importance of the data discussed here in this regard is also drawn out in what follows.

Questions of voicing, aspiration and allied concerns in the phonology of obstruents have long been a focus of phonologists' attention. They form one of the key areas of study in segmental phonology, and yet the basic disagreement outlined in this paper remains. As I show below, while there may be differences in the precise ways in which analyses are spelt out, they can nonetheless typically be assigned to one of two broad traditions in terms of how the set of laryngeal specifications that they assume are put to use in the modelling of phonological contrasts. This paper, therefore, firstly identifies these two traditions, considering how they make fundamentally different predictions in terms of what should be possible in naturally innovated phonological change. I then present two sets of data which confirm the predictions of one tradition and refute those of the other. In connection with this, as we shall see, the paper has implications for the analysis of the underlying laryngeal contrast in reference varieties of languages such as English and German.

The structure of this paper is as follows: section 1 introduces certain fundamental phonological assumptions which underlie much of phonology and the rest of this paper; section 2 sets out the state of debate in contemporary models of laryngeal phonology and outlines the framework-independent basic disagreement which lies at the heart of this article; section 3 introduces the two sets of diachronic evidence which will weigh on the debate identified in section 2 (these are the 'Inner-German Consonant Weakening' and the 'Southern English Fricative Voicing'); section 4 illustrates how the data sets are decisive in the debate between the two analytical traditions; and section 5 concludes.

1.1. Fundamental phonological assumptions

A set of basic background assumptions underlie what follows, all of which rest on long traditions in phonological theory. I assume that (i) phonological processes map underlying segments (or 'inputs') onto surface segments (or 'outputs'), (ii) such segments have an articulated structure (in terms of 'distinctive features' or 'elements'), (iii) the underlying segments of any individual linguistic system form a segmental inventory, (iv) these inventories are constrained according to (implicational, universal) markedness principles, and that (v) new phonological processes can be innovated into a phonological system in line with these markedness principles. Many of these assumptions cut across phonological frameworks, and indeed much of the discussion in

this paper will be framework-independent, as long as these basic assumptions are allowed.

While some of these assumptions are so well established in phonological thinking that they are hardly worth mentioning, others are not uncontroversial; nonetheless, I assume them as given here as considerations of space and appropriateness preclude their lengthy justification.[3] While these fundamental assumptions are widely held, they are implemented differently in different theoretical frameworks. The most crucial of these assumptions for what follows are (iv) and (v), which are arguably, two sides of the same coin. There are indeed several long traditions of argumentation in the study of markedness, universals and typology (see, for example, Trubetzkoy 1939, Greenberg 1966, Maddieson 1984), and these markedness statements have quite different formulations in different frameworks. So, for example, the same set of markedness generalisations could, by different authors, be ascribed to a set of I-linguistically innate universal principles, or could be seen as derivable from the set of features or elements assumed or their possible geometry, or could be thought to be due to universals of physiology, ergonomics, acoustics and/or perceptual pressures, or could be described as a reflection of a fixed (part of a) constraint hierarchy. The precise means of formalisation of such generalisations will, to a large degree, not be important for the purposes of this paper, the crucial point is that such generalisations are agreed to exist.

One eloquent and relatively neutral expression of this kind of markedness generalisation can be found in a now-classic phonological textbook:

> ... a sound change turning all instances of [p, t, k] into [b, d, g] has never been reported. If such a sound change were to take place, the resulting system would include a series of voiced stops but no series of voiceless stops. In other words, the Jakobsonian implicational universal whereby /b, d, g/ implies /p, t, k/ would be violated. As pointed out by Greenberg, any sound change which produces an impossible sound system (such as the one which would result from a change voicing all voiceless stops) is an impossible change.
>
> Hyman (1975, 17-18)

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[3] The attribution of ontological reality to segmental inventories, for example, is not easily compatible with a strong interpretation of 'Richness of the Base' (Prince & Smolensky 1993, Kirchner 1997). While this does not mean that questions relating to segmental inventories cannot be addressed in a phonology which respects the Richness of the Base, it will make discussion here much more straightforward to ignore it, as I do other quibbles with points (i-v) (of necessity, due to constraints of space).

This quotation neatly ties together the notions of markedness principles and universals with the idea that there are 'possible' and 'impossible' phonological innovations; that is, if phonological diachrony is constrained by principles of markedness, then there will be asymmetries within the set of changes which we can *a priori* imagine in terms of the possibility of their occurrence. Certain phonological processes which we might think are potentially possible, the claim goes, can, in fact, never be innovated through natural phonological change because they would violate universal principles of markedness. As Hyman (1975) states, these are impossible changes. The quotation is not slipped in here so innocently. It makes a claim about possible process types which would probably find general agreement among phonologists, and yet the two sets of data to be discussed in section 3 seem to falsify this claim outright. As we will see below, however, the data only *appears* to falsify this universal because the conventional analysis of it depends on a faulty theoretical model. The conclusion to be reached in sections 4 and 5 will rescue a form of Hyman's generalisation and back up the basic point.

A more recent and concise formulation of the point that Hyman makes is found in a key contemporary reference work:

> For the obstruents, the least marked category is voiceless, but the obstruents often show a contrast between [+voice] and [–voice].
>
> Cohn (2002, 200)

While this essentially makes the same point as Hyman (1975), it extends the basic markedness generalisation to all obstruents, taking in fricatives as well as plosives, something which will be of importance below. As we will see in section 2.3, this is an issue which requires some consideration.

To turn, briefly, to issues connected with the structure of segments, it is well known that different frameworks model structural issue in different ways. Approaches may make use of any of the following: a set of binary features, underspecification in underlying representations, a strict feature geometry, fully specified privative elements, and surface non-specification. Much of the discussion to follow is compatible with most models of segmental structure; indeed, it is arguably in the realm of laryngeal phonology that there is most compatibility and agreement between models.

Where the discussion forces a choice of terminology, it is chiefly cast in terms of privative units, as in the frameworks of Dependency Phonology (eg, Anderson & Ewen 1987, Ewen & van der Hulst 2001) and Government Phonology (eg, Kaye Lowenstamm & Vergnaud 1985, Harris 1994). Privative units are also commonly used in feature geometric models, however, (eg,

Clements 1985, Lombardi 1991/1994, Clements & Hume 1995, Iverson & Salmons 1995), especially in the description of laryngeal phonology, as we will see in section 2. This is part of the reason why much of the discussion below is essentially framework-neutral, because privativity is widely assumed in laryngeal phonology. One aspect of many models which make use of privative features or elements is that they allow for the *non-specification* of a segment for a particular feature, both underlyingly and on the surface.

One final, quite commonly made assumption, which will inform the discussion here, is that one type of possible phonological process is *decomposition*. This notion goes back at least to Lass (1976) and has been well developed in the Dependency Phonology and Government Phonology literature. Again, however, it also features in feature geometric work, such as McCarthy (1988), Keyser & Stevens (1994) and Fallon (1998). It is best known in connection with cases of debuccalisation, where processes such as those in (1) are modelled as the complete loss of oral specifications (perhaps under one or several supralaryngeal nodes).[4]

(1)   x   h   (initially in Germanic)
       s   h   (in codas in Andalusian Spanish)
       p   h   (widespreadedly in Kannada)

The analysis often given for such processes (eg, in Lass 1976, McCarthy 1988, Harris 1990) is that oral specifications are lost in the segments, while the laryngeal specifications remain, and are interpreted as [h]; this makes crucial use of the notion of non-specification, as the resulting segment has no specification for oral features. Such analyses also predict that the opposite type of process is possible: where laryngeal specifications are lost and oral specifications remain, a process which we might describe as *delaryngealisation*. Despite the tacit prediction of their existence in work on debuccalisation, processes of delaryngealisation are not typically described in the literature on such issues. They will, however, feature importantly in what follows.

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[4] While there is a significant distinction to be made in principle, I do not distinguish here between the use of a shafted arrow ('   ') for synchronic processes and an shaftless arrow ('>') for diachronic data. In many ways, but with certain clear caveats, the two phenomena can be seen as the 'same kind of thing'; see Honeybone (2001/2002) for a full discussion of the issues.

2. Laryngeal specifications: differences in details and the fundamental debate

Any model of segmental structure needs to account for the laryngeal phonology of the series of segments which occur in phonological inventories. The focus in this paper is purely on obstruent laryngeal phonology, and all else (place and manner specifications, for example) is put to one side. Indeed, the focus is narrower still – it lies on the type of contrasts that are found among series of obstruents in a set of frequently described languages. As we will see, there is a substantial disagreement on the best way to characterise this subset of contrasts.

In principle, such disagreements could exist in two main ways: (i) in terms of the *set* of subsegmental units used, or (ii) in terms of the way in which these units are *used* in the characterisation of segments. For the purposes of this paper, much of the disagreement that exists in terms of (i) is not of fundamental importance. The key debate is of type (ii), where two traditions of analysis can be recognised. While the disagreements of type (i) are not ignored completely below, we will see that the proposals which have been made in connection with them are, in fact, largely compatible with one another and can be fitted into the two basic traditions identified in terms of (ii). The laryngeal units which will be adopted in this section can be spelt out in various ways, in line with a range of theories as to the nature of subsegmental structure.[5]

The remainder of this section considers existing approaches to obstruent laryngeal phonology in some detail. Section 2.1 discusses the types of units that have previously been proposed to account for obstruent laryngeal specifications, as in (i). In section 2.2, I explain the disagreement, of the type (ii), on which the data in section 3 will weigh. In section 2.3, I focus on the status of fricatives in particular, and in section 2.4, I summarise the debate between the two fundamental traditions of analysis.

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[5] Although, as Uffmann (this volume) and Yip (this volume) consider, OT might lead us to reconsider the questions of whether and in what ways subsegmental units ('features') are arranged geometrically, this does not bring into question the assumption that there are such units. The sets of subsegmental units that are used in phonology have not changed under the influence of OT, so there are indisputably unbroken lines of theorising in this regard. All questions of the possible geometry of features can, in fact, be ignored in this paper, as nothing hinges on such issues.

2.1. Which laryngeal specifications are needed?

Many languages have two series of obstruents. This includes most European languages, such as English, Dutch, Spanish, German and French.[6] It is understandably traditional to transcribe the opposition in such series using the two series of base symbols which are available in systems such as the International Phonetic Alphabet (IPA 1999), as shown in (2).[7]

(2)   /p, t, k/   :   /b, d, g/

The bare minimum required to account for this opposition in terms of features or elements is either one binary feature, such as [+/− voice], or one privative unit, such as, for example [+/–voice], which can contrast with non-specified segments. It is uncontroversial, however, that more than just this one laryngeal specification is required in order to be able to characterise the contrasts which occur in languages with more than two series of obstruents, as in (3), for example:

(3)   /p, t, k/   :   /b, d, g/   :   /p^h, t^h, k^h/
                                                    Thai (Maddieson 1984)

       /p, t, k/   :   /p', t', k'/   :   /p^h, t^h, k^h/
                                                    Eastern Armenian (Maddieson 1984)

       /p, t, k/   :   /b, d, g/   :   /p^h, t^h, k^h/   :   /b^h, d^h, g^h/
                                                    Hindi (Iverson & Salmons 1995)

One influential system of specifications which has been proposed to account for all possible laryngeal contrasts is that of Lombardi (1991/1994). This abstracts away from phonetic detail to recognise six possible contrasting basic laryngeal types in stop systems, given with Lombardi's comments in (4).

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[6] As we will see below, this is not, in fact, true for all varieties of these languages. It is true for their reference varieties, however, and, as is common, but maybe unfortunate, I use the language names here to mean 'the reference varieties of English, Dutch, Spanish etc'.

[7] In this section and elsewhere I use symbols for plosives at the three cardinal places of articulation as shorthand for 'the obstruents of the phonological system', regardless of which obstruents actually occur in the systems.

(4) a. voiced glottalized (usually implosive)
     b. voiced
     c. voiceless
     d. voiced aspirate ("murmured")
     e. voiceless aspirated
     f. voiceless glottalized (usually ejective)

It is straightforward to apply this taxonomy to the languages from (3). In this way, Thai contrasts /**c** : **b** : **e**/, while Eastern Armenian has /**c** : **f** : **e**/, and Hindi has /**c** : **b** : **e** : **d**/. Lombardi proposes to account for the whole of this laryngeal phonology using only three privative features. These are reproduced here in the top line of (5), which also revisits the segment-types from (4). The table shows how the individual features are used to characterise types of segments. The plus signs simply indicate the presence of the feature in the make-up of a segment; where they are absent, the segment is considered to be non-specified for that feature. The table also includes a transcription for the segment-types involved. As we will see in section 2.2, there are real issues to be addressed in terms of transcription for certain languages.

(5)

	[aspiration]	[voice]	[glottalization]	**transcription**
voiceless				/p, t, k/
voiced		+		/b, d, g/
voiceless aspirated	+			/p^h, t^h, k^h/
voiced aspirated	+	+		/b^h, d^h, g^h/
voiceless glottalised			+	/p', t', k'/
voiced glottalised		+	+	/ɓ, ɗ, ɠ/

While Lombardi's approach is couched in a feature-geometric framework, the units assumed are entirely privative, which makes the proposal quite straightforwardly commensurable with those which have been proposed in models which only allow privative units, as we will see directly. Indeed, the area of laryngeal phonology is one of those where the notion of privativity has been most widely accepted in phonology. This approach, as shown in (5), also makes use of complete non-specification and of double specification. The plain voiceless stop is characterised by the absence of any feature; although no laryngeal activity is specified, the segment can still be heard thanks to the other (oral) aspects of articulation. The voiced aspirated and voiced glottalised segments are both characterised by the use of two features simultaneously.[8]

The approach outlined here is, for our purposes at least, essentially compatible with several other systems which have recently been proposed in the

literature on laryngeal specifications. These are Harris (1994), Iverson & Salmons (1995) and Jessen (1998). While there are differences among these authors in terms of the interpretation of the units that they use and the data and evidence that they discuss in connection with them, there is a broad comparability between their proposals, as shown in (6).[9]

(6)	Lombardi	Harris[10]	Iverson & Salmons	Jessen[11]
	[aspiration]	H	[spread glottis]	[+tense]
	[voice]	L	[voice]	[+voice]
	[glottalization]		[constricted glottis]	[+checked]

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[8] The only combination of features which does not occur is [aspiration] + [glottalization]. As a reviewer points out, this could be expressed through the assumption of a high-ranking constraint or principle such as *[asp, glot]. However, if the translation of these features into, respectively, [spread glottis] and [constricted glottis] (as illustrated below) is on the right lines, it may well be that this is not a constraint which needs to be provided by Universal Grammar. Rather, the nature of the vocal tract ('Universal Phonetics') precludes this combination, as it is impossible to both spread and constrict the vocal folds at the same time (this assumes that such actions are the prime or default exponents of these features). The gap in the attested set of combinatory possibilities in (5) would then be explainable on functional grounds.

[9] Uffmann (this volume) uses the same terminology as Iverson & Salmons, Botma (this volume) uses that of Harris, and Kim (this volume) that of Lombardi. While there can be differences in the implications involved in the assumption of one of these traditions rather than another, for the purposes of this paper, they are equivalent. Kim argues in favour of a position of essentially this type, with three privative features, and against the use of phonological length to capture this array of phenomena, but argues explicitly against the use of [spread glottis] and [constricted glottis] as they are not abstract enough. However, I believe many who use even these designations for the units accord them a relatively abstract interpretation in underlying forms, recognising that they are exponed in quite a wide variety of ways. The set of units adopted here are certainly intended to be abstract phonological entities. The ways in which they are exponed, or phonetically implemented, require careful consideration in their own right, although I lack the space to explore this here (for some discussion, see Iverson & Salmons 2003 and Iverson & Ahn, to appear).

[10] Harris (1994) does not discuss glottalised segments, and hence the fourth row is left empty here; we could, however, in the spirit of such work, add the element |ʔ| in this slot, in line with Botma (this volume).

[11] Jessen has recently worked with a [spread glottis]-based nomenclature, for example in Jessen & Ringen (2002).

As we will see imminently, some of the positions mentioned in (6) rest on long traditions, and there is a key note of disagreement between Lombardi and the other three systems in terms of their *use*. In most of what follows, I adopt essentially this three-member set of laryngeal specifications, although practically all of the discussion involves only two of these specifications. Rather than take over one of the sets of feature names, at the expense of the others, I refer to the units as in (7). This names the specifications relatively transparently and has them enclosed in vertical slashes (borrowing a convention of Dependency Phonology). The units given in (7) can thus be spelt out in various ways, for example using the systems given in (6). The accompanying descriptions in (7) are purely indicative, and are not intended to imply that all surface/output segments derived from a segment which is underlying specified in this way will necessarily have these characteristics.

(7) |spread| – in aspirated segments

        |voice| – in voiced segments

        |constricted| – in 'glottalised' segments, such as ejectives and implosives

Although it is included here for completeness, |constricted| will hardly feature further at all in discussion here. Rather, discussion will centre of the use of |spread| and |voice| to characterise the nature of oppositions in individual languages.[12]

2.2. How are these laryngeal specifications used?

Given the set of specifications adopted in (7), after those proposed in (6), the series of segments which occur in various languages can mostly be characterised quite straightforwardly. To return to the languages mentioned above, in (3), we can characterise the contrasts that they show as in (8).

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[12] The core of the set of specifications in (7) is also compatible in terms of the key points discussed below with the system of 'Laryngeal Dimensions' proposed in Avery & Idsardi (2001), as shown by Iverson & Salmons (2003) and Iverson & Ahn (to appear), especially once |constricted| is removed from the picture. For the purposes of sections 2.2 onwards, Avery & Idsardi's proposal can be translated as follows: |spread| = Glottal Width, and |voice| = Glottal Tension.

(8)   Thai .... non-specified : |voice| : |spread|
       Eastern Armenian .... non-specified : |constricted| : |spread|
       Hindi................................. non-specified : |voice| : |spread| :
                                                                    |voice|+|spread|

Where only two such series of obstruents occur, however, in what might be thought to be the most straightforward languages to describe, considerable debate has emerged as to their correct characterisation. It is here that the two traditions of analysis will diverge. In languages where these two obstruent series are typically transcribed as in (2) – repeated here as (9a) – two ways have been proposed to describe the contrast. The point is far-reaching. In principle it affects all languages which (i) have two series of obstruents, and (ii) are not analysed as having a contrast based on |constricted| (ie, which do not feature ejectives or implosives), and (iii) are not standardly considered to have a contrast based on aspiration. This applies to reference forms of English, German, Dutch, Hungarian, Russian, Serbo-Croat, Spanish, Welsh and many other languages.

One of the two traditions to be evaluated here can be regarded as the 'standard' position. On these assumptions, the obstruent series in all these languages are claimed to be analysed and transcribed correctly in (9a). Given the set of laryngeal specifications set out above, this means that the segmental characterisations should be as in (9b) – where 'non-spec' stands for 'non-specified'; to illustrate the translatability into other models mentioned above, (9c) shows how this can be translated into a model of laryngeal specifications which makes use of binary features.

(9a) /p, t, k/ : /b, d, g/ │ (9b) non-spec : |voice| │ (9c) [–voice] : [+voice]

This means, of course, that on this position, the underlying contrast in all the languages just mentioned is characterised in exactly the same way. Differences are described in terms of the phonological processes which derive their surface/output segments.

It what follows, I label this tradition of analysis 'tradition (i)'. The tradition has been given various names in the past and there have been many proponents of it, both those who view it as the 'obviously' correct type of analysis and do not overtly defend it, and those who have explicitly argued in its favour and against 'tradition (ii)', which I describe presently. Hall (2001) traces overt argumentation for this approach back to Lisker & Abramson (1964) and labels it the tradition of "broad interpretation of the feature [voice]" (2001, 32). Keating (1984) argues explicitly for this type of approach, and it is adopted

in Lombardi (1991/1994). Most standard descriptions of the languages concerned seem to adopt this approach (for example, Macpherson 1975 for Spanish, Booij 1995 for Dutch, Wiese 1996 for German and Hammond 1999 for English). It is, arguably, the 'unmarked', or standard position.

I label the opponent to this assumption in the battle of analytical traditions 'tradition (ii)'. It, too, has been given various names, and there are several recent and ancient proponents of it.[13] While it is not always described in this way, it seems to me that tradition (ii) crucially stems from a rejection of (9a), and this leads to a disagreement about (9b/c). As we shall see, the implications of this are considerable when they are drawn out. Proponents of the tradition often shy away from following these conclusions through, however, and the discussion in section 2.2.1 is intended as a corrective to this. Nonetheless, the tradition is coherent and is rooted in insights which have been made frequently in the history of phonology.

Hall (2001) traces overt argumentation for this tradition back to Jakobson (1949) and labels it the tradition of "narrow interpretation of the feature [voice]" (2001, 32). It is also, however, recognisable in the old 'Germanic' tradition which makes use of a distinction between *fortis* and *lenis* obstruents rather than a distinction of voicing (see, for example Sievers 1876 and Kohler 1984). Anderson & Ewen (1987) foresee many of the ideas in this position, and recent proponents include Harris (1994), who argues for it on independent phonological grounds, and Iverson & Salmons (1995, 1999, 2003) and Iverson & Ahn (to appear), whose argumentation for this position has perhaps been most influential. Jessen (1998) picks up and reinforces Jakobson's argumentation and terminology, while Jessen & Ringen (2002) provides further evidence while adopting Iverson & Salmons' terminology. Avery & Idsardi (2001) also argue essentially in this way, and, finally, Petrova (2001) and Honeybone (2001/2002) independently take this lead to investigate certain historical processes in the light of this tradition.

The essential difference between the two traditions is that tradition (ii) argues that there is, in fact, a distinction to be made between (at least) two subsets within the set of languages which have two series of obstruents and which are not analysed as having a contrast based on |constricted|. Thus a division has to be made among the group of languages mentioned above (English, Dutch, French, Russian, Serbo-Croat, Spanish, Welsh and others).

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[13] In Honeybone (2001/2002) I describe this position as 'laryngeal realism', and I return to this label in the final section.

Key issues in this controversy relate to the fact that languages with two series of plosives (and this argumentation is at least partly transferable to series of other types of obstruents, as we shall see in section 2.3) differ from each other, both in terms of the segments' static phonological patterning and in terms of their dynamic phonological behaviour. In the discussion to follow, I call these two key linguistic sub-groupings; '**type A**' languages, which group (reference varieties of) English, Icelandic and German, for example, and '**type B**' languages, which include (reference varieties of) Serbo-Croat, Dutch, Hungarian and Spanish and others.[14]

The characteristics of type A languages are that (i) the 'voiceless' stops are aspirated, at least in most or many environments, (ii) the 'voiced' series show inconclusive evidence of spontaneous voicing, and (iii) it is typical to find assimilation to 'voicelessness' in clusters, and not to 'voicedness', thus sonorants are often seen to devoice when adjacent to underlyingly 'voiceless' obstruents, as in English *plan* [pl̥an], *treat* [tɹ̥iːt], *crud* [kɹ̥ʊd], and German *Platz* [pl̥ats] place, *Krach* [kʀ̥aːχ] noise.[15]

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[14] I leave open, for the moment, the question of whether more than two types of languages need to be recognised in this regard, although it may be clear that tradition (ii) allows for this in principle; I return to this question, briefly, in section 2.3 and the next note. The recognition that tradition (ii) *allows* for an underlying distinction between at least 'type A' and 'type B' languages in principle (which tradition (i) does not) is essentially all that is needed for the purposes of this paper. The precise ways in which languages are assigned to these two 'types' in this section is heuristic and not necessarily final.

[15] This type of argumentation is set out variously, and in more detail, in Harris (1994), Iverson & Salmons (1995), Jessen (1998), Petrova (2001) and Honeybone (2001/ 2002). The analysis of 'sonorant devoicing' given here is essentially compatible with that of Botma (this volume), where |H|, translated here as |spread|, is shown to be responsible for the 'devoicing' of sonorants in many situations. The facts of sonorant devoicing in English and German are somewhat more complicated than the simple presentation given here implies, however, especially in connection with the behaviour of fricatives (see, for example, Tsuchida, Cohn & Kumada 2000 and the discussion in section 2.3 of this paper), nonetheless, I believe the essential points made here stand. As a reviewer also points out, languages which otherwise exhibit the properties of type B languages may exhibit signs of sonorant devoicing of this type. This may either be indicative of the fact that they represent another 'type' of language, using both |spread| and |voice| underlyingly, or that the 'Laryngeal Dimensions' approach of Avery & Idsardi (2001) is on the right lines. These points are addressed from a tradition (ii) perspective in Iverson & Salmons (2003).

In type B languages, in contrast, (i) the voiceless series are unaspirated, (ii) the voiced series are typically fully voiced, and (iii) it is common to find assimilation to voicedness in clusters, thus, for example, assimilation occurs in Dutch compounds (and elsewhere), as illustrated in *potdicht* [pɔddɪxt] 'tight' and *kookboek* [kogbuk] 'cookbook' (from Booij 1995), and in Hungarian, as illustrated by *kút-ban* [kuːdbɔn] 'in a well' and *liszt-böl* [lizdbœl] 'from flour' (from Siptár & Törkenczy 2000).[16]

While both traditions of laryngeal analysis can acknowledge and account for these facts using a number of phonological processes, most importance has been placed on them in tradition (ii). Tradition (i) simply maintains the analysis in (9): the underlying laryngeal contrast in both type A and type B languages is underlyingly the same, and a set of phonological processes derive the allophonic/surface/output differences between the two sets of languages.

Tradition (ii), in contrast, maintains that the laryngeal opposition in type A languages is made using a different subsegmental unit to that which is used in type B languages. This is a major difference between the two traditions, and, as we will see, it means that they make different predictions as to what is a possible phonological innovation. I turn to this issue in due course; for the moment it is important to be clear as to precisely what the claim of tradition (ii) is. In terms of the set of laryngeal specifications adopted in (7), which, it should be remembered, can be spelt out in various ways, as shown in (6), the essence of tradition (ii) is shown in the difference between (10b) and (11b).[17]

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[16] While such languages have also been described as featuring assimilation to 'voice-lessness', this can be reanalysed for example as the delinking of |voice|, see Lombardi (1991/1994); in any case this does not destroy the asymmetry between type A and type B languages, as formulated above, because there is still no assimilation to 'voicedness' in type A languages.

[17] These featural characterisations of the segments could also be translated into binary features, with (10b) characterised as [−spread] *vs* [+spread] and (11b) as [−voice] *vs* [+voice]. From here on, I mostly only give privative characterisations of such contrasts. Work such as Wetzels & Mascaró (2001) argues forcefully against the prevailing consensus that laryngeal features are privative, although even this work must presumably allow for a |spread|-like feature, to account for the facts in (3)/(8) and for surface aspiration in most Germanic languages. Note that, while the specific linguistic analyses in Wetzels & Mascaró (2001) must be wrong if tradition (ii) is right (and see Iverson & Salmons 2003 for arguments that they are), the actual set of features which Wetzels & Mascaró must assume is not in itself incompatible with tradition (ii).

In (10a) and (11a), I push this essence of tradition (ii) to its logical conclusion and transcribe the actual types of underlying contrast which are assumed for type A and type B languages in this tradition.

(10a) /p, t, k/ : /pʰ, tʰ, kʰ/   (10b) non-spec : |spread| type A
(eg, English, German)

(11a) /p, t, k/ : /b, d, g/   (11b) non-spec : |voice| type B
(eg, Spanish, Russian)

This may strike the reader as radical. However, (10a) simply draws out and makes explicit the assumption which tradition (ii) unavoidably commits itself to: the contrast in type A languages is based on aspiration, not voicing. The implications of this position are explored in some detail in what follows (and in further detail in Honeybone 2001/2002). In support of this position, we can note that the most detailed investigation into the phonetic properties of the obstruents of German (a type A language) – the work of Jessen (eg, 1998) – reports on the results of instrumental investigation into the acoustics and articulation of German obstruents. In terms of the two series of plosives in German, he argues that voicing is simply not the basis of the contrast. Aspiration, on the other hand, is very robust in key environments and he takes this to support the assumptions of tradition (ii).[18]

2.2.1. Symbols for segments

If tradition (ii) is accepted, then the symbols which are standardly used in segmental transcriptions are confused; this is because the 'standard' approach is essentially that of tradition (i), as explained above. In the view of tradition (ii), therefore, the sets of symbols /p, t, k/ and /b, d, g/ have been used in such standard practice to transcribe what are, in fact, two different types of phonological object each (thus the two series of symbols have been used to transcribe three different types of phonological objects in all).

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[18] On tradition (ii) assumptions, allophonic surface variation must still be accounted for: this will need to involve deaspiration of underlying /pʰ, tʰ, kʰ/ in certain environments (for example, in intervocalic, foot-internal environment) and through passive voicing of /p, t, k/ in intersonorant environments.

It will thus be helpful, when weighing up the two traditions in section 3, to give segments symbols which are unambiguous. This means that we will need to make a distinction between the symbols used to transcribe the obstruents of type A languages and those of type B languages, just as we would for those of languages which contrast plain plosives with |constricted| plosives. This is, in fact done in (10) and (11), but this conflicts with the usage of the same symbols in (9). In this and certain following sections, therefore, I adopt symbols which can be used on the assumptions of tradition (ii) to transcribe the obstruents transparently with respect to their laryngeal specifications. There are not enough base symbols in systems such as the IPA for all the types of obstruents discussed here, but diacritics can be used to achieve clarity. This is, of course, already the case for |constricted| languages, where it is conventional to use /p', t', k'/ for ejectives, for example.

A symbol is proposed in (12) for each of the three types of segment which are thought to occur underlyingly on tradition (ii) assumptions in languages like English, German, Spanish and Dutch. The exemplification features both plosives and fricatives, at the canonical three places of articulation. I turn to focus on the status of fricatives in the next section.

(12)
'neutral', 'voiceless' **non-specified**	'voiceless aspirated' **|spread|**	'voiced' **|voice|**
p^o	p^h	b
t^o	t^h	d
k^o	k^h	g
f^o	f^h	v
s^o	s^h	z
x^o	x^h	

The transcriptions in (12) need some explanation. While it is not perhaps strictly necessary, (12) makes overt which segments are underlyingly non-specified through the use of a non-IPA superscript diacritic 'o'. This is reminiscent of the IPA diacritic used to represent devoicing, but is also intended to be different, as it does not imply that any phonological process has applied to the segments concerned. It is also worth noting here that, just as /b, d, g/ need not always surface as fully voiced, or indeed as /p^h, t^h, k^h/ need not necessarily surface as aspirated, this goes all the more for /f^h, s^h, x^h/. The symbols in (12) describe underlying specifications, and, because those plosives which have surface aspiration are typically transcribed using a superscript [^{h}], I have ex-

tended this usage here, logically. Petrova (2001) makes a similar proposal, but uses the convention /^{sg}/ for an underlying spread glottis specification, thus: /p^{sg}, t^{sg}, k^{sg}, f^{sg}, s^{sg}, x^{sg}/.

To take this one stage further, we can note that, therefore, under tradition (ii) assumptions, certain types of phonological segment have been represented in the spelling systems of languages in more than one way, and conversely one series of letters (eg ‹b, d, g›) has been used to represent more than one kind of phonological segment. To provide for absolute clarity, the correspondences for English and Spanish, as examples of type A and type B languages respectively, are given in (13).

(13) Letters   English   Spanish
      ‹p›   /p^h/   /p^o/
      ‹t›   /t^h/   /t^o/
      ‹k›   /k^h/   /k^o/

      ‹b›   /p^o/   /b/
      ‹d›   /t^o/   /d/
      ‹g›   /k^o/   /g/

2.3. Laryngeal specifications in plosives and fricatives

Most of the discussion of laryngeal specifications in tradition (ii), in this paper and elsewhere, has focussed on the analysis of the behaviour of plosives, and some reflection is in order when we widen the focus to include other types of obstruents, such as fricatives. There are two issues which arise in this regard, which are rather reminiscent of the two types of disagreement recognised at the start of section 2. These are (i) whether precisely the same set of subsegmental units as occur in plosives can also occur in fricatives (ie, whether contrasts between two series of fricatives can be made in all of the same ways as can contrasts between two series of stops), and (ii) whether a single language always makes the contrast between its series of plosives and series of fricatives (if it has both) in the same way (which was implicitly assumed in the recognition of type A and type B languages, above).

In terms of (i), I assume what I take to be the null hypothesis, which is that the laryngeal phonological possibilities in plosives and fricatives are in principle essentially the same. The essential points of this assumption are that: (a) as well as the hardly controversial |voice|, there is phonetic evidence that fricatives can be characterised by |spread|, or |constricted| – there are, for

example, fricatives with surface aspiration in such languages as Burmese, and there are ejective fricatives in such languages as Tlingit and Hausa (see Ladefoged & Maddieson 1996, 178-9); however, (b) if fricatives are underlyingly characterised by |spread|, we need not assume that they will necessarily have aspiration on the surface – this is because there is no clear release phase in fricatives, unlike in plosives, and the oral articulatory gestures in fricatives can be prolonged to be essentially co-extensive with the laryngeal gestures (although, of course, it is possible to time articulatory gestures to achieve surface aspiration, as in the just-mentioned Burmese, which contrasts [s, sʰ, z], as Ladefoged & Maddieson 1996, 179, show), and (c) there is no *theoretical* reason why the same two traditions discussed in section 2.2 should not be considered to apply equally to plosives and to fricatives.

In terms of (ii), some important work (eg, Vaux 1998, Tsuchida, Cohn & Kumada 2000, Iverson & Salmons 2003, Jansen 2004, to appear) has flagged up potential differences in terms of the patterning of plosives and fricatives in individual languages (although some of this work argues from a tradition (i) perspective, I think it can also be interpreted along tradition (ii) lines). For example, part of Vaux' (1998) argument is that languages may have different specifications in fricatives to those which they have in plosives; Tsuchida, Cohn & Kumada (2000) argue that this is the case for the variety of contemporary English that they investigate, and Iverson & Salmons (2003) argue the same for Dutch. It thus seems possible that tradition (ii) will need to recognise more than two 'types' of languages: 'type C' might use |spread| in plosives and |voice| in fricatives, and 'type D' might use |voice| in plosives and |spread| in fricatives. A reasonable null hypothesis remains, however, that specifications will be the same across obstruent classes within one language, unless there is evidence to the contrary.

None of these points are incompatible with the essential assumptions made here and below. On tradition (ii) assumptions, therefore, a type A (or type D) language might have the contrast in (14), where (14a) makes use of the symbols developed in section 2.2.1 at the three places of articulation which are shared by Modern English and German.[19]

(14a) /fᵇ, sᵒ, ʃᵒ/ : /fʰ, sʰ, ʃʰ/   (14b) non-spec : |spread|

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[19] Tsuchida, Cohn & Kumada's analysis of the fricatives of Modern English claims that they are not of the type in (14), and it is clear to me that further research is needed in the area of fricative laryngeal specifications, both in terms of their synchrony and diachrony. In any case, the situation reconstructed below for Old English rests on

This is possible even if the fricatives of the language are not typically described as being accompanied by Voice Onset Delay, as this need not be thought of as the necessary phonetic method of exponence of the specification; the action of controlled glottal spreading can occur in the production of a fricative just as it can in a plosive.

2.4. Laryngeal specifications: the two traditions

We saw at the start of this section that, in principle, disagreements could exist in connection with the set of units used to account for the types of laryngeal contrast found in languages in two main ways. These are (i) in terms of the *set* of subsegmental units used, and (ii) in terms of the way in which these units are *used* in the characterisation of segments. The section has identified a set of 3 such units which is broadly compatible with most of the work in this area. While the units used here are privative, they can be translated into binary features relatively straightforwardly.

The key theoretical issue on which the data to be presented in the next section will weigh is a disagreement of type (ii). We have seen that there are two competing traditions of analysis of the specifications found in languages with two series of obstruents. These traditions can be understood in terms of almost any set of laryngeal units, as disagreements of type (ii) are separable from those of type (i). The question as to which of these traditions is correct is naturally of some importance for theories of segmental phonology, and section 3 contributes to the debate between these two traditions through the presentation of crucial data from phonological change. In section 4 we will see that this data can only be insightfully understood according to the assumptions of one of these traditions. It should be clear that the two traditions make different predictions in terms of the principles of implicational markedness which were discussed in section 1.1, and the types of phonological change which they allow. This is because they envisage different sets of underlying segments and contrasts, among which different types of markedness relations may hold. It is this fact which will allow us to decide between the two traditions.

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solid ground thanks to comparative and other evidence, as shown in Honeybone (2001/2002). There is an interesting story to tell about the inheritance and change of laryngeal features in the fricatives of English since OE times, and I intend, later, to tell it.

3. Diachronic evidence for models of laryngeal specifications

Diachronic data is sometimes dismissed as uninteresting in phonological theorising. This is an unfortunate position to take, however, as such data can provide crucial evidence on one side or the other of a phonological debate. The phonological innovations that I introduce in this section will prove to be of fundamental importance for the debate between the two traditions of laryngeal analysis which was outlined in the last section.[20] As we will see, our knowledge of both innovations is well supported by various types of evidence, including the existence of present-day non-reference varieties of the languages into which they were innovated which still show their effects. Nonetheless, on one (and only one) of the traditions outlined above, they are predicted to be 'impossible changes', violating the long-cherished markedness generalisations, of the type discussed in section 1.1. In this section, the two changes are presented in their 'standard' interpretations. These interpretations are taken from philological and dialectological material, where phonological concerns of the type discussed in this paper are not much taken into account.

One key type of phonological change is the innovation of a synchronic phonological process. Such processes can remain active in the synchronic phonology of a language for a long period or can in due course be lexicalised into the underlying segments of a system.[21] In this section, two such processes are discussed which were long ago lexicalised into the underlying forms of the linguistic systems concerned. In section 3.1, I discuss a process which I label the 'Inner-German Consonant Weakening', and in section 3.2, I discuss the 'Southern English Fricative Voicing'. After the simple presentation of the data in this section, I return to both sets of data in section 4, to interpret them in the light of the discussion of laryngeal phonology from section 2.2.

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[20] Various types of evidence have been brought to bear in favour of one or other of the two traditions in previous literature, including evidence from acquisition, for example, by van der Feest, Fikkert, Kager, Kerkhoff & Zamuner who argue for tradition (ii), at the Old World Conference in Phonology in 2003, where a version of this current paper was presented. To my knowledge, this is the first time that the relatively little known diachronic evidence discussed here is considered in this connection.

[21] The latter type of change is known under various names, as well as 'lexicalisation'; Prince & Smolensky (1993), for example, refer to it as Lexicon Optimisation.

Structuralist historical phonology recognises several dichotomies among types of phonological change; one of these is between (i) processes which change the number of segments or contrasts (ie, mergers and splits) and (ii) processes which do not affect the number of contrasts (shifts in all realisations of a segment, and hence its underlying form). The change discussed in section 3.1 is a case of segmental merger, and that discussed in section 3.2 is a simple shift. The presentation of the data in sections 3.1 and 3.2 make use of 'standard' symbols, not those from section 2.2.1, in line with the general 'standard' philological nature of the presentation. The data all involves obstruent segments; that in section 3.1 involves plosives, that in 3.2, fricatives.

3.1. The 'Inner-German Consonant Weakening'

While it clearly occurred centuries previously, and earlier scholars had noted its effects, Lessiak (1933) is typically credited with being the first to recognise the processhood of this phenomenon. He called it the *binnenhochdeutsche Konsonantenschwächung* which I translate as 'the Inner-German Consonant Weakening' (the 'IGCW'). Kranzmeyer (1956) worked out further details of the process, which was not innovated in exactly the same way in all dialects. It was typically quite general, however, and took as its input the stops which are standardly described as 'voiceless plosives'. The process is typically described as having occurred across the board. König (1978, 148) describes the IGCW as being carried out in "allen Positionen" [= 'all phonological environments' – initial, medial and final] for a broad swathe of Central and Upper German dialects. The effects of the IGCW can be heard in many present-day non-reference traditional dialects (in the sense of Wells 1982), but they have not made it into reference forms of the language. The process is often situated as an aspect of Middle High German, and is described in Handbooks which deal with this period, and also in 'Histories of German' such as Paul (1944), Schieb (1970), Keller (1978) and Schmidt (1984).

The processes formulated here are based on the correspondences given in Albrecht (1881) and Bergmann (1991) for the city of Leipzig specifically, (the same correspondences are described more generally by Schmidt & Vennemann 1985 for the 'Upper Saxon' variety, and Bergmann 1991 pinpoints the area as the South Osterländisch variety of Upper Saxon). This variety displays the IGCW at its fullest extent, and the processes given in (15), therefore, represent the IGCW at its most extreme.

(15)   IGCW

p   t   k
  ↘   ↘   ↘
      b   d   g
  ↗   ↗   ↗
b   d   g
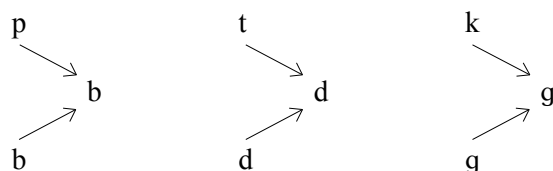
The High German Consonant Shift complicates matters, as it preceded the IGCW and removed certain occurrences of the plosives in question from the varieties into which the IGCW was innovated; however, not all such plosives had been affected by the shift and others had subsequently been borrowed back into these linguistic varieties. It was therefore clearly the case that there were two series of stops before the process was innovated and, after the process had been lexicalised (because it was entirely context-free this could presumably happen quite quickly), there was only one. The general picture for the IGCW is, thus, a set of segmental mergers as in (15).

Descriptions of modern dialects, as in the data in (16), are often explicit in advocating IPA transcriptions which use one symbol (such as [d]) for both of the synchronic reflexes of what was an underlying contrast in stops (such as between what is typically described as /t/ and /d/) before the innovation of the IGCW. It is doubtless true that in some varieties a minimal contrast in velar stops is maintained. However, Bergmann (1991) explicitly endorses the formulation given here; as well as the common merger in labial and coronal segments, he writes: "[i]n south Osterländisch NHG /k/ and /g/ have merged in a single phoneme /g/" (1991, 295).

It is not possible to present full philological support for this process here, due to the constraints of space, but the innovation rests on a clear bed of evidence (see Honeybone 2001/2002 for a fuller discussion and description of the available facts). The best evidence for the IGCW can be gained through the comparison of present-day dialect forms which exhibit the effects of the process with forms from dialects which do not. Such evidence is given in (16), which compares reference German forms, which retain the pre-IGCW segments (which are also shown in the first column), with forms from non-reference dialects which show the effects of the IGCW. The phonetic transcriptions for the non-reference varieties are taken from Albrecht (1881), Schübel (1955), Bock (1965) and Weldner (1991) and are reproduced as they appear in the sources.

(16)

p, b	reference German	*pakeːt*	'package'	reference German		*blɛç*	'metal'
	Barchfeld German	*bagɛd*		Waldau German		*blax*	
t, d	reference German	*tiːf*	'deep'	reference German		*drai*	'three'
	Waldau German	*d̄if*		Stadtsteinach German		*drai*	
k, g	reference German	*kartn*	cards	reference German		g*artn*	'garden'
	Leipzig German	g*ardn*		south Osterländisch		g*ardn*	

The evidence from such non-reference varieties, which are the descendents of those varieties into which the IGCW was innovated, shows no contrast in plosives in any environment, confirming the analysis of the IGCW as a set of segmental mergers among the series of underlying plosives. The mergers seem clearly to be transcribed as being in the direction of the 'voiced' stops.

3.2. The 'Southern English Fricative Voicing'

The process described in this section is relatively well known among English philologists and historical linguists, and yet, while its implications for laryngeal phonology have previously been noted, they have not been fully exploited. The process affected the set of fricatives in one (or, at least, not all) varieties of Old to Middle English. The fricative segments of English have had quite a complex history, which has generated quite some substantial discussion, and it is not possible to review all of this here. It is, however, important to distinguish the process discussed here from the situation in the construct of 'standard' Old English, as is typically described in textbooks.

The phenomena that I deal with in this section have been referred to as 'Old English Fricative Voicing' (for example, by Lass 1991-93) and as 'the Voicing of Initial Fricatives in Middle English' (by Fisiak 1984, for example). I use the phrase 'Southern English Fricative Voicing' (or 'SEFV'), which simply reflects the fact that the effects of the processes in question came to light in the historical orthographic record of Southern English; they can also, in fact, still be heard in present-day non-reference traditional dialects in certain parts of southern Britain, as shown below. The developments are described in Handbook-style treatments of English historical phonology, such as Ellis (1869), Sweet (1888), Wright (1928), Luick (1914-1940), Mossé (1952), Brunner (1965), Prins (1972) and Lass (1992). While we cannot be entirely sure of the precise area originally affected by the process, Fisiak (1984)

shows that the dialects of the whole of the South of England and parts of the West Midlands (but not East Anglia, or the East Midlands or any further north) show evidence of the process having been innovated into them.

It is widely recognised that there was only one series of underlying fricatives in Old English ('OE'). It is normal in the philological Handbooks to distinguish between two separate phenomena in dealing with the laryngeal states of these fricatives. The normal position is to describe one of these as the original OE situation, and to asume that this situation was sustained in Northern and Midland dialects; it is this which is often described for OE fricatives in textbooks. The other phenomenon is considered to be a southern innovation; it is this that we are dealing with here as the SEFV. In non- and pre-SEFV OE (ie, in the system retained in Northern and Midland dialects), there were two types of *surface* fricative segment. These differed in terms of their laryngeal specifications, and the difference between them is standardly described as 'voiced' *vs* 'voiceless'. These segments were in complementary distribution and it is normal to describe them as being related to each other by a phonological process of medial voicing. Lass (1994, 72) formulates this as a phonological rule, reproduced here in (17), where '(L)' stands for an optional liquid.

(17)   Non- and Pre-SEFV OE:

$$
\begin{bmatrix} f \\ \theta \\ s \end{bmatrix} \quad \begin{bmatrix} v \\ \eth \\ z \end{bmatrix} \quad / \quad V\,(L)\,\_\,V
$$

The underlying segments are assumed to be voiceless /f, θ, s/ because the majority of surface segments are of this type: in initial and final position [f, θ, s] occur, whereas [v, ð, z] occur only medially. This is not the SEFV. This is simply a common case of medial voicing, as has been described in many linguistic systems. This situation, as formalised in (17), was part of the phonology of pre-SEFV OE which was, in fact, the input to the SEFV. This historical input thus consisted of underlyingly voiceless fricatives which were contextually voiced on the surface.

The SEFV changed this situation substantially. It is typically described as having occurred domain *initially*. However, it is not clear that *any* 'voiceless' fricatives remained on the surface in the varieties where this process was innovated, as the domain-initial 'voiced' segments joined the medial segments which were already of that type. This forces us to the analysis of a change in

the underlying segments as the process was lexicalised.[22] If we follow Luick's (1914-1940) formulation (and add in the segment /ʃ/ which was derived from Germanic /sk/ clusters and which Fisiak 1984 and Lass 1991-93 show also underwent the process), the SEFV can be represented as in (18).

(18)   SEFV

      f   v
      θ   ð
      s   z
      ʃ   ʒ

The SEFV thus involved a shift of, presumably first surface, and then underlying segments, leaving only those on the right-hand side of the arrows in (18) in the underlying inventory. Just as was the case for the IGCW, we cannot discuss a full range of philological evidence for the SEFV here, although much exists (see Honeybone 2001/2002 for some further discussion). There is both evidence from Middle English texts, where non-standardised spellings reflect the fact that the process was innovated into the variety spoken by the writer, and from present-day non-reference varieties, which maintain the effects of the change, as descendents of those varieties into which the SEFV was innovated.

Some of the orthographic evidence is given in (19), taken from Luick (1914-1940). This compares Middle English spellings with Modern English spellings. The Middle English forms in (19) are from the text the *Ayenbite of Inwyt* where ‹u› is used where modern standard English spelling uses ‹f›, and ‹z› where modern standard English spelling uses ‹s›. The Modern English forms are indicative of both the input to the SEFV, which is also given in the first column in (19), and of the varieties of the language into which the SEFV was *not* innovated, as Modern English spelling is based on these varieties. The Middle English forms can only be interpreted as an attempt by the author to spell out the effects of the SEFV, which were that certain, southern, varieties of English had fricatives with different laryngeal specifications to other, northern varieties.

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[22] It may be that fricatives of the other type remained domain-finally, but even if this were the case, any reasonable analysis would be forced to assume a 'rule-inversion' type change (see Vennemann 1972) and assume that the underlying segments had changed following the lexicalisation of the process.

(19) f | Modern English   *f*ather | Modern English   *f*rom
      | Middle English   *u*ader | Middle English   *u*ram

      s | Modern English   *s*in | Modern English   *s*word
      | Middle English   *z*enne | Middle English   *z*uord

There is also evidence for the SEFV of the type given for the IGCW in (16). This comes from the phonology of present-day non-reference traditional dialects of English (in the sense of Wells 1982), and is presented in (20). This data is taken from fieldworker transcriptions of twentieth century southern non-reference dialects which were recorded for the *Survey of English Dialects* (see for example Orton 1962). These show (in the second column) transcriptions of initial 'voiced' fricatives where reference English has 'voiceless' segments (given in the first column).

(20)   *SED* evidence for the SEFV

f | [v] in *farmer*
θ | [ð] in *thumb*
s | [z] in *six*
ʃ | [ʒ] in *shilling*

This evidence indicates that the *SED* fieldworkers wanted to transcribe a difference that they perceived between the laryngeal state of the fricatives in these words in southern traditional dialects and those in reference English. While a *contrast* among two series of fricatives has developed in reference English since OE, no such contrast is recorded here. Rather, the fieldworkers equated the fricatives of these southern varieties with only one of the series which exist in present-day reference English – the 'voiced' series.

The presentation of the details of the SEFV in this section, and of the IGCW in section 3.1 has followed a relatively 'standard' approach, in line with the analysis of the data in the sources from which it was taken. It will not have escaped the attentive reader's notice that, on these analyses, both sets of data are potentially very problematic for laryngeal phonological theory, a point which I explore in the next section. Both the IGCW and the SEFV seem clear cases of counterevidence to the markedness principles discussed in section 1.1.

4. Interpreting the IGCW and the SEFV in the light of laryngeal phonology

The SEFV and the IGCW have in common the facts that (i) they involve changes in the underlying laryngeal specifications of the segments involved, and (ii) they are perceived by speakers and linguists as involving the innovation of processes which turned 'voiceless' obstruents into 'voiced' obstruents, that is, obstruents written, for example, ‹p, t, k, f, s› into those written ‹b, d, g, v, z›. Taken at face value, the two processes are clear counterexamples to the claim that voiced obstruents can only exist in a system if there are also voiceless obstruents, which we saw Hyman (1975) and Cohn (2002) express in section 1.1.

In his own treatment of the SEFV, Lass (1991-1993) discusses precisely this kind of phonological dilemma. He writes that the SEFV produces:

> ... a fricative system with only one lexical or non-derived glottal state, but ... voiced rather than voiceless. Is this legal? The answer seems to be no. According to the best recent survey (Maddieson 1984: ch2), there don't appear to be any languages like this; and ... the general uniformitarian principle [is] that we do not reconstruct for the past any *état de langue* that is in principle impossible at present ...
>
> <div align="right">Lass (1991-1993, 29)</div>

The SEFV thus appears to be an 'impossible' change, leaving an 'impossible' phonological system which conflicts with long-held phonological beliefs about markedness in segmental inventories.
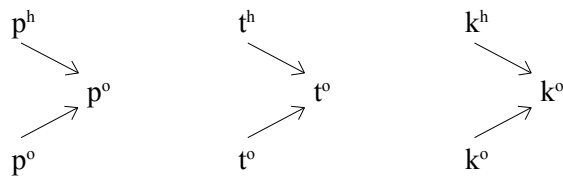
However, there is a way out from this unfortunate situation. The problems identified here are, in fact, only tied to tradition (i) of the analysis of the laryngeal specifications of segments. In line with this tradition, the only possible way to model these processes is as shown in (15) and (18) and we are either left with two impossible phonological processes, or we are forced to abandon the markedness principle and associated universals of phonological theory. It was made clear above that the presentation of data in section 3.1 and 3.2 proceeded with 'standard' assumptions. These are the assumptions of tradition (i). Lass (1991-1993) views the SEFV as being so problematic because he assumes that the underlying fricatives derived by it have to be characterised by |voice|.

If we interpret the IGCW and the SEFV in terms of tradition (ii), however, the problems of analysis disappear. On the assumptions of tradition (ii), we can analyse the changes as the innovation of processes which changed |spread| segments to non-specified segments, thus leaving only plain/neutral segments
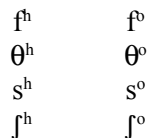
in the systems. In terms of the symbols introduced in section 2.2.1, these are /p^o, t^o, k^o/ in the IGCW and /f^o, θ^o, s^o, $\int^o$/ in the SEFV, and this is entirely compatible with markedness principles and with observed phonological universals. It is far from phonologically impossible for languages to have only one series of obstruents, but it is impossible for them to be specified by |voice|. Maddieson (1984) reports 50 cases of languages with only one series of plosives, which is 15.8% of his corpus; these all have plain voiceless segments, which we might analyse as being characterised by neither |spread| nor |voice|, and this is exactly what results from the two historical changes on this analysis.

On these assumptions, the two processes should, in fact, be represented as in (21) and (22).

(21) IGCW: take 2

$$p^h \searrow \qquad t^h \searrow \qquad k^h \searrow$$
$$\qquad \nearrow p^o \qquad \qquad \nearrow t^o \qquad \qquad \nearrow k^o$$
$$p^o \qquad \qquad t^o \qquad \qquad k^o$$

(22) SEFV: take 2

$$f^h \qquad f^o$$
$$\theta^h \qquad \theta^o$$
$$s^h \qquad s^o$$
$$\int^h \qquad \int^o$$

In order for this interpretation of the IGCW and the SEFV to work, we have to assume that: (a) neutral non-specified obstruents exist, (b) the inputs to the processes were characterised by |spread|, and (c) the outputs of the processes are perceived as 'voiced' segments because of the systems into which they were innovated. There is independent evidence for (b), and we can assume that the segments affected by the two processes were inherited as |spread| obstruents from Germanic. This evidence derives from patterns of assimilation in Germanic languages, subsequent phonological developments in other obstruents, and from the application of the comparative method to the contemporary forms of Germanic languages; it is discussed in detail in Honeybone (2001/2002). Point (c) is, in fact, predicted by tradition (ii). If, previously,

and in neighbouring varieties of the languages concerned, the set of segments written as eg, ‹b, d, g› are neutral segments and those written ‹p, t, k› are |spread| segments, then, when segments such as /pʰ, tʰ, kʰ/ lose their |spread| specification, they will be identified with those written ‹b, d, g›, that is, those which are standardly (on tradition (i) assumptions) described as voiced. The analyses of the data in (21) and (22) thus fare much better than those in (15) and (18). They are supported independently by the points just discussed, they are fully compatible with phonological theory and they rescue the long-cherished markedness generalisations expressed in section 1.1.

A further point noted in section 1.1 was that phonologists frequently deal with processes of segmental decomposition. It was noted that, while debuccalisation has often been described, the yin to this yang, delaryngealisation, has not, even though it is predicted by the model to occur. On tradition (ii) assumptions (and only on tradition (ii) assumptions), both the ICGW and the SEFV are cases of delaryngealisation. This is a positive result. If a model predicts the existence of a type of process, we should be able to find examples of it. I contend that the two diachronic developments described here are precisely that. Given all this, it seems that only one of the two traditions of laryngeal analysis is compatible with the data from the IGCW and the SEFV. This is tradition (ii).

5. Conclusions

The diachronic data discussed in this paper provide a perfect way to decide between the two traditions of analysis which were recognised in section 2. The IGCW and SEFV can only be insightfully interpreted on the assumptions of tradition (ii), a tradition which I label 'laryngeal realism' in Honeybone (2001/2002). The crucial conclusion from this is that tradition (ii) is the better way of accounting for the laryngeal contrasts in languages with two series of obstruents. This tradition allows both processes to be understood as a simple, if hitherto neglected type of phonological change: delaryngealisation. They both involve the loss of |spread| in the 'voiceless' series of obstruents. These changes seem natural and simple; they both consist in the loss of what can be conceived of as an articulatory gesture. This also makes the direction of the IGCW segmental merger quite expected, as the resulting single series was the unmarked, neutral set in the input phonological system.

I have further claimed here that the assumptions of tradition (ii) are, in fact, vital in order to reconcile the fact that the IGCW and the SEFV were naturally innovated phonological processes with fundamental assumptions

of phonology in the area of markedness. Tradition (ii) ('laryngeal realism') allows us to maintain these ideas, as it provides the analytical option that the segments created by the IGCW and SEFV were non-specified 'plain' obstruents, of the type which are, confusingly, often transcribed as /b, d, g, v, z, / in type A languages and as /p, t, k, f, s, x/ in type B languages. I have transcribed them here as /pº, tº, kº, fº, sº, xº/ for the sake of clarity. The markedness universal expressed in section 1.1 can be retained if it is recast to recognise that an unconditioned merger involving pʰ, tʰ, kʰ   b, d, g is impossible, as is pº, tº, kº   b, d, g, but pʰ, tʰ, kʰ   pº, tº, kº is fine, and we have seen that it occurs; we might further predict that b, d, g   pº, tº, kº can also occur (in fricatives as well as in stops).

All this indicates that we should accept tradition (ii) and reject tradition (i) as a means of characterising segmental laryngeal contrasts. The assumptions made here, following tradition (ii), have some far reaching implications for the phonology of type A languages, such as reference varieties of English and German. They also illustrates the important role that diachronic evidence can play in phonological argumentation.

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