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Laryngeal realism and laryngeal relativism: Two voicing systems in Polish?

Abstract
This paper argues against the 'what you see is what you get' bias in laryngeal phonology. It contains a new analysis of voicing in modern Polish, which incorporates phonetic interpretation into representation based phonology, and which assumes that the relation between the two aspects of sound systems is largely arbitrary. It is demonstrated that Polish in fact possesses two opposite laryngeal systems, corresponding to its two major dialects and yielding virtually identical phonetic facts, except for the phenomenon of Cracow sandhi voicing.

Key words:
voicing, phonological representation, phonetic interpretation, sandhi phonology, laryngeal realism, laryngeal relativism

Streszczenie
Laryngalny realizm i laryngalny relatywizm: Dwa systemy dźwięczności w języku polskim?
Niniejszy artykuł argumentuje przeciwko traktowaniu faktów powierzchniowych jako bezpośredniego wyznacznika reprezentacji fonologicznej w przypadku zjawisk dźwięczności. Zawarta jest tu nowa analiza systemu dźwięczności we współczesnym języku polskim, która integruje interpretację fonetyczną z reprezentacyjnym modelem fonologii i która zakłada, że relacja między tymi aspektami systemów dźwiękowych jest w dużym stopniu arbitralna. Wykazuje się również, że język polski posiada dwa przeciwstawne systemy laryngalne, korespondujące z jego dwoma głównymi dialektami, które jednakowoż odpowiadają za właściwie identyczne fakty fonetyczne, z wyjątkiem znanego zjawiska udźwięcznienia międzywyrazowego w tzw. dialektach krakowsko-poznańskich.

Słowa klucze:
dźwięczność, reprezentacja fonologiczna, interpretacja fonetyczna, fonologia międzywyrazowa, realizm laryngalny, relatywizm laryngalny

1. Introduction

Given a set of phonetic facts characterizing a voicing system with a two-way laryngeal contrast, such as: the phonetic shape of the two series, voice alternations due to final devoicing and various types of assimilations, is it immediately obvious what system we are dealing with in terms of phonological representation? This paper argues against the 'what you see is what you get' bias in laryngeal phonology, and proposes a new analysis

of the voicing complex in modern Polish, which incorporates phonetic interpretation into representation based phonology, and which assumes that the relation between the two aspects of sound systems is largely arbitrary.

For some time now, the phonological theory has distinguished between two main types of systems with a two-way laryngeal contrast (Harris 1994, 2009, Honeybone 2002, 2005, Iverson and Salmons 1995).[1] One of them is said to be represented by most Germanic languages and is characterized by a *fortis* / *lenis* distinction. Another way to express this division is to refer to the 'spread glottis' vs. 'non-spread glottis' languages rather than 'voiceless' vs. 'voiced'. The latter group, represented by Romance and Slavic languages, is assumed to base the opposition on the feature |voice| rather than on |spread glottis|.

In privative models of phonological representation (e.g. Avery 1996, Harris 1994, Honeybone 2002, Iverson and Salmons 1995, 2003b, Lombardi 1991, 1995b), the correlation between the phonologically marked and the phonologically unmarked obstruents in the two groups of languages is typically viewed as the following. In Germanic languages, the VOT lag, i.e. aspiration corresponds to the *fortis* segment which is marked with the feature |spread glottis|,[2] or element |H|, depending on the model, while the unmarked segment is voiceless unaspirated, or may be weakly or 'passively' voiced. In Romance and Slavic languages the marked segment contains |voice|, or |L|, which corresponds to full voicing (VOT lead) during the closure of stops, while the unmarked series are voiceless unaspirated.

One of the distinguishing factors among the privative models is the treatment of the unmarked series. Thus, in some traditions it is lexically underspecified but receives phonetic content (features) in derivation (e.g. Iverson and Salmons 1995, 2003b). In the 'laryngeal realism' tradition (Harris 1994, 2009, Honeybone 2002, 2005), on the other hand, no systematic level of phonetic representation is postulated at which more concrete representations are derived. The unmarked segment is non-specified and as such it is directly interpretable on language specific basis. This difference aside, however, what seems to connect the two privative traditions is a strong phonetic bias with respect to the analytical decision as to what actual phonological representation stands behind the observable surface facts. In other words, the presence of full voicing is taken to be the indication of the presence of the feature |voice|, or element |L|, while aspiration leads to the postulation of |spread glottis|, or |H|.[3] As shown above,

[1] This comment is limited to European languages and does not take into account the systems with glottalization, i.e. the feature |constricted glottis|.

[2] For uniformity reasons, throughout this paper I use the following bracketing convention: /xyz/ for symbolic phonological representation, [xyz] for phonetic forms, |x| for subsegmental features or elements.

[3] This outline simplifies things a little, but only a little. Authors do correlate the respective representations also with phenomena such as presence or absence of a particular type of assimilation. However, it seems that, again, while phonetically correct, alternative analyses of such facts may be given. It is often argued within privative frameworks that assimilation is possible only if the active feature / element is spread. If we talk about phonological assimilation only, it is correct. However, the fact that assimilation as a phonetic fact can be symmetrical, that is, both to voiced and to voiceless segments in e.g. Polish, suggests that there is also a phonetic or interpretational assimilation, which has little

this is the basis of the division into Germanic (aspiration) and Romance and Slavic (voicing) groups, which these traditions attempt to model privatively.[4]

While phonetically adequate, the major division into voicing and aspiration languages may well be wrong phonologically if translated directly. Taking the laryngeal realism view as a starting point, with its claim that the unmarked objects are simply non-specified and receive direct language specific phonetic interpretation,[5] I will attempt to demonstrate that a language like Polish, which is phonetically speaking a voicing language, in fact possesses two opposite laryngeal systems, corresponding to its two major dialects and yielding virtually identical phonetic facts when we limit our investigation to the domain of phonological word. However, the difference between the two systems, becomes apparent in the celebrated though poorly understood phenomenon of sandhi voicing. If the analysis to be presented below is correct, then 'laryngeal realism' will have to be supplemented with a fair dose of relativism as far as the correlation between phonetic cues and phonological categories is concerned. Crucially, it will be claimed that the phonetic interpretation of phonological representations of laryngeal contrasts does not boil down only to the decision as to the phonetic shape of the non-specified series. In fact, both the marked and the unmarked objects have to be interpreted in a largely arbitrary, language specific, manner. Full voicing in obstruents does not guarantee the presence of |L|, while |H| cannot be directly read off from the presence of aspiration.

The Polish facts, and the analysis proposed below, suggest that the relationship between phonetics and phonology is largely if not fully arbitrary. Paradoxically, this view allows us to reconcile two extreme positions taken by contemporary analysts with respect to the phonology – phonetics connection, of which one claims that phonology proper should be substance free, and the other, that phonetic theory has explanatory power. Both views may be correct at the same time. I begin with a sketch of what laryngeal realism is and a fairly uncontroversial definition of what is understood by 'laryngeal system' in this paper.

2. Laryngeal realism

The discussion in this paper is couched in a tradition of laryngeal realism (Honeybone 2002, 2005), and uses Government Phonology (GP) elements (Harris 1994, 2009). This tradition shares the privativity assumption with other frameworks (e.g. Avery 1996, Avery and Idsardi 2001, Bethin 1984, 1992, Lombardi 1991, 1995b, Iverson

to do with active phonological categories, but may be taken for such. The problem is that linguists usually only begin to look for phonetic causes of assimilation when in need of defending a privative system of representing contrasts. The position taken here is that first one has to make sure that we are not dealing with mere phonetics before we posit the phonological representation.

4 An interesting exception to the Germanic group is constituted by Dutch (Lombardi 1995a, Iverson and Salmons 1995, 2003b, Honeybone 2002, van Rooy and Wissing 2001) in that it appears to look like the Romance and Slavic languages in having a robust VOT lead in stops. The immediate analytical decision to assign |voice| to such obstruents on the basis of the VOT may well be wrong.

5 Throughout this paper the term 'interpretation' is used rather than 'implementation' or 'spell-out'. The terms are synonymous if we look from the perspective of 'laryngeal realism'. However, the latter two are strongly associated with derivational traditions.

and Salmons 1995, 2003b) claiming that laryngeal specification in phonological representation is privative, and that in each phonological system there should be one series of obstruents which is phonologically unmarked in terms of laryngeal categories. Thus, in a pre-contrast system — which only has one series of obstruents – no laryngeal specification is employed at all. An unmarked series is also present in two-, three-, or even four-way contrast languages. As mentioned earlier, what makes the laryngeal realism view different from other privative models is the claim that the unmarked objects are not underspecified in the sense that they must receive full specification in the course of derivation. Rather, the neutral objects are non-specified and receive phonetic interpretation as such. Naturally, the absence of a systematic phonetic level of representation in GP does not relieve the laryngeal realism view of the obligation to explicate how the representations are interpreted. These principles, albeit phonetic, allow for more accurate analyses of the actual phonological side of the system. In other words, for any type of laryngeal specification, the phonetic interpretation principles must somehow be made clear. Thus, phonological marking and the principles of phonetic interpretation together constitute a laryngeal system. This concept will be further developed below.

Given the two groups of languages mentioned above, namely, the aspiration and voicing ones, corresponding to Germanic languages on the one hand and Romance and Slavic on the other, the main two strands within laryngeal realism, that is, (Harris 1994, 2009) and (Honeybone 2002, 2005) provide the following representations of the contrasts.[6]

(1) *Phonological representations in a two-way system*

		Harris	Honeybone
a.	*aspiration languages* English, Icelandic, German	|H| vs. non-spec	|spread| vs. non-spec
b.	*voicing languages* Spanish, Russian, Polish	|L| vs. non-spec	|voice| vs. non-spec

Despite the different notations, Honeybone is in fact calling his categories 'elements'. Their articulatory definition is used in order to approximate their interpretability. Harris, on the other hand, treats his elements as abstract cognitive units which may be given both articulatory and acoustic/auditory definitions if need be.

The two types of languages broadly correspond to the traditional philological and phonetic division between the *fortis/lenis* languages, mainly Germanic, and the voiced/voiceless languages, mainly Romance and Slavic. The idea behind these distinctions is that two-way contrast systems cannot be boiled down to one – voiced vs.

[6] I ignore the third articulatory dimension, i.e. glottalization for which Honeybone (2002) proposes the element |constricted|. This is the category found in e.g. ejectives and implosives.

voiceless.[7] Rather, there are two main types of systems in two-way contrast languages, System (1a) has a contrast between the aspirated and the non-specified or neutral, while system (1b) contrasts voiced with non-specified. The big question concerns the phonetic shape of the non-specified series in both types of systems, an issue to which we return shortly.

Another characteristic feature of laryngeal realism which links it with other traditions is its view that the subsegmental elements should be mappable onto unitary phonetic concepts. In its generality, this statement is indubitably correct. A phonological contrast should be expressed in the phonetics. However, the common phonological practice involves what appears to be a wrong tacit assumption that there exists some sort of biuniqueness between the phonetic facts and phonological representation. This assumption transpires from the illustration in (1) and boils down to assuming that the presence of aspiration (VOT lag) means that the language employs the category |spread|, or the element |H|, and conversely, that the presence of this category must yield aspiration (VOT lag), while the absence of |spread| precludes aspiration. Likewise, the presence of full voicing (long negative VOT) suggests the presence of |voice|, or |L|. In short, this is a 'what you see is what you get' approach to phonological representation, which has a typological and didactic value, but does not help us understand the reality when confronted with a particular system, like Polish.

It is interesting that when phonological arguments are reached for in order to argue for a particular representation of a voicing contrast, they typically refer to assimilation as spreading of an active laryngeal category, or to final devoicing, which is assumed to be a case of delaryngealization. Both arguments are misleading and may be wrong. Van Rooy and Wissing (2001) neatly demonstrate that the so called voice assimilation, e.g. in Dutch, need not be due to |voice| spreading. It may well be connected with the fact that fully voiced obstruents (with long negative VOT) do spill over their voicing to the preceding segments as a universal phonetic fact and not as a phonological one. This suggests that if there is a system with long VOT lead in which the voicing is proved not to be connected with an active laryngeal category, the system is still expected to exhibit voice assimilation. This will be shown to be the case in Polish. Likewise, Harris (2009) convincingly argues that not every case of final devoicing is in fact phonological delaryngealization. All the above points strongly suggest that an analysis of a particular voicing system should do much more than look at the acoustics and the presence of assimilation and devoicing.

In what follows, I employ Harris's elements |H| and |L|, which seem to be more abstract than Honeybone's elements and allow for more variation.[8] Indeed, if the division into H- and L-systems could be done so easily on the basis of observable VOT values, half of the analytical job would be done by looking at the spectrograms. We

[7] See, however, Keating (1984) for a fairly successful account.

[8] Though it must be admitted that Harris's definitions of the elements as 'stiff' and 'slack' vocal folds, which clearly relate to the proposals in Halle and Stevens (1971), also seem to suffer from what Hale and Reiss (2000) might call 'substance abuse'. The proposal in this paper does not preclude a complete absence of phonetic substance in |L| and |H|. This point will be briefly returned to at a relevant stage below.

would also expect little variation between the actual phonetic details in individual systems. On the other hand, not only such details differ, but also they are difficult to understand under the view that VOT lead languages are L-systems, and VOT lag languages are H-systems. At least, as will be demonstrated presently, it would not be so difficult to understand the laryngeal system of Polish. It will be shown that a degree of relativity should be allowed to be involved in the relation between phonetics and phonology which allows at least some H-systems to pass for L-systems.[9]

3. What is a laryngeal system?

What is meant by the laryngeal system is the totality of phonological and phonetic aspects which are responsible for the observed phonetic facts, where phonology and phonetics are kept strictly apart,[10] and yet they form two sides of the same coin. The phonological aspects include the representation of the categorical distinction between the marked and non-specified consonants, the well-formedness conditions, which are responsible for the distribution of the utilized laryngeal category within the phonological word, and the phonological processes in which the active (present) category is manipulated by phonology. On the other hand, the phonetic aspects involve the necessary principles of interpretation, which are responsible for a particular phonetic realization of the phonological representations. The acknowledgement of the existence of phonetic interpretation principles does not reintroduce the systematic phonetic level of representation into GP. These principles have a status of a mere description of how the phonological representations are interpreted. They are more like the postlexical allophonic rules which were regarded as phonetic effects in standard generative models (e.g. Lombardi 1996). Schematically, our understanding of a system is represented below.

(2) *Laryngeal System* = *Phonology* (grammar-internal) & *Phonetics* (grammar-external)

Representation & *Computation*
- privative categories
- (un)licensing, spreading
- (de)composition

Phonetic interpretation
- universal principles
- language / system specific conventions (rules)
- sociolinguistic modifications

[9] In the Germanic group, this could be the case with Dutch, which has been deemed a voicing language (L-system) on the basis of the presence of full voicing in obstruents. This appears to be the assumption of, e.g. Honeybone (2002) who explains this anomaly — Dutch is a Germanic language, by claiming that a representational switch has occurred due to contact with Romance languages. It is contended in this paper that the contact may introduce a shift in interpretation without necessarily one in representation.

[10] The grammatical side of the system (phonology) involves abstract symbols and principles of their distribution as well as manipulation. Principles of phonetic interpretation are understood as grammar-external (e.g. Harris 2003).

The laryngeal system is a combination of phonology and phonetics to go with it, which relate to each other like two sides of the same coin. The system should not be understood as synonymous to observable phonetic facts. It is what underlies the observed phonetic facts. It is therefore possible that seemingly identical phonetic facts will be due to two completely different systems. Logically, only by considering the totality of the given laryngeal system, i.e. both phonology and phonetic interpretation principles, is one able to arrive at the correct phonological representation. Similarly, in language acquisition, learners sift through the laryngeal facts in order to tell the phonetics from the phonology that stands behind it. It will be shown that even the seemingly ambiguous systems have diagnostic phenomena to help the learner arrive at the correct system.

3.1. The phonological side

The phonological side of the laryngeal system is not restricted to representation. It also involves phonological processing, which in GP is mainly limited to licensing a given category in the representation, delinking under weak licensing and possibly spreading, or put differently, to composition and decomposition. In GP, most of the phenomena, follow from the general design of phonological representation, but some are due to an arbitrary computational decision in a given system. For example, the distribution of the laryngeal element in the phonological word is based on licensing. If unlicensed, the element is delinked. However, at which point, or in which contexts the system is unable to license the laryngeal category is an arbitrary systemic decision. Hence, final devoicing occurs in Polish but not in French or Ukrainian, which are assumed to have the same phonological representation of the laryngeal contrast. It is also arbitrary whether a given system allows its active laryngeal category to spread, and what types of segments will be targets of this spreading.

As far as the representation of laryngeal distinctions is concerned I follow the laryngeal realism with its privative elements, here |L| and |H|, and the concept of non-specification of the unmarked series. There are two important comments that need to be made at this point. Firstly, while phonology is kept distinct from phonetics the definitions of the elements, albeit abstract, do have a gross phonetic pattern, e.g. 'slack vocal folds' / 'low tone' and 'stiff vocal folds' / 'high tone' (Harris 1994). Secondly, although the interpretation of the non-specified series may be said to belong to the phonetic interpretation module, this is an area where phonetics and phonology directly interact, as will be demonstrated below. In particular, it appears to be insufficient to rely solely on universal phonetic principles here. The interpretations are to a great extent system dependent, and system, it will be recalled, is also phonology.

3.2. Phonetic interpretation principles and… rules

In a model in which phonetics and phonology are kept apart, the interaction between the two areas is to a large degree arbitrary. Yet, at the same time, we must admit that the principles of phonetic interpretation are system dependent, that is, they depend on the particular phonology too. This is only an apparent paradox. It all depends on what is understood by universal phonetic principles and what is and how is it system dependent. Very generally, it is assumed here that universal principles relate more to

types of segments than to types of subsegmental categories such as features or elements. An example of this type of principle is for example a default interpretation of sonorants as voiced, but not a default interpretation of |H|, or |spread glottis| as aspiration. The latter, is a result of a language specific phonetic interpretation rule.[11] Finally, the sociolingistic modifications, which will not be further discussed in this paper, add the individual or group properties to the system.[12]

As for the universal phonetic principles, below, I will refer only to two. The first one relates to the general aerodynamics leading to spontaneous vibration of vocal folds and its inhibition. The vibration of the vocal folds cannot be directly controlled. Rather, it is controlled indirectly by means of articulatory gestures that produce the aerodynamic context for spontaneous voicing to take place. In this sense, all voicing, if understood as vibration of the vocal folds, is spontaneous, but some types of segments require active gestures to allow for it, while other types of segments get it for free.[13] The different types of situations, that is, spontaneous, active or passive voicing will be discussed in more detail below, and supplemented with a fourth one.

The second universal phonetic interpretation principle to be used here refers to sufficient discriminability, both in production and perception between two series of obstruents in a two-way contrast system. It is this principle, that is directly responsible for the interaction of phonetics with phonology proper in that its task is to phonetically express the categorical distinctions provided by phonology within a particular phonetic space.[14] In effect, this universal phonetic principle is responsible for language specific interpretations of contrasts, that is, for language specific interpretation rules or conventions. This point will be elaborated on below.

As for the universality of phonological elements, the discussion goes well beyond the scope of this paper and will therefore be left for another occasion. If one strives to eliminate substance from phonological representations altogether, then even the rather abstract definitions of the GP elements would have to be viewed as emergent rather than inherent.[15] It is not impossible that even the gross patterns for elements may in fact be derived in acquisition, in which case the actual phonological categories might be deprived of phonetic substance completely. One argument in favour of such

[11] I use the term 'rule' deliberately. It is fairly accurate to refer to arbitrary relations between phonological (non)specifications and their phonetic interpretation. It will shortly become obvious, however, that the types of rules to do with interpretation of laryngeal systems are not entirely arbitrary in their nature, and a different term might be in order, for example, interpretation convention or pattern.

[12] In this respect, the phonetic interpretation side of the laryngeal system is almost identical to the one proposed in Lieberman (1970: 317), in which three types of implementation rules are distinguished: i) universal, ii) language specific, iii) individual.

[13] The active gestures are mere candidates for active laryngeal features in a privative phonological representation. Languages make an arbitrary selection in this respect, as will be shown below.

[14] For some phonetic proposals to do with utilization of phonetic space see, e.g. Liljencrants and Lindblom (1972) and Stevens (1972).

[15] I agree with propositions that phonology should be substance free (e.g. Ploch 1999, Hale and Reiss 2000), but not with the innateness of concrete elements or features that some of these authors propose (Hale and Reiss 2008). Truly substance-free phonology must view all its categories relating to the melodic level as emergent.

a move is the fact that, e.g. what relates substantively to the elements |I,U,A| in vowel systems as understood in GP can be easily 'derived' from longstanding principles of phonetics such as (sufficient) dispersion, quantal theory and their later refinements (e.g. Liljencrants and Lindblom 1972, Stevens 1972, Schwartz, Boë and Abry 2007). By Occam's razor, what can be determined by phonetics or in language acquisition should not be duplicated by phonological theory (Hale and Reiss 2000). This even more acutely begs the question of what the elements in GP are or should be, a problem that will not be solved here.

Before looking at the language specific principles of phonetic interpretation of laryngeal contrasts it will be useful to remind ourselves of some basic phonetic facts concerning the property of voice in speech sounds, as well as the voicing effects following from the workings of laryngeal systems.

4. Spontaneous, active and passive voicing

It was mentioned above that all voicing involves spontaneous voicing if viewed in terms of vocal fold vibration only. However, depending on the different types of segments, that is, sonorants vs. obstruents, and on the different phonological status of the obstruents, that is, marked vs. non-specified, we may distinguish three different situations to do with voicing. Later below, I will introduce a fourth one.

4.1. Spontaneous voicing

For spontaneous voicing to occur certain articulatory parameters and aerodynamic conditions must be met (e.g. Chomsky and Halle 1968, Halle and Stevens 1971). Notably, a sufficient drop in air pressure and air flow between the trachea and pharynx must be maintained. This occurs in the case of unoccluded speech sounds such as vowels and sonorant consonants which are not characterized by an intra-oral air pressure build-up.

Under certain conditions, all to do with the same aerodynamic characteristics, also obstruents can be spontaneously voiced. There are a number of articulatory parameters which allow for the state in which vocal folds vibrate spontaneously in stops (e.g. Westbury and Keating 1986: 151).[16] These include, for example, relatively short closure, contracting the respiratory muscles, decreasing the average area of the glottis and / or tension of the vocal folds, decreasing the level of activity in muscles which underlie the walls of the supraglottal cavity, actively enlarging the volume of that cavity, etc. In other words, there are a number of articulatory means of orchestrating the vocal fold vibration. However, there is no direct gesture causing the vibration.

[16] Logically, fricatives, which are somewhere between the stops and sonorants in articulatory terms should be subject to spontaneous voicing more readily than stops, but less readily than sonorants. This is true, of course, only if we take one articulatory parameter into account, that is, the degree of closure. However, if, for example, the duration of fricatives is longer in a given system than that of stops, then the propensity to spontaneous voicing of such fricatives relative to stops may not be observed.

An important aspect of spontaneous voicing in obstruents is connected with adjacent phonetic context. Some contexts are more conducive to spontaneous voicing maintenance than others. For example, as noted in e.g. Westbury and Keating (1986), Harris (2009), word-initial and word-final contexts have an inhibitory effect on such natural voicing and are relatively worse than the intervocalic context, which allows for a maintenance of the articulatory state connected with vocal fold vibration. Surprisingly, it appears that in intervocalic contexts it is more 'natural' in terms of articulation to have a voiced stop than a voiceless unaspirated one, as the latter requires a change in a steady articulatory state – switching off the vibration of the vocal folds.

In connection with this last observation, Westbury and Keating (1986: 163) note an interesting paradox concerning the consonantal systems depending on the number of laryngeal contrasts. They observe that a number of languages maintain articulatorily more difficult stops intervocalically than is necessary. Thus, in pre-contrast systems, that is, systems with no phonological contrast based on voice, in which one series of obstruents is present, a voiceless unaspirated stop is maintained also in intervocalic position, even though it would be more natural, in the sense of ease of articulation, to spontaneously voice the stop in that position. Naturally, such medial voicing would not lead to any introduction or neutralization of contrasts as it would be allophonic in nature.

On the other hand, in languages which have a two-way laryngeal contrast, such as English, speakers may produce voicing in word-initial /b, d, g/ even though it is not necessary for the maintenance of contrast because the other type of stops, /p, t, k/, are articulated with aspiration in that position. The pre-voicing of these consonants in the word-initial context occurs despite the fact that it requires a greater articulatory effort. Westbury and Keating conclude, quite rightly, it seems, that next to phonetic naturalness there is a systemic tendency to maintain the phonetic similarity among the positional allophones. In the case of pre-contrast systems, this appears to be a reverse tendency to contrast enhancement, while in English it seems that we are dealing both with maintenance of phonetic similarity among the positional allophones, and maintaining sufficient discriminability between the two laryngeally contrasting series of stops.[17]

There are two important observations here. Firstly, ease of articulation cannot be viewed as the only factor in a sound pattern. Secondly, and more importantly for our purposes, there seem to be systemic decisions – 'more powerful principles' as Westbury and Keating call them (p. 163) – as to the phonetic shape of one of the obstruents in a system possessing a two-way contrast. What are these powerful principles? Clearly these are not purely phonetic. They are systemic, that is, phonologically dependent decisions on phonetic interpretation of segments.[18]

In what follows, the term spontaneous voicing will be restricted to vowels and sonorant consonants. We have seen that in obstruents spontaneous voicing is possible in pre-contrast systems, but even there, it may be systemically blocked or enforced.

[17] The word-initial voicing is more crucial in the case of fricatives where aspiration is less robust.

[18] We are talking about articulatory parameters leading to a sufficient phonetic discriminability of the pair of laryngeally contrastive consonants. Phonetic theory has a long tradition of the concept of sufficient dispersion, sufficient discriminability etc. (e.g. Liljencrants and Lindblom 1972, Schwartz, Boë and Abry 2007).

For these reasons, depending on the phonetic distinction (sonorant vs. obstruent) and phonological status (marked vs. unmarked in a given system) we are going to use different terms for the observed voicing situations.[19] This brings us to the concepts of active and passive voicing of obstruents, where a fair dose of terminological confusion seems to exist in the literature.

4.2. Active voicing

In Harris (2009), active voicing in obstruents is said to be connected with an interpretation of a laryngeal category responsible for voicedness (element |L|), which is present in the representation. Active voicing, thus, is a sort of compensation by an active gesture or gestures in the face of intra-oral air pressure build-up which, due to obstruent stricture, has an inhibitory effect on vocal fold vibration.[20] Simplifying things a little, in such cases there seems to be a one-to-one correspondence between the presence of a voicing cue in the signal (negative VOT) and the presence of the phonological category |L| in representation. According to laryngeal realism (Harris 2009, Honeybone 2002), laryngeal specification in two-way contrast systems is privative, that is, one of the series of obstruents is marked, while the other remains non-specified. In the case of active voicing it is the voiced series that contains |L| and the non-specified obstruents are voiceless unaspirated. It is interesting to note at this point that in such a system the interpretation of the unmarked in fact forbids spontaneous voicing of this type of segment to avoid conflation with the fully voiced objects, another systemic decision, it seems.[21] To sum up, active voicing has been associated in the literature with the presence of full voicing connected with the presence of a phonological category |L|.

4.3. Passive voicing

Passive voicing occurs in unmarked obstruents in which the aerodynamic conditions for voicing are said not to be actively controlled (Kohler 1984: 162). This may occur in systems like English in which the so called voiced obstruents are in fact phonologically unspecified and the voiceless aspirated stops are marked with a laryngeal category (Avery and Idsardi 2001, Harris 1994, 2009, Iverson and Salmons 1995, 2003a, Kohler 1984). In Iverson and Salmons (2003a: 51) the definition is a little more restrictive in that it is viewed as an extension of spontaneous voicing from a preceding segment onto an

[19] Given the indirectness of all the aerodynamic conditions to do with vocal fold vibration we may view all voicing as spontaneous under particular articulatory settings. However, in obstruents, as opposed to sonorants, active manipulation of the parameters takes place and different terminology expresses just this fact.

[20] Recall the articulatory parameters mentioned above which may contribute to the maintenance of vibration.

[21] There seems to be an asymmetry between voicing and aspiration languages, which was noted already in Lisker and Abramson (1964). Namely, fully voiced obstruents do not contrast with partially voiced ones, while voiceless unaspirated can contrast with voiceless aspirated (e.g. Icelandic). This asymmetry may follow from the general phonetic fact that voicing is more difficult to maintain and its robustness / value / duration is more difficult to be compared by degrees to allow for any discriminability.

unmarked obstruent. The rightward influence allows Iverson and Salmons to view the /b/ in *rubber* and the /d/ in *bad* as passively voiced. However, the /b/ in *bad* cannot be viewed as passive voicing. The question is what this voicing is when it occurs initially?

It is tempting to equate passive voicing with spontaneous voicing discussed above. However, unlike in sonorants which are universally voiced spontaneously,[22] this type of voicing in obstruents requires some systemic conditions to be met. On the phonetic side, crucial in this type of voicing, is a voiced environment as well as an articulation which is conducive to maintaining the air pressure drop across the vocal folds. We may identify this articulation as weak, or lenis. More importantly, however, there are other conditions which allow for the passive voicing which make it quite different from the spontaneous voicing in sonorants. Specifically, the passive voicing in obstruents can (is more likely to) occur in a system which has i) a two-way laryngeal contrast and ii) it concerns the non-specified obstruent series in a system in which the marked segments contain the element |H|, or any other category which is responsible for long VOT lag, that is, aspiration. Clearly, these are phonological not phonetic conditions. Thus, passive voicing is not just phonetics. It is, in equal measure, an interpretational phenomenon which is dependent on the particular phonological marking in a given system.[23] It is a systemic decision (contrast enhancement) that leads to lenis articulation. These articulatory parameters are in a sense actively set to be weak. This point becomes particularly clear when we consider the interpretation of the unmarked series in a voicing language, that is, in one that marks full voicing with a category, e.g. |L|. Here, passive voicing is simply forbidden, as it would be difficult to distinguish between a fully voiced and weakly voiced obstruents, let alone produce such a contrast.

To conclude, passive voicing is a term describing a situation in which we are dealing with phonetic voicing of an unmarked object in an H-system (aspiration language). From the interpretational point of view, passive voicing may involve an active decision, a kind of enhancement of the categorical distinction if one prefers.[24] Either the system allows for passive voicing of its unmarked objects (English) or not (Icelandic).[25] The positive decision may still involve a degree of variability, for example, there is a difference between initial medial and final lenis obstruents in English. The difference, however, between passive and active voicing is two-fold. Firstly, active voicing is more

[22] There are of course both phonetic and phonological conditions under which also sonorants may be realized as voiceless.

[23] Iverson and Salmons seem to express the same point of view by claiming that passive voicing is in fact a shallow phonological rather than purely phonetic fact. This echoes Westbury and Keating's (1986) 'more powerful principles' mentioned above.

[24] It would be a strange kind of enhancement, as it would be implemented by weakening the articulation, which seems to be a contradiction in terms. For different takes on the role of enhancement in phonology and phonetics see e.g. Avery and Idsardi (2001), Iverson and Salmons (2003a), Jakobson and Waugh (1979), Liljencrants and Lindblom (1972), Lindblom (1986), Stevens and Keyser (1989), Vaux (1998).

[25] Passive voicing is present in Icelandic fricatives (e.g. Gussmann 2009: 53) and is rather interesting as there seems to be a distinction between non-contrastive passive voicing of the interdental fricative after continuants and vowels, e.g. *heiðin* [hei:ðɪn] 'pagan', and contrastive voicing of the labiodentals, e.g. *fara* [fa:ra] 'travel' vs. *vara* [va:ra] 'warn'.

robust, that is, full voicing is present (long negative VOT), and secondly, it is connected with the presence of a laryngeal category in the phonological representation. Passive voicing is less robust and phonetic in nature. Thus, phonetic interpretation is indirectly conditioned by phonology in that one or the other marking system makes particular phonetic distinctions or target values available.

5. Laryngeal realism and the VOT continuum

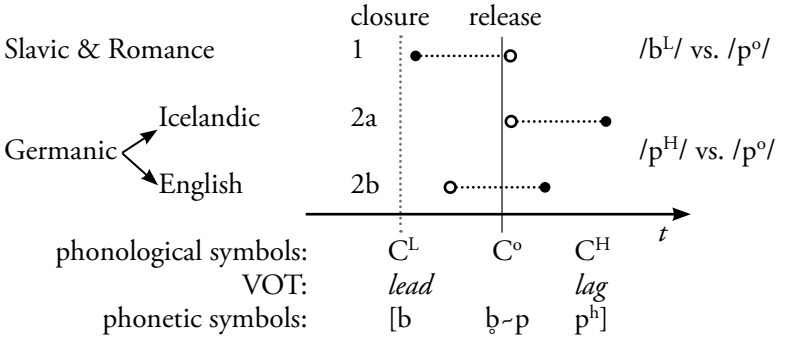
What are these phonetic distinctions? For the purpose of illustration only, I choose the VOT continuum (Lisker and Abramson 1964, Lieberman 1970, Keating 1984), which presents three major phonetic categories which are utilized by languages, i.e. i) long lead (negative VOT, which is found in fully voiced stops), ii) short lag (voiceless unaspirated stops), and iii) long lag (voiceless aspirated stops). Equally well, it must be stressed, one could use the articulatory parameters of the type proposed in Halle and Stevens (1971), or Avery and Idsardi (2001) to achieve the same descriptive goals. Insofar as the traditional distinctive features now fall into the phonetic interpretation side of particular sound systems, it is no longer an issue whether they be articulatory or acoustic in nature, or whether they present us with strict predictive potential. In fact, both may be required for an exhaustive description of phonetic interpretation. In this sense, one must fully agree with Lass (1984: 99), who claims that the two sets of features are complementary, a proposal that even today must sound sacrilegious to the analysts who set great store at the predictive power of a feature system, where uniformity is one of the requirements. Thus, paradoxically, arbitrariness of the relationship between phonological primes and their phonetic interpretation allows us to build bridges between the different approaches to the nature of distinctive features by rendering the debate largely vacuous.

The three phonetic categories along the VOT continuum[26] are incorporated below in the graph which symbolically represents the laryngeal realism view. The main difference from proposals such as Keating (1984) is that voiceless unaspirated stops are non-specified, which is represented by C^{o}. The 'voice' languages select the category |L|, responsible for long VOT lead, and are represented as C^{L}. On the other hand, the aspiration languages use |H| in their obstruents, that is, C^{H}.

The dark circle refers to an employment of a laryngeal category within the VOT-defined phonetic space where the occlusion interval is the domain typically associated with the element |L| and the post-release space belongs to |H|. The dotted line between the realizations of the marked and the unmarked (white circle) is a symbolic representation of sufficient phonetic distance. It is symbolic because it does not really refer only to the VOT, but in fact to a combination of the articulatory and perceptual distance between two contrastive series. In fact all the dimensions here, including that of time, are deliberately symbolic and relative rather than concrete and absolute.

[26] As mentioned earlier, the same idea may to some extent be expressed through articulatory parameters, for example, |slack vocal cords|, |stiff vocal cords| and |spread glottis| of Halle and Stevens (1971), the features |voice|, |voiceless unaspirated| and |voiceless aspirated| of Keating (1984), or the Glottal Tension and Glottal Width dimensions in the model of Avery and Idsardi (2001).

(3) *The laryngeal realism view*



Under the laryngeal realism view, the Slavic and Romance languages utilize the element |L| in their grammar, which is mapped onto voice in the signal, while the Germanic languages utilize the element |H|, which is responsible for aspiration.

There is a sub-division among the Germanic languages into those allowing for passive voicing, like English or German, which has been fully recognized in privative literature, and those that generally do not, like Icelandic. Thus, some relativity in the phonetic interpretation of the unmarked series is already in place. Since the passively voiced obstruents in English are not just voiced in the first or last phase of closure, but may in fact be fully voiced in some environments, this variability is expressed in the above graph by placing the unmarked end of the contrastive relationship towards the middle of the VOT lead space. Note that, given the symbolic phonetic distance between the unmarked and the marked series, this slight swing to the left tallies also with the phonetic and phonological status of aspiration in English, in that it is not as robust distributionally as it is in Icelandic.[27]

We may assume then that it is probably not a coincidence that the presence of passive voicing in English and its absence in Icelandic are accompanied by slightly different aspiration systems in terms of phonological robustness. Specifically, in Icelandic aspiration survives in more contexts than in English, including shifts such as preaspiration or devoicing of the preceding coda sonorants when normal aspiration cannot be produced (e.g. Gussmann 1999). To put it in very crude impressionistic words: the more robust aspiration the less robust passive voicing. This in fact is an effect of the phonetic interpretation principle which strives to achieve sufficient discriminability of the two series in non-neutralizing contexts. The comparison of Icelandic and English leads us to a hypothesis that there is not only a cross-linguistically unstable interpretation of the unmarked obstruent series showing in the variability of passive voicing, but that there may also be no stable phonetic interpretation of the marked

[27] Whether an 'aspiration' language allows for passive voicing or not is generally assumed to be facultative (e.g. Iverson and Salmons 2003a: 52). If the phonetic principle of sufficient discriminability is indeed at play, it predicts that passive voicing should be more likely in the case of less stable distribution of aspiration.

series, as the different robustness of aspiration in Icelandic and English shows.[28] What is stable, barring cases of neutralization, is the relative phonetic distance between the respective phonetic realisations of the two series.

The relativity in the relationship between the phonological representation and phonetic interpretation is obvious. The question is how much of it can be allowed, and what are the phonological and phonetic consequences of that move. Can an H-system show no traces of aspiration in the marked series and full voicing in the unmarked one? Would such voicing be passive or active? The hypothesis I would like to put forward at this stage is that indeed there is a fair degree of relativity in that a phonetically 'voicing' language may in fact be defined by the presence of |H|, where the marked series shows no appreciable aspiration at all, while the unmarked series is realized with full voice (VOT lead). This situation is phonetically identical to active voicing in obstruents, but since the fully voiced object is not marked phonologically, it will be viewed as a case of enhanced passive voicing.[29] The difference becomes crucial when we look at the behaviour of the two types of fully voiced obstruents.

6. Laryngeal relativism

It appears that phonetic interpretation involves a systemic decision, which can be summarized as placing the two phonetic realizations (of the marked and of the unmarked objects) of the contrastive series of obstruents somewhere along the VOT continuum so that the two objects are articulatorily and auditorily distinguishable.[30] This guarantees some variability, as well as some recurrent patterns because there are some restrictions on the phonetic space thus defined. For example, the fact that we have three phonetic categories along the VOT continuum, that is, VOT lead, short lag, and long lag,[31] does not mean that we can have three phonetic contrast systems of the type: i) fully voiced vs. voiceless unaspirated, ii) fully voiced vs. voiceless aspirated, iii) voiceless unaspirated vs. voiceless aspirated. Of these, option ii) is not utilized in languages because, universally, phonetic principles strive for sufficient, not maximal dispersion of contrast (e.g. Schwartz, Boë, Vallée and Abry 1997). Thus, the arbitrariness of the

[28] These differences in the robustness of aspiration might be derivable phonologically from the licensing strength, an idea that will not be pursued here for reasons of space.

[29] Thus, there are four voicing situations with respect to phonological marking and phonetic interpretation: i) spontaneous, ii) active, iii) passive, and iv) enhanced passive. Note that phonetically ii) and iv) are identical, except that only the former is due to the presence of a laryngeal element. Both iii) and iv) involve an unmarked obstruent. The difference lies only in the phonetics, that is, the robustness VOT, which leads linguists to confuse situations ii) and iv).

[30] The similarity to Stevens' (1972) quantal theory is not accidental here. We are in the realm of phonetics. See also Cho and Ladefoged (1999) for a similar model of utilizing the VOT space, where modal values of VOTs |voice|, |voiceless unaspirated| and |voiceless aspirated| must be first selected and then specific target values are assigned to them by language specific rules. Thus the two models are generally comparable. Except that instead of selecting two modal values of a two-way contrast, a privative model selects one.

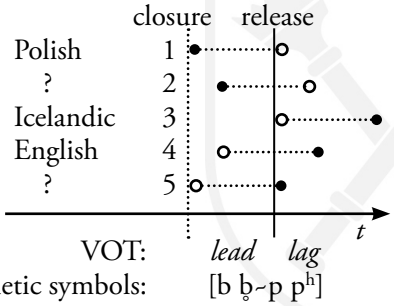
[31] The three regions of stability, to use Stevens's terminology (Stevens 1972) correspond to the distinctions proposed in Lisker and Abramson (1964), and, in general, to the 'articulatory-to-acoustic bottleneck that nature provides' (Beckman and Pierrehumbert 2003: 32).

connection between phonological categories and their phonetic interpretation does not mean that everything goes. The phonetic space available for the phonology-phonetics connection imposes restrictions. Phonology merely introduces or not a categorical distinction and defines the behavior of the active category.

This arbitrariness, however, allows for situations in which a so called 'aspiration' language could, for language specific reasons, not only have unstable aspiration, but assign very little or none to its laryngeal category residing on the VOT lag side of the graph. After all, a VOT value is only one of the possible acoustic cues relating to laryngeal distinctions (Wright 2004). If that is the case, then the unmarked series in such a system will have to be phonetically interpreted in such a way that sufficient phonetic distance is maintained. This leads to an H-system ('aspiration' language) which superficially looks like a 'voicing' one, that is an L-system. However, here the fully voiced objects are due to passive voicing, enhanced passive voicing, that is.

The graph below is meant to symbolically represent the idea of relativity and arbitrariness in the relationship between the phonological categories |L,H| and their phonetic exponence, i.e. voicing (VOT lead) and aspiration (VOT lag). The numbers refer to arbitrarily chosen system types involving a two-way laryngeal contrast. It is not a typology, as phonetic variability is much greater than what (4) can express. Rather, it is a starting point for our discussion of the voicing phenomena in Polish.

(4) *Laryngeal relativism view*



The important assumptions of laryngeal relativism are the following. Both the marked and the unmarked series of obstruents are subject to arbitrary assignment of phonetic qualities respecting the principle of sufficient phonetic distance between the two series. Speakers and learners of a language must work out these relationships and know what categorical distinction stands behind them.

The need to maintain a fairly stable perceptual and articulatory distance between the two series leads to some asymmetries in the utilization of the VOT space, which allow us to point to particular constraints on the arbitrariness of the connection between a phonological category and its phonetic interpretation. Although the relationship between phonology and phonetics is arbitrary, there are limits as to how the phonetic space can be used in two-way contrast systems under discussion. For example, the so called passive voicing is possible only in H-systems and impossible in L-systems, because both perceptually and articulatorily it is difficult to contrast fully voiced with slightly

voiced objects. One of the reasons might be the indirect nature of maintaining vibration of the vocal folds through a number of articulatory parameters mentioned above. The vibration is simply difficult to control in obstruents, and different values of negative VOT are not utilized for contrasts with each other. On the other hand, the phonetic contrast between the voiceless aspirated and voiceless unaspirated is easier in this respect. For one thing, |spread glottis| is a direct articulatory gesture as opposed to vibration of the vocal folds, in that concrete muscles are directly responsible for the former but not for the latter. Secondly, the aspirated systems like English, in which the aspiration is nonetheless fairly unstable, select other articulatory parameters leading to sufficient phonetic differentiation of the two series, which has been associated with the lenis / fortis distinction (Wright 2004).

Returning to the discussion of the graph in (4), the voiceless unaspirated articulation of the unmarked series in system 1, e.g. Polish, is as close as it can get to the fully voiced marked congener in terms of phonetic distance. This observation will become very important in our analysis of Polish. No example is provided for system 2, which is given here as a mirror image of what may be assumed for English, that is, system 4. It is not impossible that system 2 does not really exist. Note that in systems like Polish, voicing is not exactly as stable as the graph might suggest in relation to system 2. Polish has final devoicing and neutralization of voice contrast before obstruents. It also has frequent devoicing of obstruents in other contexts, a fact which is not readily acknowledged by phonologists.[32] There is a difference between the relative phonetic robustness of the long negative VOT, in which case, phonetically speaking Polish is system 1, and the phonological robustness of the category responsible for the phonetic effect of long negative VOT, in which case, due to such phenomena as final devoicing and voice neutralization before obstruents, Polish might be viewed as system 2. The resolution of this problem is not really important for our purposes here.

Systems 3 and 4 have already been discussed above. They constitute the two main variants of the laryngeal contrast placement within the VOT-defined phonetic space that have been widely recognized for Germanic languages. System 5, on the other hand, is a possibility, which laryngeal relativism predicts to occur, and which this paper tries to argue for. It is phonologically speaking an H-system, which on the surface bears a full resemblance to an L-system. It will be proposed that Polish has both systems 1 and 5 which correspond to a major dialectal division involving other aspects of phonological, phonetic and morphological distinctions (Nitch 1957, Urbańczyk 1984).[33]

Let us begin by reviewing the basic voicing facts of Polish under the laryngeal realism view, that is, assuming that Polish is an L-system. This will allow us to see how phonetic interpretation works in this system. Then problems with this assump-

[32] Although these may be said to be stylistically conditioned or as occurring in contexts where no confusion is possible, forms like [tɔpʃɛ] instead of [dɔbʒɛ] for *dobrze* 'good', [t͡ɕɛɲ tɔpr̪i] instead of [d͡ʒɛɲ dɔbr̪i] for *dzień dobry* 'good day', or [cɛnɛk] instead of [ɟɛnɛk] for *Gienek* 'name' are very common. Note that none of these contexts is word-final.

[33] If laryngeal relativism proves correct, acoustic measurements which are meant to help discover phonological categories no longer make any sense, because long negative VOT cannot be directly equated with an active phonological category, be it the element |L|, or features |voice| or |slack vocal folds|.

tion are identified, which are mostly connected with the celebrated phenomenon of sandhi voicing in Cracow Polish.

7. Polish as an L-system

To begin with, a brief comment on phonological notation needs to be made. Following the arguments laid out by Honeybone (2002: 141–142) I am going to use three types of symbols for obstruents depending on their laryngeal specification involving the elements |L,H|. In phonological transcription, Honeybone uses a system of three symbols /p^{o}, p^{h}, b/ to refer to neutral, voiceless aspirated and fully voiced respectively. This notational system will have to be modified slightly to fit the laryngeal relativism view and to avoid reference to the confusing phonetic correlates, that is, aspiration in symbols which are meant to express phonological categories. Instead, /C^{o}, C^{H}, C^{L}/ will be used to refer to obstruents in abstraction of the actual classes such as fricatives, stops, or particular place of articulation.

When more concrete representations of particular word-forms are referred to, the symbols such as /t^{o}/ or /d^{L}/ will express the expected phonetic interpretation in a non-neutralizing context, e.g. /t^{o}ɔm/ > [tɔm] *tom* 'volume' vs. /d^{L}ɔm/ > [dɔm] *dom* 'house'. Likewise, a delaryngealized (neutralized) lexical /b^{L}/ will be referred to as /b^{o}/ in phonological representation. Here, the voiced symbol is a mere transcriptional trace of what object we are dealing with lexically. However, its phonetic interpretation will be identical to /p^{o}/, e.g. /ʒab^{L}a/ > [ʒaba] *żaba* 'frog' ~ /ʒab^{L}/→/ʒab^{o}/ > [ʒap] *żab* 'frog, gen.pl.'.[34] Thus, the phonetic interpretation takes into account only the superscripted value in the phonological representation.

An additional phonetic interpretation principle that will hold in this system is that the neutral series cannot be passively voiced.[35] This is an interpretational restriction that must be made cross-linguistically as contrasts based on the different values of negative VOT (degrees of voicing) are not used in languages (e.g. Lisker and Abramson 1964). Let us now proceed to the discussion of Polish as an L-system, that is one using the element |L| in the marked, voiced series. It is the kind of assumption that laryngeal realism would make about a system with an opposition of fully voiced with voiceless unaspirated stops.

[34] The symbol '→' refers to a truly phonological process (delaryngealization), while '>' refers to phonetic interpretation. More data and discussion are provided below.

[35] Recall that passive voicing may occur only in H-systems. The consistent voicelessness of the non-specified series may be viewed as a case of systemic enhancement – the prohibition on passive voicing, it will be recalled, is a systemic if not universal decision particular to L-systems. Similar claims are made about Korean in e.g. van Rooy and Wissing (2001). Since the voiceless unaspirated stops in Polish are also described as produced with a constricted and raised glottis (Dłuska 1981: 79), following Avery and Idsardi's (2001) model, we may assume that this systemic enhancement takes the phonetic form of glottal constriction, a tensing gesture which precludes passively induced vibration of the vocal folds. Systemically induced enhancement is a phonetic effect on the one hand, but it is based on a particular phonological marking scheme. In this respect, enhancement is an interface phenomenon.

7.1. Polish voice facts

The basic facts of the Polish voicing system are well known (e.g. Bethin 1984, 1992, Gussmann 1992, 2007, Rubach 1996). Polish has a two-way voicing contrast among obstruents, which is typically depicted as fully voiced versus voiceless unaspirated. The system has also been described as *fortes* versus *lenes* (Benni 1964: 19, Wierzchowska 1971: 149), but unlike in German or English in which the *fortes* series is accompanied by aspiration in stops, the distinction along the articulatory strength parameter does not seem to have any consequences in Polish. The relatively stronger constriction in the voiceless unaspirated series is assumed to be a natural phonetic consequence of the lack of voicing.

The distribution of the voicing distinction is easily captured in descriptive terms. The voice contrast is found before vowels /_V/ and before sonorant consonants followed by vowels /_SV/. The two contexts can be schematically merged into one /_(S)V/ as shown in (5a). The contrast is neutralized word-finally, whether the sonorant is present or not /_(S)#/ (5b), and before other obstruents (5c). Various phonological models use different formal explanations of the relationship between the maintenance of contrast, that is, licensing the laryngeal category, and its loss – delaryngealization. Since the formal GP explanation of the distribution of the laryngeal contrast has absolutely no bearing on our discussion of the voicing system of Polish I will refrain from providing unnecessary technicalities. The basic facts will still remain as illustrated in (5). The three configurations are given below.

(5) a. ...C (S) V...
Lar

b. ...C (S) #
Lar

c. ...C (S) C...
Lar

C = obstruent, (S) = optional sonorant, Lar = laryngeal element, V = vowel

Let us survey the main voicing facts under the assumption that the laryngeal element employed is |L|, as suggested, e.g. in Gussmann (2007). The data in (6) correspond to the configuration in (5a), where the laryngeal element is retained (licensed). Then, the obstruent is phonetically interpreted as fully voiced (/C^{L}/ > [long negative VOT]). A non-specified obstruent in this system is realized as voiceless unaspirated (/C^{o}/ > [short lag VOT]).

(6)	*...C(S)V...*	*C retains its lexical laryngeal specification*			
	#C^{o}V	/p$^{j o}$it͡ɕ^{o}/	>	[p^{j}it͡ɕ]	pić ‘to drink’
	#C^{L}V	/b^{jL}it͡ɕ^{o}/	>	[b^{j}it͡ɕ]	bić ‘to hit’
	#C^{o}SV	/p^{o}wɔt^{o}ɛm/	>	[pwɔtɛm]	płotem ‘fence, instr.’
	#C^{L}SV	/b^{L}wɔt^{o}ɛm/	>	[bwɔtɛm]	błotem ‘mud, instr.’
	VC^{o}V	/rɨs^{o}a/	>	[rɨsa]	rysa ‘scratch’
	VC^{L}V	/rɨz^{L}a/	>	[rɨza]	ryza ‘ream’
	VC^{o}SV	/ɔk^{o}ɲɛ/	>	[ɔkɲɛ]	oknie ‘window, loc.’
	VC^{L}SV	/ɔg^{L}ɲɛ/	>	[ɔgɲɛ]	ognie ‘fire, pl.’

Prevocalically, or intervocalically, the element |L| is licensed and the contrast is maintained even when a sonorant consonant intervenes between the obstruent and the vowel. In traditional accounts the context in which the contrast is maintained may be said to involve a simplex or a complex onset.[36]

As shown in (5b,c), the voice contrast is suspended word-finally and before another obstruent. The former situation leads to final obstruent devoicing (FOD), while the latter effects to assimilation. Let us look at FOD first. Word-final devoicing results in surface ambiguities. For example, a surface form [stuk] may have two lexical sources, that is, *stóg* 'heystack' with final devoicing, or *stuk* 'a knock', with a lexically voiceless obstruent. The word-final devoicing takes place even if the lexically voiced obstruent is followed by a sonorant (7b), as well as in obstruent clusters (7c).[37]

(7) *Final obstruent devoicing (FOD)*

a. waga / wag [vaga / vak] 'scale, nom.sg. / gen.pl.'
koza / kóz [kɔza / kus] 'goat, nom.sg. / gen.pl.'
rada / rad [rada / rat] 'avice, nom.sg. / gen.pl.'
noże / nóż [nɔʒɛ / nuʃ] 'knife, nom.pl. / nom.sg.'

b. dobro / dóbr [dɔbrɔ / dupr] 'goodness, nom.sg. / gen.pl.'
kadra / kadr [kadra / katr] 'personnel, nom.sg. / gen.pl.'
blizna / blizn [blizna / blisn] 'scar, nom.sg. / gen.pl.'

c. gwiazda / gwiazd [gvʲazda / gvʲast] 'star, nom.sg. / gen.pl.'
prawda / prawd [pravda / praft] 'truth, nom.sg. / gen.pl.'
wróżba / wróżb [vruʒba / vruʃp] 'prophecy, nom.sg. / gen.pl.'

Phonologically speaking the final devoicing is a result of L-delinking in a non-licensing context. What remains in that position is a delaryngealized object which is identical to the non-specified series in that system, and must receive the same phonetic realization, that is, voiceless unaspirated. Compare the forms *wag* [vak] 'scale, gen.pl.' and *byk* [bɨk] 'bull', of which the former illustrates FOD, as it alternates with *waga* [vaga] 'scale, nom.sg.'.

(8)

	Lexical representation		Phonological representation		Phonetic interpretation
		L-delinking			
a.	/v^{L}ag^{L}/	→	/v^{L}ag^{o}/[38]	>	[vak]
b.	/b^{L}ɨk^{o}/	=	/b^{L}ɨk^{o}/	>	[bɨk]

[36] And conversely, the neutralization / delaryngealization context has been referred to as coda. Although Government Phonology has a specific view on this context, it will be bypassed for reasons of space.

[37] The forms in (7c) combine FOD and assimilation in obstruent clusters.

[38] The proposals which rely on experimental results and suggest that the neutralized obstruents are different from the lexically voiceless ones in German or Polish notwithstanding (e.g. Port and O'Dell 1985, Gianinni and Cinque 1978), the symbol /g^{o}/ is used here only to express the fact that it is a neutralized

As shown in (7c) above, final devoicing affects also entire clusters. This brings us to the other context in which voicing cannot be used contrastively. It is when it is followed by another obstruent. In this context, the first obstruent is not free to maintain its own voice specification and must agree with that of the following obstruent, even if the two consonants are separated by a sonorant.

Generally we can divide the facts into static voice agreement occurring inside stems (9a) and dynamic assimilation which may occur inside stems (9b), across morpheme (9c), and word boundaries (9d).

(9) a. *Static voice agreement*

kto	[ktɔ]	'who'	*kd, *gt
gdy	[gdɨ]	'when'	*kd, *gt
krtań	[krtaɲ]	'larynx'	*krd, *grt
drgać	[drgat͡ɕ]	'tremble'	*drk, *trg

Dynamic voice agreement (assimilation)

b.	dech / tchu	[dɛx / txu]	'breath, nom.sg. / gen.sg.'
c.	prosić / prośba	[prɔɕit͡ɕ / prɔʑba]	'to ask / a request'
	ryza / ryzka	[rɨza / rɨska]	'ream / dim.'
	mędrek / mędrka	[mɛndrɛk / mɛntrka]	'smart-ass / gen.sg.'
d.	rzut bagnetem	[ʒud bagnɛtɛm]	'bayonet throw'
	wiatr zachodni	[vʲadr zaxɔdɲi]	'western wind'

A few comments concerning the data in (9) are in order. Firstly, stem-internal alternations of voice as in *dech* / *tchu* (9a) are extremely rare in Polish. For such an alternation to arise, two obstruents of opposite voice value must be separated by a vowel alternating with zero. This is one of the reasons why the forms in (9b) are quoted in almost every analysis of voicing facts in Polish. There seems to be no example of the reverse type of assimilation, that is, to a voiced obstruent.[39]

Secondly, assimilations across morpheme boundaries in (9c) are highly restricted due to the lexical catalogue of suffixes in Polish. Thus, assimilation to a voiced obstruent is basically limited to the fairly unproductive nominalizing *-ba* suffix, and the context before the clitic *-by*, *niósłby* [ɲuz(w)bɨ] 'would carry', while the assimilation to a voiceless obstruent is generally limited to the suffix *-ek*/*-ka* (Gussmann 2007: 292). However, there are two aspects which offset this deficiency. One of them is the relatively high incidence of lexical items involving the static sequences of two voiced obstruents,

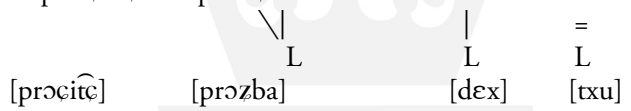
lexical /gᴸ/. In other words, it merely records a trace of a phonological process. However, the velar plosive here is in no way different phonologically from the lexical /kᵒ/ in this system. Both are interpreted as [k] in this context. What is truly important is the superscript symbol, which defines the laryngeal status in these segments and determines the actual phonetic interpretation in a given system.

39 It is impossible to ascertain if this gap is a result of some principle. However, it is interesting in connection with the intriguing phenomenon of the so called progressive devoicing in, e.g. *krwi* [krfʲi] 'blood, gen.sg.'. There are reasons to assume that the labio-dental fricative is lexically voiced, which should produce *[grvʲi], parallel to the forms in (9a).

as in (9a). The other fact concerns voice assimilation across word boundaries. One type which is common to all varieties of Polish involves assimilation of a word-final voiceless obstruent to the following voiced one, regardless of the lexical origin of the former, e.g. *brat Basi* [brad baɕi] 'Barbra's brother'. Thus, we can safely conclude that at least in surface terms, we are dealing with a symmetrical phenomenon of voice agreement in obstruent clusters, that is, both to voiced and to voiceless.

When confronted with symmetrical assimilation, a privative account must distinguish between a phenomenon which is a result of spreading of the active laryngeal category, in this case |L|, as in, e.g. *prosić* / *prośba* [prɔɕit͡ɕ] / [prɔʑba] 'to ask / a request', and one which is quite different in kind. Since Polish, under this view, utilizes only the element |L|, the assimilation to a voiceless obstruent as in *dech* / *tchu* [dɛx] / [txu] 'breath, nom.sg. / gen.sg.' must be viewed as non-assimilatory in nature. It is interpreted as a neutralization (delaryngealization) similar to word-final devoicing, as schematized in (5b, c). The two types of assimilation are illustrated below.

(10) a. /pᵒrɔɕᵒit͡ɕᵒ/ ~ /pᵒr ɔɕᵒ bᴸa/ b. /dᴸɛxᵒ/ ~ /dᵒxᵒu/



It is irrelevant at this stage whether there is such a thing as L-spreading and linking to the preceding neutral segment, or whether the actual voicing of the fricative in [prɔʑba] should be left to the interpretational side of the system.[40] What is important is the fact that surface symmetrical assimilations can be given an asymmetrical account. In the case of *dech* / *tchu* [dɛx] / [txu] 'breath, nom.sg. / gen.sg.' there is an additional complication that the licensing of the laryngeal element in the first consonant depends on the fate of the following alternating vowel. When it is phonetically realized in *dech*, the element |L| remains in the representation and is interpreted as voicing.[41] The neutralized obstruent /Cᵒ/ must be interpreted as voiceless in *tchu*.

Thus, Polish seems to allow for two configurations of obstruent clusters in phonological representation (11). They may be lexical or 'derived' by element spreading (/CᵒCᴸ/ → /CᴸCᴸ/) or element delinking (/CᴸCᵒ/ → /CᵒCᵒ/).[42]

(11) a. Cᵒ Cᵒ b. Cᴸ Cᴸ

[40] For the purposes of this paper I assume a common view that the laryngeal element spreads and links to the preceding neutral segment. In other words, we are dealing with a purely phonological rather than phonetic phenomenon. Whether it is a correct assumption is another story, and one that cannot be discussed here.

[41] The mechanics of vowel – zero alternation in Polish within GP is well known and involves the interpretation of empty nuclei that contain a floating melody in relevant contexts (e.g. Cyran 2010, Gussmann 2007, Gussmann and Kaye 1993, Scheer 2004). This detail is ignored in our discussion as it bears little on the issue at hand.

[42] Recall that the obstruents may be separated by a sonorant. Thus, in fact, we are talking about /Cᵒ(S)Cᵒ/ and /Cᴸ(S)Cᴸ/, respectively.

The asymmetrical analysis of assimilations gains real support in cases where it is accompanied by an asymmetry in phonetic facts as well. For example, Ukrainian is reported not to delaryngealize its marked obstruents word-finally or, as predicted, in front of a following voiceless obstruent (e.g. Lombardi 1995a: 54).

The conclusion we can draw from the above discussion is that in languages like Polish, the symmetry of voice assimilation in the phonetic sense in a system which uses privative categories must mean that one of the assimilations is not phonological in the sense of category spreading. Thus non-assimilatory neutralization may occur not only word-finally but also medially. The three aspects of Polish voicing discussed above, that is, the distribution of contrast, final devoicing and voice agreement in obstruent clusters are common to the two major dialect groups in Polish. There is, however, one phenomenon that sets the two main dialects of Polish apart, and is unexplainable under the laryngeal realism view in which Polish is an L-system.

7.2. The problem of Cracow sandhi voicing

There is one type of assimilation of voice across a word-boundary which is common to both major dialects, that is, Warsaw Polish (WP) and Cracow Polish (CP).[43] This is when the following word begins with a fully voiced obstruent (12c). Another situation where the two dialects are identical is the context in front of a voiceless obstruent (12d) in that the final obstruent of the first word must be voiceless, regardless of its lexical origin. The phenomenon that distinguishes the two major dialects is the celebrated CP sandhi voicing which, irrespective of the lexical marking, affects the last obstruent of the word, when the following word begins with a vowel, or a sonorant consonant (12a,b).[44]

(12)			*WP*	*CP*
a.	rzut oka	‘glimpse’	t-ɔ	d-ɔ
	rad ojcowskich	‘fatherly advice, gen.pl.’	t-ɔ	d-ɔ
b.	rzut młotem	‘hammer throw’	t-m	d-m
	rad matczynych	‘motherly advice, gen.pl.’	t-m	d-m
c.	rzut bagnetem	‘bayonet throw’	d-b	d-b
	rad głupich	‘silly advice, gen.pl.’	d-g	d-g
d.	rzut poziomy	‘horizontal plan’	t-p	t-p
	rad przyjacielskich	‘friendly advice, gen.pl.’	t-p	t-p

Let us first note a few things about the Warsaw Polish dialect. It appears that it is indeed an L-system. This correctly accounts for all the facts observed in this dialect. For example, the L-system in WP provides a clear answer as to why this dialect cannot

[43] These are more dialect groups. CP comprizes Little Poland, Silesia, Great Poland as well as small areas like Kashubia, etc. WP is Mazovian and North Eastern dialects. Voicing is not the only characteristic of this major dialectal divide. Nitch (1957) and other dialectologists (e.g. Urbańczyk 1984) identify a number of features connected with this division.

[44] Similar phenomena are recorded in Breton (Ternes 1970), West Flemmish (De Schutter and Taeldeman (1986), Catalan (Wheeler 1986), as well as in varieties of German and Italian (Krämer 2001).

have sandhi voicing before sonorants, and why it is possible before a voiced obstruent. There are both phonological and interpretational reasons for this. Firstly, WP has the element |L| in the voiced obstruents. This makes them stand out from all the other phonetically voiced segments in that dialect – the sonorant consonants and vowels are spontaneously voiced, not actively by means of the presence of a laryngeal category. Hence, if we assume a spreading analysis for assimilation in this dialect, only the actively voiced obstruents have something phonologically real to spread.[45] Secondly, the role of vowels in WP, among other things, is to license the lexically present laryngeal element |L| in the preceding onset, which is then fully voiced. On the other hand, the non-specified series in that system must be voiceless. Note, that in the sandhi context both the lexically voiceless (non-specified /C^{o}/ in WP) and the lexically voiced obstruents (/C^{L}/) are treated uniformly before a following vowel-initial word in, e.g. *rzut oka* [t-ɔ] 'glimpse', *rad ojcowskich* [t-ɔ] 'fatherly advice, gen.pl.', which clearly shows that the word-final delinking of the element |L| in *rad* [rat] < /rad^{o}/ ← /rad^{L}/ 'advice, gen.pl.' cannot be undone when the next word begins with a vowel. Thus, the delaryngealized segment will have to be interpreted before another vowel-initial word in the same way as a lexically non-specified one, that is, as voiceless, e.g. *rzut* [ʒut] < /ʒ^{L}ut^{o}/ 'a throw'.

In other words, sandhi voicing before sonorants is simply impossible in the L-system of WP, but it is possible before a voiced obstruent which contains an active category |L|. Thus, the L-system perfectly accounts for the Warsaw Polish facts, and is absolutely unable to handle the Cracow Polish data in (12a, b). One must bear in mind, that, word-internally the voicing facts are identical in CP and WP. Both dialects have a phonetic contrast between fully voiced vs. voiceless unaspirated obstruents, and identical voicing phenomena such as final devoicing and assimilation of voice in obstruent clusters.

Cracow voicing is problematic for phonological theory, regardless of whether a privative or a binary feature system is used. In supposedly privative models (e.g. Bethin 1984, 1992) the feature [+voice] must be assumed to be present in the representation of vowels and sonorant consonants at least at the relevant, late (post-lexical) level of representation in order to be manipulated by late rules. In binary feature systems (e.g. Gussmann 1992, Rubach 1996) the assimilation rules also must be kept at bay at earlier levels of derivation in order not to produce wrong results word-internally. The specification of sonorants may only become active late in the derivation and only in Cracow Polish.

Most of these analytical problems with CP voicing partly stem from the assumption that it must be dealt with in terms of phonological computation, manipulating active categories such as the feature [+voice]. In this respect, the same problems beset the privative model employing elements, which is part of the laryngeal realism tradition

[45] Note that the assimilation facts in WP are in fact identical word-internally and in sandhi. The assimilation to a voiced obstruent will be a result of |L| spreading in both contexts. Likewise, the assimilation to a voiceless obstruent will in both cases be a case of neutralization (delaryngealization).

(e.g. Gussmann 2007). If voicing in obstruents can only be due to the presence of the element |L|, then one must postulate that this element is present somewhere in the representation of the initial segments in CP. Since, having a laryngeal specification of sonorants goes strongly against the element theory, neither Gussmann (2007) nor Michalski (2009) provides an analysis of the CP facts.[46] Michalski, however, expresses an intuition, which appears to be partly correct. Since representationally the facts cannot be accounted for, they will most probably be accounted by phonetics. Under our understanding of laryngeal system in (2), these are two half-truths. Yes, the Cracow voicing will be shown to be due to the phonetic interpretation, but the interpretation directly depends on the proposed system, that is, both representation and interpretation. In short, phonetics cannot help us understand CP sandhi if CP is an L-system. In this respect, given the right representation, CP voicing can be given a representational account.

Let us observe, that in CP, unlike in WP, voiced obstruents are no different in behaviour from sonorants in the sandhi context. I will claim that this is because their voicing is of identical phonological status. It is not due to an active category, a view which is markedly different from those assuming that full voicing (long negative VOT) is a result of being marked with |L|. The answer to the problem of CP sandhi is simple. If phonetics is responsible for CP voicing it must be the right phonetics, that is part of the system in which phonetic voicing is commonplace, rather than a case of an ad hoc rule in sandhi.[47]

8. Cracow Polish is an H-system

In this section, we are going to assume that CP is an H-system in which the arbitrary side of the phonology – phonetics relationship within laryngeal relativism approach yields the phonetic interpretation of so defined contrast as in system 5 in (4). In other words, it is an H-system which produces almost identical phonetic facts as the L-system, that is, it has no aspiration in the marked objects and full voicing in the unmarked. This full voicing will be referred to as enhanced passive voicing, a complex term which expresses the fact that the voicing is not due to an active laryngeal specification, but is rather an interpretation of an unmarked object. It will be shown presently, that despite the reversed representation, not only the surface facts but also the phonological computation is identical to that in WP. Namely, the laryngeal element is delinked word-finally and before another obstruent, as schematized in (5) above. What is different is the phonetic interpretation of the respective representations.

Let us begin, as above, with the representation and interpretation of the contrast, showing that system 5 proposed in (4) is indeed a plausible linguistic entity. As in (6) we represent the distribution of the contrast, now defined as |H| vs. non-specified. The

[46] Interestingly, while Michalski criticizes Gussmann for reducing this problem to a footnote, his own promise to solve the problem is never fulfilled.

[47] A similar postulate is raised by Bethin (1984).

interpretation of /C^{H}/ is a voiceless unaspirated obstruent (/p^{H}/ > [p]), while /C^{o}/ is realized as a fully voiced obstruent (/p^{o}/ > [b]) except for two contexts, i) word-finally, and ii) before a voiceless obstruent.

(13) *Cracow Polish*

#C^{H}V	/p^{jH}it͡ɕ^{H}/ → /p^{jH}it͡ɕ^{o}/	>	[p^{j}it͡ɕ]	pić ‘to drink’
#C^{o}V	/b^{jo}it͡ɕ^{H}/ → / b^{jo}it͡ɕ^{o}/	>	[b^{j}it͡ɕ]	bić ‘to hit’
#C^{H}SV	/p^{H}wɔt^{H}ɛm/	>	[pwɔtɛm]	płotem ‘fence, instr.’
#C^{o}SV	/b^{o}wɔt^{H}ɛm/	>	[bwɔtɛm]	błotem ‘mud, instr.’
VC^{H}V	/rɨs^{H}a/	>	[rɨsa]	rysa ‘scratch’
VC^{o}V	/rɨz^{o}a/	>	[rɨza]	ryza ‘ream’
VC^{H}SV	/ɔk^{H}ɲɛ/	>	[ɔkɲɛ]	oknie ‘window, loc.’
VC^{o}SV	/ɔg^{o}ɲɛ/	>	[ɔgɲɛ]	ognie ‘fire, pl.’

The first two examples illustrate also word-final delaryngealization, to which we will return presently. It is necessary to assume that the enhanced passive voicing in Polish requires a (spontaneously) voiced segment to follow rather than to precede. This assumption covers both the word-initial presence of negative VOT in #C^{o}(S)V and its absence in the word-final context ...C^{o}#, where the absence of the following vowel leads to what has normally been assumed to be final-devoicing. Here, we are simply dealing with the absence of phonetic voicing, not with FOD proper. Indeed, from the point of view of phonetic interpretation the final non-voicing and voice assimilation, may appear to be more problematic in an H-system. But are they?

Let us begin with final obstruent devoicing (FOD) and compare the systems of WP and CP. I assume that there may be a difference between the so called lexical and phonological representation. The difference is due to the operation of phonological processes, such as spreading, and delinking, which are due to different licensing conditions resulting from morphological activity, e.g. suffixation. If no phonological process takes place, then the phonological representation is identical to the lexical one. The illustration is based on two alternating pairs: *waga* / *wag* ‘scale, nom.sg. / gen.pl.’ and *byka* / *byk* ‘bull, gen.sg. / nom.sg.’, of which only the first pair exhibits FOD. For comparison, Warsaw and Cracow dialects are juxtaposed. The following symbols are used: ‘→’ a phonological process, ‘=’ no change between lexical and phonological representations, ‘>’ phonetic interpretation.

(14)

	lexical representation		phonological representation		phonetic interpretation	
a. *Warsaw Polish*						
	/v^{L}ag^{L}-/	=	/v^{L}ag^{L}a/	>	[vaga]	‘scale, nom.sg.’
FOD	/v^{L}ag^{L}-/	→	/v^{L}ag^{o}/	>	[vak]	‘scale, gen.pl.’
	/b^{L}ɨk^{o}-/	=	/b^{L}ɨk^{o}a/	>	[bɨka]	‘bull, gen.sg.’
	/b^{L}ɨk^{o}-/	=	/b^{L}ɨk^{o}/	>	[bɨk]	‘bull, nom.sg.’

b. *Cracow Polish*

	/v^{o}ag^{o}-/	=	/v^{o}ag^{o}a/	> [vaga]
'FOD'[48]	/v^{o}ag^{o}-/	=	/v^{o}ag^{o}/	> [vak]
	/b^{o}ɨk^{H}-/	=	/b^{o}ɨk^{H}a/	> [bɨka]
	/b^{o}ɨk^{H}-/	→	/b^{o}ɨk^{o}/	> [bɨk]

In Warsaw Polish, final devoicing is a case of delaryngealization whereby the element |L| is delinked domain-finally (see, e.g. Gussmann 2007). The neutral (or neutralized) obstruent in the L-system is phonetically interpreted as voiceless unaspirated. Note that before a vowel, all the interpretational distinctions are maintained.

In Cracow Polish, on the other hand, which is an H-system, /C^{o}/ is phonetically realized as a fully voiced object when followed by a vowel (C^{o}V), e.g. *byk* [bɨk] 'bull', or a sonorant consonant and a vowel (C^{o}SV), e.g. *broda* [brɔda] 'beard'. In the case of *wag* 'scale, gen.pl.', we must claim that the absence of a vowel in the word-final, or domain-final position disallows the enhanced passive voicing of the obstruent. The system specific interpretational rule takes the following form /g^{o}/ > [k] / _#. This type of analysis has also been proposed for German (Brockhaus 1995, Harris 2009).

Thus, final devoicing in an H-system is in fact a misnomer. It is rather a case of absence of passive voicing in front of silence. Word-final context inhibits passive or natural voicing in obstruents (Westbury and Keating 1986, Harris 2009). Thus FOD in CP is an interpretational rather than phonological phenomenon. It is a consequence which, if correct, is another argument against the common practice of making an automatic equation between a phonetically observed fact and its phonological status.

It is a good moment to ponder on the fallacy of handbook analyses of voice alternations in word-final position, which take any such instance as a case of phonological devoicing rather than lack of passive voicing. Given an alternation of the type *waga* / *wag* [vaga / vak] 'scale, nom.sg. / gen.pl.', the standard argument that we are dealing with final devoicing and not word-medial voicing is to refer to word-medial cases in which a voiceless obstruent survives, e.g. *byka* [bɨka] 'bull, gen.sg.'. If there was a process of intervocalic voicing, the argument goes, then we would have *[bɨga] instead of [bɨka]. It is clear from the representations in (14) and the discussion above, that, first of all, intervocalic voicing may occur as a case of enhanced passive voicing of the neutral series of obstruents in an H-system, in which, word-medial voiceless obstruents carry a laryngeal specification (C^{H}), which is licensed by vowels. In this respect, we cannot expect the vowel to license the laryngeal element |H| responsible for voicelessness of the obstruent and induce enhanced passive voicing at the same time. The obstruent which is lexically specified with |H| may be passively voiced only if it first loses its laryngeal element. Thus the argument using *[bɨga] is false. Note, at this point, that in an L-system, like WP, passive voicing of the unmarked objects

[48] The inverted commas express the fact that in Cracow Polish there is no phonological FOD, there is phonetically based non-voicing of the neutral object.

is also impossible due to universal interpretational reasons: no passive voicing occurs in a language employing |L| for its fully voiced obstruents.

Returning now to the analysis of FOD in (14), I assume that the element |H| in word-final position will be unlicensed and delinked, just as the element |L| is delinked in WP. Computationally, then, the phonologies of CP and WP are identical, except that a different laryngeal element is lost. This delaryngealization in an H-system has no phonetic consequences as long as the simplified consonant is prepausal, because a neutralized /k°/ in *byk* will obviously have the same phonetic interpretation as the lexically neutral /g°/ of *wag* in that dialect, that is, voiceless unaspirated due to absence of the phonetic conditions for interpreting such an abject as voiced. The consequence of the delaryngealization in the H-system will become obvious presently.

So far, we have seen that two disparate systems may yield identical phonetic facts under the laryngeal relativism view. The systems are characterized as having:

- reversed marking of the voice opposition,
- identical phonological computation (licensing conditions on the distribution of the laryngeal element employed),
- respectively different principles of phonetic interpretation.[49]

WP and CP have more or less identical fully voiced and voiceless unaspirated obstruents, the same contrast distribution within the word and identical phonetic effects connected with the right edge of words. Except that in the case of WP we are dealing with truly phonological final devoicing (L-delinking), while in CP it is interpretational, an absence of enhanced passive voicing. Let us compare the two systems in how they deal with the voice agreement facts in Polish.

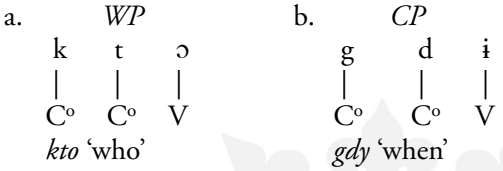
The privative tradition in laryngeal phonology introduced a subtle distinction in the analysis of such symmetrical voice assimilation facts as the ones observed in, e.g. Polish (Lombardi 1995a, 1995b). Since only one member of the opposition can be marked with an active category, surface symmetrical assimilations must be treated as two different phenomena: i) true phonological assimilation due to category spreading, and ii) neutralization. In this respect, the voice assimilation phenomena within the phonological word in CP will look almost identical to what was shown for WP in (10) above, except that the reversed marking enforces a reversed interpretation of the facts. The net result is that two obstruents will either bear the same laryngeal element (lexically or by spreading), or both be neutral (lexically or by delaryngealization). The schemes in (15) are parallel then to those in (11).

[49] 'Different principles of phonetic interpretation' refer obviously to the system based decisions, such that an L-system must not have passive voicing of the neutral obstruents, and an H-system with no aspiration (VOT lag) must have enhanced passive voicing of the neutral obstruents (long negative VOT). These system based decisions are not exactly universal interpretations, such as defaults of the type: sonorant > voiced. Note that in this approach there is no universal default: obstruent > voiceless, especially in a two-way contrast systems, as this necessarily involves a systemic, not universal decision. The only universal phonetic aspect of these system based decisions is perhaps the notion of sufficient phonetic distance between the two series, along the VOT continuum.

(15) a. C^o C^o b. C C
Lar

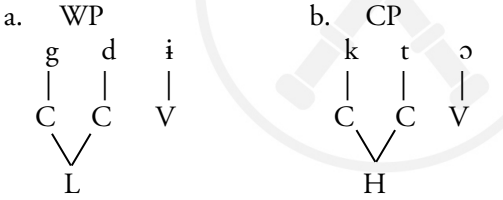
The configuration in (15a) relates to the pattern in which the cluster lexically consists of two non-specified obstruents. Note, however, that the phonetic interpretation of /C^o/ differs between CP and WP. While in WP this cluster will be voiceless, in CP it will be voiced as shown below.

(16) *Voice agreement of neutral obstruents*



When a vowel follows, the voicing of the cluster in CP can be maintained throughout: the enhanced passive voicing of [d] is a context for the same type of voicing of the first obstruent, a simple case of anticipatory assimilation, which is common and expected in a system with long negative VOT in its voiced obstruents.[50] The sequence /g^od^o/ will be pronounced as voiceless in CP only when no vowel follows, e.g. *szmaragdy* / *szmaragd* [ʃmaragdɨ / ʃmarakt] ‘emerald, pl. / sg.’. Let us compare the forms in (16) above with voice agreement of marked obstruents, that is, the respective structures relating to (15b).

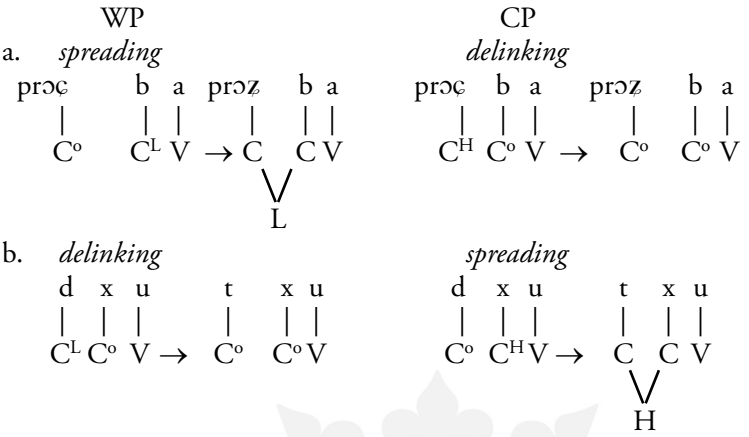
(17) *Voice agreement of marked obstruents*



As can be seen, we are dealing with the same two words as in (16) above, except that their representations are reversed for the respective dialects. The configurations in which the two obstruents are lexically marked by one laryngeal category, may be viewed as identical to the phonological representations obtained through spreading, that is, in dynamic assimilation. This is illustrated below on the basis of the forms *prosić* / *prośba* [prɔɕit͡ɕ / prɔʑba] ‘to ask / a request’ and *dech* / *tchu* [dɛx / txu] ‘breath, nom.sg. / gen.sg.’.

[50] This proposal enforces a reanalysis of assimilations. It seems that systems with long negative VOT will exhibit assimilation to voiced regardless whether this phonetic value is due to an active laryngeal category, or is simply a case of enhanced passive voicing as in CP. There are other candidate languages which might behave like CP, namely, Dutch, Yiddish, and Afrikaans (van Rooy and Wissing 2001).

(18) *Dynamic assimilation*



The derivation of [prɔʒba] in the two dialects takes two different paths as illustrated in (18a). In WP, the consonant sequence is composed of an unmarked object followed by a marked one. The laryngeal element spreads from the second obstruent to the first one. In CP, on the other hand, it is the first obstruent in the sequence that is marked. But it is now in the context for delinking.

In [txu] (18b), we know that the first obstruent is lexically distinct from the following one, and it should yield a voiced segment if a vowel intervenes ([dɛx]). This translates into a marked segment in WP and an unmarked one in CP. Thus, in WP we are dealing with delinking of the laryngeal element |L| in [txu], while in CP it is a case of spreading of |H|. The two systems work in a mirrored fashion, producing generally identical phonetic facts using reversed phonological representations, identical phonological computation to do with active categories, and reversed, or opposite phonetic interpretation principles if not rules. This of course refers to those principles of phonetic interpretation which are system dependent rather than universal. Namely, vowels and sonorant consonants are voiced in both dialects not for systemic reasons but for universal ones – spontaneous voicing. The interpretation of obstruents with respect to voicing is systemic. In Polish, this is particularly clear in that the neutral obstruents (/Co/) are phonetically realized as voiceless unaspirated in the Warsaw dialect and as fully voiced in Cracow.

9. Cracow sandhi voicing revisited

In both dialects, the laryngeal category is not licensed in two contexts: i) before an obstruent, and ii) word-finally. It is the latter context that is relevant to the sandhi phenomena, where the two dialects differ. One should bear in mind that both dialects restrict the word-final position to a neutral obstruent (...Co#), except that it is a different interpretational object in each system. This obstruent must be realized as voiceless pre-pausally in both dialects. In WP, which is an L-system, it is voiceless because it

is either lexically neutral or delaryngealized, while in CP, which is an H-system, it is voiceless word-finally because there is no phonetic context for passive voicing to occur. However, in CP the lexical distinction between the two series of obstruents is also neutralized to /C°/.

Now, the sandhi facts are due to the disparate function of vowels in the two dialects. In WP, they license the element |L| in the fully voiced obstruents, but are unable to do it across word boundaries, hence we get *rad ojcowskich* [rat ɔjt͡sɔfskʲix] and not *[rad ɔjt͡sɔfskʲix]. In CP, on the other hand, the vowels merely provide the phonetic context for the enhanced passive voicing in the neutral series. This is exactly, what happens in the case of the celebrated CP sandhi voicing. Note that the voicing occurs also before sonorant consonants, as long as they are adjacent, which supports the view that what is crucial in CP voicing is phonetic adjacency.[51] Of course, the voice assimilation also takes place before a word beginning with a voiced obstruent, which in CP is also missing a laryngeal category for voice. Thus all three types of voiced segments pattern together for a reason: they are phonologically of the same kind, that is, non-specified for voice. Let us illustrate the sandhi context before a word beginning with a vowel for both WP and CP.[52]

(19) *Warsaw Polish*

a. *rzut oka* 'glimpse' — phonetic adjacency and interpretation

C^L	V	C^o	#	V	C^o	V	
|	|	|		|	|	|	
ʒ	u	t		ɔ	k	a	$t^oɔ$ > [tɔ]

b. *rad ojcowskich* 'fatherly advice, gen.pl.'

L-delinking

C	V	C^L	#	→	C	V	C^o	#	V...	
|	|	|			|	|	|		|	
r	a	d			r	a	d		ɔjt͡sɔfskʲix	$d^oɔ$ > [tɔ]

[51] This echoes the contention of Rubach (1996). However, Rubach needs the phonetic adjacency in order to allow for spreading of the feature [+voice] from vowels, sonorant consonants and voiced obstruents. Thus, his analysis is computational. This is no place to deal with this or any other previous analysis of Polish voicing facts in detail. One thing is clear. We do not need to refer to phonological specification of vowels, or an arbitrary presence of a late spreading rule of that feature in CP as opposed to WP. All these follow from the general characteristics of the two laryngeal systems in Polish.

[52] In order not to complicate the picture additionally, sonorant consonants are represented as C with no superscript. This is to avoid a possible misunderstanding that a non-specified sonorant should be interpreded in the same way as a non-specified obstruent in a given system. Sonorants are non-specified laryngeally, but they are universally interpreted as voiced as explained in Section 4.

Cracow Polish

c. *rzut oka* 'glimpse'

H-delinking

C^o	V	C^H	#	→	C^o	V	C^o	#	V	C^o	V	
|	|	|			|	|	|		|	|	|	
ʒ	u	t			ʒ	u	t		ɔ	k	a	$t^oɔ$ > [dɔ]

d. *rad ojcowskich* 'fatherly advice, gen.pl.'

C	V	C^o	#	V...	
|	|	|		|	
r	a	d		ɔj͡tsɔfsk^{j}ix	$d^oɔ$ > [dɔ]

Both WP and CP allow only for non-specified obstruents to occur word-finally. They may either be lexically non-specified (/C^o#/), or neutralized (/C^{Lar}#/ → /C^o#/). The neutralization or delaryngealization takes the form of L-delinking in WP and H-delinking in CP. The resulting non-specified object is realized as voiceless in both dialects only if nothing follows, that is, pre-pausally. If the following word begins with a vowel, which provides phonetic, not phonological adjacency, the neutral obstruent in WP must still be realized as voiceless (19a,b) because the L-delinking cannot be undone, while in CP it must be realized as voiced (19c,d). In this respect, Cracow sandhi voicing is not really a result of an arbitrary rule, as previous accounts of the phenomenon would have it. It is obligatory, given the laryngeal system of that dialect.

As shown above, the CP sandhi voicing can be accounted for within a privative model deprived of the phonetic level of representation by assuming a particular view of a laryngeal system, and an extension to laryngeal realism, which I call laryngeal relativism. A system comprises phonological representation of the contrast, phonological computation, and phonetic interpretation, which first of all relies on the principle of minimal contrast, while the actual phonetic values – here defined in terms of VOT – are associated with particular laryngeal categories in an arbitrary, system specific fashion. The laryngeal relativism view predicts the existence of systems like Cracow Polish. It is an H-system which phonetically looks identical to an L-system. The opposite marking goes with the opposite interpretation of the unmarked segments, which is crucial in the phenomenon of CP sandhi voicing.[53]

10. Conclusion

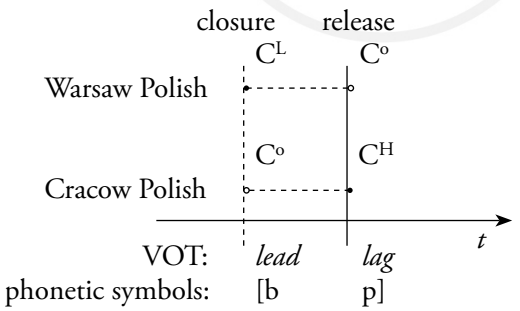
This paper argues that Polish possesses two opposite laryngeal systems with respect to the representation of the voiced – voiceless contrast, which correspond to the two major dialect groups Cracow (CP) and Warsaw Polish (WP). The former is an H-system, in which full voicing (long negative VOT) is a result of enhanced passive voicing

[53] A similar intuition that Dutch, Afrikaans and Yiddish represent an intermediate category between Germanic |tense| and Slavic |voice| systems is expressed in van Rooy and Wissing (2001: 319). Clearly what the authors understand as an intermediate category is a system which has negative VOT as enhanced passive voicing with no phonological category standing behind it.

of a laryngeally neutral segment, while the latter is an L-system, in which the long negative VOT directly corresponds to an active laryngeal category. The two systems are characterized by identical computational components governing the distribution and phonological activity (spreading, delinking) of the respective active category. Laryngeal systems involve an arbitrary relation between phonological representations and their phonetic interpretation. However, the nature of the phonetic space available for laryngeal distinctions is such that the possibilities are in fact highly constrained.

Under the laryngeal relativism view, which involves arbitrary assignment of concrete phonetic categories to particular phonological representations, the phonetic interpretation conventions in the two dialects of Polish yield identical phonetic facts, that is, symmetrical voice assimilations and final obstruent devoicing when limited to the domain of word. However, the true linguistic nature of all these phonetic phenomena is different. As a consequence, not every final devoicing or assimilation of voice can be viewed as a proper phonological phenomenon. Thus, it seems that all the classic criteria for categoryhood in laryngeal phonology must be treated with reservation. Long negative VOT is not a guarantee of the presence of the feature |voice| or element |L|. This means, that spectrograms are not telling us what type of system we are dealing with. They only provide the information on the phonetic side of the equation. When confronted with dynamic phenomena involving alternations, final obstruent devoicing may indeed be a case of delaryngealization in an L-system, but it can only be a case of absence of passive voicing in an H-system. Likewise, voice assimilation may be either due to feature spreading or feature delinking (neutralization). The obvious question that arises at this point is what criteria for categoryhood we are left with? This paper partly answers this question. The sandhi phenomena in Polish can only be understood if Cracow Polish is an H-system and Warsaw Polish is an L-system. The representational and interpretational relationship between these two dialects is illustrated again below under the laryngeal relativism view.

(20) *Two laryngeal systems of Polish*



As illustrated above, the phonetic interpretation of the obstruents with respect to voicing is systemic. The neutral obstruent (/C^o/) is phonetically realized as voiceless unaspirated in the Warsaw dialect and as fully voiced in Cracow. The mirrored systems produce generally identical phonetic facts using reversed phonological representations,

identical phonological computation and reversed phonetic interpretation principles which take the VOT space and respect at least one universal phonetic principle, namely, that of sufficient phonetic distance between two phonetic categories.

The laryngeal relativism view allows us to understand Cracow sandhi voicing in the following way. Phonology is responsible only for the word-final delaryngealization. The sandhi voicing is not due to phonological spreading of a laryngeal feature, which would force us to assume that sonorants carry laryngeal categories, but due to interpretation of a neutral object which is phonetically adjacent to a phonetically voiced segment, something that is also regular word-internally in that dialect.[54]

For the purpose of simplicity of exposition a number of phenomena to do with voicing in Polish have been left out. These include, for example, the behaviour of sonorants in assimilations, progressive voice assimilation. These and other phenomena related to voice in Polish will be discussed on another occasion.

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[54] In this respect, this analysis responds positively to the postulate formulated in, e.g. Bethin (1984), that the Cracow sandhi voicing should respect the same principles as those operating word-internally.

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